Howell, Beth (MRC)

From: VITA WPS <vitashare@vita.virginia.gov>
Sent: Tuesday, September 12, 2017 8:31 AM
To: MRC - jpa Permits
Subject: FileCatalyst Authentication code for files from Robbie Clark

Enterprise solution for sending large files

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SEP 12 2017
MARINE RESOURCES
COMMISSION

Mountain Valley PIPELINE

September 11, 2017

By UPS Ground

Mr. Todd Miller
Norfolk District
U.S. Army Corps of Engineers
9100 Arboretum Pkwy, Suite 235
Richmond, Virginia 23236

Mr. Randy Owen
Commonwealth of Virginia
Marine Resources Commission
2600 Washington Avenue, 3rd Floor
Newport News, Virginia 23607

Mr. Steven Hardwick
Commonwealth of Virginia
Department of Environmental Quality
629 East Main Street
Richmond, Virginia 23219

RECEIVED
SEP 12 2017
MARINE RESOURCES COMMISSION

Re: Mountain Valley Pipeline
Joint Permit Application

Dear Messrs. Miller, Owen, and Hardwick:

Please find enclosed a copy of the Joint Permit Application (JPA) for the Mountain Valley Pipeline project. A digital copy via an FTP site VITASHARE for DEQ and VMRC

I look forward to working with you throughout this process and welcome any comments or questions you may have on the enclosed JPA. Please feel free to contact me any time at 724-873-3465 or bclauto@eqt.com.

Sincerely,

Brian M. Clauto
EQT Corporation

Enclosures

FOR AGENCY USE ONLY	
	Notes: RECEIVED SEP 12 2017 MARINE RESOURCES COMMISSION
JPA# 17-1609	

APPLICANTS

PLEASE PRINT OR TYPE ALL ANSWERS. If a question does not apply to your project, please print N/A (not applicable) in the space provided. ***If additional space is needed, attach extra 8 ½ x 11 inch sheets of paper.***

Check all that apply			
Pre-Construction Notification (PCN) ☒ NWP # 12 *(For Nationwide Permits ONLY - No DEQ-VWP permit writer will be assigned)*	SPGP ☐	DEQ Reapplication ☐ Existing permit number:	Receiving federal funds ☐ Agency providing funding:

PREVIOUS ACTIONS RELATED TO THE PROPOSED WORK (Include all federal, state, and local pre-application coordination, site visits, previous permits, or applications whether issued, withdrawn, or denied)

Historical information for past permit submittals can be found online with VMRC - https://webapps.mrc.virginia.gov/public/habitat/ - or VIMS - http://ccrm.vims.edu/perms/newpermits.html

Agency	Action / Activity	Permit/Project number, including any non-reporting Nationwide permits previously used (e.g., NWP 13)	Date of Action	If denied, give reason for denial
USACE/VDEQ	Pre-application meeting	N/A	4/19/17	
USACE	Draft JPA Submission	N/A	2/29/16 and 5/17/17	
USACE	Wetland and waterbody site verifications	N/A	See Attachment C	
VMRC	Pre-application meeting	N/A	5/31/17	

1. APPLICANT, AGENT, PROPERTY OWNER, AND CONTRACTOR INFORMATION
The applicant(s) is/are the legal entity to which the permit may be issued (see How to Apply at beginning of form). The applicant(s) can either be the property owner(s) or the person/people/company(ies) that intend(s) to undertake the activity. The agent is the person or company that is representing the applicant(s). If a company, please also provide the company name that is registered with the State Corporation Commission (SCC), or indicate no registration with the SCC.

Legal Name(s) of Applicant(s)			Agent (if applicable)		
Mountain Valley Pipeline, LLC			Tetra Tech, Inc.		
Mailing address 555 Southpointe Blvd., Suite 200			Mailing address 661 Anderson Drive		
City Canonsburg	State PA	ZIP Code 15317	City Pittsburgh	State PA	ZIP Code 15220
Phone number w/area code (724) 395-3931	Fax		Phone number w/area code (412) 921-7090	Fax (412) 921-4040	
Mobile	E-mail RCooper@eqt.com		Mobile	E-mail	
State Corporation Commission Name and ID number (if applicable) Mountain Valley Pipeline, LLC T0586216			State Corporation Commission Name and ID number (if applicable) Tetra Tech, Inc. F0572851		

Certain permits or permit authorizations may be provided via electronic mail. If the applicant wishes to receive their permit via electronic mail, please provide an e-mail address here: RCooper@eqt.com

1. APPLICANT, AGENT, PROPERTY OWNER, AND CONTRACTOR INFORMATION (Continued)

Property owner(s) legal name, if different from applicant See Attachment D			Contractor, if known Not known		
Mailing address			Mailing address		
City	State	ZIP code	City	State	ZIP code
Phone number w/area code	Fax		Phone number w/area code	Fax	
Mobile	E-mail		Mobile	E-mail	
State Corporation Commission Name and ID number (if applicable)			State Corporation Commission Name ID number (if applicable)		

2. PROJECT LOCATION INFORMATION

(Attach a copy of a detailed map, such as a USGS topographic map or street map showing the site location and project boundary, so that it may be located for inspection. Include an arrow indicating the north direction. Include the drainage area if the SPGP box is checked on Page 7.)

Street Address (911 address if available) See Attachment A.	City/County/ZIP Code See Attachment A.
Subdivision N/A	Lot/Block/Parcel # N/A

Name of water body(ies) within project boundaries and drainage area (acres or square miles).
See Attachment G for name of water bodies in project boundary. See Attachment H for drainage areas for permanent impacts.

Tributary(ies) to: N/A
Basin: See Attachment A Sub-basin: See Attachment A.
(*Example: Basin: James River Sub-basin: Middle James River*)

Special Standards (based on DEQ Water Quality Standards 9VAC25-260 et seq.): See Attachment H-2

Project type (check one)

- [ ] Single user (private, non-commercial, residential)
- [x] Multi-user (community, commercial, industrial, government)
- [ ] Surface water withdrawal

Latitude and longitude at center of project site (decimal degrees): See Attachment A. / -
(Example: 37.33164/-77.68200)

USGS topographic map name: See Attachment G.

8-digit USGS Hydrologic Unit Code (HUC) for your project site (See http://cfpub.epa.gov/surf/locate/index.cfm): See Attachment A
If known, indicate the 10-digit and 12-digit USGS HUCs (see *http://dswcapps.dcr.virginia.gov/htdocs/maps/HUExplorer.htm* :
See Attachment A.

Name of your project (*Example: Water Creek driveway crossing*) Mountain Valley Pipeline

Is there an access road to the project? ☑ Yes ☐ No. If yes, check all that apply: ☑ public ☑ private ☑ improved ☑ unimproved

Total size of the project area (in acres): 2,137 acres

2. PROJECT LOCATION INFORMATION (Continued)

Provide driving directions to your site, giving distances from the best and nearest visible landmarks or major intersections:
See Attachment A for driving directions and Attachment H for site maps.

Does your project site cross boundaries of two or more localities (i.e., cities/counties/towns)? ☑ Yes ☐ No
If so, name those localities:

3. DESCRIPTION OF THE PROJECT, PROJECT PRIMARY AND SECONDARY *PURPOSES*, PROJECT *NEED*, INTENDED USE(S), AND ALTERNATIVES CONSIDERED (Attach additional sheets if necessary)

- The purpose and need must include any new development or expansion of an existing land use and/or proposed future use of residual land.
- Describe the physical alteration of surface waters, including the use of pilings (#, materials), vibratory hammers, explosives, and hydraulic dredging, when applicable, and *whether or not tree clearing will occur* (include the area in square feet and time of year).
- Include a description of alternatives considered and measures taken to avoid or minimize impacts to surface waters, including wetlands, to the maximum extent practicable. Include factors such as, but not limited to, alternative construction technologies, alternative project layout and design, alternative locations, local land use regulations, and existing infrastructure
- For utility crossings, include both alternative routes and alternative construction methodologies considered
- For surface water withdrawals, public surface water supply withdrawals, or projects that will alter in-stream flows, include the water supply issues that form the basis of the proposed project.

See Attachment B for Project description, purpose, and need.

See Attachment I for information on wetland and waterbody crossing methods and a description of impact avoidance, minimization, and alternatives analysis.

See Attachment J for NWP 12 Condition Compliance.

Date of proposed commencement of work (MM/DD/YYYY) December 2017	Date of proposed completion of work (MM/DD/YYYY) December 2018
Are you submitting this application at the direction of any state, local, or federal agency? ☐ Yes ☑ No	Has any work commenced or has any portion of the project for which you are seeking a permit been completed? ☐ Yes ☑ No

If you answered "yes" to either question above, give details stating when the work was completed and/or when it commenced, who performed the work, and which agency (if any) directed you to submit this application. In addition, you will need to clearly differentiate between completed work and proposed work on your project drawings.
N/A

Are you aware of any unresolved violations of environmental law or litigation involving the property? ☑ Yes ☐ No
(If yes, please explain)
Two pending challenges to use of eminent domain provisions of the Natural Gas Act for project easement:
Berkley v Mountain Valley Pipeline, 7:17-CV-357 (W.D. Va.)
Bold Alliance v FERC, 1:17-CV-1822 (D.D.C.)

4. PROJECT COSTS

Approximate cost of the entire project, including materials and labor: $ 1,100,000,000
Approximate cost of only the portion of the project affecting state waters (channelward of mean low water in tidal areas and below ordinary high water mark in nontidal areas): $ >500,000

5. PUBLIC NOTIFICATION (Attach additional sheets if necessary)

Complete information for all property owners adjacent to the project site and across the waterway, if the waterway is less than 500 feet in width. If your project is located within a cove, you will need to provide names and mailing addresses for all property owners within the cove. If you own the adjacent lot, provide the requested information for the first adjacent parcel beyond your property line.

Failure to provide this information may result in a delay in the processing of your application by VMRC.

Property owner's name	Mailing address	City	State	ZIP code
Property Owner List is provided in Attachment D.				

Name of newspaper having general circulation in the area of the project: See Mountain Valley Pipeline FERC Docket CP16-10-000
Address and phone number (including area code) of newspaper See Mountain Valley Pipeline FERC Docket CP16-10-000

Have adjacent property owners been notified with forms in Appendix A? ☐ Yes ☑ No (attach copies of distributed forms)

6. THREATENED AND ENDANGERED SPECIES INFORMATION

Please provide any information concerning the potential for your project to impact state and/or federally threatened and endangered species (listed or proposed). Attach correspondence from agencies and/or reference materials that address potential impacts, such as database search results or confirmed waters and wetlands delineation/jurisdictional determination. Include information when applicable regarding the location of the project in Endangered Species Act-designated or -critical habitats. Contact information for the U.S. Fish and Wildlife Service, National Oceanic and Atmospheric Administration, Virginia Dept. of Game and Inland Fisheries, and the Virginia Dept. of Conservation and Recreation-Division of Natural Heritage can be found on page 4 of this package.

7. HISTORIC RESOURCES INFORMATION

Note: Historic properties include but are not limited to archeological sites, battlefields, Civil War earthworks, graveyards, buildings, bridges, canals, etc. Prospective permittees should be aware that section 110k of the NHPA (16 U.S.C. 470h-2(k)) prevents the USACE from granting a permit or other assistance to an applicant who, with intent to avoid the requirements of Section 106 of the NHPA, has intentionally significantly adversely affected a historic property to which the permit would relate, or having legal power to prevent it, allowed such significant adverse effect to occur, unless the USACE, after consultation with the Advisory Council on Historic Preservation (ACHP), determines that circumstances justify granting such assistance despite the adverse effect created or permitted by the applicant.

Are any historic properties located within or adjacent to the project site? ☑ Yes ☐ No ☐ Uncertain
If Yes, please provide a map showing the location of the historic property within or adjacent to the project site.

Are there any buildings or structures 50 years old or older located on the project site? ☑ Yes ☐ No ☐ Uncertain
If Yes, please provide a map showing the location of these buildings or structures on the project site.

Is your project located within a historic district? ☑ Yes ☐ No ☐ Uncertain

If Yes, please indicate which district: See Attachment F.

7. HISTORIC RESOURCES INFORMATION (Continued)

Has a survey to locate archeological sites and/or historic structures been carried out on the property?
☑ Yes ☐ No ☐ Uncertain

If Yes, please provide the following information: Date of Survey: See Attachment F.

Name of firm: Tetra Tech, Inc., New South Associates

Is there a report on file with the Virginia Department of Historic Resources? ☑ Yes ☐ No ☐ Uncertain

Title of Cultural Resources Management (CRM) report: See Attachment F.

Was any historic property located? ☑ Yes ☐ No ☐ Uncertain

8. WETLANDS, WATERS, AND DUNES/BEACHES IMPACT INFORMATION

Report each impact site in a separate column. If needed, attach additional sheets using a similar table format. Please ensure that the associated project drawings clearly depict the location and footprint of each numbered impact site. For dredging, mining, and excavating projects, use Section 17.

	Impact site number 1	Impact site number 2	Impact site number 3	Impact site number 4	Impact site number 5
Impact description (use all that apply): F=fill EX=excavation S=Structure T=tidal NT=non-tidal TE=temporary PE=permanent PR=perennial IN=intermittent SB=subaqueous bottom DB=dune/beach IS=hydrologically isolated V=vegetated NV=non-vegetated MC=Mechanized Clearing of PFO *(Example: F, NT, PE, V)*	See Attachment H.	See Attachment H.	See Attachment H.	See Attachment H.	See Attachment H.
Latitude / Longitude (in decimal degrees)					
Wetland/waters impact area (square feet / acres)					
Dune/beach impact area (square feet)					
Stream dimensions at impact site (length and average width in linear feet, and area in square feet)					
Volume of fill below Mean High Water or Ordinary High Water (cubic yards)					

9. APPLICANT, AGENT, PROPERTY OWNER, AND CONTRACTOR CERTIFICATIONS (Continued)

Is/Are the Applicant(s) and Owner(s) the same? ☐ *Yes* ☑ *No*

Legal name & title of Applicant Mountain Valley Pipeline, LLC	Second applicant's legal name & title, if applicable N/A
Applicant's signature SVP, MVP Construction and Engineering	Second applicant's signature
Date 9/11/2017	Date
Property owner's legal name, if different from Applicant See Attachment D.	Second property owner's legal name, if applicable See Attachment D.
Property owner's signature, if different from Applicant	Second property owner's signature
Date	Date

CERTIFICATION OF AUTHORIZATION TO ALLOW AGENT(S) TO ACT ON APPLICANT'S(S') BEHALF (IF APPLICABLE)

I (we), Mountain Valley Pipeline, LLC (and) N/A,
APPLICANT'S LEGAL NAME(S) – *complete the second blank if more than one Applicant*

hereby certify that I (we) have authorized Tetra Tech, Inc. (and) N/A
AGENT'S NAME(S) – *complete the second blank if more than one Agent*

to act on my (our) behalf and take all actions necessary to the processing, issuance, and acceptance of this permit and any and all standard and special conditions attached. I (we) hereby certify that the information submitted in this application is true and accurate to the best of my (our) knowledge.

Applicant's signature SVP, MVP Construction & Engineering	Second applicant's signature, if applicable N/A
Date 9/11/2017	Date N/A
Agent's signature and title Tetra Tech, Inc.	Second agent's signature and title, if applicable N/A
Date	Date N/A

CONTRACTOR ACKNOWLEDGEMENT (IF APPLICABLE)

I (we), N/A (and) N/A,
APPLICANT'S LEGAL NAME(S) – *complete the second blank if more than one Applicant*

have contracted N/A (and) N/A
CONTRACTOR'S NAME(S) – *complete the second blank if more than one Contractor*

to perform the work described in this Joint Permit Application, signed and dated N/A.

I (we) will read and abide by all conditions as set forth in all federal, state, and local permits as required for this project. I (we) understand that failure to follow the conditions of the permits may constitute a violation of applicable federal, state, and local statutes and that we will be liable for any civil and/or criminal penalties imposed by these statutes.
In addition, I (we) agree to make available a copy of any permit to any regulatory representative visiting the project site to ensure permit compliance. If I (we) fail to provide the applicable permit upon request, I (we) understand that the representative will have the option of stopping our operation until it has been determined that we have a properly signed and executed permit and are in full compliance with all of the terms and conditions.

Contractor's name or name of firm (printed/typed) N/A	Contractor's or firm's mailing address N/A	
Contractor's signature and title N/A	Contractor's license number N/A	Date N/A
Applicant's signature N/A	Second applicant's signature, if applicable N/A	N/A
Date N/A	Date N/A	

19. NONTIDAL STREAM CHANNEL MODIFICATIONS FOR RESTORATION OR ENHANCMENT, or TEMPORARY OR PERMANENT RELOCATIONS (Continued)

Will low-flow channels be maintained in the modified stream channel? ☐ Yes ☐ No.
Describe how:
N/A

Will any structure(s) be placed in the stream to create riffles, pools, meanders, etc.? ☐ Yes ☐ No
If yes, please explain:
N/A

20. UTILITY CROSSINGS

Type of crossing: ☐ overhead ☑ trenched ☑ directionally-drilled

Method of clearing corridor of vegetation (check all that apply): ■ mechanized land clearing that disturbs the soil surface
■ cutting vegetation above the soil surface

Describe the materials to be used in the installation of the utility line (including gravel bedding for trenched installations, bentonite slurries used during direction-drilling, etc.) and a sequence of events to detail how the installation will be accomplished (including methods used for in-stream and dry crossings).
See Attachment I.

Will the proposed utility provide empty conduits for any additional utilities that may propose to co-locate at a later date? ☐ Yes ☑ No.

For overhead crossings over navigable waterways (including all tidal waterways), please indicate the height of other overhead crossings or bridges over the waterway relative to mean high water, mean low water, or ordinary high water mark:
N/A

Nominal system voltage, if project involves power lines: N/A

Total number of electrical circuits: N/A

Will there be an excess of excavated material? ☐ Yes ☑ No
If so, describe the method that will be undertaken to dispose of, and transport, the material to its permanent disposal location and give that location:

Will any excess material be stockpiled in wetlands? ☑ Yes ☐ No
If so, will the stockpiled material be placed on filter fabric or some other type of impervious surface? ☑ Yes ☐ No

Will permanent access roads be placed through wetlands/streams? ☑ Yes ☐ No
If yes, will the roads be (check one) ☐ at grade ■ above grade?

Will the utility line through wetlands/waters be continually maintained (e.g. via mowing or herbicide)? ☑ Yes ☐ No
If maintained, what is the maximum width? 10 feet

21. ROAD CROSSINGS

Have you conducted hydraulic studies to verify the adequacy of the culverts? ☐ Yes ☑ No
If so, please attach a copy of the hydraulic study/report.
Virginia Department of Transportation (VDOT) standards require that the backwater for a 100 year storm not exceed 1 foot for all road, culvert, and bridge projects within FEMA-designated floodplains. Virginia Department of Environmental Quality (DEQ) requires pipes and culverts 24 inches or less in diameter to be countersunk three inches below the natural stream bed elevations, and pipes and culverts greater than 24 inches to be countersunk at least six inches below the natural stream bed elevations. Hydraulic capacity is determined based on the reduced capacity due to the countersunk position.

Will the culverts be countersunk below the stream bottom? ☑ Yes ☐ No. If no, explain:
Where possible, existing culverts will be used. Culvert enhancement/installation will follow best management practices. See Attachment I for construction and Attachment J.

If the project entails a bridged crossing and there are similar crossings in the area, what is the vertical distance above mean high water, mean low water, or ordinary high water mark of those similar structures? N/A feet above N/A
For all bridges proposed over navigable waterways (including all tidal water bodies), you will be required to contact the U.S. Coast Guard to determine if a permit is required of their agency.

On separate sheets of paper, describe the materials to be used, the method of construction (including the use of cofferdams), the sequence of construction events, and if bedrock conditions may be encountered. Include cross-sections and profile plans of the culvert crossings including wing walls or rip rap. See Attachment I for description of method and materials to be used. See Attachment H4 for access road typicals and details. See the Project ESCP for the construction sequence.

22. IMPOUNDMENTS, DAMS, AND STORMWATER MANAGEMENT FACILITIES

If the impoundment or dam is a component of a water withdrawal project, also complete Sections 24 through 26.

Will the proposed impoundment, dam, or stormwater management facility be used for agricultural purposes (e.g., in the operation of a farm)? For DEQ permitting purposes, a farm is considered to be a property or operation that produces goods for market.
☐ Yes ☐ No N/A

What type of materials will be used in the construction (earth, concrete, rock, etc.)? N/A

What is the source of these materials? N/A

Provide the dimensions of proposed impoundment, dam, or stormwater management facility, including the height and width of all structures.
N/A

Storage capacity* of impoundment: N/A acre-feet
*should be given for the normal pool of recreational or farm ponds, or design pool for stormwater management ponds or reservoirs (the elevation the pond will be at for the design storm, e.g., 10-year, 24-hour storm)

Surface area** of impoundment: N/A acres
**should be given for the normal pool of recreational or farm ponds, or design pool for stormwater management ponds or reservoirs (the elevation the pond will be at for the design storm, e.g., 10-year, 24-hour storm)

Is the proposed project excluded from the Virginia Dam Safety Regulations? ☐ Yes ☐ No ☐ Uncertain

If not excluded, does your proposed project comply with the Virginia Dam Safety Regulations? ☐ Yes ☐ No ☐ Uncertain

Does the proposed design include a vegetation management area per §10.1-609.2? ☐ Yes ☐ No ☐ Uncertain
If your answer to these questions is no or uncertain, you should contact the Virginia Department of Conservation and Recreation's Dam Safety Program at (804) 371-6095, or reference the regulations on the Web at http://www.dcr.virginia.gov/dam_safety_and_floodplains/index.shtml

For stormwater management and flood control facilities:

Design storm event: N/A year storm

Retention time: N/A hours

Current average flow (flow rate under normal rainfall conditions): N/A cfs

Method used to derive average flow: N/A

Proposed peak outflow for the design storm provided above: N/A cfs

Has the facility been designed as an Enhanced Extended Detention Basin or an Extended Detention Basin in accordance with the Minimum Standard 3.07 of the Virginia Stormwater Management Handbook, Volume I (published by the Virginia Department of Conservation and Recreation, 1999), or in accordance with the latest version of this handbook? ☐ Yes ☐ No

22. IMPOUNDMENTS, DAMS, AND STORMWATER MANAGEMENT FACILITIES (Continued)

Will the impoundment structure be designed to pass a minimum flow at all times? ☐ Yes ☐ No

If so, please give the minimum rate of flow: N/A cfs

What is the drainage area upstream of the proposed impoundment? N/A square miles

How much of your proposed impoundment structure will be located on the stream bed? N/A square feet

What is the area of vegetated wetlands that will be excavated and/or back-flooded by the impoundment? N/A square feet

What is the *area and length* of streambed that will be excavated and/or back-flooded by the impoundment? N/A square feet
N/A linear feet

Are fish ladders being proposed to accommodate the passage of fish? ☐ Yes ☐ No

23. OUTFALLS NOT ASSOCIATED WITH PROPOSED WATER WITHDRAWAL ACTIVITIES

Type and size of pipe(s): N/A - See Attachment B

Daily rate of discharge: N/A - See Attachment B mgd

If the discharge will be thermally-altered, provide the maximum temperature: N/A - See Attachment B

Contributing drainage area: N/A - See Attachment B square miles

Average daily stream flow at site: N/A - See Attachment B cfs

Have you received a Virginia Discharge Elimination System (VPDES) permit for the proposed project? ☐ Yes ☐ No.

If yes, please provide the VPDES permit number: N/A - See Attachment B.

If no, is there a permit action pending? ☐ Yes ☐ No. If pending, what is the facility name? N/A - See Attachment B.

The following sections are typically related to surface water withdrawal activities; Federal Energy Regulatory Commission license projects; or impacts likely to require instream flow limits. Examples of such projects include, but are not limited to, reservoirs, irrigation projects, power generation facilities, and public water supply facilities that may or may not have associated features, such as dams, intake pipes, outfall structures, berms, etc.

If completing these sections, enter "N/A" in any section that does not apply to the project.

24. INTAKES, OUTFALLS, AND WATER CONTROL STRUCTURES (INCLUDING ALL PROPOSED WATER WITHDRAWAL ACTIVITIES)

For intakes:

Type and size of pipe(s): N/A - See Attachment B

Type and size of pump(s): N/A - See Attachment B

Average and Maximum daily rate of withdrawal: N/A - See Attachment B and N/A - See Attachment B mgd

Velocity of withdrawal: N/A - See Attachment B fps

Screen mesh size: N/A - See Attachment B inches / N/A - See Attachment B mm

If other sizing units, please specify: N/A - See Attachment B

Contributing drainage area at withdrawal point(s): N/A - See Attachment B square miles

Average daily stream flow at withdrawal point(s) (flow rate under normal rainfall conditions): N/A - See Attachment B cfs

Method(s) used to derive average daily stream flow

N/A - See Attachment B

Average annual stream flow at withdrawal point(s): N/A - See Attachment B cfs

Latitude and longitude of withdrawal point(s) (degrees, minutes, seconds): N/A - See Attachment B

For outfalls:

Type, size, and hydraulic capacity (under normal conditions) of pipe(s): N/A - See Attachment B, _____, and N/A - See Attachment B

Daily rate of discharge: N/A - See Attachment B mgd

If the discharge will be thermally-altered, provide the maximum temperature: N/A - See Attachment B

Contributing drainage area at discharge point(s): N/A - See Attachment B square miles

Average daily stream flow at discharge point(s) (flow rate under normal rainfall conditions): N/A - See Attachment B cfs

Method(s) used to derive average daily stream flow

N/A - See Attachment B

Latitude and longitude of discharge point(s) (degrees, minutes, seconds): N/A - See Attachment B

For intakes and dams, use the table below to provide the median monthly stream flows in cubic feet per second (cfs) at the water intake or dam site (not at the stream gage; if there is not a gage at the intake or dam site, you will need to interpolate flows to the intake or dam site based upon the most closely related watershed in which there is an operational stream gage monitored by the United States Geologic Survey (USGS)). Median flow is the value at which half of the measurements are above and half of the measurements are below. Median is also sometimes referred to as the '50% exceedence flow'. The median flow generally must be calculated from USGS historical data. Please do not provide *mean (average)* flow.

Month	Median flow (cfs)	Month	Median flow (cfs)
January	N/A - See Attachment B	July	N/A - See Attachment B
February		August	
March		September	
April		October	
May		November	
June		December	

Describe the stream flow gages used, USGS stream flow gage site number and site name (e.g., USGS 01671100 Little River near Doswell, VA), the type of calculations used (such as drainage area correction factors), and the period of record that was used to calculate the median flows provided in the table above. Generally, the period of record should span a minimum of 30 years.

N/A - See Attachment B

24. INTAKES, OUTFALLS, AND WATER CONTROL STRUCTURES (Continued)

For interbasin transfer of water resources proposed from either the Chowan River, New River, Potomac River, Roanoke River, Big Sandy River, or Tennessee River basins to another river basin, provide the following information:

Destination location (discharge point) of the transfer:
8-digit USGS Hydrologic Unit Code (HUC) (See http://cfpub.epa.gov/surf/locate/index.cfm): N/A
If known, indicate the 10-digit and 12-digit USGS HUCs (see http://dswcapps.dcr.virginia.gov/htdocs/maps/HUExplorer.htm):

N/A - See Attachment B

N/A - See Attachment B

Latitude and Longitude: _____- _____-_____/ _____-_____-_____

Provide any available historical low-flows at the intake or dam site.
N/A

Describe how the proposed withdrawal at the intake or dam site will impact stream flows in terms of rates, volumes, frequency, etc. (e.g., percent of the flow to be withdrawn, percent of withdrawal returned to the original source, etc.).
N/A

Describe how the withdrawal of water will vary over time. For example, will the withdrawal vary by the time of year, by the time of day, or by the time of week? Examples of projects that should describe variable withdrawals include, but are not limited to: power plant cooling withdrawals that increase and decrease seasonally; golf course irrigation; municipal water supply; nurseries; ski resorts that use water for snowmaking; and resorts with weekend or seasonal variations.
N/A

Provide the amount of water that will be lost due to consumptive use. For the purpose of this application, consumptive use means the withdrawal of surface waters without recycling of said waters to their source or basin of origin. Examples of consumptive uses are water that is evaporated in cooling towers or by other means in power plants; irrigation water (all types); residential water use that takes place outside of the home; and residential water use both inside and outside of homes for residences served by septic systems. Projects that propose a transfer of water from one river basin to another and/or localities that sell water to other jurisdictions, should document the portion of the withdrawal that is not returned to the originating watershed.

Proposed monthly consumptive volume (million gallons): N/A

Attach a map showing the *location* of the withdrawal and of the return of flow, and provide the *amount* of the return flow (million gallons).

APPENDIX C

Chesapeake Bay Preservation Act Information

Please answer the following questions to determine if your project is subject to the requirements of the Bay Act Regulations:

1. Is your project located within Tidewater Virginia? ☐ Yes ☑ No (See map on page 31) - If the answer is "no", the Bay Act requirements do not apply; if "yes", then please continue to question #2.

2. Please indicate if the project proposes to impact any of the following Resource Protection Area (RPA) features:

   ☐ Tidal wetlands,

   ☐ Nontidal wetlands connected by surface flow and contiguous to tidal wetlands or water bodies with perennial flow,

   ☐ Tidal shores,

   ☐ Other lands considered by the local government to meet the provisions of subsection A of 9VAC25-830-80 and to be necessary to protect the quality of state waters (contact the local government for specific information),

   ☐ A buffer area not less than 100 feet in width located adjacent to and landward of the components listed above, and along both sides of any water body with perennial flow.

If the answer to question #1 was "yes" and any of the features listed under question #2 will be impacted, compliance with the Chesapeake Bay Preservation Area Designation and Management Regulations is required. **The Chesapeake Bay Preservation Area Designation and Management Regulations** are enforced through locally adopted ordinances based on the Chesapeake Bay Preservation Act (CBPA) program. Compliance with state and local CBPA requirements mandates the submission of a ***Water Quality Impact Assessment (WQIA)*** for the review and approval of the local government. Contact the appropriate local government office to determine if a WQIA is required for the proposed activity(ies).

The individual localities, not the DEQ, USACE, or the Local Wetlands Boards, are responsible for enforcing the CBPA requirements and, therefore, local permits for land disturbance are not issued through this JPA process. **Approval of this wetlands permit does not constitute compliance with the CBPA regulations nor does it guarantee that the local government will grant approval for encroachments into the RPA that may result from this project.**

Notes for all projects in RPAs

Development, redevelopment, construction, land disturbance, or placement of fill within the RPA features listed above requires the approval of the locality and may require an exception or variance from the local Bay Act ordinance. Please contact the appropriate local government to determine the types of development or land uses that are permitted within RPAs.

Pursuant to 9VAC25-830-110, *on-site delineation of the RPA is required for all projects in CBPAs.* Because USGS maps are not always indicative of actual "in-field" conditions, they may not be used to determine the site-specific boundaries of the RPA.

Notes for shoreline erosion control projects in RPAs

Re-establishment of woody vegetation in the buffer will be required by the locality to mitigate for the removal or disturbance of buffer vegetation associated with your proposed project. Please contact the local government to determine the mitigation requirements for impacts to the 100-foot RPA buffer.

Pursuant to 9VAC25-830-140 5 a (4) of the Virginia Administrative Code, shoreline erosion projects are a permitted modification to RPAs provided that the project is based on the "best technical advice" and complies with applicable permit conditions. In accordance with 9VAC25-830-140 1 of the Virginia Administrative Code, the locality will use the information provided in this Appendix, in the project drawings, in this permit application, and as required by the locality, to make a determination that:

1. Any proposed shoreline erosion control measure is necessary and consistent with the nature of the erosion occurring on the site, and the measures have employed the "best available technical advice"
2. Indigenous vegetation will be preserved to the maximum extent practicable
3. Proposed land disturbance has been minimized
4. Appropriate mitigation plantings will provide the required water quality functions of the buffer (9VAC25-830-140 3)
5. The project is consistent with the locality's comprehensive plan
6. Access to the project will be provided with the minimum disturbance necessary.

Mountain Valley Pipeline Project

Standard JPA-NWP12 Pre-Construction Notification, Virginia

Attachment A: Project Location Information

September 2017

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1.1 Project Name 1
1.2 Counties in Project 1
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ATTACHMENT A: PROJECT LOCATION INFORMATION

1.0 PROJECT LOCATION INFORMATION

1.1 PROJECT NAME

Mountain Valley Pipeline (MVP)

1.2 COUNTIES IN PROJECT

The proposed Project will cross the boundaries of multiple localities in Virginia to include: Pittsylvania, Franklin, Roanoke, Montgomery, Craig, and Giles Counties. Figure 1 (Project Overview Map), attached, shows the project location in Virginia.

1.3 WATERBODIES CROSSED BY PROJECT

Waterbody crossing information can be located in Attachment G (Wetlands and Waterbodies Identification and Preliminary Jurisdictional Determination Request) and Attachment H (Wetlands and Waterbodies Impact Analysis and Compensatory Mitigation Plan).

1.4 PROJECT COORDINATES

Coordinates for the northern terminus of the Project in West Virginia are: 39.562436° N, 80.543057° W

Coordinates for the Project crossing from West Virginia to Virginia are: 37.402524° N, 80.689885° W

Coordinates for the southern terminus of the Project in Virginia are: 36.833476° N, 79.337114° W

1.5 DIRECTIONS TO SITE

Directions are provided from Roanoke, VA to the location of the pipeline crossing the VA state line in Giles County, VA:

- Take Exit 1S to merge into 1-81 S toward Salem/Bristol, go 25 miles.
- Take Exit 118C-B-A to merge onto US-460 W, go 14 miles. Keep left to stay on US-460 W, go 30 miles. Turn right onto State Route 643, go 3 miles.
- Continue onto Virginia Line Road
- Turn right onto Market Street
- Continue onto US-219 N/Seneca Trail S for 5 miles
- Turn right onto Wilson Mill Road, go approximately 2 miles

Directions are provided from Roanoke, VA to the location the terminus of the Project located in Pittsylvania County, VA:

- Take VA-116 S/Mt. Pleasant Boulevard SE for approximately 13 miles.
- Turn right onto VA-122 S
- Turn left onto State Route 670, go 5 miles.
- Turn right onto State Route 834, go 7.5 miles.
- Turn left onto Turtle Hill Road, go approximately 0.3 miles
- Turn left onto VA-40 E, go 16.5 miles
- Turn right onto Old Mine Road, go 1.5 miles.
- Turn left to stay on Old Mine Road, go 3.7 miles.
- Turn right onto US-29 S, go 4 miles
- Take the exit toward Chalk Level Road, turn left onto Chalk Level Road, go 2 miles
- Turn right onto Transco Road.

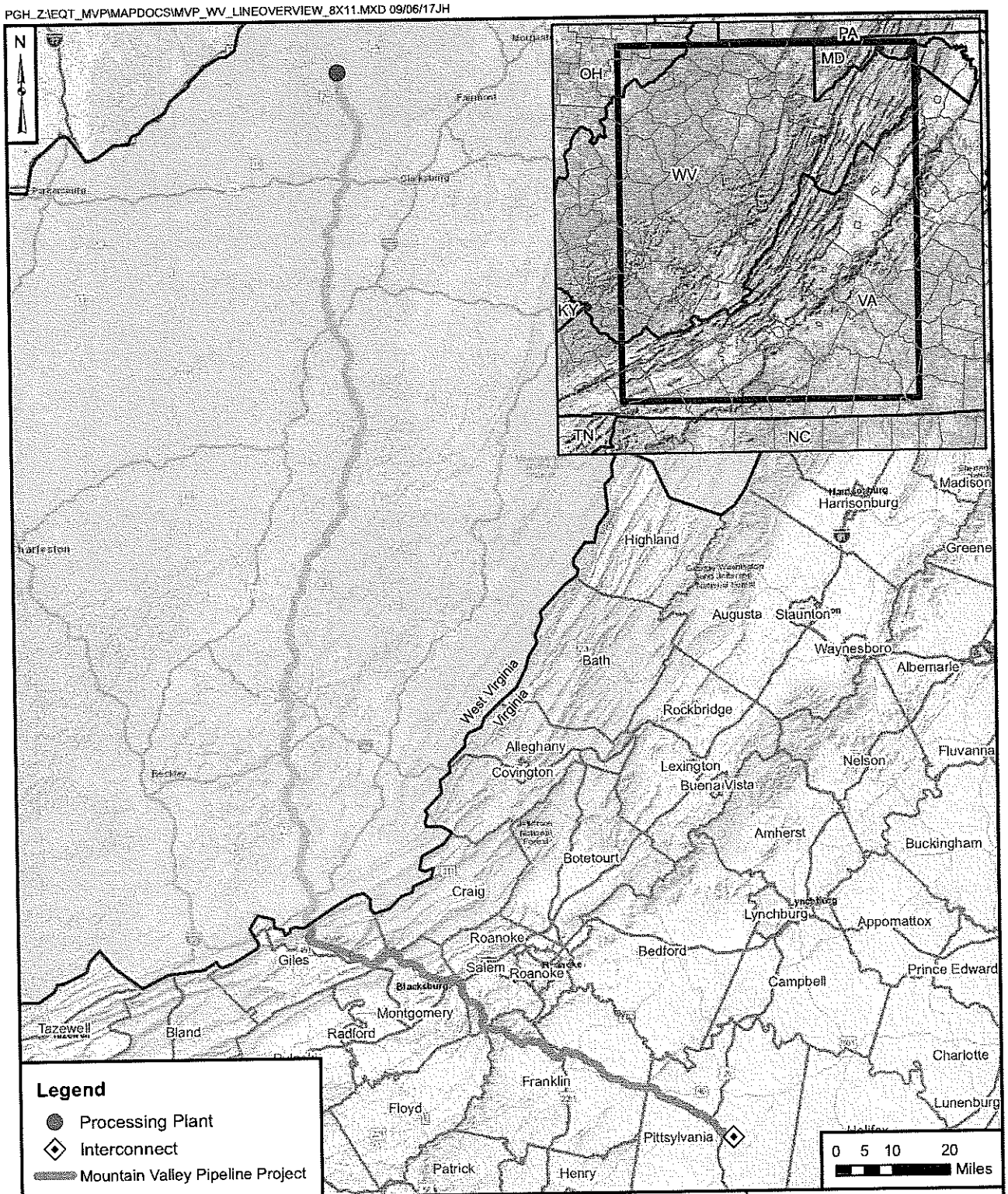
1.6 8-DIGIT AND 10-DIGIT USGS HYDROLOGIC UNIT CODES (HUCS) FOR COUNTIES IN PROJECT SITE

Virginia			
Major Region (2-digit HUC)	**Sub-Basin (8-digit HUC)**	**Watershed (10-digit HUC)**	**County**
Ohio Region (05)	Middle New (05050002)	Sinking Creek-New River (0505000203)	Craig, Giles, Montgomery
Mid-Atlantic Region (02)	Upper James (02080201)	Upper Craig Creek (0208020110)	Montgomery
Ohio Region (05)	Middle New (05050002)	East River-New River (0505000206)	Giles
	Upper Roanoke (03010101)	North Fork Roanoke River (0301010102)	Montgomery
	Upper Roanoke (03010101)	Mason Creek-Roanoke River (0301010103)	Montgomery, Roanoke
South Atlantic-Gulf Region (03)	Upper Roanoke (03010101)	South Fork Roanoke River (0301010101)	Montgomery, Roanoke
	Banister (03010105)	Upper Blackwater River (0301010105)	Franklin, Roanoke
	Banister (03010105)	Lower Blackwater River (0301010106)	Franklin
	Banister (03010105)	Upper Pigg River (0301010108)	Franklin
	Banister (03010105)	Lower Pigg River (0301010110)	Franklin, Pittsylvania
	Banister (03010105)	Stinking River-Banister River (0301010502)	Pittsylvania
	Banister (03010105)	Cherrystone Creek-Banister River (0301010501)	Pittsylvania

FIGURES

Figure 1 **Project Overview Map**

PGH_Z:\EQT_MVP\MAPDOCS\MVP_WV_LINEOVERVIEW_8X11.MXD 09/06/17JH



TETRA TECH

PROJECT OVERVIEW MAP

MOUNTAIN VALLEY PIPELINE PROJECT

WEST VIRGINIA - VIRGINIA

DRAWN BY: J. HERNING 09/06/2017
CHECKED BY: P. SMITH 09/06/17
APPROVED BY: H. SCHUMACHER 09/06/17

CONTRACT NUMBER: 112IC07157

FIGURE NUMBER	REV
1	0

Mountain Valley Pipeline Project

Standard JPA-NWP12 Pre-Construction Notification, Virginia

Attachment B: Description of Project

September 2017

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1.0 PROJECT PURPOSE AND NEED 1
2.0 PROJECT DESCRIPTION 1
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ATTACHMENT B: DESCRIPTION OF PROJECT

1.0 PROJECT PURPOSE AND NEED

The proposed Mountain Valley Pipeline Project (Project) is a new pipeline designed to transport up to 2.0 million dekatherms per day (MMDth/d) of natural gas from the Appalachian Basin to growing markets in the Mid-Atlantic and southeastern United States. As is described more fully in Section 1.2 Purpose and Need of the Projects of the *Mountain Valley Project and Equitrans Expansion Project Final Environmental Impact Statement* (June 2017) (FEIS), the general purpose of the Project is to provide timely, cost-effective access to supplies to meet the growing demand for natural gas for use by local distribution companies (LDCs), industrial users, and power generation facilities in the Mid-Atlantic, southeastern, and Appalachian markets. The Project will also provide the opportunity for unserved and underserved markets along the route to access natural gas supplies. For example, the routing of the project through the southwest Virginia area resulted in Roanoke Gas Company (Roanoke Gas) becoming a Project shipper and requesting a specific tap location to support its LDC system's growth and expansion. Roanoke Gas' involvement as a shipper and its site-specific delivery point are concrete evidence of MVP's purpose and need to provide opportunities for economic growth and development along the route of the Project.

A sizable portion of natural gas production growth is occurring in the Appalachian Basin shale region. Appalachian Basin shale gas production has increased from 2 billion cubic feet per day (Bcf/d) in 2010 to over 15 Bcf/d in July 2014. The Project will provide for transportation of these prolific natural gas supplies to Station 165, the pooling point for natural gas in Transco Zone 5 where this natural gas can serve the growing demand for natural gas for use by LDCs, industrial users, and power generation facilities all along the Eastern seaboard.

The overall purpose and need with respect to the single and complete projects included in this preconstruction notification are as follows: The purpose of the proposed projects is to construct a natural gas pipeline and associated infrastructure (including access roads) within the Virginia portion of the right-of-way approved by the Federal Energy Regulatory Commission (FERC) in a certificate of public convenience and necessity to be issued to the Mountain Valley Pipeline, in a timely, efficient, and cost-effective manner.

2.0 PROJECT DESCRIPTION

Mountain Valley Pipeline, LLC (MVP) is a joint venture between EQT Midstream Partners, LP and affiliates of NextEra US Gas Assets, LLC; Con Edison Gas Midstream, LLC; WGL Midstream; and RGC Midstream, LLC. MVP is proposing to construct and operate a pipeline approximately 303-miles in length and 42-inches in diameter in order to provide timely and affordable access to the growing demand for natural gas. Providing up to 2.0 MMDth/d, this pipeline will allow for the sale of natural gas to LDCs, industrial users, and power generation facilities in the Mid-Atlantic and southeastern markets, as well as other potential markets in the Appalachian region.

The proposed Project will span 11 counties in West Virginia and six counties in Virginia. The proposed pipeline route will begin at the existing Equitrans, L.P. transmission system near the Mobley processing facility in Wetzel County, West Virginia (WV) and extend to the Transco Zone 5 compressor station 165 in Transco Village, in Pittsylvania County, Virginia (VA). Approximately 107 miles of the Project pipeline and 57 miles of Project access roads are located within VA. In addition to the proposed pipeline, the Project will include the use of existing access roads, construction of new access roads, construction of three compressor stations along the route in WV, as well as the installation of other ancillary facilities that are required for the safe and reliable operation of the pipeline. The Project is located within three districts of the United States Army Corps of Engineers (USACE): USACE Norfolk District, USACE Huntington District, and USACE Pittsburgh District. Additional information is available within the FEIS that was prepared by the Federal Energy Regulatory Commission (FERC) and entered on FERC Docket CP16-10-000 in June 2017.

The information provided in this Standard Joint Permit Application (JPA)-Nationwide Permit (NWP) 12 Preconstruction Notification is an update to the Standard JPA-NWP 12 submitted to the USACE Norfolk District in February 2016.

In addition to this Standard JPA-NWP 12 update for the USACE Norfolk District, Pre-Construction Notifications (PCN) updates were submitted to the USACE Pittsburgh District and USACE Huntington District in February 2017 for portions of the proposed Project within these USACE districts.

3.0 SINGLE AND COMPLETE PROJECT DESCRIPTION

MVP submits this application for authorization under Nationwide Permit 12 (NWP 12) to conduct 537 crossings of wetlands and waters of the United States in Virginia. Each of these crossings is necessary for the construction of a natural gas transportation pipeline (i.e., a "utility line") or the construction of access roads for the construction and/or maintenance of the utility line. None of these crossings will result in the loss of greater than 1/2 acre of non-tidal waters or, in case of access roads, will impact greater than 1/3 acre of waters. Accordingly, each of these proposed crossings is a single and complete project eligible for coverage under NWP 12.

The Wetlands and Waterbodies Impact Overview Map (Attachment H-1) provides an overview map of all planned crossings, the Impact Detail Figures (Attachment H-3) shows the locations and impacts for all crossings, and Tables 2.2, 3.2 and 3.3 in Attachment H-2 provide the corresponding impact calculations and impacted feature characteristics.

4.0 HYDROSTATIC TESTING

A pipeline must be pressure tested after backfilling and before placing it into operation in order to establish the Maximum Allowable Operating Pressure (MAOP). Pressure testing may also be conducted on a pipe segment prior to lowering-in as directed by the Construction Supervisor. Pressure testing, or hydrostatic testing as it is called when the test is conducted with water, is often conducted while clean-up activities are on-going. MVP will obtain all water to conduct hydrostatic testing from municipal water sources. No surface water withdrawals are proposed for project use in Virginia.

Hydrostatic test water will be released to upland areas through an energy dissipating dewatering device in accordance with STD & SPEC 3.26 Dewatering Structure and Typical Construction Detail MVP-ES2 Pumped Water Filter Bag (Attachment H-4). The dewatering structures will be sized to accommodate the rate and volume of release. These activities will be monitored and regulated to prevent erosion and over pumping of the dewatering structures. Releases will be stopped when necessary to perform maintenance of the dewatering structures and ensure they remain in good working order. No hydrostatic test releases will occur directly to waterbodies, wetlands or other identified sensitive areas.

Because MVP does not intend to discharge any hydrostatic test water to waterbodies, the Project does not require coverage under a Virginia Pollutant Discharge Elimination System (VPDES) permit for this activity. Nevertheless, as an additional best management practice (BMP), all upland releases of hydrostatic test water will be conducted in accordance with the sampling, monitoring, and effluent limit conditions (pH of 6.0-9.0, no more than 15.0 mg/l petroleum hydrocarbons and 0.011 total residual chlorine) of the General VPDES Permit for Discharges from Petroleum Contaminated Sites, Groundwater Remediation, and Hydrostatic Tests, VAG83, 9 VAC 25-120-80, applicable to discharges of hydrostatic test water.

Mountain Valley Pipeline Project

Standard JPA-NWP12 Pre-Construction Notification, Virginia

Attachment C: USACE Field Verification Site Visits (2015-2017)

September 2017

Contents (Submitted Digitally):

Site Forms

Site Photos

Mapbooks

GIS Shapefiles

KMZ Site Locations

ATTACHMENT C: USACE FIELD VERIFICATION SITE VISITS (2015-2017)

The United States Army Corps of Engineers (USACE) field verified numerous delineated wetland and waterbody features during the 2015-2017 field season to verify wetland boundaries, wetland habitat types, and stream flow regimes of features identified by Tetra Tech, Inc. during wetland delineation and waterbody identification field surveys. The field verification site location, date of field visits, name of the features reviewed, and date of field visit verification package submittals are provided in Table 1. Site forms, site photos, mapbooks, GIS shapefiles, and KMZ mapping for the site location visits are provided digitally in Attachment C. The location of each site verification is presented on the Wetlands and Waterbodies Impact Overview Map (Attachment H-1). Attachments G-2 through G-5 present the results of wetlands delineation reports including the sites that were field verified by USACE.

TABLES

Table 1 USACE Field Verification Site Visits

Table 1
USACE Field Verification Site Visits

Site Number	Field Verification Package Submittal Date to USACE	Wetlands Reviewed	Streams Reviewed	County	Latitude	Longitude	Date Reviewed
Site 1	1/25/2016	W-D2 W-H4	S-H6	Pittsylvania	36.830906	-79.352352	07/31/15
Site 2	1/25/2016	W-OO1 W-H1 W-H2 W-H3 W-D1	S-H3 S-H4 S-H5	Pittsylvania	36.833773	-79.359240	07/31/15
Site 3	1/25/2016	W-G2 W-A1-PFO W-A1-PEM	S-G1 S-G2	Pittsylvania	36.851692	-79.387072	07/31/15
Site 4	1/25/2016	-	S-E5 S-E6 S-Q16	Pittsylvania	36.870446	-79.405807	07/31/15
Site 5	1/25/2016	W-Q1 W-Q2 W-DD2	S-Q1 S-Q2 S-Q3 S-Q4 S-Q5 S-Q6	Pittsylvania	36.884825	-79.428399	09/10/15
Site 6	1/25/2016	W-E3-PSS W-E3-PFO	S-E8 S-E9 S-E10	Pittsylvania	36.912168	-79.467574	07/31/15
Site 7	1/25/2016	W-H5	S-H13 S-H14	Pittsylvania	36.924943	-79.517240	09/10/15
Site 8	1/25/2016	W-A3	S-H7 S-A4	Pittsylvania	36.932020	-79.532852	07/31/15
Site 9	1/25/2016	-	S-C7 S-F1 S-F2	Pittsylvania	36.944058	-79.571485	07/31/15
Site 10	1/25/2016	N/A	S-H9 S-H10 S-H11 S-H12	Pittsylvania	36.949370	-79.579208	07/31/15
Site 11	1/25/2016	W-A5	S-A6	Pittsylvania	36.952175	-79.579942	07/31/15
Site 12	1/25/2016	W-B4-PEM W-B4-PSS	S-G8 S-Q15	Pittsylvania	36.957639	-79.583877	07/31/15
Site 13	1/25/2016	-	S-G11 S-G12	Pittsylvania	36.962427	-79.590506	09/10/15
Site 14	1/25/2016	-	S-D1	Pittsylvania	36.964413	-79.595833	09/10/15
Site 15	1/25/2016	-	S-D3 S-D4	Pittsylvania	36.965390	-79.605114	09/10/15
Site 16	1/25/2016	W-MM17	S-D7	Franklin	36.964847	-79.616985	09/10/15
Site 17	1/25/2016	W-B6	S-G15	Franklin	36.967385	-79.636405	09/09/15
Site 18	1/25/2016	W-H6	S-A7 S-H17 S-H18 S-H19	Franklin	36.972107	-79.662992	09/09/15
Site 19	1/25/2016	W-E4 W-II6	S-E14 S-E15	Franklin	36.995759	-79.735838	09/09/15
Site 20	1/25/2016	W-E5	S-E18 S-II5	Franklin	37.001184	-79.747732	09/09/15
Site 21	1/25/2016	W-DD1 W-A12	S-A41	Franklin	37.032281	-79.788112	09/09/15

Table 1
USACE Field Verification Site Visits

Site Number	Field Verification Package Submittal Date to USACE	Wetlands Reviewed	Streams Reviewed	County	Latitude	Longitude	Date Reviewed
Site 22	1/25/2016	W-GG2 W-A11	S-A38 S-A40 S-GG5	Franklin	37.036256	-79.799356	09/09/15
Site 23	1/25/2016	W-B20 W-B22	S-S8 S-S9 S-B15 S-B16 S-B17	Franklin	37.054399	-79.859754	09/09/15
Site 24	1/25/2016	-	S-C12	Franklin	37.068713	-79.922821	09/16/15
Site 25	1/25/2016	-	S-C23 S-C24 S-C25	Montgomery	37.254152	-80.267745	09/16/15
Site 26	1/25/2016	W-C8 W-C10 W-C11 W-C12	S-MM31 S-C32 S-C33 S-C36	Montgomery	37.257078	-80.281427	09/15/15
Site 27	1/25/2016	W-F8 W-F9-PEM W-F9-PFO	S-F15 S-F16A S-F16B	Montgomery	37.257932	-80.285622	09/15/15
Site 28	1/25/2016	W-QQ1	S-NN8A S-E36	Montgomery	37.267391	-80.326872	09/15/15
SITE 2a, 2b	4/21/2016	W-MM7 W-MM6 W-MM5 W-CC2 PFO&PEM	S-CC15 S-MM8 S-CC13 S-CC14	Pittsylvania	36.902991	-79.468234	04/05/16
SITE 3	4/21/2016	W-H11 W-A8 W-H10	S-H30 S-A18 S-A19 S-A20 S-A20-1	Franklin	36.987935	-79.700810	04/05/16
SITE 4	4/21/2016	W-II2 W-II3	S-II2 S-II3	Franklin	37.050118	-79.906987	04/05/16
SITE 6a, 6b	4/21/2016	W-D6 W-D7 W-D8	S-HH2 S-D13 S-D14 S-D17 S-HH3 S-D11	Franklin	37.122469	-80.078491	04/05/16

Table 1
USACE Field Verification Site Visits

Site Number	Field Verification Package Submittal Date to USACE	Wetlands Reviewed	Streams Reviewed	County	Latitude	Longitude	Date Reviewed
SITE 5	4/21/2016	W-E10 W-E7 W-E8 W-E9	S-E28 S-E31 S-E32 S-E34 S-E35 S-E33	Franklin	37.084573	-79.947195	04/06/16
SITE 9a, 9b	4/21/2016	-	S-E24	Giles	37.326389	-80.567473	04/06/16
SITE 10	4/21/2016	-	S-Z9 S-Z8 S-Z7	Giles	37.344031	-80.627300	04/06/16
SITE 1a, 1b	7/7/2016	W-MM15-PSS W-MM15-PFO W-H18-PSS W-H18-PFO W-KL7 W-GH15	S-KL15 S-KL16 S-KL18 S-H42 S-H44 S-H45 S-GH41 S-GH42 S-GH43	Pittsylvania	36.831381	-79.343161	06/23/16
SITE 2	7/7/2016	W-IJ22-PFO W-IJ22-PEM W-MM4	S-OO3 S-OO3	Pittsylvania	36.827557	-79.350407	06/23/16
SITE 4	7/7/2016	-	S-C1 S-C2	Pittsylvania	36.863543	-79.397929	06/23/16
SITE 9a, 9b	7/7/2016	W-II8	S-II7 S-II8 S-II9 S-II10 S-II11 S-II12	Franklin	37.091506	-79.989168	06/24/16
SITE 10	7/7/2016	-	S-RR8 S-RR9 S-RR10 S-RR11 S-RR12	Franklin	37.102501	-80.041036	06/24/16
SITE 11	7/7/2016	W-MM16 W-II4 W-II5	S-MM27 S-MM28 S-II4	Franklin	37.115752	-80.059748	06/24/16

Table 1
USACE Field Verification Site Visits

Site Number	Field Verification Package Submittal Date to USACE	Wetlands Reviewed	Streams Reviewed	County	Latitude	Longitude	Date Reviewed
SITE A	8/4/2016	W-EF6 W-IJ21	S-IJ25 S-IJ26	Pittsylvania	36.835035	-79.338866	07/18/16
SITE B	8/4/2016	W-B1 W-B2	S-B1	Pittsylvania	36.850661	-79.381797	07/18/16
SITE C	8/4/2016	W-F6 W-B15	S-B8 S-B9 S-B10 S-ZZ1 S-ZZ2	Pittsylvania	36.876826	-79.416000	07/18/16
SITE D	8/4/2016	-	S-MM10 S-CC11	Pittsylvania	36.895843	-79.452845	07/18/16
SITE E	8/4/2016	-	S-G6 S-G7	Pittsylvania	36.920816	-79.505889	07/18/16
SITE F	8/4/2016	W-B8 W-B9	-	Franklin	37.015318	-79.757815	07/19/16
SITE G	8/4/2016	W-B11	S-G21 S-G22 S-G23	Franklin	37.019702°	-79.761778	07/19/16
SITE H	8/4/2016	-	S-RR13 S-RR14 S-OO6 S-OO7	Montgomery	37.314378	-80.402012	07/19/16
SITE I	8/4/2016	-	S-Y2 S-Y3	Giles	37.331710	-80.583324	07/19/16
SITE J1, S-J2	8/4/2016	-	S-G29 S-G30	Giles	37.349291	-80.652839	07/19/16

Table 1
USACE Field Verification Site Visits

Site Number	Field Verification Package Submittal Date to USACE	Wetlands Reviewed	Streams Reviewed	County	Latitude	Longitude	Date Reviewed
JNF-1	9/7/2017	-	S-SS3 S-MN18 S-MN19	Giles	37.40025	-80.685449	07/06/17
JNF-2	9/7/2017	W-KL14	-	Giles	37.395901	-80.680461	07/06/17
JNF-3	9/7/2017	-	S-PP15	Giles	37.392641	-80.690075	07/06/17
JNF-4	9/7/2017	-	S-PP14	Giles	37.392792	-80.694208	07/06/17
JNF-5	9/7/2017	-	S-PP17	Giles	37.386779	-80.700461	07/06/17
JNF-6	9/7/2017	-	S-PP18	Giles	37.385523	-80.708752	07/06/17
JNF-7	9/7/2017	-	S-PP19	Giles	37.382171	-80.714019	07/06/17
JNF-8	9/7/2017	W-UU11 W-UU12	S-UU8 S-UU8-Braid S-UU9	Giles	37.380080	-80.720452	07/06/17
JNF-9	9/7/2017	-	S-HH16	Giles	37.376304	-80.725812	07/06/17
JNF-10	9/7/2017		S-MN17 S-MN17-Braid S-MN20	Giles	37.373939	-80.731807	07/06/17
JNF-11	9/7/2017	W-HH15, W-HH14	S-HH14 S-HH15	Giles	37.370769	-80.737187	07/06/17
JNF-12	9/7/2017	-	S-HH11 S-HH13	Giles	37.366228	-80.747620	07/06/17
JNF-13	9/7/2017	W-CD46	S-PP20 S-PP21	Montgomery	37.316594	-80.408742	07/07/17
Giles-10	9/7/2017	W-Z5 W-Z3	S-Z10 S-Z11 S-Z12 S-Z13 S-Z14	Giles	37.341748	-80.619287	07/07/17

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Attachment D: Public Notification

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1.1 Agency Public Notification Processes 1
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ATTACHMENT D: PUBLIC NOTIFICATION

1.0 PUBLIC NOTIFICATION

1.1 AGENCY PUBLIC NOTIFICATION PROCESSES

An extensive public notification and outreach process has been undertaken for the Project in accordance with the Federal Energy Regulatory Commission's (FERC) and Virginia Department of Environmental Quality's (DEQ) review processes. This process provided notification to all landowners potentially affected by the Project, as well as the general public.

On October 27, 2014, MVP filed a request to enter into the Commission's pre-filing environmental process for the Project. The FERC granted MVP's request on October 31, 2014, and established pre-filing Docket No. PF15-3-000. As part of the pre-filing process, MVP initially hosted 14 public open house meetings at various locations in West Virginia and Virginia between December 2014 and January 2015. The purpose of the open house meetings was to inform the public about the Project, and for company representatives to answer questions about the location of planned facilities. About 800 people attended those 14 open house meetings (Table 1).

On February 18, 2015, MVP filed several revisions to its planned pipeline routing. Accordingly, MVP held two additional open house meetings in April 2015 (Table 1) to inform the public and answer questions regarding these newly developed routes; about 200 people attended.

On April 17, 2015, the FERC issued a *Notice of Intent to Prepare an Environmental Impact Statement for the Planned Mountain Valley Pipeline Project, Request for Comments on Environmental Issues, and Notice of Public Scoping Meetings* (NOI). The NOI was published in the *Federal Register* and sent to the parties on FERC's environmental mailing list, which included federal and state resource agencies; elected officials; environmental groups and non-governmental organizations (NGO); Native American and Indian tribes; potentially affected landowners; local libraries and newspapers; and other stakeholders who had indicated an interest in the MVP.

FERC issued its Final Environmental Impact Statement (FEIS) for the Project on June 23, 2017. Notice of the FEIS was published in the Federal Register on June 29, 2017. FERC also sent copies of the FEIS all relevant parties, including potentially affected landowners.

DEQ has also engaged in a public notification process in accordance with its review of the Project under Clean Water Act § 401. Public notices were posted to DEQ's website and published in newspapers of general circulation along the Project route. DEQ hosted public hearings and meetings on the following dates: August 8, 2017 (Radford, VA); August 8, 2017 (Chatham, VA); August 10, 2017 (Newport, VA); August 10, 2017 (Roanoke, VA).

1.2 LIST OF AFFECTED LANDOWNERS

The List of Affected Landowners contains information that is customarily treated as privileged and confidential by FERC pursuant to 18 C.F.R. §388.112. MVP previously submitted this information to FERC as privileged and confidential and it has not heretofore been publicly disclosed. The list can be made available if necessary, but has not been included in this public submission.

TABLE

Table 1 **Open House Locations for the MVP Project**

Table 1 Open House Locations for the MVP Project

Date	Location
December 15, 2014	Hampton Inn Gretna/Alta Vista/Chatham; Gretna / VA
December 16, 2014	Harvester Performance Center; Rocky Mount / VA
December 17, 2014	Salem Civic Center; Salem / VA
December 18, 2014	Days Inn Blacksburg; Blacksburg / VA
January 12, 2015	Pearisburg Community Center; Pearisburg / VA
January 13, 2015	Lindside United Methodist Church; Lindside / WV
January 14, 2015	Summers County Courthouse; Hinton / WV
January 15, 2015	Rupert Community Center; Rupert / WV
January 20, 2105	Summersville Arena and Conference Center; Summersville / WV
January 21, 2015	Webster Springs Municipal Building; Webster Springs / WV
January 22, 2015	Burnsville Community Center; Burnsville / WV
January 26, 2015	Plantation Inn and Suites; Jane Lew / WV
January 27, 2015	Progressive Women's Association; Clarksburg / WV
January 28, 2015	Jacksonburg Fire Department; Jacksonburg / WV
April 6, 2015	Union Church of God; Union / WV
April 7, 2015	Craig County High School; New Castle / VA

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Attachment E: Threatened and Endangered Species and Sensitive Stream Resources

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1.0 THREATENED AND ENDANGERED SPECIES 1
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ATTACHMENT E: THREATENED AND ENDANGERED SPECIES AND SENSITIVE STREAM RESOURCES

1.0 THREATENED AND ENDANGERED SPECIES

MVP reviewed the United States Fish and Wildlife Service (USFWS) online Information for Planning and Conservation (IPaC) system and requested records of any known federally listed, state-listed, rare or special concern species within the Project area from the USFWS, Virginia Department of Conservation and Recreation (VDCR), and Virginia Department of Game and Inland Fisheries (VDGIF). Qualified biologists familiar with the Project area and sensitive species reviewed information provided by the agencies and developed a list of protected species that could potentially occur within the Project area. MVP submitted listed bat, plant, and freshwater mussel survey study plans detailing survey locations and methods to the agencies for their approval. Similar study plans for other taxonomic groups have been submitted as necessary following further coordination with federal and state agencies. Likewise concerns for twenty-two (22) migratory bird species identified were addressed via field surveys for selected species, and a Migratory Bird Conservation Plan. The Federal Energy Regulatory Commission (FERC) initiated formal consultation with the USFWS by submitting a Biological Assessment for the Project in July 2017. MVP anticipates formal consultation to be complete and the Biological Opinion issued in November 2017.

2.0 SENSITIVE STREAM RESOURCES

2.1 TROUT WATERS

The Virginia Department of Environmental Quality (VDEQ) has established a classification system for trout waters. There are two classes: Class V—Stockable trout waters and Class VI—Natural trout waters. The VDGIF has also established trout water classifications as follows: Classes i through iv rate wild trout habitat; Classes v through viii rate cold water habitat not suitable for wild trout but adequate for year-round hold-over of stocked trout. 9 VAC 25-260-370.B. The VDEQ and VDGIF trout classifications are listed in the Virginia Water Quality Standards, 9 VAC 25-260. Designated Trout Waters also are identified in a Geographic Information Systems (GIS) shapefile available on the VDEQ website (VDEQ 2017a), which has been used by MVP to identify trout streams.

There are eleven (11) Project crossings of wild and stockable trout waters (Attachment H Table 2.2 and Table 2.3). The VDGIF-recommended time-of-year restrictions for work in wild trout waters in the Cold Water Stream Survey database include October 1st through March 31st for Brown Trout (*Salmo trutta*) and Brook Trout (*Salvelinus fontinalis*), and March 15th through May 15th for Rainbow Trout (*Oncorhynchus mykiss*). There is no recommended time-of-year-restrictions for work in stockable trout streams; however, MVP will consult with the VDGIF regional offices prior to construction in stockable trout streams to avoid interfering with active stocking activities.

2.2 TIER III WATERS

The Commonwealth of Virginia further designates all surface waters within the Commonwealth into one of three levels, or tiers, of antidegradation protection as set forth by the Antidegradation Policy found in the Virginia Administrative Code, 9VAC25-260-30. Tier III waters are considered to be of exceptional quality and are designated by name within the administrative code and are identified on the Virginia Department of Environmental Quality website (VDEQ 2017b).

The Project does not cross any Tier III water segments.

2.3 Anadromous Fish Use Areas

VDGIF has identified stream reaches that are confirmed or potential migration pathways, spawning grounds, or nursery areas for anadromous fish (VDGIF 2017). The species included in the VDGIF Anadromous Fish Use Area database include alewife (*Alosa pseudoharengus*), blueback herring (*Alosa aestivalis*), American shad (*Alosa sapidissima*), hickory shad (*Alosa mediocris*), striped bass (*Morone saxatilis*), and some populations of yellow perch (*Perca flavescens*). Anadromous Fish Use Area boundaries were established at impediments or where habitat became unsuitable.

The Project does not cross any Anadromous Fish Use Areas.

2.4 Designated Critical Resource Waters

No Designated Critical Resource Waters, including the Chesapeake Bay National Estuarine Research Reserve, occur in the Project area.

3.0 Time of Year Restrictions for Construction

Per USACE Norfolk District NWP Regional Condition 6, the following time-of-year-restrictions will be followed for the stream crossing:

1. Natural Trout Streams - restrictions set forth by the VDGIF, October 1st through March 31st for Brown Trout (*Salmo trutta*) and Brook Trout (*Salvelinus fontinalis*), and March 15th through May 15th for Rainbow Trout (*Oncorhynchus mykiss*).
2. Stockable Trout Streams - there is no time of year restrictions for stockable trout; however, MVP will consult with the VDGIF regional offices before constructing in stockable trout streams.

Additional time-of-year restrictions will be observed for streams containing sensitive species, as specified in Table 4.6.1-2 of the FEIS.

4.0 REFERENCES

VDEQ (Virginia Department of Environmental Quality). 2017a. Virginia Department of Environmental Quality Office of Water Monitoring and Assessment. VEGIS Dataset. 2014_Integrated_WQ_Report_Rivers shapefile available at: http://www.deq.virginia.gov/ConnectWithDEQ/VEGIS/VEGISDatasets.aspx. File Date: 6/2016. File download: 6/2017

VDEQ (Virginia Department of Environmental Quality). 2017b. Exceptional State Waters (Tier III). Online at: http://www.deq.virginia.gov/Programs/Water/WaterQualityInformationTMDLs/WaterQualityStandards/ExceptionalStateWaters(TierIII).aspx.

VDGIF (Virginia Department of Game and Inland Fisheries). 2017. Anadromous Fish Use Areas. Shapefile available at: https://www.dgif.virginia.gov/gis/data/download/

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Attachment F: Historic Resources

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ATTACHMENT F: HISTORIC RESOURCES

MVP completed archaeological survey of approximately 98 percent of the direct area of potential effect for the Project facilities in Virginia. This includes the pipeline corridor and all ancillary facilities such as access roads, laydown yards, and extra workspace. Surveys for aboveground historic resources have been completed for the entire project. The Virginia Department of Historic Resources (VDHR) issued comments on the effects to National Register of Historic Places (NRHP) eligible and listed aboveground resources. The VDHR comments indicated that the Project will adversely impact five historic districts crossed by the Project (Big Stony Creek Historic District, Greater Newport Rural Historic District, Bent Mountain Rural Historic District, North Fork Valley Historic District, and Coles-Terry Rural Historic District). MVP has developed treatment plans to address the adverse impacts on these historic properties. Treatment plans have been submitted to the VDHR and consulting parties for comment. To date, impacts on eligible or listed archaeological sites have been avoided. The FERC is developing a Programmatic Agreement that will provide a process for completing survey on no access properties, if any, and that will include the treatment plans to address the adverse impacts on historic districts. MVP anticipates the Programmatic Agreement to be executed by mid-November 2017.

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Attachment G: Wetlands and Waterbodies Identification and Preliminary Jurisdictional Determination Request

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Contents:

G-1. Wetland and Waterbodies Survey Status and Preliminary Jurisdictional Determination (PJD) Request

G-2. Pittsylvania County Delineation

G-3. Franklin County Delineation

G-4. Montgomery and Roanoke Counties Delineation

G-5. Giles and Craig Counties Delineation

G-6. Desktop Evaluation of Unsurveyed Areas for Wetlands

GIS Shape Files and KMZ Files to be Submitted Digitally

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Attachment G-1: Wetlands and Waterbodies Survey Status and Preliminary Jurisdictional Determination (PJD) Request

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2.0 PRELIMINARY JURISDICTIONAL DETERMINATION REQUEST 1

ATTACHMENT G-1: WETLANDS AND WATERBODIES SURVEY STATUS AND PJD REQUEST

1.0 WETLANDS AND WATERBODIES SURVEY STATUS

The proposed Project is approximately 107 miles long within the USACE Norfolk District, with approximately 57 miles of proposed temporary and permanent access roads. Wetland delineation and Waters of the U.S. surveys were performed for approximately 106 miles of centerline and 56 miles of proposed access roads, leaving less than one mile of pipeline ROW and one half mile of proposed access roads unsurveyed within the USACE Norfolk District for the Mountain Valley Pipeline Project. The study area for the Project was limited to a 300-foot wide corridor for the proposed pipeline route, a 100-foot wide corridor for proposed access roads, and to the proposed limit of disturbance (LOD) for compressor stations, storage yards, and other ancillary facilities.

The results of the wetland and waterbody field survey are presented in the Aquatic Resource Reports (Attachments G-2 through G-5). While a majority of the Project has currently been surveyed for wetlands and waterbodies, field teams have not been granted access by landowners to less than one mile of pipeline ROW and one half mile of proposed access roads within the USACE Norfolk District. A desktop wetland and waterbody evaluation of these unsurveyed areas was conducted to evaluate the likely presence and approximate location of wetlands and waterbodies in order to estimate potential impacts until surveys can be conducted in these areas. Attachment G-6 describes the methodology and summarizes the results of the desktop evaluation.

2.0 PRELIMINARY JURISDICTIONAL DETERMINATION REQUEST

MVP is requesting a Preliminary Jurisdictional Determination (PJD) in the portion of the proposed Project located within the USACE Norfolk District. MVP is requesting a PJD for all wetlands and streams within the "Study Corridor-PJD Boundary" identified in the attached Aquatic Resource Reports (Attachment G-2 through G-5) for field-delineated features and in the desktop evaluation of unsurveyed areas (Attachment G-6) for desktop identified features. A USACE Norfolk District Pre-Application And/Or Jurisdictional Waters Determination Request Form for the Project is included in this attachment.

Norfolk District Regulatory Office Pre-Application And/Or Jurisdictional Waters Determination Request Form

NORFOLK DISTRICT REGULATORY OFFICE PRE-APPLICATION AND/OR JURISDICTIONAL WATERS DETERMINATION REQUEST FORM

This form is used when you want to determine if areas on your property fall under regulatory requirements of the U.S. Army Corps of Engineers (USACE). Please supply the following information and supporting documents described below. This form can be filled out online and/or printed and then mailed, faxed, or e-mailed to the Norfolk District. Submitting this request authorizes the US Army Corps of Engineers to field inspect the property site, if necessary, to help in the determination process. **THIS FORM MUST BE SIGNED BY THE PROPERTY OWNER TO BE CONSIDERED A FORMAL REQUEST.**

The printed form and supporting documents should be mailed to:

U.S. Army Corps of Engineers, Norfolk District
Regulatory Branch
803 Front Street
Norfolk, Virginia 23510-1096

Or faxed to (757) 201-7678

Or sent via e-mail to: CENAO.REG_ROD@usace.army.mil

Additional information on the Regulatory Program is available on our website at:
http://www.nao.usace.army.mil/
Please contact us at 757-201-7652 if you need any assistance with filling out this form.

Location and Information about Property to be subject to a Jurisdictional Determination:

1. Date of Request: 9/8/2017
2. Project Name: Mountain Valley Pipeline
3. City or County where property located: Giles, Craig, Montgomery, Roanoke, Franklin, & Pittsylvania Counties, Virginia
4. Address of property and directions (attach a map of the property location and a copy of the property plat): See Attachment A for directions to the site and project location map.
5. Coordinates of property (if known): Project crossing from WV to VA: 37.402524°N, 80.68988 W; Project southern terminus: 36.833476° N, 79.337114° W
6. Size of property in acres: 2,114 acres
7. Tax Parcel Number / GPIN (if available): See Table 2 of Attachment D.
8. Name of Nearest Waterway: See Table 2.2 and 2.3 of Attachment H, and Attachments G2-G6

9. Brief Description of Proposed Activity, Reason for Preapplication Request, and/or Reason for Jurisdictional Waters Determination Request:
   See Attachment B

10. Has a wetland delineation/determination been completed by a consultant or the Corps on the property previously? ☐ YES ☐ NO ☒ UNKNOWN

    If yes, please provide the name of the consultant and/or Corps staff and Corps permit number, if available:

Property Owner Contact Information:

Property Owner Name: See Table 2 in Attachment D
Mailing Address:
City: State: Zip:
Daytime Telephone:
E-mail Address:

If the person requesting the Jurisdictional Determination is **NOT** the Property Owner, please also supply the Requestor's contact information here:

Requestor Name: Mountain Valley Pipeline, LLC
Mailing Address: 555 Southpointe Blvd., Suite 200
City: State: Zip: Canonsburg, Pennsylvania 15317
Daytime Telephone: (724) 395-3931
E-mail Address: RCooper@eqt.com

Additionally, if you have any of the following information, please include it with your request: wetland delineation map, other relevant maps, drain tile survey, topographic survey, and/or site photographs.

CERTIFICATION: I am hereby requesting a preapplication consultation or jurisdictional waters and/or wetlands determination from the U.S. Army Corps of Engineers, for the property(ies) I have described herein. I agree to allow the duly authorized representatives of the Norfolk District Corps of Engineers and other regulatory or advisory agencies to enter upon the premises of the project site at reasonable times to evaluate inspect and photograph site conditions. This consent to enter the property is superior to, takes precedence over, and waives any communication to the contrary. For example, if the property is posted as "no trespassing" this consent specifically supercedes and waives that prohibition and grants permission to enter the property despite such posting. I hereby certify that the information contained in the Request for a Jurisdictional Determination is accurate and complete:

_____ _____
Property Owner's Signature Date

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Attachment G-6: Desktop Evaluation of Unsurveyed Areas for Wetlands and Waterbodies

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ATTACHMENT G-6: DESKTOP WETLAND EVALUATION OF UNSURVEYED AREAS

DESKTOP WETLAND EVALUATION OF UNSURVEYED AREAS

1.0 INTRODUCTION

The proposed Project is approximately 107 miles long within Virginia, with approximately 57 miles of proposed temporary and permanent access roads. Mountain Valley Pipeline, LLC (MVP) was able to conduct field surveys for wetlands and waterbodies on over 106 miles of pipeline route and 56 miles of proposed access roads, leaving less than one mile of pipeline ROW and one half mile of proposed access roads unsurveyed within Virginia (VA).

The results of the wetland and waterbody field survey are presented by county in the Aquatic Resource Reports in Attachment G2 – G5. While a significant majority of the Project has currently been surveyed for wetlands and waterbodies, field teams have not been able to access certain locations in Roanoke, Montgomery and Pittsylvania counties.

In areas where right-of-entry for physical survey was not granted, desktop methods were used to identify potential stream channels, waterbodies, and wetlands. These estimates allow for analysis of potential impacts to Waters of the U.S. until field surveys can be conducted in these areas.

2.0 METHODS

A desktop evaluation using available Geographic Information Systems (GIS) data was used to interpret site conditions and evaluate the likely presence and approximate locations of wetlands and waterbodies. Data used for this desktop review included:

- Virginia Based Mapping Program (VBMP) statewide aerial photography collected in 2011 at 1-foot resolution (VBMP 2011)
- Google Earth aerial imagery (current and historic aerial imagery) (Google Earth 2011)
- Light Detection and Ranging (LiDAR) survey data showing 2-foot topographic contours (project specific dataset)
- U.S. Geological Survey (USGS) 7.5-Minute Topographic Maps (USGS 2009)
- U.S. Fish and Wildlife Survey (USFWS) National Wetland Inventory (NWI) digital dataset (USFWS 2010)
- National Hydrography Dataset (NHD) digital dataset (USGS 2013)

The USACE requires the use of the procedures enumerated in the *USACE Wetland Delineation Manual (1987 Manual)* and the *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Eastern Mountains and Piedmont Region* (USACE Regional Supplement) for making jurisdictional determinations. According to the *1987 Manual*, an area is defined as a wetland if, under normal circumstances, it meets all three of the following criteria:

1. Predominance of hydrophytic vegetation (plants adapted for life in saturated soil conditions);
2. Hydric soils (soils formed under water, or in saturated conditions); and
3. Wetland hydrology (presence of inundated or saturated soils at some time during the growing season).

Evaluation of site conditions for likely wetland locations utilized the datasets listed above. NWI data was used to identify likely wetland locations in unsurveyed areas. Contours from 7.5 minute USGS maps and LiDAR were used to identify floodplains adjacent to channels, or concave areas where wetlands may naturally form. VBMP aerial imagery, arranged to display the near infrared band, referred to as color infrared (CIR), was used to identify any potential inundated, wet, or clayey areas. CIR imagery displays near infrared wavelengths as red and health vegetation reflects a lot of near infrared electromagnetic (USDA 2013). Dense vigorously growing vegetation will appear as an intense bright red color. Light red, magenta, or pink colors indicate slow-growing vegetation (mature evergreens, agricultural fields outside of growing season). Light pink colors indicate dead or dormant vegetation. Gray-tan to blue-green colors indicate clayey soils and light blue to pale colors indicate sediment-laden water. Dark blue and black colors indicate asphalt or deep water in larger rivers, lakes, and ponds. As a result, CIR imagery amplifies the differences between vegetation types making wetland vegetation easier to identify using desktop methods. Wetland type was determined from consideration of surrounding vegetation, landscape position, and profession judgment and defined using the Wetland and Deepwater Habitats Classification (Cowardin et al. 1979).

The evaluation of site conditions for likely channel and waterbody features primarily utilized VBMP aerial imagery, NHD dataset, and topographic contours from 7.5 minute USGS maps and LiDAR to identify potential stream channels that may exhibit regular water flow, typical of waters of the U.S. Regulatory authority over non-tidal waters extends to the "ordinary high water mark (OHWM) provided the jurisdiction is not extended by the presence of wetlands" (33 CFR Part 328.4); however, channel OHWM could not be mapped using desktop methods.

Stream flow duration (ephemeral, intermittent, or perennial), was estimated using professional experience, considering physical characteristics such as the prominence and width of the channel, size of the drainage basin, and position of the feature in the drainage basin. Consistent with CIR imagery, waterbodies appeared black and were easily distinguishable.

Upon review of the available GIS data, professional experience and judgement were used to identify likely stream channels, waterbodies, and areas likely to exhibit wetland characteristics on unsurveyed sites.

Desktop analysis occurred in Roanoke, Montgomery and Pittsylvania counties of Virginia, in areas of the MVP Project study area for which access was not granted or was otherwise inaccessible for conducting field surveys. This area represents less than one percent of the project area in the pipeline ROW and proposed access roads. Study area widths varied depending on the project feature (e.g., right-of-way, access road, etc.). In general, a 100ft-wide survey corridor was applied to access roads (50ft on each side of the centerline) and a 300ft-wide survey corridor was applied to the pipeline ROW (150ft on each side of the centerline).

3.0 RESULTS

Unsurveyed areas are shown on the Desktop Wetland and Stream Evaluation Detail Map attached. Each unsurveyed area is labeled with a unique name (e.g. Roanoke-US-1) and associated latitude and longitude. The map index inset shows the location of the unsurveyed areas in relationship to the associated Aquatic Resource Report detail maps showing field delineated wetlands and streams in the vicinity of the unsurveyed area. For example, on Page 1 of the Desktop Wetland and Stream Evaluation Detail Map the map inset shows the page number of the Desktop Wetland and Stream Evaluation Detail Map showing (Page 1) and the page number of associated map (Figure [Fig.] 4-8) in the Aquatic Resource Report for Montgomery and Roanoke Counties located in Attachment (Att.) G-4 that shows field delineated wetlands and waterbodies in the vicinity of unsurveyed areas Montgomery-US-1 and Roanoke-US-1.

The desktop evaluation identified four potential wetlands within the Project area, totaling approximately 0.4 acres (Table 1). An additional three streams were identified within the LOD, totaling 522 linear feet (Table 2). The Detail Maps attached show the wetlands and waterbodies identified during this desktop evaluation.

The results of this desktop evaluation only pertain to locations that have not yet been field verified; field verification of results will occur when wetland and waterbody survey permission is granted for inaccessible parcels. The Aquatic Resource Report will be updated as field surveys are completed for these areas.

REFERENCES

Cowardin, L. M., Carter, V., Golet, F. C., & LaRoe, E. T. 1979. Classification of wetlands and deepwater habitats of the United States. US Department of the Interior, US Fish and Wildlife Service.

Google Earth V 7.1.5.1557. 2011. Virginia: image date January 1, 2011. Common Wealth of Virginia 2015. http://www.earth.google.com. November 23, 2015.

U. S. Department of Agriculture (USDA). 2013. Four Band Digital Imagery: information sheet. Available online at: http://www.fsa.usda.gov/Internet/FSA_File/fourband_infosheet_2012.pdf. January 4, 2016.

U. S. Fish and Wildlife Service (USFWS). 2010. National Wetlands Inventory website. U.S. Department of the Interior, Fish and Wildlife Service, Washington, D.C. http://www.fws.gov/wetlands. January 4, 2016.

U.S. Geological Survey (USGS). 2009. Unites States Geological Survey Topographical Mapping. Available at: http//nmviewogc.cr.usgs.gov/viewer.htm.

U.S. Geological Survey (USGS). 2013. National Hydrography Geodatabase: The National Map viewer. Available online at: http://viewer.nationalmap.gov/viewer/nhd.html?p=nhd. January 4, 2016.

Virginia Based Mapping Program (VBMP). 2011. VBMP2011/VBMP2011_Infrared_WGS. False-color infrared, 200 scale, 1-foot ground sample distance (GSD) orthophotography. WGS 1984 Web Mercator (Auxiliary Sphere). Available online at: http://gismaps.vita.virginia.gov/arcgis/rest/services

TABLES

Table 1	Desktop Mapped Wetlands for Virginia
Table 2	Desktop Mapped Streams for Virginia

Table 1. Desktop Mapped Wetlands for Virginia

Wetland ID	County	Latitude[1]	Longitude[1]	Cowardin Class[2]	HGM[3]	Water Type[4]	Associated Waterbodies	Size (square feet) in survey area	Open/Closed Boundary[5]	Detail Map Page
TTVA-W-CD11	Montgomery	37.22866	-80.20044	PEM	RIVERINE	RPWWD	S-CD12	13,808	Open	4, 5
TTVA-W-300	Roanoke	37.14569	-80.13102	PSS	RIVERINE	RPWWD	TTVA-S-301	1,079	Closed	6
TTVA-W-301	Roanoke	37.14476	-80.13245	PEM	SLOPE	RPWWD	-	174	Closed	6
TTVA-W-307	Roanoke	37.128947	-80.130434	PEM	DEPRESSIONAL	NRPWW	S-B20	665	Closed	7
							Total Wetland Size	**15,726**		

Notes:

1 - In decimal degrees.

2 - PEM = Palustrine Emergent
- PSS = Palustrine Scrub-Shrub

3 - HGM = Hydrogeomorphic

4 - RPWWD = Wetlands directly abutting Relatively Permanent Waters (RPWs) that flow directly or indirectly into Traditional Navigable Waterways (TNWs)
- NRPWW = Wetlands adjacent to non-RPWs that flow directly or indirectly into TNWs

5 - Open=Wetland continues outside of survey area boundary
- Closed = Wetland does not continue outside of survey area boundary

Table 2. Desktop Mapped Streams for Virginia

Stream ID	NHD Stream Name[1]	County	Latitude[2]	Longitude[2]	Flow Regime	Water Type[3]	Linear Feet in Survey Area[4]	Detail Map Page
TTVA-S-CD12	UNT to South Fork Roanoke River	Montgomery	37.228776	-80.200445	Perennial	RPW	488	4, 5
TTVA-S-301	UNT to Mill Creek	Roanoke	37.145680	-80.130990	Perennial	RPW	17	6
TTVA-S-EF44	UNT to Bottom Creek	Roanoke	37.143100	-80.138910	Perennial	RPW	17	6
				Total Linear Feet			**522**	

Notes:

1 - For identified streams without a NHD (National Hydrography Dataset) name, the identified stream was given the name, "Unidentified Tributary (UNT)", of the first named receiving waterbody

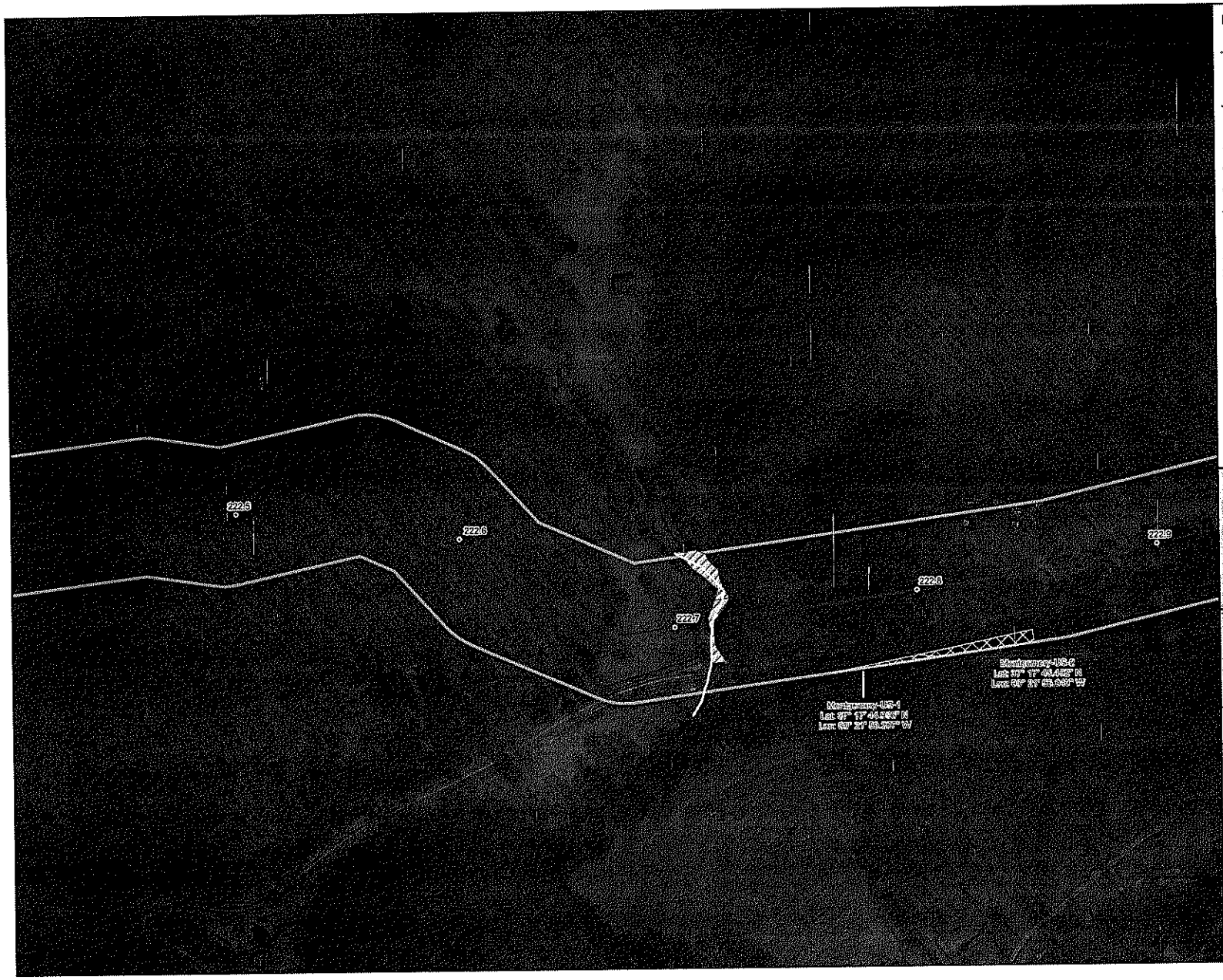
2 - In decimal degrees

3 - RPW = Relatively Permanent Waters
- NRPW = Non-Relatively Permanent Waters

4 - Survey area includes 300ft-wide ROW and 100ft-wide access road survey corridor

FIGURES

Desktop Wetland and Stream Evaluation Detail Map



Legend

- Study Area - Preliminary Jurisdictional Determination Boundary
- Mile Marker
- Unsurveyed Area
- Alignment Centerline
- County Boundary

Stream - Desktop Survey

- Perennial
- Intermittent
- Ephemeral

Stream Field Survey

Wetland - Desktop Survey

- PEM
- PSS
- PFO
- Pond

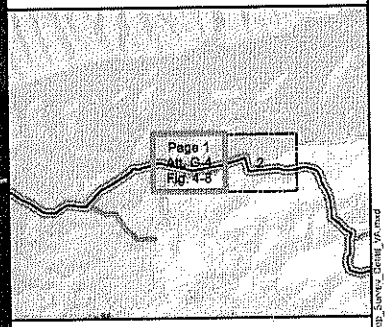
Wetland Field Survey

NAD 1983 UTM 17N

N W E S

1 in = 200 ft

0 100 200 300 400 Feet



Mountain Valley Pipeline Project

Mountain Valley PIPELINE

Detail Map
Desktop Wetland and Stream Evaluation

Attachment G-6, Page 1 of 8

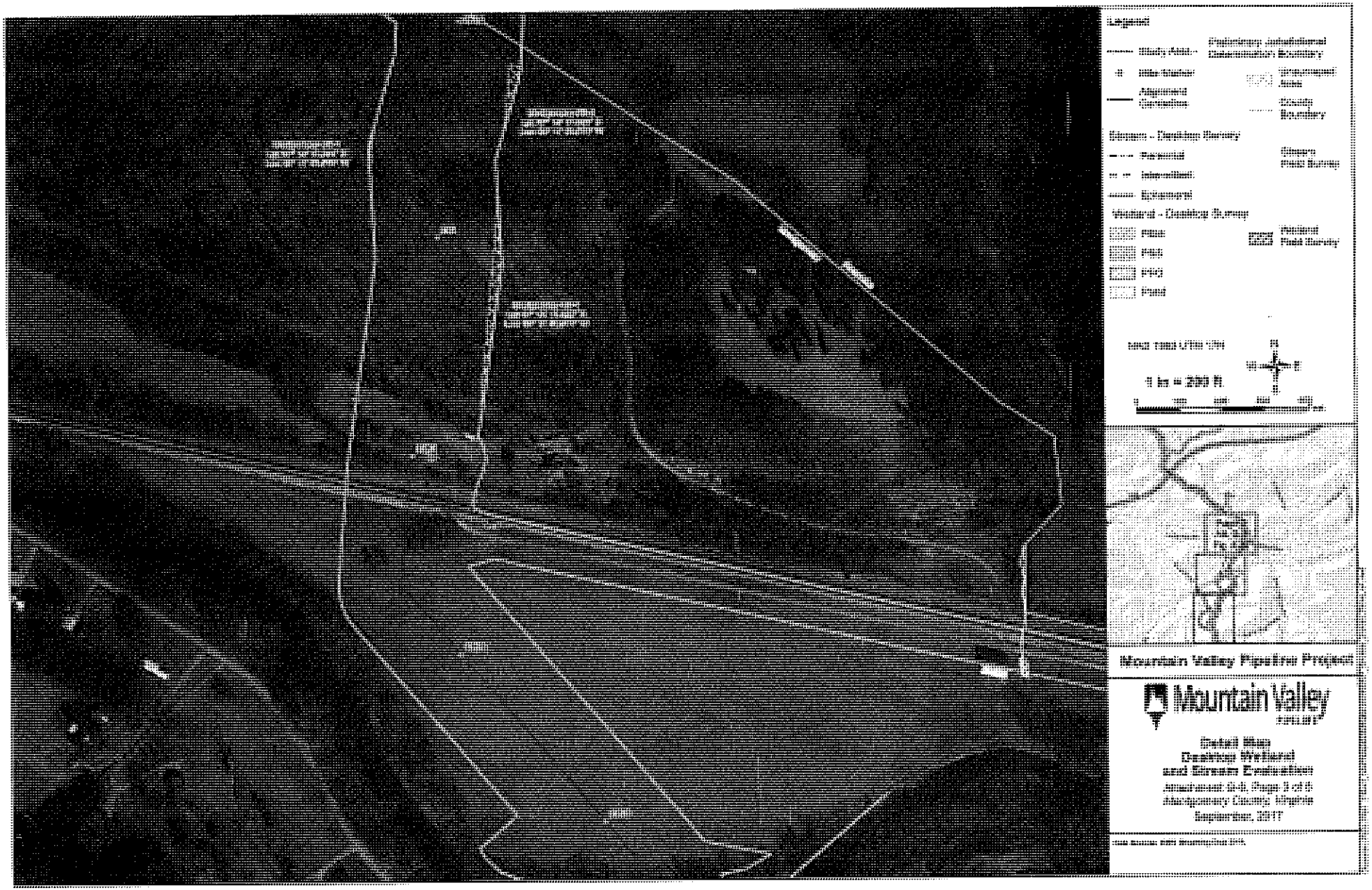
Montgomery County, Virginia

September, 2017

Data Sources: ESRI Streaming Data 2014.

Document Path: P:\GIS_MVP\Projects\Wetlands\MVP_Olympic_Survey_Detail_VA.mxd

Legend
Mountain Valley Pipeline Project
Mountain Valley
Detail Map
Desktop Wetland
and Stream Evaluation
Montgomery County, Virginia
September, 2017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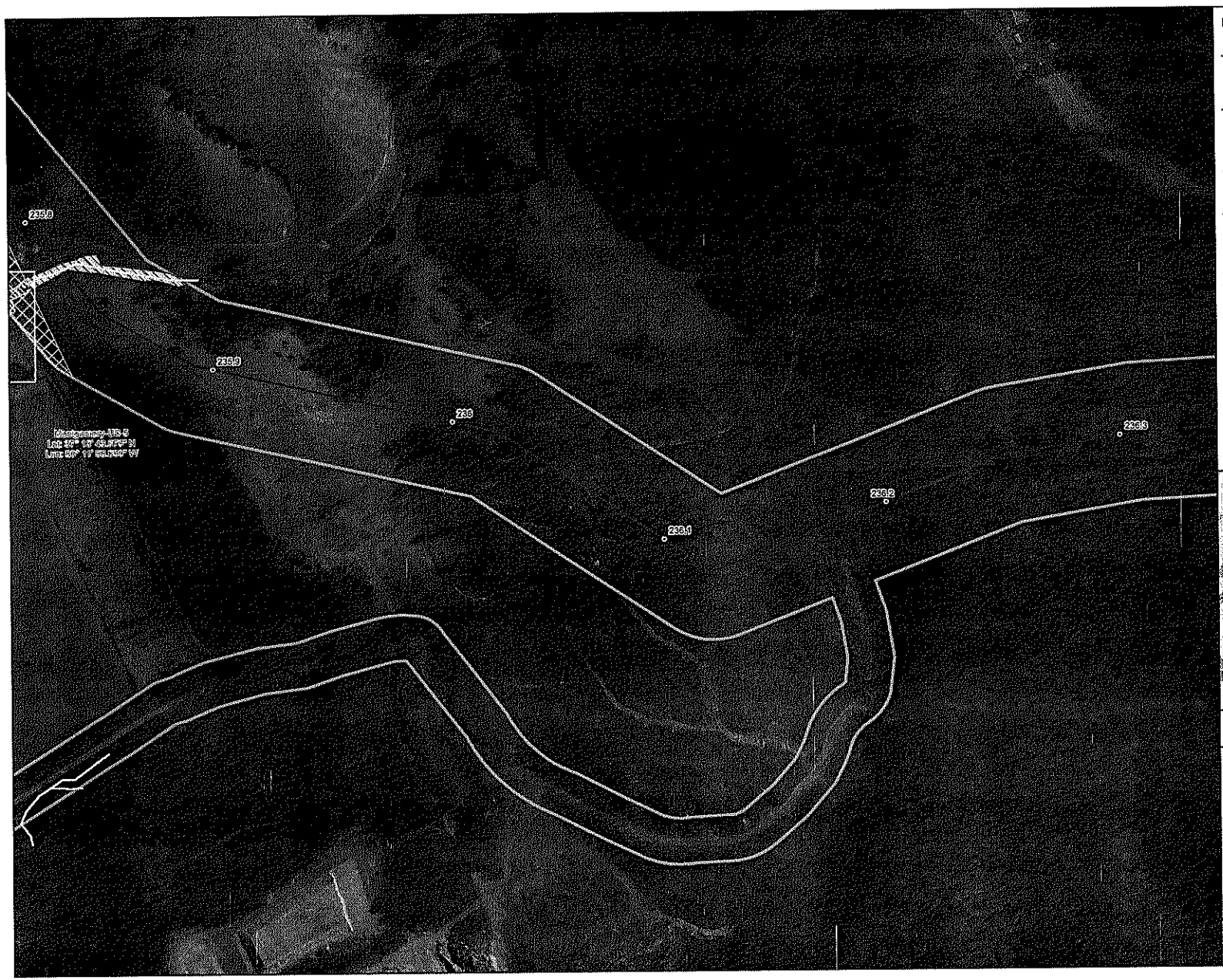
Study Area
Preliminary Jurisdictional Determination Boundary
Site Marker
Unsurveyed Area
Alignment Centerline
County Boundary
Stream - Desktop Survey
Perennial
Intermittent
Ephemeral
Stream Field Survey
Wetland - Desktop Survey
PSS
PFO
Field
Wetland Field Survey
1 in = 200 ft.
Mountain Valley Pipeline Project
Mountain Valley
Detail Map
Desktop Wetland
and Stream Evaluation
Attachment G-6, Page 3 of 6
Montgomery County, Virginia
September, 2017

Legend:
Mountain Valley Pipeline Project
Mountain Valley
Detail Map
September, 2017



Legend

Study Area - Preliminary Jurisdictional Determination Boundary

Mile Marker

Alignment Centerline

Unsurveyed Area

County Boundary

Stream - Desktop Survey

Perennial

Intermittent

Ephemeral

Stream Field Survey

Wetland - Desktop Survey

PEM

PSS

PFO

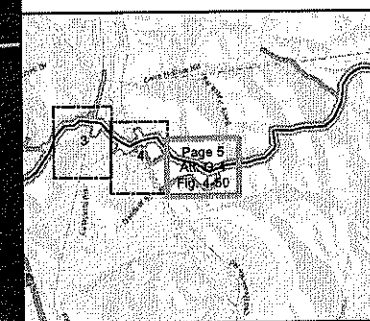
Pond

Wetland Field Survey

NAD 1983 UTM 17N

1 in = 200 ft

0 100 200 300 400 Feet



Mountain Valley Pipeline Project

Mountain Valley PIPELINE

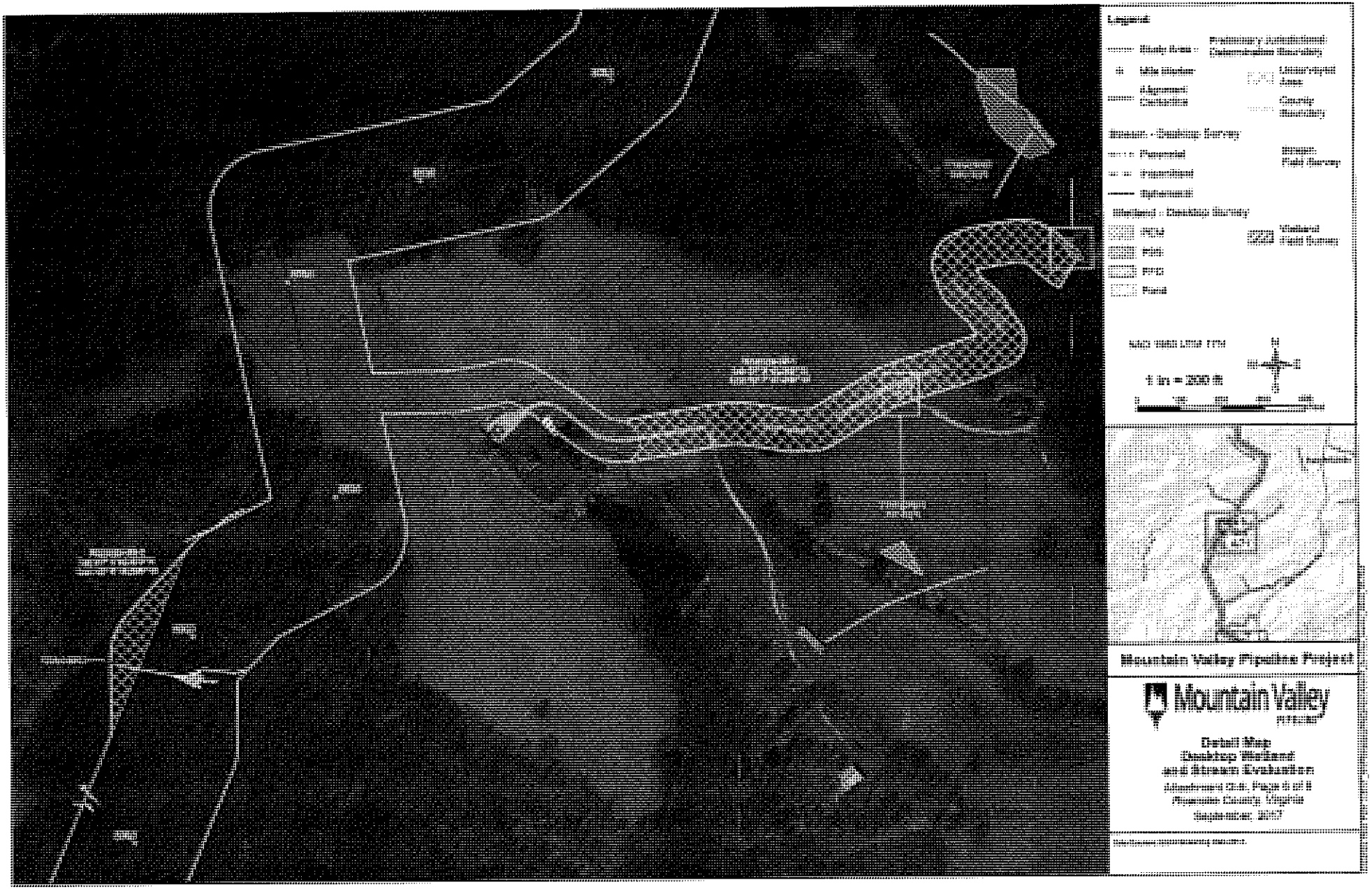
Detail Map
Desktop Wetland and Stream Evaluation

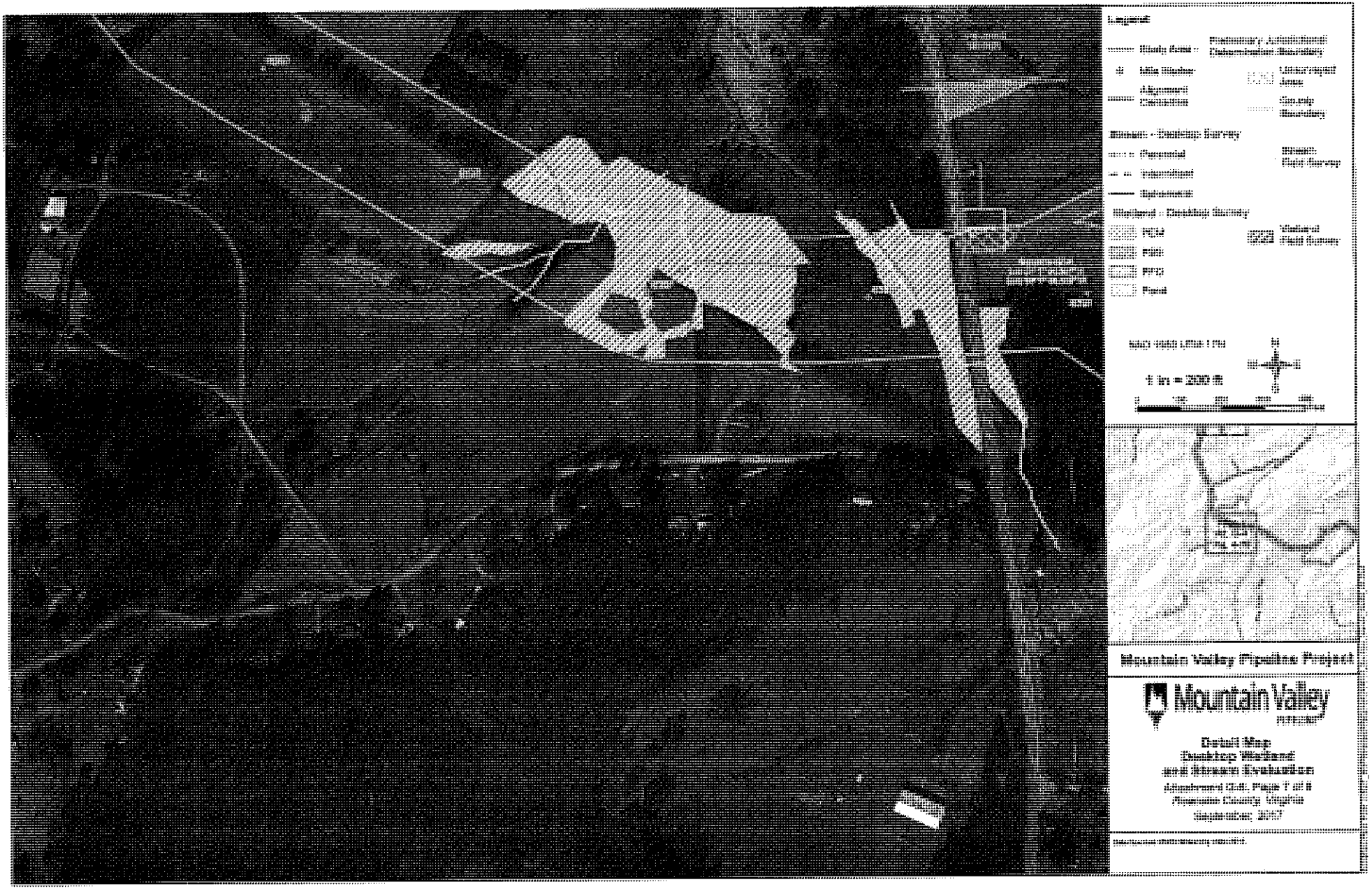
Attachment G-6, Page 5 of 8

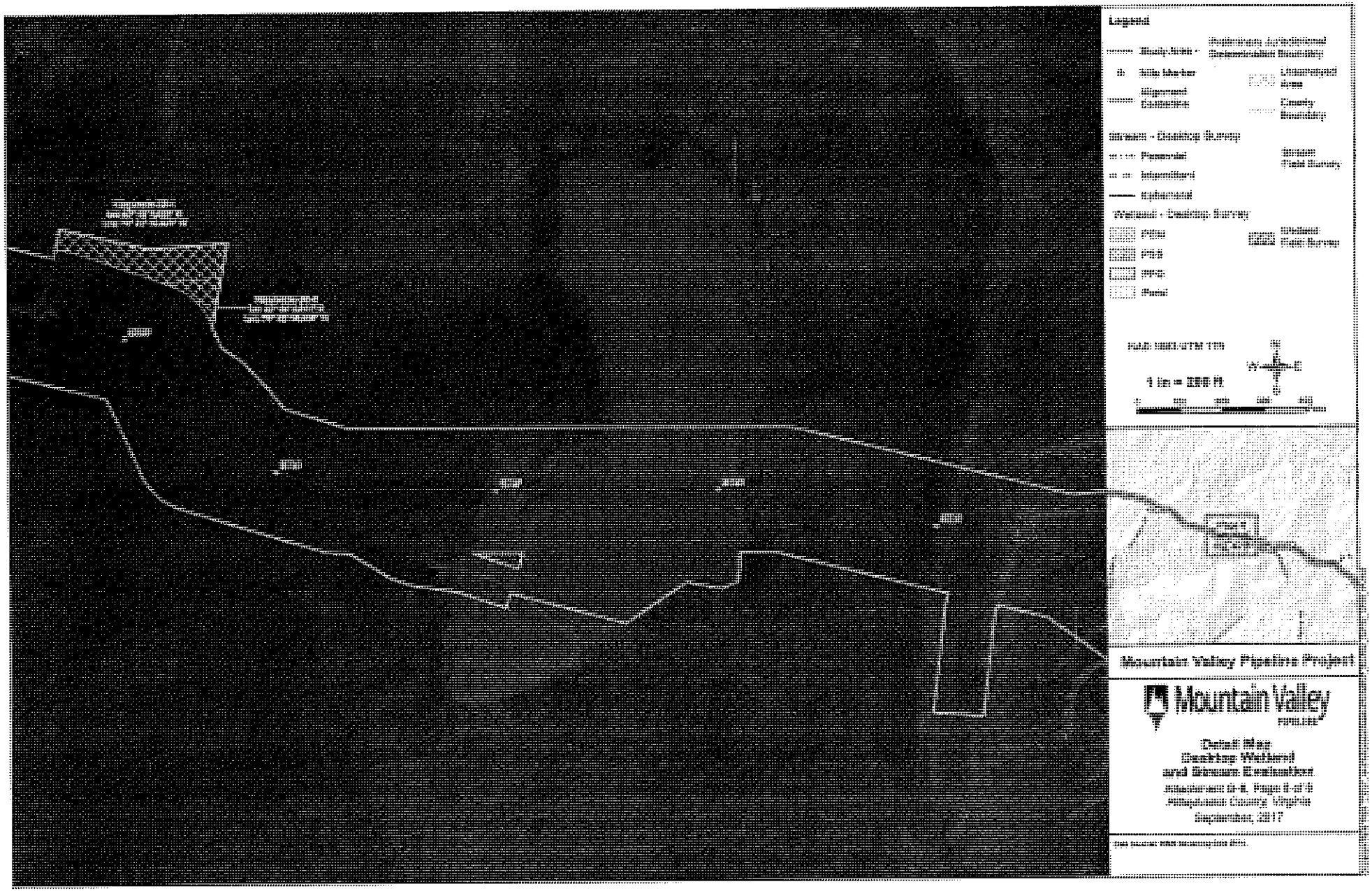
Montgomery County, Virginia

September, 2017

Data Sources: ESRI Streaming Data 2014.


Legend
Study Area
Preliminary Jurisdictional Determination Boundary
Mile Marker
Alignment Centerline
Unsurveyed Area
County Boundary
Stream - Desktop Survey
Perennial
Intermittent
Ephemeral
Stream Field Survey
Wetland - Desktop Survey
PEM
PSS
PFO
Pond
Wetland Field Survey
1 in = 200 ft
Mountain Valley Pipeline Project
Mountain Valley
Detail Map
Desktop Wetland
and Stream Evaluation
Pleasant County, Virginia


Legend
Mountain Valley Pipeline Project
Mountain Valley
Detail Map
Desktop Wetland
and Stream Evaluation
Franklin County, Virginia
September 2017


Legend
Mountain Valley Pipeline Project
Mountain Valley
Detail Map
Desktop Wetland
and Stream Evaluation
September, 2017

Mountain Valley Pipeline Project

Standard JPA-NWP12 Pre-Construction Notification, Virginia

Attachment H: Wetlands and Waterbodies Impact Analysis and Compensatory Mitigation Plan

September 2017

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H-1. Wetland and Waterbodies Impact Overview Map

H-2. Wetlands and Waterbodies Impact Analysis and Compensatory Mitigation Plan

H-3. Impact Detail Figures

H-4. Non-Virginia Marine Resource Commission (VMRC) Stream Plans and Cross Sections

H-5. Virginia Marine Resource Commission (VMRC) Stream Impact Plans and Cross Sections

Mountain Valley Pipeline Project

Standard JPA-NWP12 Pre-Construction Notification, Virginia

Attachment H-1: Wetlands and Waterbodies Impact Overview Map

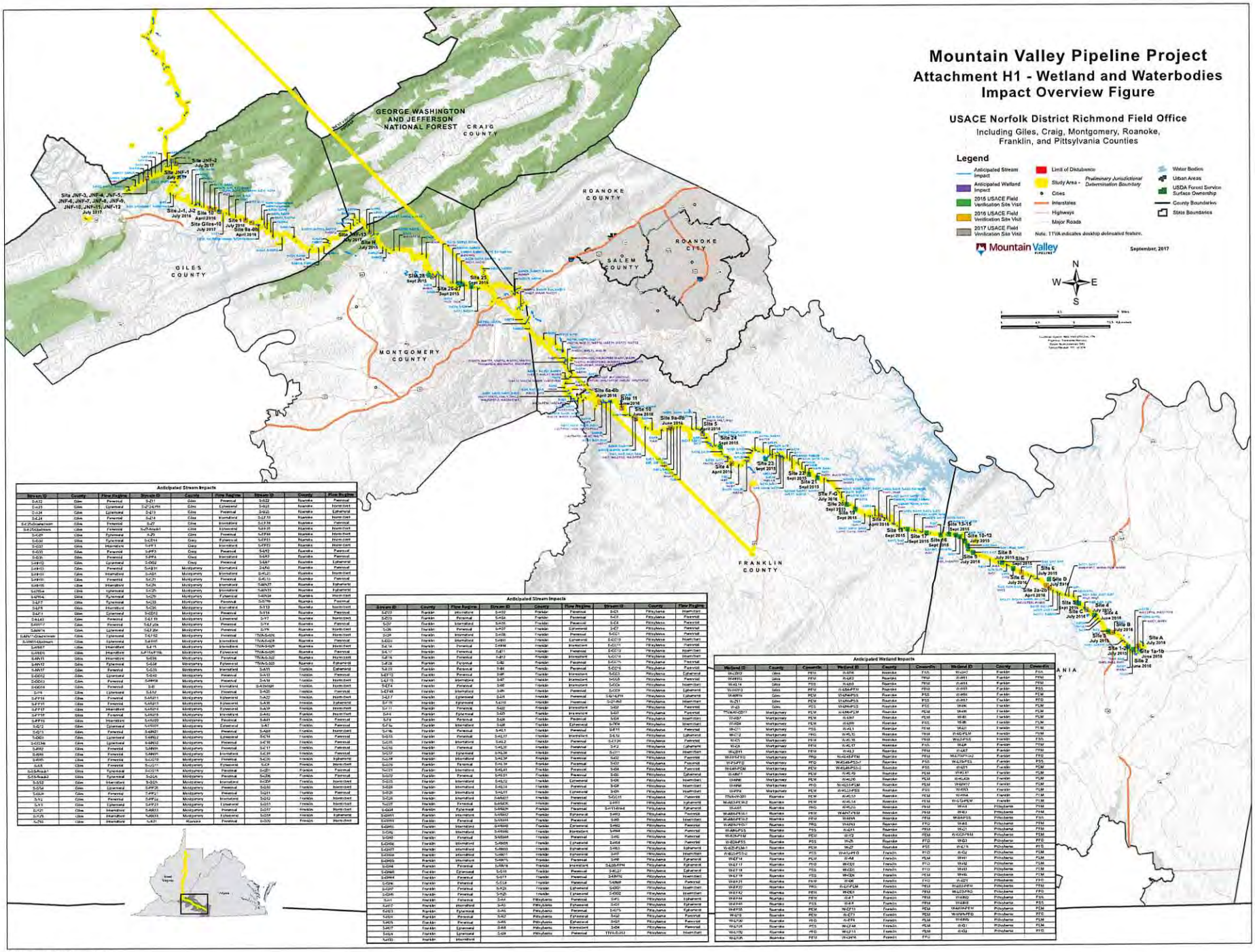
September 2017

Mountain Valley Pipeline Project

Attachment H1 - Wetland and Waterbodies Impact Overview Figure

USACE Norfolk District Richmond Field Office

Including Giles, Craig, Montgomery, Roanoke, Franklin, and Pittsylvania Counties



Anticipated Stream Impacts

Stream ID	County	Flow Regime	Stream ID	County	Flow Regime	Stream ID	County	Flow Regime
S-A32	Giles	Perennial	S-J21	Giles	Perennial	S-R22	Roanoke	Perennial
S-A33	Giles	Ephemeral	S-K21A-PH	Giles	Ephemeral	S-R23	Roanoke	Intermittent
S-A34	Giles	Ephemeral	S-J23	Giles	Perennial	S-R24	Roanoke	Ephemeral
S-A24	Giles	Perennial	S-J14	Giles	Intermittent	S-LF31	Roanoke	Intermittent
S-K7b-Downstream	Giles	Perennial	S-J7	Giles	Intermittent	S-LF34	Roanoke	Perennial
S-K7b-Upstream	Giles	Perennial	S-J7-Branch	Giles	Ephemeral	S-LF41	Roanoke	Intermittent
S-K29	Giles	Ephemeral	S-J25	Giles	Perennial	S-LF44	Roanoke	Intermittent
S-K30	Giles	Ephemeral	S-CF14	Craig	Ephemeral	S-LF51	Roanoke	Intermittent
S-K31	Giles	Intermittent	S-F11	Craig	Intermittent	S-LF52	Roanoke	Intermittent
S-K33	Giles	Perennial	S-F13	Craig	Perennial	S-LF12	Roanoke	Perennial
S-K35	Giles	Perennial	S-F14	Craig	Intermittent	S-LF13	Roanoke	Perennial
S-H112	Giles	Ephemeral	S-G02	Craig	Perennial	S-LF7	Roanoke	Ephemeral
S-H113	Giles	Perennial	S-G01	Montgomery	Intermittent	S-LF10	Roanoke	Perennial
S-H111	Giles	Intermittent	S-H31	Montgomery	Intermittent	S-LF11	Roanoke	Intermittent
S-H110	Giles	Perennial	S-K21	Montgomery	Perennial	S-LF15	Roanoke	Perennial
S-H115	Giles	Intermittent	S-K24	Montgomery	Intermittent	S-LN17	Roanoke	Ephemeral
S-H116a	Giles	Ephemeral	S-K25	Montgomery	Intermittent	S-LN131	Roanoke	Ephemeral
S-H114	Giles	Ephemeral	S-K26	Montgomery	Ephemeral	S-LN134	Roanoke	Intermittent
S-J17	Giles	Ephemeral	S-K33	Montgomery	Perennial	S-STR6	Roanoke	Perennial
S-J16	Giles	Intermittent	S-K36	Montgomery	Intermittent	S-T13	Roanoke	Intermittent
S-J11	Giles	Ephemeral	S-K012	Montgomery	Perennial	S-T14	Roanoke	Perennial
S-J14a1	Giles	Perennial	S-K119	Montgomery	Ephemeral	S-T7	Roanoke	Intermittent
S-H117	Giles	Perennial	S-K1-pole	Montgomery	Perennial	S-T4	Roanoke	Perennial
S-H117A	Giles	Ephemeral	S-K1-BK	Montgomery	Perennial	S-T5	Roanoke	Intermittent
S-H117-Downstream	Giles	Ephemeral	S-K142	Montgomery	Intermittent	TRANS-S-N1	Roanoke	Intermittent
S-H117-Upstream	Giles	Ephemeral	S-K141	Montgomery	Intermittent	TRANS-S-N2	Roanoke	Intermittent
S-H107	Giles	Intermittent	S-K15	Montgomery	Intermittent	TRANS-S-N3	Roanoke	Intermittent
S-H101	Giles	Intermittent	S-F-Trib11b	Montgomery	Ephemeral	TRANS-S-N4	Roanoke	Perennial
S-H111	Giles	Intermittent	S-K06	Montgomery	Perennial	TRANS-S-N5	Roanoke	Intermittent
S-H112	Giles	Ephemeral	S-K3F	Montgomery	Ephemeral	TRANS-S-N6	Roanoke	Ephemeral
S-H117	Giles	Perennial	S-K3b	Montgomery	Intermittent	S-N11	Franklin	Ephemeral
S-K012	Giles	Ephemeral	S-K40	Montgomery	Perennial	S-N12	Franklin	Perennial
S-K013	Giles	Perennial	S-K41B	Montgomery	Perennial	S-N13	Franklin	Intermittent
S-K014	Giles	Perennial	S-K1	Montgomery	Intermittent	S-N10-NP	Franklin	Intermittent
S-K1	Giles	Perennial	S-L12	Montgomery	Perennial	S-N7	Franklin	Perennial
S-F11A	Giles	Perennial	S-N121	Montgomery	Intermittent	S-N7-Branch	Franklin	Ephemeral
S-F11B	Giles	Perennial	S-N121	Montgomery	Ephemeral	S-N8	Franklin	Intermittent
S-F11T	Giles	Intermittent	S-N114	Montgomery	Intermittent	S-N9	Franklin	Intermittent
S-F11P	Giles	Perennial	S-N115	Montgomery	Intermittent	S-N2	Franklin	Perennial
S-F11B	Giles	Intermittent	S-N123	Montgomery	Perennial	S-N1	Franklin	Perennial
S-G12	Giles	Ephemeral	S-N117	Montgomery	Intermittent	S-N4	Franklin	Perennial
S-G13	Giles	Perennial	S-N82	Montgomery	Perennial	S-N5	Franklin	Perennial
S-G60	Giles	Ephemeral	S-N82	Montgomery	Perennial	S-C17	Franklin	Perennial
S-G53a	Giles	Ephemeral	S-N82	Montgomery	Perennial	S-C16	Franklin	Perennial
S-R92	Giles	Perennial	S-N81	Montgomery	Perennial	S-C17	Franklin	Perennial
S-R91	Giles	Perennial	S-N81	Montgomery	Intermittent	S-C18	Franklin	Perennial
S-R95	Giles	Perennial	S-C019	Montgomery	Perennial	S-C20	Franklin	Ephemeral
S-K4	Giles	Perennial	S-C011	Montgomery	Perennial	S-C9	Franklin	Intermittent
S-G3-Road1	Giles	Ephemeral	S-C015	Montgomery	Perennial	S-C21	Franklin	Perennial
S-G3-Road2	Giles	Ephemeral	S-C24	Montgomery	Perennial	S-C26	Franklin	Perennial
S-S32	Giles	Intermittent	S-S03	Montgomery	Intermittent	S-C27	Franklin	Intermittent
S-S34	Giles	Ephemeral	S-PF28	Montgomery	Perennial	S-S10	Franklin	Intermittent
S-S35	Giles	Perennial	S-PF21	Montgomery	Perennial	S-S11	Franklin	Perennial
S-Y2	Giles	Perennial	S-PF24	Montgomery	Intermittent	S-S12	Franklin	Intermittent
S-Y3	Giles	Ephemeral	S-PF27	Montgomery	Ephemeral	S-S13	Franklin	Intermittent
S-Y21	Giles	Intermittent	S-R83	Montgomery	Perennial	S-S17	Franklin	Intermittent
S-Y25	Giles	Intermittent	S-R93	Montgomery	Ephemeral	S-S14	Franklin	Ephemeral
S-Y6	Giles	Intermittent	S-R31	Roanoke	Perennial	S-S15	Franklin	Intermittent

Anticipated Stream Impacts

Stream ID	County	Flow Regime	Stream ID	County	Flow Regime	Stream ID	County	Flow Regime
S-C10	Franklin	Intermittent	S-H32	Franklin	Perennial	S-E3	Pittsylvania	Intermittent
S-C13	Franklin	Perennial	S-H34	Franklin	Perennial	S-C2	Pittsylvania	Perennial
S-C7	Franklin	Intermittent	S-H35	Franklin	Perennial	S-C4	Pittsylvania	Perennial
S-C8	Franklin	Perennial	S-H37	Franklin	Ephemeral	S-C7	Pittsylvania	Perennial
S-C9	Franklin	Intermittent	S-H38	Franklin	Perennial	S-C21	Pittsylvania	Perennial
S-C22	Franklin	Intermittent	S-H41	Franklin	Ephemeral	S-C23	Pittsylvania	Intermittent
S-C14	Franklin	Perennial	S-H44	Franklin	Intermittent	S-C11	Pittsylvania	Perennial
S-C15	Franklin	Perennial	S-E11	Franklin	Perennial	S-C12	Pittsylvania	Intermittent
S-C16	Franklin	Perennial	S-E12	Franklin	Intermittent	S-C14	Pittsylvania	Intermittent
S-C20	Franklin	Perennial	S-E2	Franklin	Perennial	S-C25	Pittsylvania	Perennial
S-C21	Franklin	Perennial	S-E1	Franklin	Perennial	S-C26	Pittsylvania	Perennial
S-E7-2	Franklin	Intermittent	S-E7	Franklin	Intermittent	S-C29	Pittsylvania	Ephemeral
S-E7-1	Franklin	Perennial	S-E8	Franklin	Perennial	S-C28	Pittsylvania	Perennial
S-E7-3	Franklin	Perennial	S-E9	Franklin	Perennial	S-C30	Pittsylvania	Intermittent
S-E7-4	Franklin	Intermittent	S-E10	Franklin	Intermittent	S-C31	Pittsylvania	Ephemeral
S-E7-5	Franklin	Intermittent	S-E11	Franklin	Perennial	S-C32	Pittsylvania	Ephemeral
S-E7-6	Franklin	Perennial	S-E12	Franklin	Intermittent	S-C33	Pittsylvania	Intermittent
S-E7-7	Franklin	Ephemeral	S-E13	Franklin	Perennial	S-C34	Pittsylvania	Intermittent
S-F15	Franklin	Ephemeral	S-E14	Franklin	Perennial	S-C01-NP	Pittsylvania	Intermittent
S-F11	Franklin	Perennial	S-E2	Franklin	Intermittent	S-D2	Pittsylvania	Perennial
S-F4	Franklin	Ephemeral	S-E5	Franklin	Intermittent	S-D3	Pittsylvania	Perennial
S-F3	Franklin	Perennial	S-E6	Franklin	Perennial	S-D4	Pittsylvania	Intermittent
S-F5a	Franklin	Intermittent	S-E8	Franklin	Ephemeral	S-D6	Pittsylvania	Intermittent
S-F5b	Franklin	Perennial	S-F13	Franklin	Perennial	S-F11	Pittsylvania	Perennial
S-G15	Franklin	Perennial	S-E17	Franklin	Intermittent	S-E10	Pittsylvania	Ephemeral
S-G16	Franklin	Intermittent	S-E2	Franklin	Perennial	S-E12	Pittsylvania	Perennial
S-G26	Franklin	Perennial	S-E21	Franklin	Perennial	S-F2	Pittsylvania	Ephemeral
S-G32	Franklin	Ephemeral	S-E23	Franklin	Perennial	S-G01	Pittsylvania	Intermittent
S-G19	Franklin	Intermittent	S-E24	Franklin	Perennial	S-G2	Pittsylvania	Perennial
S-G20	Franklin	Perennial	S-E31	Franklin	Perennial	S-G3	Pittsylvania	Perennial
N-G21	Franklin	Intermittent	S-E41	Franklin	Perennial	S-G4	Pittsylvania	Perennial
S-G22	Franklin	Perennial	S-E51	Franklin	Perennial	S-G5	Pittsylvania	Ephemeral
S-G23	Franklin	Intermittent	S-E52	Franklin	Ephemeral	S-G6	Pittsylvania	Intermittent
S-G24	Franklin	Intermittent	S-E53	Franklin	Perennial	S-G8	Pittsylvania	Intermittent
S-G25	Franklin	Intermittent	S-E54	Franklin	Ephemeral	S-G9	Pittsylvania	Intermittent
S-G28	Franklin	Intermittent	S-N027	Franklin	Perennial	S-G011	Pittsylvania	Perennial
S-G27	Franklin	Perennial	S-N028	Franklin	Perennial	S-H1	Pittsylvania	Ephemeral
S-G04	Franklin	Ephemeral	S-H020	Franklin	Perennial	S-H1-Road	Pittsylvania	Ephemeral
S-G04H1	Franklin	Intermittent	S-H002	Franklin	Ephemeral	S-H3	Pittsylvania	Perennial
S-G04H2	Franklin	Perennial	S-H004	Franklin	Perennial	S-H5	Pittsylvania	Intermittent
S-G05	Franklin	Intermittent	S-H006	Franklin	Ephemeral	S-H6	Pittsylvania	Perennial
S-G05H1	Franklin	Intermittent	S-H006	Franklin	Intermittent	S-H9A	Pittsylvania	Perennial
S-G06	Franklin	Perennial	S-H008	Franklin	Perennial	S-H8	Pittsylvania	Perennial
S-G06E	Franklin	Intermittent	S-H009	Franklin	Ephemeral	S-H14	Pittsylvania	Perennial
S-G06T	Franklin	Intermittent	S-H010	Franklin	Ephemeral	S-H13	Pittsylvania	Ephemeral
S-G06W	Franklin	Intermittent	S-H011	Franklin	Ephemeral	S-H7	Pittsylvania	Intermittent
S-G06G	Franklin	Intermittent	S-H015	Franklin	Perennial	S-H9	Pittsylvania	Ephemeral
S-G04	Franklin	Perennial	S-H014	Franklin	Intermittent	S-H35-FPH	Pittsylvania	Ephemeral
S-G04H	Franklin	Ephemeral	S-G16	Franklin	Perennial	S-H1-2	Pittsylvania	Ephemeral
S-G04H4	Franklin	Perennial	S-G17	Franklin	Perennial	S-H4-FN	Pittsylvania	Intermittent
S-G04L	Franklin	Perennial	S-G14	Franklin	Perennial	S-H9P	Pittsylvania	Perennial
S-G07	Franklin	Perennial	S-H23	Franklin	Ephemeral	S-G02	Pittsylvania	Intermittent
S-G08	Franklin	Perennial	S-H25	Franklin	Ephemeral	S-H02	Pittsylvania	Intermittent
S-H1	Franklin	Perennial	S-H4	Pittsylvania	Perennial	S-H3	Pittsylvania	Ephemeral
S-H7	Franklin	Intermittent	S-H3	Pittsylvania	Ephemeral	S-H1	Pittsylvania	Ephemeral
S-H13	Franklin	Ephemeral	S-H5	Pittsylvania	Perennial	S-H7	Pittsylvania	Ephemeral
S-H24	Franklin	Perennial	S-H2	Pittsylvania	Ephemeral	S-H2	Pittsylvania	Perennial
S-H25	Franklin	Perennial	S-H6	Pittsylvania	Ephemeral	S-H3	Pittsylvania	Perennial
S-H27	Franklin	Ephemeral	S-H8	Pittsylvania	Intermittent	S-H4	Pittsylvania	Perennial
S-H34	Franklin	Ephemeral	S-H9	Pittsylvania	Perennial	TTVA-S-H13	Pittsylvania	Intermittent
S-H33	Franklin	Intermittent						

Anticipated Wetland Impacts

Wetland ID	County	Cowardin	Wetland ID	County	Cowardin	Wetland ID	County	Cowardin
W-J102	Giles	PFO	W-K16	Roanoke	PSS	W-N21	Franklin	PSS
W-H115	Giles	PFO	W-K23	Roanoke	PFO	W-N11	Franklin	PFO
W-K14	Giles	PSS	W-K03	Roanoke	PFO	W-N11	Franklin	PSS
W-H110	Giles	PFO	W-K4-PFO	Roanoke	PFO	W-N11	Franklin	PEM
W-H111	Giles	PFO	W-K4-PSS	Roanoke	PSS	W-N11	Franklin	PEM
W-K11	Giles	PFO	W-K4-PSS	Roanoke	PSS	W-N7	Franklin	PFO
W-J3	Giles	PSS	W-K4-PSS	Roanoke	PSS	W-N6	Franklin	PEM
TTVA-W-C011	Montgomery	PEM	W-K4-PEM	Roanoke	PEM	W-N1	Franklin	PEM
W-K07	Montgomery	PEM	W-K07	Roanoke	PEM	W-N6	Franklin	PEM
W-K04	Montgomery	PEM	W-K07	Roanoke	PSS	W-N1	Franklin	PEM
W-K11	Montgomery	PSS	W-K11	Roanoke	PEM	W-N1	Franklin	PEM
W-K12	Montgomery	PFO	W-K13	Roanoke	PEM	W-N1-PEM	Franklin	PSS
W-K3	Montgomery	PEM	W-K17	Roanoke	PSS	W-N4	Franklin	PEM
W-K01	Montgomery	PEM	W-K2	Roanoke	PEM	W-N7	Franklin	PEM
W-K14-FO	Montgomery	PFO	W-K4-PFM	Roanoke	PEM	W-N7-FO	Franklin	PFO
W-K14-FO	Montgomery	PFO	W-K4-PSS-2	Roanoke	PSS	W-N7-PSS	Franklin	PSS
W-K4-PEM	Montgomery	PEM	W-K4-PSS-2	Roanoke	PSS	W-N11	Franklin	PEM
W-K4-1	Montgomery	PEM	W-K10	Roanoke	PEM	W-N11	Franklin	PEM
W-K4-2	Montgomery	PEM	W-K4-10	Roanoke	PEM	W-N4-10	Franklin	PEM
W-K4-3	Montgomery	PFO	W-K11-PEM	Roanoke	PEM	W-N4-11	Franklin	PEM
W-K4-4	Montgomery	PEM	W-K11-PSS	Roanoke	PSS	W-N4-3	Franklin	PEM
TTVA-W-301	Roanoke	PEM	W-K11-3	Roanoke	PEM	W-N3-PEM	Franklin	PEM
W-K3-PEM-2	Roanoke	PEM	W-K11-4	Roanoke	PEM	W-N3-PEM	Franklin	PEM
W-K4-1	Roanoke	PFO	W-K11-5	Roanoke	PEM	W-N4	Pittsylvania	PEM
W-K3-PEM-1	Roanoke	PEM	W-K11-PEM	Roanoke	PEM	W-N2	Pittsylvania	PEM
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W-K3-PEM-1	Roanoke	PEM	W-N7	Roanoke	PSS	W-N1-A	Pittsylvania	PFO
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W-K3-21	Roanoke	PEM	W-N7-6	Franklin	PEM	W-N3	Pittsylvania	PEM
W-K3-22	Roanoke	PEM	W-N7-7	Franklin	PEM	W-N3	Pittsylvania	PEM
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W-K3-119	Roanoke	PEM	W-N7-104	Franklin	PEM	W-N3	Pittsylvania	PEM
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W-K3-121	Roanoke	PEM	W-N7-106	Franklin	PEM	W-N3	Pittsylvania	PEM
W-K3-122	Roanoke	PEM	W-N7-107	Franklin	PEM	W-N3	Pittsylvania	PEM
W-K3-123	Roanoke	PEM	W-N7-108	Franklin	PEM	W-N3	Pittsylvania	PEM
W-K3-124	Roanoke	PEM	W-N7-109	Franklin	PEM	W-N3	Pittsylvania	PEM
W-K3-125	Roanoke	PEM	W-N7-110	Franklin	PEM	W-N3	Pittsylvania	PEM

Mountain Valley Pipeline Project

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Attachment H-2: Wetlands and Waterbodies Impact Analysis and Compensatory Mitigation Plan

September 2017

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ATTACHMENT H-2: IMPACT ANALYSIS AND COMPENSATORY MITIGATION PLAN

1.0 IMPACT ANALYSIS

MVP is committed to avoiding and minimizing impacts to sensitive resources such as wetlands and waterbodies. MVP conducted comprehensive alternatives analysis (Attachment I) to avoid and minimize environmental impacts.

Where wetlands and waterbodies cannot be avoided, MVP will seek to minimize impacts by reducing to a 75-foot construction limit-of-disturbance (LOD) along the pipeline right-of-way (ROW) and reducing to a 25-foot construction LOD along access roads where practicable, and through the use of wetland and waterbody-specific construction procedures. See Attachment I for a detailed description of impact avoidance and minimization measures undertaken. In addition, pipeline and access road crossing methods are described in Attachment I. Crossing details are provided in Attachment H-4 for all stream and wetland crossings. Stream and wetland crossing typicals are provided in Attachment H-4 for non-Virginia Marine Resource Commission (VMRC)-jurisdictional streams. For VMRC-jurisdictional streams (see Attachment H-5, Table 1), specific crossing plans and cross sections are provided in Attachment H-5.

The anticipated number of stream and wetland crossings are summarized in Table 1. Anticipated impacts to streams and wetlands are summarized in Tables 2.1 and 3.1, respectively.

For impact calculations, anticipated permanent impacts include:

- Streams without existing culverts that will be impacted by new culvert installation within the LOD of permanent access roads
- Scour protection within stream channels will extend from the culvert outlet to the edge of LOD. Scour protection (i.e., riprap) will be sized to withstand the tailwater velocity and shear corresponding to the design flow event. The length of stream receiving scour protection is considered to be permanently impacted.
- Streams with existing culverts that require replacement by a new culvert of greater length. For impact calculations, the length of stream previously culverted is considered to have no impact due to culvert replacement by a culvert of the same length. The length of stream that was previously not culverted is considered to be permanently impacted by culvert installation.
- Palustrine emergent (PEM) wetlands that will be impacted by the placement of fill within the LOD of permanent access roads
- Conversion of palustrine forested (PFO) or palustrine scrub-shrub (PSS) wetlands to PEM wetlands within the LOD of the pipeline ROW or temporary access roads. No permanent fill will be placed in these PFO or PSS wetlands; however, woody vegetation will be cut and temporary crossing structures will be placed in these wetlands during construction

Temporary impacts include:

- Streams that will be impacted within the LOD of the pipeline ROW, temporary access roads, Additional Temporary Workspace (ATWS), or Laydown Yards
- PEM wetlands that will be impacted by the placement of temporary crossing structures within the LOD of the pipeline ROW, ATWS, or Laydown Yards during construction

Streams crossing the LOD in an existing culvert or under an existing bridge, where no culvert replacement is anticipated, will not be impacted. Tags have been added to the Detail Map in Attachment H-3 at these locations to note that there will be no impact at these existing culverted/bridged waterbody crossings.

The Detail Figures in Attachment H-3 include tags which identify wetlands and streams that are protected and either have no impact or only a temporary impact for permanent access roads and ATWS/Laydown Yards. The resource-specific tags include the following:

- Existing culvert/bridge, no impact

- Culvert/bridge replacements are not anticipated for features with this tag; therefore, these features will not be impacted.

- Temporary stream crossing structure to be placed at existing crossing during construction. May include temporary in-stream work. Temporary impact.
  - This tag is for permanent access roads with existing ford crossings - temporary crossing structures will be utilized to cross streams during construction. These features will not be permanently impacted by the placement of fill or new culverts; all impacts will be temporary.

- Erosion and Sediment (E&S) Best Management Practices (BMP) protections. No impact
  - This tag is for wetlands and streams in access roads, ATWS, and laydown yards with no timber mat crossing and with compost filter sock or other E&S protection. These features will be protected by E&S BMPs and will not be impacted by project activities.

- Timber mat crossing in wetlands during construction.
  - For PEM wetlands in access roads, ATWS, or pipeline construction area with timber mat crossings. Timber mats will be utilized during construction to cross wetlands, resulting in temporary impacts.

Wetlands and waterbodies mapped outside the LOD of either access roads or pipeline corridors will not be impacted.

The results of the stream and wetland impact analysis for field identified features are provided in Tables 2.2 and 3.2, respectively. These tables provide feature impact locations, impact type (e.g. Pipeline ROW, Temporary Access Road), general feature characteristics, and anticipated impact calculations.

Desktop surveys have identified two potential impacts on unsurveyed properties that have not been field-verified (Table 3.3 for wetlands). MVP will provide supplemental impact analyses for the desktop evaluated wetland impacts after survey access is granted and these areas are field-verified.

Wetland functions and values were assessed for all wetlands located within the proposed Project LOD using the USACE Highway Methodology (USACE 1999). The USACE Highway Methodology is a well-established and effective methodology for evaluating wetland functions and values. In accordance with the method, eight functions and five values were assessed for each permanently impacted wetland. The suitability of the wetland to provide the function or value is assessed. Those determined to not provide the function or value or provide it at an insignificant level were considered not to be providing the function and were not listed. Wetland delineation data sheets, pictures, topographical maps, soils maps, aerial maps, wetland and stream delineations, agency information (e.g., endangered species presence), other field survey information (e.g., threatened and endangered species), and best professional judgement were used during each evaluation. The results are presented in Table 6 and list only the principle functions provided. MVP anticipates compensatory mitigation at mitigation banks or VARTF will likely add functional uplift for many of the permanent wetland impacts.

The Compensatory Mitigation Plan for permanent impacts is presented in Section 4.0, below.

2.0 PROJECT CONSTRUCTION

2.1 TEMPORARY EROSION CONTROL AND SEDIMENT CONTROL

Sediment barriers will be installed immediately after initial disturbance of the waterbody or adjacent upland. Sediment barriers will be properly maintained throughout construction and reinstalled as necessary (such as after backfilling of the trench) until replaced by permanent erosion controls or restoration of adjacent upland areas is complete. Sediment barriers will be installed across the entire construction LOD at all waterbody crossings. Where waterbodies are adjacent to the construction LOD, sediment barriers will be installed along the edge of the construction LOD as necessary to contain spoil and sediment within the ROW. Trench plugs will be used at all non-flumed waterbody crossings to prevent diversion of water into upland portions of the pipeline trench and to keep any accumulated trench water out of the waterbody. Trench plugs will be of sufficient size to withstand upslope water pressure.

2.2 EQUIPMENT BRIDGES

Only rubber tubing clearing equipment may cross waterbodies before installation of equipment bridges. The number of such crossings of each waterbody will be limited. Soil will not be used to construct or stabilize equipment bridges. Equipment bridges will be constructed using one of the following methods:

1. Equipment pads and culvert(s);
2. Clean rockfill and culvert(s) that conforms to the requirements in VESCH STD and Spec. 3.24-2; or
3. Flexi-float or portable bridges.

Each equipment bridge will be designed and maintained to withstand and pass the highest flow that would occur while the bridge is in place and prevent soil from entering the waterbody. Equipment bridges will be removed as soon as possible after permanent seeding unless it is authorized to remain as a permanent bridge. If there will be more than one month between final cleanup and the beginning of permanent seeding and reasonable alternative access to the ROW is available, equipment bridges will be removed as soon as possible after final cleanup.

2.3 TRENCHING

Trenching will begin after grading is completed. If trenching of adjacent upland areas has been completed but will not be backfilled before the waterbody or wetland crossing is trenched, a trench plug will be left in place at the end of the waterbody or wetland crossing to prevent storm water runoff from entering the waterbody or wetland by way of the trench.

Any water that must be removed from the work area will be discharged through a dewatering structure. Discharge points will be located in an upland area, including the buffer, whenever possible. The discharge will be carefully monitored to prevent erosion and sedimentation in the waterbody or wetland, and in such a manner that no heavily silt-laden water flows into any waterbody.

A minimum of the top one foot of topsoil will be conserved from over the trench in wetlands without standing water or saturated soil.

No aboveground facilities will be located in any wetland, except where the location of such facilities outside of wetlands would prohibit compliance with U.S. Department of Transportation regulations.

If standing water or saturated soils are present, low-ground-weight construction equipment will be used or normal equipment will be operated on temporary wetland crossing structures such as timber mats, prefabricated equipment mats, or geotextile fabric overlain with gravel. Geotextile fabric used for this purpose must be strong enough to allow removal of all gravel and fabric from the wetland.

2.4 Spoil Pile Placement and Control

All spoil from minor and intermediate waterbody crossings, and upland spoil from major waterbody crossings, will be placed in the construction LOD at least 10 feet from the water's edge or in additional extra work area. Sediment barriers will be used to prevent the flow of spoil into any waterbody.

Whenever practicable, excavated material will be placed on a Corps confirmed upland site. However, when it is not practicable to place excavated material on an upland site, any excavated material stockpiled in vegetated wetland areas will be placed on a matted straw layer, for use as a semi-permeable surface.

2.5 Backfilling

Backfilling will begin promptly after pipe installation is completed. Permanent trench breakers will be installed in the banks of stream channels and at the ends of wetlands. In designated trout streams, the top 12 inches of backfill will be made with clean one-inch diameter stone.

2.6 Final Grading and ROW Maintenance

Final grading will begin after backfilling is completed. Disturbed areas will be restored to pre-construction contours, and in wetlands, topsoil will be replaced last. Sediment barriers at the edge of the wetland or edge of the water will be repaired or replaced as necessary. Permanent ROW diversions (interceptor diversions) will be installed at the edge of the buffer area or base of the slope nearest the waterbody and wetland. All materials used to stabilize the equipment work area will be removed (e.g. timber riprap or timber mats).

Temporarily disturbed waters and wetlands will be restored to their pre-construction contours within 12 months of commencing the temporary impact. After restored to their natural contours, soil will be mechanically loosened to a depth of 12 inches and wetland areas will be seeded with appropriate native vegetation. If soil and weather conditions do not allow for a true final grade to be established (e.g. if the permit specified a winter construction window), best possible grade will be established, erosion and sediment control measures will be restored or replaced as needed, and temporary stabilization will be applied.

Vegetation maintenance adjacent to waterbodies will be limited to allow a riparian strip at least 35-feet wide, as measured from the waterbody's ordinary high water mark, to permanently revegetate with native plant species across the entire ROW. However, to facilitate periodic pipeline corrosion/leak surveys, a corridor centered on the pipeline and up to 10 feet wide will be mowed annually and may be maintained in an herbaceous state. In addition, trees that are located within 15 feet of the pipeline and are greater than 15 feet in height may be cut and removed from the ROW. See Project Specific Standards and Specifications For Virginia for more details.

2.7 Detailed Project Construction Plans

The Erosion and Sediment Control Plan (ESCP) provides a detailed description of construction materials, methods, and sequence. The ESCP also provides typical plans and cross sections of the proposed wetland and stream crossings. The ESCP can be provided upon request.

3.0 TEMPORARY IMPACT RESTORATION

3.1 Stream Restoration

It is anticipated that the Project will have impacts on field identified stream crossing locations and will not have impacts on desktop identified streams (Table 2.2). Table 2.2 identifies all anticipated field-identified stream impacts, stream flow regime, and stream Waters Type. It is anticipated that all stream impacts within the pipeline LOD will be temporary, occurring during pipeline construction activities. It is anticipated that temporary waterbody impacts will not result in the adverse impact of water quality, physical habitat, or aquatic species within the Project Area because of the short duration of stream crossing construction activities, implementation of best management practices and erosion and sedimentation control measures, and the temporary nature of the impacts.

Construction across waterbodies will be performed in a manner that minimizes the amount of time that the pipeline trenches will be left open. Construction methods at waterbody crossings are described in Attachment I: Alternatives Analysis.

The pipeline will be installed to provide a minimum of three feet of cover from the waterbody bottom to the top of the pipeline. Trench spoil will be placed on the bank above the high water mark for use as backfill.

MVP will follow the FERC Wetland and Waterbody Procedures (FERC 2013) to limit water quality and aquatic resource impacts during and following construction. Construction activities will be scheduled so that the pipeline trench is excavated immediately prior to pipe laying activities. In accordance with the FERC Wetland and Waterbody Procedures (FERC 2013), the duration of construction will be limited to 24 hours across minor waterbodies (10 feet wide or less) and 48 hours across intermediate waterbodies (between 10 and 100 feet wide) when blasting or extensive rock excavation is not required.

In accordance with the FERC Wetland and Waterbody Procedures (FERC 2013), normal backfill cover requirements will be met. Compaction percentage of backfill will be equal to or above that of the adjacent undisturbed areas. Ditch plugs of crushed stone, sandbags, or dry soil may also be used to keep backfill from sloughing in toward the center of the waterbody. All waterbody banks will be restored to their original grades and foreign objects will be removed from the waterbody. Excavated material not required for backfill will be removed and disposed of at an upland site.

Cleanup and restoration will commence as soon as practicable following the completion of backfilling and testing. Cleanup and restoration activities include replacing grade cuts to original contours, seeding, fertilizing, and mulching to restore ground cover, minimize erosion, and stabilize stream banks for their natural reversion toward their previous state. Original streambed and bank contours will be re-established for surface water and groundwater flow, and mulch, jute thatching, or bonded fiber blankets will be installed on the stream banks.

Seeding of disturbed stream approaches will be completed in accordance with FERC Wetland and Waterbody Procedures (FERC 2013) after final grading, weather and soil conditions permitting. MVP is committed to increase conservation and biodiversity in the region by using native grasses and wildflowers. Slope breakers will be installed adjacent to stream banks to minimize the potential for erosion. Sediment barriers, such as silt fence and/or straw bales will be maintained across the ROW until permanent vegetation is established. Temporary equipment bridges will be removed following construction. All temporary stream impacts will be restored to their pre-construction contours within 12 months of commencing construction.

3.2 Wetland Restoration

While significant effort was made to avoid wetland and waterbody impacts, some impacts to wetlands and waterbodies are unavoidable due to the constraints of siting and constructing a 303-mile linear project. It is anticipated that the Project will have impacts on both field and desktop delineated wetland crossing locations (Tables 3.1 and 3.2).

Where wetlands cannot be avoided, MVP will minimize impacts through the use of wetland construction procedures. Techniques to avoid or minimize impacts include top soil conservation, construction neck downs, avoiding placement of workspaces in critical habitats, revegetation, backfilling and grading, and open-cut/conventional lay or dry ditch crossing methods. Crossing of jurisdictional wetlands will be completed in accordance with USACE Nationwide Permit (NWP) 12 conditions, the FERC Wetland and Waterbody Procedures (FERC 2013), and the Final Environmental Impact Statement (June 2017). Restoration and monitoring of wetland crossings will be conducted in accordance with the FERC Wetland and Waterbody Procedures (FERC 2013) to ensure successful wetland revegetation.

Per USACE NWP 12 regional requirement, clearing of wetlands will be minimized to the maximum extent practicable. Grubbing and removal of vegetation would be limited to the permanent easement.

The majority of impacts are anticipated to be temporary impacts to PEM wetlands in the temporary work areas and permanent ROW. Temporary construction impacts in wetlands may include loss of herbaceous vegetation; soil disturbance associated with grading, trenching, and stump removal; soil compaction;

sedimentation and turbidity increases; and hydrological profile changes. Wetland soils (hydric soils) are susceptible to compaction with operation of construction equipment over wet soils, thereby reducing the porosity and moisture-holding capacity of the soils and interfering with the hydrology of the wetland. MVP will segregate the topsoil up to one foot in depth in wetlands where hydrologic conditions permit this practice. Any excavated material stockpiled in vegetated wetland areas will be placed on a matted straw layer, for use as a semi-permeable surface. Segregated topsoil will be placed in the trench following subsoil backfilling. In order to minimize compaction, MVP will limit construction traffic to only that required to accomplish the task. Low-ground-pressure equipment will be used, or temporary equipment mats will be installed to allow passage of equipment with minimal disturbance of the surface soils and vegetation. Compacted areas will be tilled as necessary.

Original surface hydrology will be re-established in wetlands by backfilling the pipe trench and grading the surface with backhoes operating from equipment mats or low ground-pressure tracked vehicles working in the spoil pile, depending upon the ambient water level, degree of soil saturation, and the bearing capacity of the soils. All excess excavated material will be removed from wetlands within 30 days. Roots and stumps will have been removed only in the areas of the pipe trench, allowing existing vegetation to recover more rapidly in the remainder of the ROW once the equipment mats and spoil piles have been removed.

Wetlands along the proposed pipeline are expected to exhibit varying degrees of saturation and water elevation, requiring a variety of plant species to be re-established. In unsaturated wetlands, most vegetation will be replaced by seeding. Due to low success rates of revegetation from seeding in saturated soils, saturated wetlands will typically be allowed to re-vegetate naturally. Wetland revegetation will be considered successful when the cover of herbaceous species is at least 70 percent of the cover of the vegetation in adjacent wetland areas that were not disturbed by construction. Revegetation efforts will continue until wetland revegetation is successful. All temporary wetland impacts will be restored to their pre-construction contours within 12 months of commencing construction.

Crossing of the pipeline through PFO and PSS wetlands has been minimized to the maximum extent practicable through project siting placement. Measures taken to avoidance of PFO fragmentation are discussed further in Attachment I: Alternatives Analysis. Impacts to PFO and PSS wetlands may include long-term conversion to emergent wetland types as a result of tree and/or shrub removal within the construction and operational ROW. Clearing for construction within PFO and PSS wetlands and vegetation maintenance during pipeline operation will be limited per the FERC Wetland and Waterbody Procedures (FERC 2013), such that only the minimum width needed for pipeline protection and surveillance is maintained, in an effort to reduce permanent impacts to PFO and PSS wetlands. In compliance with USACE NWP 12 conditions, any unavoidable permanent loss that may occur to wetlands will be kept under 0.5 acres of cumulative impacts per single and complete project.

4.0 COMPENSATORY MITIGATION PLAN

Compensatory mitigation is *required* on a one-to-one basis for any single and complete project that meets one of the two following criteria:

- Permanent loss of a wetland exceeds 1/10 acre and preconstruction notification (PCN) is required. NWP Gen. Cond. 23(c); NWP Reg. Cond. 10.
- Permanent loss of a stream exceeds 300 linear feet. NWP Reg. Cond. 10

Compensatory mitigation *may* be required for any single and complete project in any of the following circumstances if the district engineer determines that compensatory mitigation is necessary to ensure that the activity results in only minimal adverse individual or cumulative environmental effects:

- Permanent loss of a wetland less than 1/10 acre that requires PCN. NWP Gen. Cond. 23(c).
- Permanent loss of a stream that requires PCN. NWP Gen. Cond. 23(d).
- Permanent conversion of a wetland from one form to another. NWP Gen. Cond. 23(3); NWP 12 Reg. Cond. 3.vi.

No single and complete project proposed in this application has an associated impact that exceeds the thresholds in NWP Gen. Cond. 23(c) or NWP Reg. Cond. 10 for requiring compensatory mitigation. For reference, no single proposed wetland loss exceeds 0.44 acre and no single proposed stream loss exceeds 57 linear feet. (Tables 2.2 and 3.2). Nevertheless, in accordance with NWP Sec. D.3, MVP proposes to minimize the individual and cumulative effects of the Project by implementing compensatory mitigation for all proposed permanent impacts, including stream losses less than 300 feet, wetland losses less than 1/10 acre, and any permanent conversions of PFO or PSS wetlands to PEM wetlands. As described below, MVP proposes to mitigate all proposed permanent stream and wetland impacts (loss or conversion) on a one-to-one ratio through the purchase of mitigation bank credits if such credits are available.

Some of the proposed impacts fall outside the service area of approved mitigation banks, leaving the VA Aquatic Resources Trust Fund (VARTF) as the only available source of credits. Credits will be purchased from the VARTF for these impacts at a one-to-one ratio if they are made available. In the event those credits are not available, MVP proposes to further mitigate the cumulative impacts of the project by obtaining credits on a two-to-one ratio from a a bank whose service area includes portions of the pipeline route.

4.1 Stream Mitigation

Proposed permanent stream impacts will result only from the culverting of streams crossing proposed permanent access roads. Credit requirements for field delineated streams were determined using the Unified Stream Methodology (USM) assessment tool, as presented in Table 5 (VDEQ 2007). USM forms for individual streams are provided in this attachment.

It is anticipated that the Virginia segment of the project will have unavoidable permanent impacts on a total of 478 feet of field identified streams, for which MVP proposes to purchase 515 compensatory mitigation credits (Table 4). MVP is proposing to purchase approximately 298 credits from the Graham and David Mitigation Bank (31,528 credits available) for mitigation of field identified stream impacts located in the Graham and David Mitigation Bank primary service area covering the following HUC 8 Watersheds: Banister (03010105), Upper Roanoke (03010101), Middle Roanoke (03010102), and Upper Dan (03010103) (USACE 2017). In addition to the Graham and David Mitigation Bank, stream credits are available for stream impacts in the Project area at the Banister Bend Mitigation Bank (2,408 credits available) in the following HUC 8 watersheds: Banister (03010105), Upper Roanoke (03010101), Middle Roanoke (03010102), Lower Dan (03010104), and Upper Dan (03010103). Credit availability letters for Graham and David and Bannister Bend Mitigation Banks are provided in this attachment. MVP is proposing to purchase 217 credits from the VARTF for Project impacts in the Middle New Watershed (HUC 05050002), located outside of the service areas of approved mitigation banks (Table 4). The VARTF has 5,000 Advanced Stream Credits available in the New River Basin. If the VARTF administrator refuses to make these credits available for purchase, however, MVP proposes in the alternative to purchase 434 credits (2x 217, previously proposed from VARTF) from a bank able to serve the Middle New (05050002). In order to further reduce the cumulative impacts to the project.

It is anticipated that the Virginia segment of the project will not have any permanent impacts on desktop identified streams.

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1 As published in the Federal Register on April 10, 2008 (73 F.R. 19594), effective June 9, 2008.

4.2 Wetland Mitigation

It is anticipated that the Virginia segment of the project will have the following unavoidable permanent impacts:

- 693 square feet of PEM wetland permanent fill impact (of which 84 square feet is desktop identified)

- 97,306 square feet of PSS wetland conversion impact, and
- 90,368 square feet of PFO wetland conversion impact (Table 3.1).

In accordance with USACE Norfolk District and Virginia Department of Environmental Quality (VDEQ) guidance, the following ratios were used to calculate proposed mitigation credits for each acre of permanent wetland impact:

- 1 to 1 for PEM wetland fill impacts,
- 1 to 1 for PSS wetland conversion impacts,
- 1.5 to 1 for PSS wetland fill impacts,
- 1 to 1 for PFO wetland conversion impacts, and
- 2 to 1 for PFO wetland fill impacts.

It is anticipated that the Project will not have any permanent fill impacts to PSS and PFO wetlands. All permanent PSS and PFO impacts are anticipated to be conversion impacts. Accordingly, a one-to-one ratio is used for all proposed wetland mitigation credits.

Based on the anticipated impact acreage and mitigation credit ratios, the total proposed credit mitigation for wetland impacts is 4.32 (Table 6). MVP is proposing to purchase approximately 1.65 credits from the Banister Bend Mitigation Bank (42.758 credits available) for mitigation of wetland impacts located in the Banister Bend Mitigation Bank service area covering the following HUC 8 Watersheds: Banister (03010105), Upper Roanoke (03010101), Middle Roanoke (03010102), Lower Dan (03010104), and Upper Dan (03010103) (USACE 2017). A credit availability letter for the Banister Bend Mitigation Bank is provided in this attachment. MVP is proposing to purchase 2.68 credits from the VARTF for Project impacts in the Upper Roanoke Watershed (HUC 03010101), and the Middle New Watersheds (HUC 05050002), located outside of the service areas of approved mitigation banks (Table 6). The VARTF has 5 Advanced Wetland Credits available in the Roanoke River Basin and 5 Advanced Wetland Credits available in the New River Basin. If the VARTF administrator refuses to make these credits available for purchase, however, MVP proposes in the alternative to purchase 5.36 (2x 2.68, previously proposed from VARTF) from a bank able to serve the Middle New (05050002) and Upper Roanoke (03010101). In order to further reduce the cumulative impacts to the project.

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1 As published in the Federal Register on April 10, 2008 (73 F.R. 19594), effective June 9, 2008.

MVP will provide updated impact information for the desktop delineated wetland permanent impacts once these areas are surveyed. It is anticipated that these estimated impact numbers will actually decrease once the field surveys are complete. MVP anticipates purchasing mitigation credits from the VARTF for impacts that may occur outside of the service area of approved mitigation banks. Based on the estimated impact acreage and mitigation credit ratios from USACE Norfolk District and VDEQ, the total credit requirement for estimated permanent impacts to desktop delineated wetlands is 0.002. This credit amount has been included in the total credits to be purchased referenced above.

5.0 REFERENCES

FERC (Federal Energy Regulatory Commission). 2013. Wetland and Waterbody Construction and Mitigation Procedures. Office of Energy Projects. May 2013.

VDEQ (Virginia) Department of Environmental Quality. 2007. Unified Stream Methodology for use in Virginia. Available online at: http://www.deq.virginia.gov/Portals/0/DEQ/Water/WetlandsStreams/USMFinal_01-18-07.pdf. Accessed January 2015.

USACE (United States Army Corps of Engineers). 2017. Regulatory In-lieu Fee and Bank Information Tracking Systems (RIBITS). Available online at: https://ribits.usace.army.mil/. Accessed January 2017.

USACE (United States Army Corps of Engineers). 1999. The Highway Methodology Workbook Supplement. NAEEP-360-1-30a.

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Table 6	Proposed Wetland Mitigation

Table 1 Stream and Wetland Crossing Summary

Survey Type	Crossing Type	Field Identified	Desktop Identified	Total Crossings
Streams	Temporary Crossings	366	0	366
	Permanent Crossings	19	0	19
	Total Stream Crossings	385	0	385
Wetlands	Temporary Crossings	89	1	90
	Permanent Conversion Crossings	50	0	50
	Permanent Fill Crossings	3	1	4
	Total Wetland Crossings	142	2	144

Table 2.1 Stream Impact Summary

Survey Type	Flow Regime	Temporary Linear Feet Impact (ft)	Permanent Linear Feet Impact (ft)	Temporary Fill (cubic yards)	Permanent Fill (cubic yards)
Field Identified	Ephemeral	6,078	97	9,501	61
	Intermittent	9,643	160	18,932	89
	Perennial	13,105	221	61,002	190
	Field Total	28,826	478	89,436	341
Desktop Identified	Ephemeral	0	0	0	0
	Intermittent	0	0	0	0
	Perennial	0	0	0	0
	Desktop Total	0	0	0	0
All Features	Ephemeral	6,078	97	9,501	61
	Intermittent	9,643	160	18,932	89
	Perennial	13,105	221	61,002	190
	Grand Total	28,826	478	89,436	341

Table 2.2 Field Survey Stream Impacts

Stream ID	HUD Stream Name[1]	County	Latitude[2]	Longitude[2]	Flow Regime	Water Type[3]	Top of Bank Width (ft)	Cowardin[4]	Stream Designation[5]	RTE[6]	HUC 8	HUC 8 Name	Impact Type	Temporary Impact (linear ft)	Permanent Impact (linear ft)	Temporary Impact Area (square ft)	Permanent Impact Area (square ft)	Depth of Fill (ft)	Temporary Fill (cubic yard)[7]	Permanent Fill (cubic yard)[7]	Figure
S-PP14	Kimballton Branch	Giles	37.392799	-80.694250	Perennial	RPW	14	R2RB1	-	-	05050002	Middle New	Permanent Access Road	50	11	700	154	3	78	17	6
S-Q13	Kimballton Branch	Giles	37.374377	-80.682038	Perennial	RPW	15	R2UB1	-	-	05050002	Middle New	Pipeline ROW	90	-	1350	-	10	500	-	17
S-PP14 & S-Q13 Total	Kimballton Branch													140	11	2050	154	-	578	17	
S-PP15	UNT to Kimballton Branch	Giles	37.392840	-80.690062	Perennial	RPW	8	R3UB1	-	-	05050002	Middle New	Permanent Access Road	15	11	90	66	3	10	7	6
S-PP17	UNT to New River	Giles	37.386777	-80.70045	Intermittent	RPW	2	R4SB3	-	-	05050002	Middle New	Permanent Access Road	-	14	-	28	3	-	3	7
S-MN20	UNT to New River	Giles	37.386744	-80.700408	Intermittent	RPW	2	R4SB3	-	-	05050002	Middle New	Permanent Access Road	-	11	-	22	3	-	2	12
S-PP18	Curve Branch	Giles	37.385534	-80.706752	Perennial	RPW	4	R2UB1	-	-	05050002	Middle New	Permanent Access Road	-	18	-	76	3	-	8	9
S-PP19	UNT to Curve Branch	Giles	37.382172	-80.714021	Intermittent	RPW	3	R4SB5	-	-	05050002	Middle New	Permanent Access Road	-	16	-	48	3	-	5	9
S-JU9	Clendennin Creek	Giles	37.381343	-80.719468	Perennial	RPW	5	R2UB1	-	-	05050002	Middle New	Permanent Access Road	-	11	-	55	3	-	6	10
S-HH16	UNT to Clendennin Creek	Giles	37.375315	-80.725511	Intermittent	RPW	5	R4SB2	-	-	05050002	Middle New	Permanent Access Road	55	-	275	-	3	31	-	11
S-Q12	UNT to Kimballton Branch	Giles	37.375311	-80.680878	Ephemeral	NRPW	4	R6	-	-	05050002	Middle New	Pipeline ROW	86	-	344	-	10	127	-	15
S-MN17	UNT to Clendennin Creek	Giles	37.373941	-80.732083	Intermittent	RPW	3	R4SB3	-	-	05050002	Middle New	Permanent Access Road	42	-	126	-	3	14	-	12
S-HH15	UNT to Clendennin Creek	Giles	37.370772	-80.737181	Perennial	RPW	5	R3UB1	-	-	05050002	Middle New	Permanent Access Road	-	14	-	70	3	-	8	13
S-HH14	UNT to Clendennin Creek	Giles	37.370751	-80.73801	Intermittent	RPW	3	R4SB5	-	-	05050002	Middle New	Permanent Access Road	-	14	-	42	3	-	5	13
S-HH13	UNT to Clendennin Creek	Giles	37.368272	-80.744808	Perennial	RPW	8	R3RB2	-	-	05050002	Middle New	Permanent Access Road	-	11	-	88	3	-	10	14
S-HH12	UNT to Clendennin Creek	Giles	37.366134	-80.746301	Ephemeral	NRPW	3	R6	-	-	05050002	Middle New	Permanent Access Road	-	11	-	33	3	-	4	14
S-SS2	UNT to Clendennin Creek	Giles	37.365662	-80.749208	Intermittent	RPW	10	R4SB3	-	-	05050002	Middle New	Permanent Access Road	-	14	-	140	3	-	16	14
S-P5	UNT to Stony Creek	Giles	37.362202	-80.688092	Ephemeral	NRPW	6	R6	-	-	05050002	Middle New	Pipeline ROW	76	-	456	-	10	173	-	20
S-S5-Braid-2	Stony Creek	Giles	37.360325	-80.684214	Ephemeral	NRPW	3	R6	-	Green floater; Candy darter; Pistolgrip	05050002	Middle New	Pipeline ROW	61	-	183	-	10	68	-	21
S-S5-Braid-1	Stony Creek	Giles	37.360278	-80.684153	Ephemeral	NRPW	4	R6	-	Green floater; Candy darter; Pistolgrip	05050002	Middle New	Pipeline ROW	81	-	324	-	10	120	-	21
S-S5	Stony Creek	Giles	37.360071	-80.683860	Perennial	RPW	40	R2UB1	Class V - vi (Stockadale)	Green floater; Candy darter; Pistolgrip	05050002	Middle New	Pipeline ROW	76	-	2739	-	10	1014	-	21
S-S5 Total	Stony Creek													320	-	3246	-		1382	-	
S-G29	UNT to Dry Branch	Giles	37.350430	-80.658259	Ephemeral	NRPW	4	R6	-	-	05050002	Middle New	Pipeline ROW	30	-	120	-	3	13	-	26
S-G30	UNT to Dry Branch	Giles	37.350373	-80.658239	Ephemeral	NRPW	8	R6	-	-	05050002	Middle New	Pipeline ROW	85	-	680	-	10	252	-	26
S-G32	Dry Branch	Giles	37.349095	-80.652040	Intermittent	RPW	8	R4SB5	-	-	05050002	Middle New	Pipeline ROW	110	-	880	-	10	244	-	27
S-G33	UNT to Dry Branch	Giles	37.348641	-80.647225	Perennial	RPW	8	R3RB2	-	-	05050002	Middle New	Pipeline ROW	99	-	792	-	10	293	-	27
S-G35	UNT to Little Stony Creek	Giles	37.344876	-80.633426	Perennial	RPW	25	R3RB2	Class VI - ii (Good)	-	05050002	Middle New	Pipeline ROW	40	-	1000	-	10	370	-	29
S-G36	UNT to Little Stony Creek	Giles	37.344786	-80.633465	Perennial	RPW	25	R3RB2	Class VI - ii (Good)	-	05050002	Middle New	Pipeline ROW	52	-	1300	-	10	481	-	29
S-G35	UNT to Little Stony Creek	Giles	37.344779	-80.633379	Perennial	RPW	25	R3RB2	Class VI - ii (Good)	-	05050002	Middle New	Pipeline ROW	36	-	950	-	10	352	-	29
S-G35 Total	UNT to Little Stony Creek													118	-	3216	-		1294	-	
S-SS4	UNT to Little Stony Creek	Giles	37.344859	-80.531295	Ephemeral	NRPW	3	R6	-	-	05050002	Middle New	Pipeline ROW	78	-	234	-	10	87	-	29
S-Z7	UNT to Little Stony Creek	Giles	37.344278	-80.526165	Intermittent	RPW	3	R4SB3	-	-	05050002	Middle New	Pipeline ROW	76	-	228	-	10	84	-	30
S-Z7-Braid-1	UNT to Little Stony Creek	Giles	37.344277	-80.526113	Ephemeral	NRPW	3	R6	-	-	05050002	Middle New	Pipeline ROW	73	-	219	-	10	81	-	30
S-Z7, S-Z7-Braid-1 Total	UNT to Little Stony Creek													149	-	447	-		165	-	
S-Z9	UNT to Little Stony Creek	Giles	37.344163	-80.528400	Perennial	RPW	4	R3UB1	-	-	05050002	Middle New	Pipeline ROW	86	-	344	-	10	127	-	29
S-Z10	UNT to Little Stony Creek	Giles	37.342351	-80.520823	Intermittent	RPW	12	R4SB3	-	-	05050002	Middle New	Pipeline ROW	76	-	912	-	10	336	-	30
S-Z11	UNT to Little Stony Creek	Giles	37.342236	-80.520542	Perennial	RPW	5	R3UB2	-	-	05050002	Middle New	Pipeline ROW	88	-	440	-	10	163	-	30
S-Z12-EPH	UNT to Little Stony Creek	Giles	37.342214	-80.520312	Ephemeral	RPW	6	R6	-	-	05050002	Middle New	Pipeline ROW	80	-	480	-	10	178	-	30
S-Z13	Little Stony Creek	Giles	37.342172	-80.520090	Perennial	RPW	25	R2RB2	Class VI - ii (Good); Brook & Rainbow Trout	-	05050002	Middle New	Pipeline ROW	77	-	1383	-	10	512	-	30
S-Z14	UNT to Little Stony Creek	Giles	37.340977	-80.518031	Intermittent	RPW	4	R4SB3	-	-	05050002	Middle New	Pipeline ROW	109	-	436	-	10	161	-	31
S-YZ1	Doe Creek	Giles	37.338952	-80.514818	Intermittent	RPW	10	R2RB2	-	-	05050002	Middle New	Temporary Access Road	102	-	1020	-	3	113	-	31
S-YZ1	Doe Creek	Giles	37.337562	-80.514711	Intermittent	RPW	10	R2RB2	-	-	05050002	Middle New	Temporary Access Road	92	-	920	-	3	102	-	31

Table 2.2 Field Survey Stream Impacts

Stream ID	NHD Stream Name[1]	County	Latitude[2]	Longitude[2]	Flow Regime	Water Type[3]	Top of Bank Width (ft)	Cowardin[4]	Stream Designation[5]	RTE[6]	HUC 8	HUC 8 Name	Impact Type	Temporary Impact (linear ft)	Permanent Impact (linear ft)	Temporary Impact Area (square ft)	Permanent Impact Area (square ft)	Depth of Fill (ft)	Temporary Fill (cubic yards)[7]	Permanent Fill (cubic yards)[7]	Figure
S-YZ1	Doe Creek	Giles	37.337046	-80.614625	Intermittent	RPW	10	R2RB2	-	-	05050002	Middle New	Temporary Access Road	121	-	1210	-	3	134	-	31
S-Y2	Doe Creek	Giles	37.331332	-80.583047	Perennial	RPW	25	R2UB2	-	-	05050002	Middle New	Pipeline ROW	79	-	1975	-	10	731	-	36
S-YZ1 & S-Y2 Total	Doe Creek													394	-	3185	-	-	1865	-	
S-A34	UNT to Doe Creek	Giles	37.337763	-80.606008	Ephemeral	NRPW	7	R6	-	-	05050002	Middle New	Pipeline ROW	66	-	802	-	10	223	-	33
S-A33	UNT to Doe Creek	Giles	37.337639	-80.605571	Ephemeral	NRPW	7	R6	-	-	05050002	Middle New	Pipeline ROW	111	-	777	-	10	268	-	33
S-A32	UNT to Doe Creek	Giles	37.335094	-80.595868	Perennial	RPW	16	R3RB1	-	-	05050002	Middle New	Pipeline ROW	78	-	1248	-	10	462	-	34
S-QQ2	Sinking Creek	Craig	37.333152	-80.429438	Perennial	RPW	35	R2UB1	Class V - vi (Stockable)	-	05050002	Middle New	Temporary Access Road	40	-	1400	-	3	158	-	67
S-NN17	Sinking Creek	Giles	37.311616	-80.515786	Perennial	RPW	55	R2UB1	Class V - v (Stockable)	-	05050002	Middle New	Pipeline ROW	77	-	2620	-	10	970	-	50
S-QQ2 & S-NN17 Total	Sinking Creek													117	-	4020	-	-	1128	-	
S-MN11-Upstream	UNT to Sinking Creek	Giles	37.332869	-80.559168	Ephemeral	NRPW	4	R6	-	-	05050002	Middle New	Temporary Access Road	15	-	60	-	3	7	-	39
S-MN11-Upstream	UNT to Sinking Creek	Giles	37.332181	-80.559979	Ephemeral	NRPW	4	R6	-	-	05050002	Middle New	Temporary Access Road	30	-	120	-	3	13	-	39
S-MN11-Downstream	UNT to Sinking Creek	Giles	37.332148	-80.560079	Ephemeral	NRPW	5	R6	-	-	05050002	Middle New	Temporary Access Road	37	-	185	-	3	21	-	39
S-MN11 Total	UNT to Sinking Creek													82	-	365	-	-	41	-	
S-Y3	UNT to Doe Creek	Giles	37.331748	-80.583355	Ephemeral	NRPW	10	R6	-	-	05050002	Middle New	Pipeline ROW	77	-	770	-	10	285	-	36
S-PP4	UNT to Sinking Creek	Craig	37.328329	-80.422810	Intermittent	RPW	2	R4SB6	-	-	05050002	Middle New	Pipeline ROW	64	-	188	-	10	62	-	65
S-PP3	UNT to Sinking Creek	Craig	37.326705	-80.425803	Perennial	RPW	3	R3UB1	-	-	05050002	Middle New	Pipeline ROW	82	-	246	-	10	91	-	65
S-RR4	UNT to Sinking Creek	Giles	37.326015	-80.556831	Perennial	RPW	3	R3RB2	-	-	05050002	Middle New	Temporary Access Road	85	-	255	-	3	28	-	42
S-E24	UNT to Sinking Creek	Giles	37.325728	-80.565062	Perennial	RPW	20	R3UB2	-	-	05050002	Middle New	Pipeline ROW	81	-	1620	-	10	600	-	38
S-E25-Downstream	UNT to Sinking Creek	Giles	37.325638	-80.564680	Perennial	RPW	8	R3RB2	-	-	05050002	Middle New	Pipeline ROW	96	-	768	-	10	284	-	38
S-E25-Upstream	UNT to Sinking Creek	Giles	37.325607	-80.564373	Perennial	RPW	10	R3UB1	-	-	05050002	Middle New	Pipeline ROW	15	-	150	-	3	17	-	38
S-E25-Downstream	UNT to Sinking Creek	Giles	37.325605	-80.564465	Perennial	RPW	8	R3RB2	-	-	05050002	Middle New	Pipeline ROW	48	-	384	-	10	142	-	38
S-E25-Downstream	UNT to Sinking Creek	Giles	37.325565	-80.564634	Perennial	RPW	8	R3RB2	-	-	05050002	Middle New	Pipeline ROW	63	-	504	-	10	187	-	38
S-E25 Total	UNT to Sinking Creek													272	-	1926	-	-	639	-	
S-PP1	UNT to Sinking Creek	Craig	37.324761	-80.431446	Intermittent	RPW	3	R4SB3	-	-	05050002	Middle New	Pipeline ROW	86	-	258	-	10	98	-	64
S-RR5	UNT to Sinking Creek	Giles	37.323702	-80.566527	Perennial	RPW	10	R3UB2	-	-	05050002	Middle New	Pipeline ROW	83	-	830	-	10	307	-	41
S-IJ19	UNT to Sinking Creek	Giles	37.322194	-80.553058	Ephemeral	NRPW	4	R6	-	-	05050002	Middle New	Temporary Access Road	43	-	172	-	3	19	-	41
S-IJ19	UNT to Sinking Creek	Giles	37.321823	-80.553311	Ephemeral	NRPW	4	R6	-	-	05050002	Middle New	Temporary Access Road	9	-	36	-	3	4	-	41
S-IJ19 Total	UNT to Sinking Creek													52	-	208	-	-	23	-	
S-IJ18	UNT to Sinking Creek	Giles	37.321756	-80.553011	Intermittent	RPW	4	R4SB2	-	-	05050002	Middle New	Temporary Access Road	44	-	176	-	3	20	-	41
S-PP22	UNT to Craig Creek	Montgomery	37.321090	-80.412631	Intermittent	RPW	2.5	R4SB5	-	-	02080201	Upper James	Pipeline ROW	63	-	207.5	-	3	23	-	70
S-CO14	UNT to Sinking Creek	Craig	37.320922	-80.435866	Ephemeral	NRPW	5.5	R6	-	-	05050002	Middle New	Pipeline ROW	6	-	33	-	3	4	-	64
S-OO12	UNT to Sinking Creek	Giles	37.318856	-80.440548	Ephemeral	NRPW	2	R6	-	-	05050002	Middle New	Pipeline ROW	25	-	50	-	3	6	-	63
S-OO13	UNT to Sinking Creek	Giles	37.318930	-80.440930	Perennial	RPW	20	R3RB2	-	-	05050002	Middle New	Pipeline ROW	77	-	1540	-	10	570	-	63
S-OO14	UNT to Sinking Creek	Giles	37.318647	-80.441619	Perennial	RPW	4	R3RB2	-	-	05050002	Middle New	Pipeline ROW	86	-	344	-	10	127	-	63
S-IJ17	UNT to Sinking Creek	Giles	37.318324	-80.547720	Ephemeral	NRPW	8	R6	-	-	05050002	Middle New	Pipeline ROW	31	-	248	-	3	26	-	44
S-IJ16-b	UNT to Sinking Creek	Giles	37.318246	-80.547711	Ephemeral	NRPW	10	R6	-	-	05050002	Middle New	Pipeline ROW	78	-	780	-	10	289	-	44
S-PP21	UNT to Craig Creek	Montgomery	37.317187	-80.409235	Perennial	RPW	4	R3UB1	-	-	02080201	Upper James	Pipeline ROW	97	-	388	-	10	144	-	70
S-PP20	UNT to Craig Creek	Montgomery	37.316523	-80.408646	Perennial	RPW	8	R3UB1	-	-	02080201	Upper James	Pipeline ROW	89	-	534	-	10	198	-	70
S-RR13	Craig Creek	Montgomery	37.314504	-80.402813	Perennial	RPW	35	R2UB1	Class V - vi (Stockable)	James spinymussel; Atlantic pigtoe	02080201	Upper James	Temporary Access Road	41	-	1435	-	3	159	-	71
S-OO6	Craig Creek	Montgomery	37.313511	-80.404606	Perennial	RPW	35	R2UB1	Class V - vi (Stockable)	James spinymussel; Atlantic pigtoe	02080201	Upper James	Pipeline ROW	76	-	2286	-	10	847	-	71
S-RR13 & S-OO6 Total	Craig Creek													117	-	3721	-	-	1006	-	
S-HH18	UNT to Craig Creek	Montgomery	37.313910	-80.398683	Perennial	RPW	6	R3RB1	-	James spinymussel; Atlantic pigtoe	02080201	Upper James	Pipeline ROW	78	-	468	-	10	173	-	72
S-RR14	UNT to Craig Creek	Montgomery	37.313815	-80.402521	Ephemeral	NRPW	7	R6	-	-	02080201	Upper James	Pipeline ROW	75	-	548	-	10	202	-	71

Table 2.2 Field Survey Stream Impacts

Stream ID	NHD Stream Name[1]	County	Latitude[2]	Longitude[2]	Flow Regime	Water Type[3]	Top of Bank Width (ft)	Condition[4]	Stream Designation[5]	RTE[6]	HUC 8	HUC 8 Name	Impact Type	Temporary Impact (linear ft)	Permanent Impact (linear ft)	Temporary Impact Area (square ft)	Permanent Impact Area (square ft)	Depth of fill (ft)	Temporary Fill (cubic yards)[7]	Permanent Fill (cubic yards)[7]	Figure
S-QQ3	UNT to Sinking Creek	Giles	37.311869	-80.532365	Ephemeral	NRPW	2	R6	-	-	05050002	Middle New	Temporary Access Road	106	-	212	-	3	24	-	46
S-QQ3	UNT to Sinking Creek	Giles	37.311398	-80.532112	Ephemeral	NRPW	2	R6	-	-	05050002	Middle New	Temporary Access Road	79	-	158	-	3	18	-	46
S-QQ3-b	UNT to Sinking Creek	Giles	37.310375	-80.532286	Ephemeral	NRPW	4.5	R6	-	-	05050002	Middle New	Temporary Access Road	2	-	9	-	3	1	-	47
S-QQ3 Total	UNT to Sinking Creek													187	-	379	-	-	43	-	
S-IJ18-a	UNT to Sinking Creek	Giles	37.311730	-80.544091	Ephemeral	NRPW	7	R6	-	-	05050002	Middle New	Permanent Access Road	6	45	42	315	3	5	35	45
S-KL43	UNT to Sinking Creek	Giles	37.307524	-80.466665	Perennial	RPW	10	R3UB1	-	-	05050002	Middle New	Pipeline ROW	75	-	750	-	10	278	-	59
S-NN11	UNT to Sinking Creek	Giles	37.305508	-80.467231	Intermittent	RPW	5	R4SB1	-	-	05050002	Middle New	Pipeline ROW	84	-	420	-	10	156	-	59
S-NN12	UNT to Sinking Creek	Giles	37.300454	-80.472911	Ephemeral	NRPW	2	R6	-	-	05050002	Middle New	Pipeline ROW	88	-	176	-	10	65	-	57
S-MN21	UNT to Mill Creek	Montgomery	37.299097	-80.391243	Perennial	RPW	7	R3US1	-	-	03010101	Upper Roanoke	Pipeline ROW	90	-	560	-	10	207	-	74
S-MM17	UNT to Sinking Creek	Giles	37.298226	-80.480624	Perennial	RPW	2	R3UB1	-	-	05050002	Middle New	Temporary Access Road	49	-	98	-	3	11	-	55
S-MN22	UNT to Mill Creek	Montgomery	37.297166	-80.389812	Ephemeral	NRPW	2	R6	-	-	03010101	Upper Roanoke	Pipeline ROW	96	-	192	-	10	71	-	75
S-RR2	Greenbriar Branch	Giles	37.296668	-80.494174	Perennial	RPW	8	R3RB2	-	-	05050002	Middle New	Pipeline ROW	85	-	850	-	10	252	-	53
S-YZ6	UNT to Greenbriar Branch	Giles	37.298812	-80.494165	Intermittent	RPW	6	R4SB5	-	-	05050002	Middle New	Pipeline ROW	38	-	228	-	3	25	-	53
S-EF62	UNT to Mill Creek	Montgomery	37.298356	-80.375118	Perennial	RPW	11	R3UB1	-	-	03010101	Upper Roanoke	Pipeline ROW	76	-	836	-	10	310	-	76
S-MM18	UNT to Sinking Creek	Giles	37.296226	-80.481455	Ephemeral	NRPW	5	R6	-	-	05050002	Middle New	Pipeline ROW	88	-	440	-	10	163	-	55
S-IJ52	UNT to Mill Creek	Montgomery	37.295153	-80.387510	Perennial	RPW	16	R3UB1	-	-	03010101	Upper Roanoke	Pipeline ROW	84	-	1344	-	10	498	-	77
S-EF65	Mill Creek	Montgomery	37.285743	-80.375921	Intermittent	RPW	6	R4SB3	Class VI - II (Good); Brown Trout	Orangefin madtom	03010101	Upper Roanoke	Pipeline ROW	152	-	912	-	10	338	-	78
S-IJ43	Mill Creek	Roanoke	37.138536	-80.139715	Perennial	RPW	16	R2UB2	Class V - vi (Stockeise)	Orangefin madtom	03010101	Upper Roanoke	Pipeline ROW	78	-	1182	-	10	438	-	141
S-EF63 & IJ43 Total	Mill Creek													231		3594			776		
S-AD1	UNT to Dry Run	Montgomery	37.291414	-80.335537	Intermittent	RPW	3	R4SB5	-	-	03010101	Upper Roanoke	Temporary Access Road	9	-	27	-	3	3	-	81
S-AD1	UNT to Dry Run	Montgomery	37.291127	-80.335628	Intermittent	RPW	3	R4SB5	-	-	03010101	Upper Roanoke	Temporary Access Road	158	-	474	-	3	53	-	81
S-AD1	UNT to Dry Run													167	-	501	-	-	56	-	
S-OO10	Bradshaw Creek	Montgomery	37.274247	-80.251505	Perennial	RPW	15	R2UB1	-	Roanoke logperch; Orangefin madtom	03010101	Upper Roanoke	Temporary Access Road	41	-	615	-	3	68	-	105
S-OO9	UNT to Bradshaw Creek	Montgomery	37.271766	-80.248758	Intermittent	RPW	3	R4SB3	-	-	03010101	Upper Roanoke	Temporary Access Road	41	-	123	-	3	14	-	105
S-G35	North Fork Roanoke River	Montgomery	37.268586	-80.313161	Perennial	RPW	20	R2UB1	-	Roanoke logperch; Orangefin madtom	03010101	Upper Roanoke	Permanent Access Road	26	-	520	-	3	58	-	89
S-G36	North Fork Roanoke River	Montgomery	37.268562	-80.314418	Perennial	RPW	20	R2UB1	-	Roanoke logperch; Orangefin madtom	03010101	Upper Roanoke	Pipeline ROW	94	-	1667	-	10	925	-	89
S-G35 Total	North Fork Roanoke River													123		2827			665		
S-G38	UNT to North Fork Roanoke River	Montgomery	37.267002	-80.312699	Ephemeral	NRPW	3	R6	-	-	03010101	Upper Roanoke	Pipeline ROW	89	-	267	-	10	99	-	89
S-G40	UNT to North Fork Roanoke River	Montgomery	37.264882	-80.307302	Perennial	RPW	3	R3RB2	-	-	03010101	Upper Roanoke	Pipeline ROW	117	-	351	-	10	130	-	90
S-PP23	UNT to North Fork Roanoke River	Montgomery	37.264956	-80.307151	Ephemeral	NRPW	2.5	R6	-	-	03010101	Upper Roanoke	Pipeline ROW	85	-	212.5	-	10	79	-	90
S-G39	UNT to North Fork Roanoke River	Montgomery	37.264617	-80.308486	Intermittent	RPW	6	R4SB1	-	-	03010101	Upper Roanoke	Pipeline ROW	82	-	492	-	10	182	-	90
S-MM14	UNT to Flatwoods Branch	Montgomery	37.258747	-80.293310	Ephemeral	NRPW	7	R6	-	-	03010101	Upper Roanoke	Pipeline ROW	105	-	735	-	10	272	-	84
S-MM15	UNT to Flatwoods Branch	Montgomery	37.258673	-80.296446	Intermittent	RPW	6	R4SB4	-	-	03010101	Upper Roanoke	Pipeline ROW	82	-	492	-	10	182	-	94
S-MM11	UNT to Flatwoods Branch	Montgomery	37.258403	-80.298186	Ephemeral	NRPW	8	R6	-	-	03010101	Upper Roanoke	Pipeline ROW	80	-	640	-	10	237	-	95
S-F16	UNT to Flatwoods Branch	Montgomery	37.258198	-80.286029	Intermittent	RPW	6	R4SB3	-	-	03010101	Upper Roanoke	Pipeline ROW	129	-	774	-	10	287	-	95
S-MM13	UNT to Flatwoods Branch	Montgomery	37.258176	-80.289222	Ephemeral	NRPW	5	R6	-	-	03010101	Upper Roanoke	Pipeline ROW	85	-	425	-	10	157	-	94
S-F16a/F16b	UNT to Flatwoods Branch	Montgomery	37.257898	-80.284735	Ephemeral	NRPW	3	R6	-	-	03010101	Upper Roanoke	Pipeline ROW	81	-	243	-	10	90	-	95
S-C38	UNT to Flatwoods Branch	Montgomery	37.257260	-80.281611	Intermittent	RPW	3	R4SB4	-	-	03010101	Upper Roanoke	Pipeline ROW	96	-	288	-	10	107	-	95
S-C36	UNT to Flatwoods Branch	Montgomery	37.257133	-80.281475	Intermittent	RPW	3	R4SB4	-	-	03010101	Upper Roanoke	Pipeline ROW	36	-	108	-	10	40	-	95
S-C36 Total	UNT to Flatwoods Branch													123		369			137		
S-C33	UNT to Flatwoods Branch	Montgomery	37.257205	-80.281785	Perennial	RPW	6	R3UB3	-	-	03010101	Upper Roanoke	Pipeline ROW	23	-	138	-	3	15	-	95
S-MM31	UNT to Flatwoods Branch	Montgomery	37.256959	-80.280329	Ephemeral	NRPW	4	R6	-	-	03010101	Upper Roanoke	Pipeline ROW	81	-	324	-	10	120	-	96
S-C29	Flatwoods Branch	Montgomery	37.256367	-80.279021	Ephemeral	NRPW	1.2	R6	-	-	03010101	Upper Roanoke	Pipeline ROW	48	-	55.2	-	10	20	-	98

Table 2.2 Field Survey Stream Impacts

Stream ID	NHD Stream Name[a]	County	Latitude[a]	Longitude[a]	Flow Regime	Water Type[b]	Top of Bank Width (ft)	Cowardin[c]	Stream Designation[d]	RTE[e]	HUC 8	HUC 8 Name	Impact Type	Temporary Impact (linear ft)	Permanent Impact (linear ft)	Temporary Impact Area (square ft)	Permanent Impact Area (square ft)	Depth of Fill (ft)	Temporary Fill (cubic yard)[f]	Permanent Fill (cubic yard)[f]	Figure
S-C25	UNT to Bradshaw Creek	Montgomery	37.254342	-80.267895	Intermittent	RPW	3	R4SB3	-	-	03010101	Upper Roanoke	Pipeline ROW	115	-	345	-	10	128	-	97
S-C24	UNT to Bradshaw Creek	Montgomery	37.254135	-80.266743	Intermittent	RPW	3	R4SB1	-	-	03010101	Upper Roanoke	Pipeline ROW	108	-	324	-	10	120	-	97
S-C21	Bradshaw Creek	Montgomery	37.251791	-80.258990	Perennial	RPW	25	R2UB1	-	Roanoke logperch; Orangefin madtom	03010101	Upper Roanoke	Pipeline ROW	89	-	1983	-	10	734	-	99
S-OO11	UNT to Bradshaw Creek	Montgomery	37.251660	-80.257426	Ephemeral	NRPW	2	R6	-	-	03010101	Upper Roanoke	Pipeline ROW	258	-	516	-	10	191	-	99
S-MN34	UNT to Roanoke River	Roanoke	37.250443	-80.204941	Intermittent	RPW	5	R4SB3	-	-	03010101	Upper Roanoke	Permanent Access Road	4	67	20	285	3	2	32	113
S-MN33	UNT to Roanoke River	Roanoke	37.24955	-80.206204	Ephemeral	NRPW	5	R6	-	-	03010101	Upper Roanoke	Permanent Access Road	5	41	25	205	3	3	23	112
S-MN32	UNT to Roanoke River	Montgomery	37.248577	-80.207762	Perennial	RPW	11	R2UB1	-	-	03010101	Upper Roanoke	Permanent Access Road	9	55	99	605	3	11	67	112
S-OO15	UNT to Roanoke River	Montgomery	37.245214	-80.208659	Perennial	RPW	4	R3RB	-	-	03010101	Upper Roanoke	Pipeline ROW	76	-	304	-	10	113	-	114
S-NN19	UNT to Roanoke River	Montgomery	37.244319	-80.206895	Intermittent	RPW	3.5	R4SB3	-	-	03010101	Upper Roanoke	Pipeline ROW	75	-	268	-	10	89	-	114
S-NN16	Roanoke River	Montgomery	37.233402	-80.197942	Perennial	TNW	70	R2UB1	Class V - ***	Roanoke logperch; Orangefin madtom	03010101	Upper Roanoke	Pipeline ROW	86	-	4305	-	10	1596	-	118
S-AB16	UNT to Roanoke River	Montgomery	37.231693	-80.198776	Intermittent	RPW	5	R4SB5	-	-	03010101	Upper Roanoke	Pipeline ROW	75	-	375	-	10	139	-	118
S-I1	UNT to Roanoke River	Montgomery	37.231179	-80.198469	Intermittent	RPW	14	R4SB3	-	-	03010101	Upper Roanoke	Pipeline ROW	75	-	1050	-	10	389	-	118
S-CD12	UNT to South Fork Roanoke River	Montgomery	37.228043	-80.200000	Perennial	RPW	18	R3UB3	-	-	03010101	Upper Roanoke	Pipeline ROW	74	-	1332	-	10	493	-	119
S-EF19	UNT to Indian Run	Montgomery	37.218102	-80.197390	Ephemeral	NRPW	5	R6	-	-	03010101	Upper Roanoke	Pipeline ROW	79	-	395	-	10	146	-	120
S-EF20a	UNT to Roanoke River	Montgomery	37.210922	-80.193318	Perennial	RPW	6	R3UB1	-	-	03010101	Upper Roanoke	Pipeline ROW	109	-	654	-	10	242	-	121
S-MM22	UNT to Roanoke River	Montgomery	37.205284	-80.187262	Perennial	RPW	15	R6	-	-	03010101	Upper Roanoke	Pipeline ROW	175	-	2625	-	10	972	-	123
S-IJ50	UNT to Roanoke River	Roanoke	37.194064	-80.167933	Perennial	RPW	25	R3RB1	-	-	03010101	Upper Roanoke	Pipeline ROW	77	-	1925	-	10	713	-	127
S-Y13	UNT to Bottom Creek	Roanoke	37.187697	-80.151146	Intermittent	RPW	8	R4SB3	-	-	03010101	Upper Roanoke	Pipeline ROW	85	-	680	-	10	252	-	130
S-Y14	UNT to Bottom Creek	Roanoke	37.187556	-80.151049	Perennial	RPW	14	R3UB1	Class VI - II (Good); Brook Trout	Orangefin madtom	03010101	Upper Roanoke	Pipeline ROW	77	-	1078	-	10	399	-	130
S-EF34	UNT to Bottom Creek	Roanoke	37.180009	-80.143500	Perennial	RPW	10	R3UB1	-	-	03010101	Upper Roanoke	Pipeline ROW	138	-	1380	-	10	511	-	132
S-EF34	UNT to Bottom Creek	Roanoke	37.180332	-80.140475	Perennial	RPW	10	R3UB1	-	-	03010101	Upper Roanoke	ATWS	17	-	170	-	3	19	-	132
S-EF34 Total	UNT to Bottom Creek													155	-	1550	-	-	573		
S-EF35	UNT to Bottom Creek	Roanoke	37.179397	-80.141344	Intermittent	RPW	8	R4SB3	-	-	03010101	Upper Roanoke	Pipeline ROW	111	-	888	-	10	329	-	132
S-EF33	UNT to Bottom Creek	Roanoke	37.179186	-80.141000	Intermittent	RPW	9	R4SB3	-	-	03010101	Upper Roanoke	Pipeline ROW	148	-	1332	-	10	493	-	132
S-UI81	UNT to Bottom Creek	Roanoke	37.172464	-80.138972	Intermittent	RPW	3	R4SB4	-	-	03010101	Upper Roanoke	Pipeline ROW	14	-	42	-	3	5	-	133
S-UI87	UNT to Bottom Creek	Roanoke	37.17204	-80.129063	Perennial	RPW	5	R3UB2	-	-	03010101	Upper Roanoke	ATWS	19	-	95	-	3	11	-	135
S-UI87	UNT to Bottom Creek	Roanoke	37.171958	-80.129051	Perennial	RPW	5	R3UB2	-	-	03010101	Upper Roanoke	ATWS	7	-	35	-	3	4	-	135
S-UI87 Total	UNT to Bottom Creek													26	-	130	-	-	15	-	
S-UI82	UNT to Bottom Creek	Roanoke	37.170458	-80.138216	Intermittent	RPW	15	R4SB4	-	-	03010101	Upper Roanoke	Pipeline ROW	224	-	3360	-	10	1244	-	134
S-UI85	UNT to Bottom Creek	Roanoke	37.169474	-80.130356	Perennial	RPW	8	R3UB2	-	-	03010101	Upper Roanoke	Permanent Access Road	-	50	-	400	3	-	44	135
S-UI83	UNT to Bottom Creek	Roanoke	37.169211	-80.138259	Intermittent	RPW	5	R4SB4	-	-	03010101	Upper Roanoke	Pipeline ROW	361	-	1805	-	10	669	-	135
S-UI86	Bottom Creek	Roanoke	37.168395	-80.138295	Perennial	RPW	20	R3UB1	Class VI - II (Good); Brook Trout	-	03010101	Upper Roanoke	Pipeline ROW	98	-	1960	-	10	726	-	134
S-UI84	UNT to Bottom Creek	Roanoke	37.168361	-80.138381	Perennial	RPW	15	R3UB2	-	-	03010101	Upper Roanoke	Pipeline ROW	35	-	525	-	3	58	-	134
S-UI89	UNT to Bottom Creek	Roanoke	37.165802	-80.139317	Perennial	RPW	10	R3UB1	-	-	03010101	Upper Roanoke	Pipeline ROW	152	-	1520	-	10	563	-	134
S-UI90	UNT to Bottom Creek	Roanoke	37.165865	-80.139378	Intermittent	RPW	5	R4SB3	-	-	03010101	Upper Roanoke	Pipeline ROW	128	-	640	-	10	237	-	134
S-KL26	UNT to Mill Creek	Roanoke	37.160173	-80.134799	Intermittent	RPW	5	R4SB5	-	-	03010101	Upper Roanoke	Pipeline ROW	82	-	410	-	10	152	-	136
S-BT9b	UNT to Mill Creek	Roanoke	37.154424	-80.129179	Perennial	RPW	15	R3UB2	-	-	03010101	Upper Roanoke	Pipeline ROW	89	-	1335	-	10	494	-	137
S-EF51	UNT to Bottom Creek	Roanoke	37.150901	-80.138742	Intermittent	RPW	3	R4SB3	-	-	03010101	Upper Roanoke	Temporary Access Road	44	-	132	-	3	15	-	139
S-KL55	UNT to Mill Creek	Roanoke	37.150009	-80.13246	Perennial	RPW	15	R3UB2	-	-	03010101	Upper Roanoke	Pipeline ROW	82	-	1230	-	10	456	-	138
S-MN27	UNT to Bottom Creek	Roanoke	37.148753	-80.136125	Ephemeral	NRPW	2	R6	-	-	03010101	Upper Roanoke	Temporary Access Road	11	-	22	-	3	2	-	139
S-EF52	UNT to Bottom Creek	Roanoke	37.149741	-80.136067	Intermittent	RPW	8	R4SB3	-	-	03010101	Upper Roanoke	Temporary Access Road	390	-	3120	-	3	347	-	139
S-U12	UNT to Mill Creek	Roanoke	37.148333	-80.133919	Perennial	RPW	13	R3UB2	-	-	03010101	Upper Roanoke	Pipeline ROW	83	-	1079	-	10	400	-	139
S-EF44	UNT to Bottom Creek	Roanoke	37.143003	-80.138399	Intermittent	RPW	7	R4SB3	-	-	03010101	Upper Roanoke	Pipeline ROW	76	-	532	-	10	197	-	140

Table 2.2 Field Survey Stream Impacts

Stream ID	KHD Stream Name[1]	County	Latitude[1]	Longitude[1]	Flow Regime	Waterbody Type[1]	Top of Bank Width (ft)	Cowardin[1]	Stream Designation[2]	RTE[2]	HUC 8	HUC 8 Name	Impact Type	Temporary Impact (linear ft)	Permanent Impact (linear ft)	Temporary Impact Area (square ft)	Permanent Impact Area (square ft)	Depth of fill (ft)	Temporary Fill (cubic yards)[3]	Permanent Fill (cubic yards)[3]	Figure
S-Y9	UNT to Mill Creek	Roanoke	37.134576	-80.137648	Intermittent	RPW	4	R4SB5	-	-	03010101	Upper Roanoke	Pipeline ROW	44	-	178	-	3	20	-	142
S-Y7	UNT to Mill Creek	Roanoke	37.134481	-80.137622	Intermittent	RPW	4	R4SB5	-	-	03010101	Upper Roanoke	Pipeline ROW	173	-	692	-	10	256	-	142
S-Y8	UNT to Mill Creek	Roanoke	37.134176	-80.137464	Perennial	RPW	4	R3UB3	-	-	03010101	Upper Roanoke	Pipeline ROW	84	-	336	-	10	124	-	142
S-B22	UNT to Mill Creek	Roanoke	37.128922	-80.133768	Perennial	RPW	4	R3UB2	-	-	03010101	Upper Roanoke	Pipeline ROW	107	-	428	-	10	159	-	145
S-B23	UNT to Mill Creek	Roanoke	37.128853	-80.133910	Intermittent	RPW	2	R4SB4	-	-	03010101	Upper Roanoke	Pipeline ROW	14	-	28	-	3	3	-	145
S-B25	UNT to Mill Creek	Roanoke	37.128490	-80.132601	Ephemeral	NRPW	5	R6	-	-	03010101	Upper Roanoke	Pipeline ROW	147	-	735	-	10	272	-	145
S-B21	UNT to Mill Creek	Roanoke	37.128484	-80.130943	Perennial	RPW	4	R3UB2	-	-	03010101	Upper Roanoke	Pipeline ROW	92	-	368	-	10	136	-	145
S-H1	Green Creek	Franklin	37.127733	-80.115787	Perennial	RPW	10	R2UB2	-	Orangefin madtom	03010101	Upper Roanoke	Pipeline ROW	78	-	780	-	10	289	-	147
S-G26	UNT to Green Creek	Franklin	37.127077	-80.111367	Intermittent	RPW	7	R4RB2	-	-	03010101	Upper Roanoke	Pipeline ROW	79	-	553	-	10	205	-	148
S-G27	UNT to Green Creek	Franklin	37.126962	-80.111052	Perennial	RPW	7	R3RB2	-	-	03010101	Upper Roanoke	Pipeline ROW	79	-	553	-	10	205	-	148
S-G24	UNT to Green Creek	Franklin	37.126412	-80.121396	Intermittent	RPW	6	R4RB3	-	-	03010101	Upper Roanoke	Pipeline ROW	75	-	450	-	10	167	-	147
S-G25	UNT to Green Creek	Franklin	37.125398	-80.121401	Intermittent	RPW	7	R4RB4	-	-	03010101	Upper Roanoke	Pipeline ROW	42	-	294	-	3	33	-	147
S-RR16	UNT to Green Creek	Franklin	37.125055	-80.113578	Intermittent	RPW	2	R3UB3	-	-	03010101	Upper Roanoke	Permanent Access Road	8	-	16	-	3	2	-	148
S-D8	North Fork Blackwater River	Franklin	37.123998	-80.074673	Perennial	RPW	16	R2UB1	-	Roanoke logperch	03010101	Upper Roanoke	Pipeline ROW	78	-	842	-	10	349	-	153 & 154
S-D3	UNT to North Fork Blackwater River	Franklin	37.123074	-80.07596	Intermittent	RPW	7	R4RB4	-	-	03010101	Upper Roanoke	ATWS	25	-	175	-	3	19	-	153
S-D2	UNT to North Fork Blackwater River	Franklin	37.122702	-80.075859	Intermittent	RPW	7	R4RB4	-	-	03010101	Upper Roanoke	ATWS	25	-	175	-	3	19	-	153
S-D9	UNT to North Fork Blackwater River	Franklin	37.122585	-80.075797	Intermittent	RPW	7	R4RB4	-	-	03010101	Upper Roanoke	Pipeline ROW	80	-	560	-	10	207	-	153
S-D9 Total	UNT to North Fork Blackwater River													150	-	910	-	-	248		
S-D10	UNT to North Fork Blackwater River	Franklin	37.122301	-80.075957	Intermittent	RPW	8	R4RB3	-	-	03010101	Upper Roanoke	Pipeline ROW	77	-	616	-	10	228	-	153
S-D11	UNT to North Fork Blackwater River	Franklin	37.121687	-80.083666	Perennial	RPW	10	R3UB1	-	-	03010101	Upper Roanoke	Pipeline ROW	81	-	810	-	10	300	-	152
S-D12	UNT to North Fork Blackwater River	Franklin	37.121556	-80.085642	Intermittent	RPW	6	R4RB4	-	-	03010101	Upper Roanoke	Pipeline ROW	54	-	324	-	10	120	-	152
S-MM26	UNT to North Fork Blackwater River	Franklin	37.121155	-80.07618	Perennial	RPW	7	R3UB2	-	-	03010101	Upper Roanoke	Pipeline ROW	78	-	546	-	10	202	-	153
S-MM26	UNT to North Fork Blackwater River	Franklin	37.121211	-80.06152	Perennial	RPW	7	R3UB2	-	-	03010101	Upper Roanoke	Pipeline ROW	92	-	644	-	10	239	-	153
S-MM26 Total	UNT to North Fork Blackwater River													170	-	1190	-	-	441	-	
S-D13	UNT to North Fork Blackwater River	Franklin	37.121513	-80.085689	Intermittent	RPW	4	R4RB4	-	-	03010101	Upper Roanoke	Pipeline ROW	117	-	468	-	10	173	-	152
S-D17	UNT to North Fork Blackwater River	Franklin	37.121324	-80.087928	Intermittent	RPW	7	R4RB3	-	-	03010101	Upper Roanoke	Pipeline ROW	542	-	3794	-	10	1405	-	152
S-D17	UNT to North Fork Blackwater River	Franklin	37.121108	-80.087080	Intermittent	RPW	7	R4RB3	-	-	03010101	Upper Roanoke	Permanent Access Road	31	34	217	238	3	24	28	152
S-D17	UNT to North Fork Blackwater River	Franklin	37.121103	-80.086852	Intermittent	RPW	7	R4RB3	-	-	03010101	Upper Roanoke	Pipeline ROW	61	-	427	-	10	158	-	152
S-D17 Total	UNT to North Fork Blackwater River													634	34	4438	238	-	1649	-	
S-I4	UNT to North Fork Blackwater River	Franklin	37.115679	-80.080900	Perennial	RPW	15	R3UB1	-	-	03010101	Upper Roanoke	Pipeline ROW	80	-	1200	-	10	444	-	156
S-EF18	UNT to Green Creek	Franklin	37.114845	-80.097650	Intermittent	RPW	2	R4SB3	-	-	03010101	Upper Roanoke	ATWS	85	-	190	-	3	21	-	151
S-GH7	UNT to North Fork Blackwater River	Franklin	37.108514	-80.054218	Perennial	RPW	9	R3UB1	-	-	03010101	Upper Roanoke	Pipeline ROW	119	-	1071	-	10	397	-	156
S-GH15	UNT to North Fork Blackwater River	Franklin	37.108177	-80.050105	Intermittent	RPW	4	R4SB5	-	-	03010101	Upper Roanoke	Pipeline ROW	75	-	300	-	10	111	-	159
S-GH14	UNT to North Fork Blackwater River	Franklin	37.105883	-80.049861	Perennial	RPW	4	R3UB3	-	-	03010101	Upper Roanoke	Pipeline ROW	76	-	304	-	10	113	-	159
S-GH11	UNT to North Fork Blackwater River	Franklin	37.104707	-80.046220	Intermittent	RPW	3	R4SB4	-	-	03010101	Upper Roanoke	Pipeline ROW	77	-	231	-	10	86	-	159
S-GH9	UNT to North Fork Blackwater River	Franklin	37.104329	-80.045343	Perennial	RPW	4	R3UB1	-	-	03010101	Upper Roanoke	Pipeline ROW	78	-	312	-	10	116	-	159
S-RR08	UNT to North Fork Blackwater River	Franklin	37.103290	-80.041869	Ephemeral	NRPW	7	R6	-	-	03010101	Upper Roanoke	Pipeline ROW	76	-	532	-	10	197	-	159
S-RR09	UNT to North Fork Blackwater River	Franklin	37.102491	-80.041048	Ephemeral	NRPW	9	R6	-	-	03010101	Upper Roanoke	Pipeline ROW	77	-	693	-	10	257	-	160
S-RR11	UNT to North Fork Blackwater River	Franklin	37.101127	-80.039653	Ephemeral	NRPW	7	R6	-	-	03010101	Upper Roanoke	Pipeline ROW	77	-	539	-	10	200	-	160
S-IJ1	UNT to North Fork Blackwater River	Franklin	37.093062	-80.027724	Perennial	RPW	12	R3UB1	-	-	03010101	Upper Roanoke	Pipeline ROW	107	-	1284	-	10	476	-	162
S-IJ2	UNT to North Fork Blackwater River	Franklin	37.092591	-80.027593	Intermittent	RPW	2.5	R4SB3	-	-	03010101	Upper Roanoke	Pipeline ROW	40	-	100	-	10	37	-	162
S-I6	UNT to Little Creek	Franklin	37.092697	-79.976402	Intermittent	NRPW	3	R4RB5	-	-	03010101	Upper Roanoke	Pipeline ROW	76	-	228	-	10	84	-	170
S-IJ3	UNT to North Fork Blackwater River	Franklin	37.092600	-80.027231	Intermittent	RPW	5	R4SB5	-	-	03010101	Upper Roanoke	Pipeline ROW	77	-	385	-	10	143	-	162

Table 2.2 Field Survey Stream Impacts

Stream ID	NHD Stream Name[a]	County	Latitude[a]	Longitude[a]	Flow Regime	Water Type[a]	Top of Bank Width (ft)	Cowardin[a]	Stream Designation[a]	RTE[a]	HUC 8	HUC 8 Name	Impact Type	Temporary Impact (linear ft)	Permanent Impact (linear ft)	Temporary Impact Area (square ft)	Permanent Impact Area (square ft)	Depth of Fill (ft)	Temporary Fill (cubic yard)[b]	Permanent Fill (cubic yard)[b]	Figure
S-GH5	UNT to Little Creek	Franklin	37.092397	-79.983227	Perennial	RPW	3	R4SB4	-	-	03010101	Upper Roanoke	Pipeline ROW	81	-	243	-	10	90	-	169
S-II12	UNT to Little Creek	Franklin	37.091808	-79.987839	Intermittent	RPW	2	R4RB4	-	-	03010101	Upper Roanoke	Pipeline ROW	85	-	170	-	10	63	-	170
S-II11	UNT to Little Creek	Franklin	37.091564	-79.988051	Perennial	RPW	4	R3UB2	-	-	03010101	Upper Roanoke	Pipeline ROW	98	-	392	-	10	145	-	170
S-II8	UNT to Little Creek	Franklin	37.091413	-79.993944	Intermittent	RPW	2	R4RB4	-	-	03010101	Upper Roanoke	Pipeline ROW	78	-	156	-	10	58	-	168
S-II3	UNT to Little Creek	Franklin	37.091382	-79.996620	Perennial	RPW	20	R3UB1	-	-	03010101	Upper Roanoke	Pipeline ROW	81	-	1620	-	10	600	-	168
S-II7	UNT to Little Creek	Franklin	37.091354	-79.992013	Intermittent	RPW	4	R4RB4	-	-	03010101	Upper Roanoke	Pipeline ROW	76	-	304	-	10	113	-	168
S-IJ4	UNT to North Fork Blackwater River	Franklin	37.091189	-80.024365	Perennial	RPW	4	R3UB1	-	-	03010101	Upper Roanoke	Pipeline ROW	101	-	404	-	10	150	-	162
S-KL1	UNT to Little Creek	Franklin	37.090405	-79.996415	Perennial	RPW	4.5	R3UB1	-	-	03010101	Upper Roanoke	Pipeline ROW	29	-	130.5	-	3	14	-	167
S-KL2	UNT to Little Creek	Franklin	37.090361	-79.996354	Perennial	RPW	3.7	R3UB2	-	-	03010101	Upper Roanoke	Pipeline ROW	76	-	281.2	-	10	104	-	167
S-GH2	UNT to Teels Creek	Franklin	37.090153	-79.953936	Intermittent	RPW	2	R4SB4	-	-	03010101	Upper Roanoke	Pipeline ROW	85	-	170	-	10	63	-	176
S-GH4	UNT to Teels Creek	Franklin	37.089812	-79.956077	Perennial	RPW	5	R3UB1	-	-	03010101	Upper Roanoke	Pipeline ROW	27	-	135	-	3	15	-	175
S-GH3	UNT to Teels Creek	Franklin	37.089745	-79.956042	Perennial	RPW	6	R4SB3	-	-	03010101	Upper Roanoke	Pipeline ROW	76	-	456	-	10	169	-	175
S-II6	UNT to Little Creek	Franklin	37.089248	-80.018301	Ephemeral	NRPW	1.5	R6	-	-	03010101	Upper Roanoke	Pipeline ROW	29	-	43.5	-	3	5	-	163
S-IJ10	Little Creek	Franklin	37.089179	-80.005026	Perennial	RPW	3	R3RB1	-	-	03010101	Upper Roanoke	Pipeline ROW	77	-	231	-	10	86	-	166
S-CD5	Little Creek	Franklin	37.057584	-79.913921	Perennial	RPW	70	R2UB1	-	Roanoke logperch	03010101	Upper Roanoke	Pipeline ROW	77	-	4424	-	10	1639	-	165
S-II2	Little Creek	Franklin	37.049219	-79.998513	Perennial	RPW	60	R2RB1	-	Roanoke logperch	03010101	Upper Roanoke	Pipeline ROW	76	-	3247	-	10	1203	-	166
S-II10, S-CD5, & S-II2 Total	Little Creek													239	-	7903	-	-	2927	-	
S-E29	UNT to Teels Creek	Franklin	37.089178	-79.950110	Perennial	RPW	8	R3UB1	-	-	03010101	Upper Roanoke	Pipeline ROW	60	-	540	-	10	237	-	176
S-E28	Teels Creek	Franklin	37.089047	-79.9613	Perennial	RPW	12	R2UB2	-	Roanoke logperch	03010101	Upper Roanoke	Pipeline ROW	82	-	984	-	10	364	-	172
S-E29	Teels Creek	Franklin	37.085247	-79.948057	Perennial	RPW	12	R2UB2	-	Roanoke logperch	03010101	Upper Roanoke	Pipeline ROW	76	-	912	-	10	338	-	172
S-E28	Teels Creek	Franklin	37.082975	-79.945556	Perennial	RPW	12	R2UB2	-	Roanoke logperch	03010101	Upper Roanoke	Pipeline ROW	101	-	1212	-	10	448	-	172
S-EF12	Teels Creek	Franklin	37.073367	-79.939865	Perennial	RPW	20	R2UB1	-	Roanoke logperch	03010101	Upper Roanoke	Pipeline ROW	79	-	1580	-	10	585	-	179
S-D23	Teels Creek	Franklin	37.070322	-79.931039	Perennial	RPW	20	R2UB2	-	Roanoke logperch	03010101	Upper Roanoke	Pipeline ROW	82	-	2066	-	10	772	-	181
S-C14	Teels Creek	Franklin	37.063956	-79.921985	Perennial	RPW	50	R2UB1	-	Roanoke logperch	03010101	Upper Roanoke	Pipeline ROW	90	-	3653	-	10	1353	-	183
S-C17	Teels Creek	Franklin	37.054390	-79.918015	Perennial	RPW	30	R2UB1	-	Roanoke logperch	03010101	Upper Roanoke	Pipeline ROW	93	-	1586	-	10	587	-	185
S-E29, S-EF12, S-D23, S-C14 & S-C17 Total	Teels Creek													512	-	12011	-	-	4449	-	
S-EF4	UNT to Teels Creek	Franklin	37.078983	-79.941911	Perennial	RPW	11	R3UB1	-	-	03010101	Upper Roanoke	Pipeline ROW	80	-	880	-	10	326	-	178
S-EF7	UNT to Teels Creek	Franklin	37.074804	-79.941123	Ephemeral	NRPW	2	R6	-	-	03010101	Upper Roanoke	Pipeline ROW	106	-	212	-	10	78	-	179
S-EF7	UNT to Teels Creek	Franklin	37.074638	-79.941336	Ephemeral	NRPW	2	R6	-	-	03010101	Upper Roanoke	ATWS	22	-	44	-	3	5	-	179
S-EF7 Total	UNT to Teels Creek													128	-	256	-	-	83	-	
S-MM42	UNT to Teels Creek	Franklin	37.070703	-79.937069	Ephemeral	NRPW	2	R6	-	-	03010101	Upper Roanoke	Pipeline ROW	81	-	162	-	10	60	-	180
S-D22	UNT to Teels Creek	Franklin	37.070101	-79.929732	Intermittent	RPW	6	R4RB4	-	-	03010101	Upper Roanoke	Pipeline ROW	83	-	664	-	10	246	-	181
S-D18	UNT to Teels Creek	Franklin	37.069560	-79.926213	Ephemeral	NRPW	2	R6	-	-	03010101	Upper Roanoke	Pipeline ROW	30	-	60	-	3	7	-	181
S-RR15	UNT to Teels Creek	Franklin	37.069542	-79.933852	Perennial	RPW	14	R3UB3	-	-	03010101	Upper Roanoke	Pipeline ROW	97	-	1358	-	10	503	-	181
S-D20	UNT to Teels Creek	Franklin	37.069465	-79.926230	Intermittent	RPW	6	R4RB4	-	-	03010101	Upper Roanoke	Pipeline ROW	78	-	608	-	10	225	-	181
S-KL51	UNT to Blackwater River	Franklin	37.064794	-79.872477	Ephemeral	NRPW	4	R6	-	-	03010101	Upper Roanoke	Pipeline ROW	28	-	112	-	3	12	-	182
S-EF48	UNT to Blackwater River	Franklin	37.064746	-79.874420	Intermittent	RPW	2	R4SB3	-	-	03010101	Upper Roanoke	Pipeline ROW	86	-	172	-	10	64	-	192
S-YZ4	UNT to Blackwater River	Franklin	37.064723	-79.878190	Ephemeral	NRPW	3	R6	-	-	03010101	Upper Roanoke	Pipeline ROW	84	-	252	-	10	93	-	191
S-YZ5	UNT to Blackwater River	Franklin	37.063464	-79.878281	Ephemeral	NRPW	4	R6	-	-	03010101	Upper Roanoke	Pipeline ROW	86	-	344	-	10	127	-	191
S-KL41	UNT to Blackwater River	Franklin	37.062262	-79.862639	Perennial	RPW	12	R3RB1	-	-	03010101	Upper Roanoke	Pipeline ROW	75	-	900	-	10	333	-	193
S-KL39	UNT to Blackwater River	Franklin	37.061193	-79.860018	Perennial	RPW	6.5	R3UB1	-	-	03010101	Upper Roanoke	Pipeline ROW	121	-	786.5	-	10	291	-	191
S-C16	UNT to Teels Creek	Franklin	37.060810	-79.921179	Perennial	RPW	15	R3UB1	-	-	03010101	Upper Roanoke	Pipeline ROW	75	-	1125	-	10	417	-	183
S-KL54	UNT to Maggodee Creek	Franklin	37.059535	-79.840624	Perennial	RPW	10	R3UB1	-	-	03010101	Upper Roanoke	Pipeline ROW	75	-	750	-	10	281	-	197

Table 2.2 Field Survey Stream Impacts

Stream ID	NHD Stream Name[1]	County	Latitude[1]	Longitude[1]	Flow Regime	Water Type[1]	Top of Bank Width (ft)	Cowardin[1]	Stream Designation[2]	RTE[3]	HUC 8	HUC 8 Name	Impact Type	Temporary Impact (linear ft)	Permanent Impact (linear ft)	Temporary Impact Area (square ft)	Permanent Impact Area (square ft)	Depth of Fill (ft)	Temporary Fill (cubic yards)[4]	Permanent Fill (cubic yards)[4]	Figure
S-C8	UNT to Blackwater River	Franklin	37.059086	-79.853595	Intermittent	RPW	5	R4RB5	-	-	03010101	Upper Roanoke	Pipeline ROW	86	-	430	-	10	159	-	195
S-F4	UNT to Blackwater River	Franklin	37.059060	-79.853379	Ephemeral	NRPW	10	R6	-	-	03010101	Upper Roanoke	Pipeline ROW	82	-	820	-	3	91	-	195
S-KL52	UNT to Maggodee Creek	Franklin	37.058165	-79.844877	Ephemeral	NRPW	1	R6	-	-	03010101	Upper Roanoke	Pipeline ROW	105	-	105	-	10	39	-	196
S-S10	UNT to Maggodee Creek	Franklin	37.057820	-79.838618	Perennial	RPW	11	R3UB2	-	-	03010101	Upper Roanoke	Temporary Access Road	6	-	88	-	3	10	-	197
S-S11	UNT to Maggodee Creek	Franklin	37.057776	-79.838583	Perennial	RPW	11	R3UB3	-	-	03010101	Upper Roanoke	Temporary Access Road	41	-	451	-	3	50	-	197
S-F8	UNT to Maggodee Creek	Franklin	37.057724	-79.836406	Perennial	RPW	30	R3RB1	-	-	03010101	Upper Roanoke	Pipeline ROW	83	-	2490	-	10	922	-	197
S-HH4	UNT to Maggodee Creek	Franklin	37.056594	-79.835785	Intermittent	RPW	9	R4RB3	-	-	03010101	Upper Roanoke	Pipeline ROW	97	-	873	-	10	323	-	198
S-KL51	UNT to Blackwater River	Franklin	37.056084	-79.850384	Perennial	RPW	5.5	R3UB2	-	-	03010101	Upper Roanoke	Pipeline ROW	67	-	368.5	-	10	136	-	195
S-KL38	UNT to Blackwater River	Franklin	37.055812	-79.853177	Perennial	RPW	7	R3UB1	-	-	03010101	Upper Roanoke	Pipeline ROW	78	-	546	-	10	202	-	190
S-C20	UNT to Maggodee Creek	Franklin	37.055193	-79.833581	Ephemeral	NRPW	4	R6	-	-	03010101	Upper Roanoke	Pipeline ROW	75	-	300	-	10	111	-	198
S-C20	UNT to Maggodee Creek	Franklin	37.054793	-79.833675	Ephemeral	NRPW	4	R6	-	-	03010101	Upper Roanoke	Temporary Access Road	28	-	112	-	3	12	-	198
S-C20 Total	UNT to Maggodee Creek													103	-	412	-		124	-	
S-C19	Maggodee Creek	Franklin	37.055147	-79.830088	Perennial	RPW	45	R2UB1	-	Roanoke logperch	03010101	Upper Roanoke	Pipeline ROW	75	-	3005	-	10	1113	-	198
S-KL36	UNT to Blackwater River	Franklin	37.053336	-79.884694	Perennial	RPW	7.5	R3UB1	-	-	03010101	Upper Roanoke	Pipeline ROW	60	-	600	-	10	222	-	189
S-F11	Blackwater River	Franklin	37.052843	-79.825711	Perennial	TNW	90	R2	-	Roanoke logperch	03010101	Upper Roanoke	Pipeline ROW	91	-	6798	-	10	2508	-	199
S-KL35	UNT to Blackwater River	Franklin	37.052125	-79.886182	Perennial	RPW	2.5	R3UB1	-	-	03010101	Upper Roanoke	Pipeline ROW	116	-	290	-	10	107	-	189
S-F9b	UNT to Blackwater River	Franklin	37.049238	-79.817223	Perennial	RPW	15	R3UB1	-	-	03010101	Upper Roanoke	Pipeline ROW	76	-	1140	-	10	422	-	200
S-F10	UNT to Blackwater River	Franklin	37.048037	-79.813934	Ephemeral	NRPW	9	R6	-	-	03010101	Upper Roanoke	Pipeline ROW	86	-	774	-	10	287	-	200
S-CD1	UNT to Blackwater River	Franklin	37.047765	-79.897636	Perennial	RPW	3.5	R3UB2	-	-	03010101	Upper Roanoke	Pipeline ROW	104	-	364	-	10	135	-	188
S-F9a	UNT to Blackwater River	Franklin	37.047172	-79.813000	Intermittent	RPW	15	R4RB3	-	-	03010101	Upper Roanoke	Pipeline ROW	55	-	825	-	10	306	-	200
S-MM29	UNT to Maple Branch	Franklin	37.043871	-79.822898	Perennial	RPW	15	R3RB1	-	-	03010101	Upper Roanoke	Temporary Access Road	42	-	630	-	3	70	-	201
S-MM23	Maple Branch	Franklin	37.043854	-79.822974	Perennial	RPW	20	R2RB1	-	-	03010101	Upper Roanoke	Temporary Access Road	78	-	1560	-	3	173	-	201
S-GG4	UNT to Blackwater River	Franklin	37.042742	-79.809015	Ephemeral	NRPW	5	R6	-	-	03010101	Upper Roanoke	Pipeline ROW	86	-	430	-	10	159	-	203
S-A36	UNT to Foul Ground Creek	Franklin	37.037816	-79.804237	Ephemeral	NRPW	4	R6	-	-	03010101	Upper Roanoke	Pipeline ROW	77	-	308	-	10	114	-	204
S-A38	UNT to Foul Ground Creek	Franklin	37.036271	-79.799442	Intermittent	RPW	9	R4RB4	-	-	03010101	Upper Roanoke	Pipeline ROW	142	-	1278	-	10	473	-	205
S-A40	UNT to Foul Ground Creek	Franklin	37.036173	-79.799240	Intermittent	RPW	5.5	R4RB4	-	-	03010101	Upper Roanoke	Pipeline ROW	13	-	75.4	-	3	8	-	205
S-A41	Foul Ground Creek	Franklin	37.031714	-79.788213	Perennial	RPW	12	R2UB1	-	-	03010101	Upper Roanoke	Pipeline ROW	76	-	912	-	10	338	-	207
S-GH36	UNT to Foul Ground Creek	Franklin	37.031063	-79.778598	Intermittent	RPW	3	R4SB5	-	-	03010101	Upper Roanoke	Pipeline ROW	83	-	249	-	10	92	-	208
S-KL17	UNT to Foul Ground Creek	Franklin	37.031011	-79.778435	Intermittent	RPW	5	R4SB3	-	-	03010101	Upper Roanoke	Pipeline ROW	77	-	385	-	10	143	-	208
S-GH37	UNT to Foul Ground Creek	Franklin	37.030874	-79.778190	Intermittent	RPW	3	R4SB3	-	-	03010101	Upper Roanoke	Pipeline ROW	46	-	138	-	3	15	-	208
S-GH38	UNT to Foul Ground Creek	Franklin	37.030972	-79.778083	Intermittent	RPW	3	R4SB4	-	-	03010101	Upper Roanoke	Pipeline ROW	7	-	21	-	3	2	-	208
S-GH39	UNT to Foul Ground Creek	Franklin	37.030861	-79.776969	Intermittent	RPW	4	R4SB4	-	-	03010101	Upper Roanoke	Pipeline ROW	103	-	412	-	10	153	-	208
S-GH40	UNT to Foul Ground Creek	Franklin	37.028893	-79.774765	Ephemeral	NRPW	3	R6	-	-	03010101	Upper Roanoke	Pipeline ROW	89	-	267	-	10	99	-	208
S-GH44	UNT to Foul Ground Creek	Franklin	37.028392	-79.773359	Perennial	RPW	6	R3UB2	-	-	03010101	Upper Roanoke	Pipeline ROW	176	-	1056	-	10	391	-	209
S-LL47	UNT to Foul Ground Creek	Franklin	37.026373	-79.773383	Ephemeral	NRPW	2	R6	-	-	03010101	Upper Roanoke	Pipeline ROW	16	-	32	-	3	4	-	209
S-G22	UNT to Poplar Camp Creek	Franklin	37.019612	-79.761958	Perennial	RPW	12	R3UB1	-	-	03010101	Upper Roanoke	Pipeline ROW	80	-	960	-	10	356	-	210
S-G23	UNT to Poplar Camp Creek	Franklin	37.019526	-79.762002	Intermittent	RPW	3	R4RB2	-	-	03010101	Upper Roanoke	Pipeline ROW	42	-	126	-	3	14	-	210
S-G21	UNT to Poplar Camp Creek	Franklin	37.019359	-79.761843	Intermittent	RPW	3	R4RB4	-	-	03010101	Upper Roanoke	Pipeline ROW	54	-	162	-	3	18	-	210
S-G20	Poplar Camp Creek	Franklin	37.017364	-79.760000	Perennial	RPW	10	R2UB1	-	-	03010101	Upper Roanoke	Pipeline ROW	80	-	800	-	10	296	-	211
S-G18	UNT to Blackwater River	Franklin	37.009236	-79.754238	Intermittent	RPW	2	R4RB4	-	-	03010101	Upper Roanoke	Pipeline ROW	51	-	102	-	10	60	-	212
S-G17	UNT to Blackwater River	Franklin	37.005495	-79.752655	Ephemeral	NRPW	5	R6	-	-	03010101	Upper Roanoke	Pipeline ROW	78	-	390	-	10	144	-	213
S-G17	UNT to Blackwater River	Franklin	37.005446	-79.753184	Ephemeral	NRPW	5	R6	-	-	03010101	Upper Roanoke	Temporary Access Road	13	-	65	-	3	7	-	213
S-G17 Total	UNT to Blackwater River													91	-	455	-		152	-	

Table 2.2 Field Survey Stream Impacts

Stream ID	NHD Stream Name[1]	County	Latitude[2]	Longitude[2]	Flow Regime	Water Type[3]	Top of Bank Width (ft)	Cowardin[4]	Stream Designation[5]	RTE[6]	HUC 8	HUC 8 Name	Impact Type	Temporary Impact (linear ft)	Permanent Impact (linear ft)	Temporary Impact Area (square ft)	Permanent Impact Area (square ft)	Depth of fill (ft)	Temporary Fill (cubic yards)[7]	Permanent Fill (cubic yards)[7]	Figure
S-E16	UNT to Blackwater River	Franklin	37.001271	-79.747749	Perennial	RPW	7	R3UB1	-	-	03010101	Upper Roanoke	Pipeline ROW	94	-	658	-	10	244	-	214
S-E17	UNT to Blackwater River	Franklin	37.000529	-79.742760	Perennial	RPW	8	R3RB1	-	-	03010101	Upper Roanoke	Pipeline ROW	95	-	760	-	10	281	-	214
S-E14	UNT to Blackwater River	Franklin	36.995814	-79.735144	Perennial	RPW	20	R2UB2	-	-	03010101	Upper Roanoke	Pipeline ROW	82	-	1640	-	10	607	-	215
S-H38	UNT to Jacks Creek	Franklin	36.989430	-79.722366	Perennial	RPW	12	R3UB2	-	-	03010101	Upper Roanoke	Pipeline ROW	95	-	1140	-	10	422	-	217
S-H32	UNT to Jacks Creek	Franklin	36.986273	-79.708199	Perennial	RPW	10	R3UB2	-	Orangefin medium	03010101	Upper Roanoke	Pipeline ROW	61	-	810	-	10	300	-	219
S-H37	UNT to Jacks Creek	Franklin	36.986031	-79.717450	Ephemeral	NRPW	6	R6	-	-	03010101	Upper Roanoke	Pipeline ROW	62	-	492	-	10	182	-	218
S-H34	UNT to Jacks Creek	Franklin	36.988009	-79.711861	Perennial	RPW	3	R3UB2	-	-	03010101	Upper Roanoke	Pipeline ROW	92	-	276	-	10	102	-	219
S-H35	UNT to Jacks Creek	Franklin	36.988008	-79.714922	Perennial	RPW	3	R3UB1	-	-	03010101	Upper Roanoke	Pipeline ROW	124	-	372	-	10	138	-	218
S-H30	UNT to Jacks Creek	Franklin	36.987961	-79.702711	Intermittent	RPW	1	R4RB5	-	-	03010101	Upper Roanoke	Pipeline ROW	4	-	4	-	3	0	-	221
S-A18	UNT to Jacks Creek	Franklin	36.987816	-79.700634	Intermittent	RPW	2.6	R4RB5	-	-	03010101	Upper Roanoke	Pipeline ROW	87	-	226.2	-	10	84	-	221
S-A19/H26	UNT to Jacks Creek	Franklin	36.987719	-79.698901	Intermittent	RPW	7	R4SB4	-	-	03010101	Upper Roanoke	Pipeline ROW	212	-	1484	-	10	550	-	221
S-A20	UNT to Jacks Creek	Franklin	36.987715	-79.698555	Perennial	RPW	7	R3RB1	-	Orangefin medium	03010101	Upper Roanoke	Pipeline ROW	96	-	888	-	10	254	-	221
S-H28	UNT to Jacks Creek	Franklin	36.985174	-79.692272	Ephemeral	NRPW	6	R6	-	-	03010101	Upper Roanoke	Pipeline ROW	16	-	96	-	3	11	-	222
S-H27	UNT to Jacks Creek	Franklin	36.985124	-79.692272	Ephemeral	NRPW	10	R6	-	-	03010101	Upper Roanoke	Pipeline ROW	36	-	360	-	3	40	-	222
S-A22	UNT to Jacks Creek	Franklin	36.984846	-79.691870	Intermittent	RPW	8	R4RB4	-	-	03010101	Upper Roanoke	Pipeline ROW	95	-	760	-	10	281	-	222
S-MM44	UNT to Little Jacks Creek	Franklin	36.982507	-79.687816	Perennial	RPW	4	R3UB1	-	-	03010101	Upper Roanoke	Pipeline ROW	94	-	376	-	10	139	-	222
S-MM46	UNT to Little Jacks Creek	Franklin	36.982240	-79.687509	Intermittent	RPW	3	R4SB5	-	-	03010101	Upper Roanoke	Pipeline ROW	9	-	27	-	3	3	-	222
S-MM45	UNT to Little Jacks Creek	Franklin	36.981971	-79.686901	Ephemeral	NRPW	4	R6	-	-	03010101	Upper Roanoke	Pipeline ROW	33	-	132	-	3	15	-	222
S-MM48	UNT to Little Jacks Creek	Franklin	36.979223	-79.684192	Perennial	RPW	7	R3UB1	-	-	03010101	Upper Roanoke	Pipeline ROW	133	-	931	-	10	345	-	223
S-H25	Little Jacks Creek	Franklin	36.978529	-79.682186	Perennial	RPW	7	R2UB2	-	-	03010101	Upper Roanoke	Pipeline ROW	80	-	560	-	10	207	-	223
S-H24	UNT to Little Jacks Creek	Franklin	36.978025	-79.680682	Perennial	RPW	10	R3UB2	-	-	03010101	Upper Roanoke	Pipeline ROW	119	-	1190	-	10	441	-	223
S-H23	UNT to Turkey Creek	Franklin	36.976421	-79.677525	Ephemeral	NRPW	5	R6	-	-	03010101	Upper Roanoke	Pipeline ROW	92	-	460	-	10	170	-	225
S-HH1	UNT to Turkey Creek	Franklin	36.974547	-79.674453	Ephemeral	NRPW	5	R6	-	-	03010101	Upper Roanoke	Pipeline ROW	18	-	90	-	3	10	-	225
S-A13	Turkey Creek	Franklin	36.973292	-79.673075	Perennial	RPW	6	R2UB1	-	Orangefin medium	03010101	Upper Roanoke	Pipeline ROW	92	-	736	-	10	273	-	225
S-A11	UNT to Turkey Creek	Franklin	36.973237	-79.689896	Ephemeral	NRPW	3	R6	-	-	03010101	Upper Roanoke	Pipeline ROW	55	-	165	-	3	18	-	227
S-H17	Dinner Creek	Franklin	36.972125	-79.662967	Intermittent	RPW	8	R4RB4	-	-	03010101	Upper Roanoke	Pipeline ROW	101	-	808	-	10	299	-	228
S-A7	UNT to Dinner Creek	Franklin	36.972032	-79.662504	Perennial	RPW	6	R3UB1	-	-	03010101	Upper Roanoke	Pipeline ROW	87	-	582	-	10	216	-	228
S-S56	Polecat Creek	Franklin	36.970904	-79.657378	Perennial	RPW	8	R3UB1	-	-	03010101	Upper Roanoke	Pipeline ROW	94	-	752	-	10	278	-	228
S-C08	UNT to Owens Creek	Franklin	36.970522	-79.653726	Intermittent	RPW	4.5	R4SB4	-	-	03010101	Upper Roanoke	Pipeline ROW	78	-	351	-	10	130	-	229
S-A88	UNT to Owens Creek	Franklin	36.970133	-79.651329	Intermittent	RPW	4	R4SB3	-	-	03010101	Upper Roanoke	Pipeline ROW	84	-	336	-	10	124	-	229
S-D03	Owens Creek	Franklin	36.969118	-79.645042	Intermittent	RPW	15	R4RB3	-	Orangefin medium	03010101	Upper Roanoke	Pipeline ROW	111	-	1665	-	10	617	-	230
S-G16	Strawfield Creek	Franklin	36.968640	-79.642174	Perennial	RPW	30	R3RB1	-	Orangefin medium	03010101	Upper Roanoke	Pipeline ROW	75	-	2250	-	10	833	-	230
S-G15	UNT to Parrot Branch	Franklin	36.967711	-79.636590	Intermittent	RPW	8	R4RB3	-	-	03010101	Upper Roanoke	Pipeline ROW	88	-	792	-	10	293	-	231
S-G13	Parrot Branch	Franklin	36.967025	-79.630747	Perennial	RPW	8	R2UB1	-	Orangefin medium	03010101	Upper Roanoke	Pipeline ROW	79	-	632	-	10	234	-	231
S-D3	UNT to Jonnikin Creek	Pittsylvania	36.965631	-79.605542	Perennial	RPW	10	R2UB1	-	Orangefin medium	03010101	Upper Roanoke	Pipeline ROW	77	-	770	-	10	285	-	235
S-D4	UNT to Jonnikin Creek	Pittsylvania	36.965800	-79.604894	Intermittent	RPW	6	R4SB5	-	-	03010101	Upper Roanoke	Pipeline ROW	105	-	630	-	10	233	-	235
S-D2	Jonnikin Creek	Pittsylvania	36.965405	-79.599130	Perennial	RPW	18	R3UB1	-	Orangefin medium	03010101	Upper Roanoke	Pipeline ROW	76	-	1404	-	10	520	-	236
S-D7	UNT to Jonnikin Creek	Franklin	36.964763	-79.617043	Intermittent	RPW	8	R4RB3	-	-	03010101	Upper Roanoke	Pipeline ROW	60	-	540	-	10	237	-	233
S-D1-EPH	UNT to Jonnikin Creek	Pittsylvania	36.964430	-79.596691	Ephemeral	NRPW	10	R6	-	-	03010101	Upper Roanoke	Pipeline ROW	61	-	610	-	10	226	-	238
S-D1-INT	UNT to Jonnikin Creek	Pittsylvania	36.964407	-79.595841	Intermittent	RPW	10	R4SB5	-	-	03010101	Upper Roanoke	Pipeline ROW	29	-	290	-	3	32	-	238
S-D1 Total	UNT to Jonnikin Creek													90		900	-		334	-	
S-G11	UNT to Jonnikin Creek	Pittsylvania	36.962420	-79.590500	Intermittent	RPW	6	R4SB3	-	-	03010101	Upper Roanoke	Pipeline ROW	77	-	462	-	10	171	-	237
S-G9	UNT to Jonnikin Creek	Pittsylvania	36.959361	-79.586437	Intermittent	RPW	4	R4SB3	-	-	03010101	Upper Roanoke	Pipeline ROW	79	-	316	-	10	117	-	239
S-G6	UNT to Jonnikin Creek	Pittsylvania	36.957605	-79.583545	Intermittent	RPW	4	R4SB3	-	-	03010101	Upper Roanoke	Pipeline ROW	90	-	360	-	10	133	-	239

Table 2.2 Field Survey Stream Impacts

Stream ID	NHD Stream Name[1]	County	Latitude[2]	Longitude[2]	Flow Regime	Water Type[3]	Top of Bank Width (ft)	Cowardin[4]	Stream Designation[5]	RTE[6]	HUC 8	HUC 8 Name	Impact Type	Temporary Impact (linear ft)	Permanent Impact (linear ft)	Temporary Impact Area (square ft)	Permanent Impact Area (square ft)	Depth of Fill (ft)	Temporary Fill (cubic yards)[7]	Permanent Fill (cubic yards)[7]	Figure
S-Q15	UNT to Jennikin Creek	Pittsylvania	36.957580	-79.583492	Ephemeral	NRPW	5	R6	-	-	03010101	Upper Roanoke	Pipeline ROW	103	-	515	-	10	191	-	239
S-A5	UNT to Rocky Creek	Pittsylvania	36.954125	-79.580670	Ephemeral	NRPW	8	R6	-	-	03010101	Upper Roanoke	Pipeline ROW	13	-	164	-	3	12	-	238
S-A6	UNT to Rocky Creek	Pittsylvania	36.952275	-79.580460	Perennial	RPW	5	R3UB3	-	-	03010101	Upper Roanoke	Pipeline ROW	83	-	415	-	10	154	-	238
S-H11-Braid	UNT to Rocky Creek	Pittsylvania	36.949615	-79.579553	Ephemeral	NRPW	2	R6	-	-	03010101	Upper Roanoke	Pipeline ROW	85	-	170	-	3	19	-	238
S-H11	UNT to Rocky Creek	Pittsylvania	36.949582	-79.579537	Ephemeral	NRPW	3	R6	-	-	03010101	Upper Roanoke	Pipeline ROW	151	-	453	-	3	50	-	238
S-H11	UNT to Rocky Creek	Pittsylvania	36.946716	-79.578865	Ephemeral	NRPW	3	R6	-	-	03010101	Upper Roanoke	Pipeline ROW	35	-	105	-	3	12	-	238
S-H11 Total	UNT to Rocky Creek													471	-	728	-	-	81	-	
S-F2	UNT to Rocky Creek	Pittsylvania	36.944049	-79.571442	Ephemeral	NRPW	7	R6	-	-	03010101	Upper Roanoke	Pipeline ROW	50	-	350	-	10	130	-	241
S-C7	UNT to Rocky Creek	Pittsylvania	36.944016	-79.571517	Perennial	RPW	20	R3UB3	-	Orangefin madtom	03010101	Upper Roanoke	Pipeline ROW	99	-	1980	-	10	733	-	241
S-E12	UNT to Pigg River	Pittsylvania	36.935986	-79.549329	Ephemeral	NRPW	3	R6	-	-	03010101	Upper Roanoke	Pipeline ROW	1	-	3	-	3	0	-	243
S-E11[8]	Pigg River	Pittsylvania	36.933353	-79.538293	Perennial	RPW	100	R2UB3	-	Roanoke logperch; Yellow lampmussel; Orangefin Madtom	03010101	Upper Roanoke	Pipeline ROW	100	-	7131	-	10	2641	-	244
S-H9[8]	UNT to Pigg River	Pittsylvania	36.932497	-79.535087	Ephemeral	NRPW	9	R6	-	-	03010101	Upper Roanoke	Pipeline ROW	77	-	462	-	10	171	-	245
S-A4[8]	UNT to Pigg River	Pittsylvania	36.932251	-79.532989	Perennial	RPW	8	R3UB2	-	-	03010101	Upper Roanoke	Pipeline ROW	122	-	976	-	3	108	-	245
S-H7[8]	UNT to Pigg River	Pittsylvania	36.932182	-79.532963	Intermittent	RPW	5	R4SB4	-	-	03010101	Upper Roanoke	Pipeline ROW	69	-	345	-	10	128	-	245
S-C3	Harpen Creek	Pittsylvania	36.929762	-79.526109	Perennial	RPW	16	R2UB2	-	Roanoke logperch; Orangefin madtom	03010101	Upper Roanoke	Pipeline ROW	61	-	1064	-	10	394	-	246
S-H13	Harpen Creek	Pittsylvania	36.925105	-79.517359	Perennial	RPW	20	R2UB2	-	Orangefin madtom	03010101	Upper Roanoke	Pipeline ROW	77	-	1540	-	10	570	-	247
S-G4	Harpen Creek	Pittsylvania	36.919463	-79.492569	Perennial	RPW	30	R2UB1	-	Orangefin madtom	03010101	Upper Roanoke	Pipeline ROW	88	-	2640	-	10	978	-	250
S-C3, S-H13 & S-G4 Total	Harpen Creek													246	-	6245	-	-	1548	-	
S-C4	UNT to Harpen Creek	Pittsylvania	36.929746	-79.526280	Perennial	RPW	4	R3UB1	-	-	03010101	Upper Roanoke	Pipeline ROW	129	-	516	-	10	191	-	248
S-G6	UNT to Harpen Creek	Pittsylvania	36.920737	-79.505899	Intermittent	RPW	6	R4SB4	-	-	03010101	Upper Roanoke	Pipeline ROW	80	-	480	-	10	178	-	249
S-G5	UNT to Harpen Creek	Pittsylvania	36.917694	-79.499604	Ephemeral	NRPW	6	R6	-	-	03010101	Upper Roanoke	Pipeline ROW	77	-	462	-	10	171	-	250
S-G3	UNT to Harpen Creek	Pittsylvania	36.915058	-79.480029	Perennial	RPW	9	R3UB1	-	-	03010101	Upper Roanoke	Pipeline ROW	82	-	738	-	10	273	-	251
S-CC16	UNT to Harpen Creek	Pittsylvania	36.913003	-79.467838	Perennial	RPW	11	R3US2	-	-	03010101	Upper Roanoke	Pipeline ROW	83	-	913	-	10	338	-	251
S-CC14	UNT to Cherrystone Creek	Pittsylvania	36.905329	-79.471492	Intermittent	RPW	8	R4SB5	-	-	03010105	Banister	Pipeline ROW	77	-	616	-	10	228	-	253
S-CC13	UNT to Cherrystone Creek	Pittsylvania	36.905307	-79.471574	Intermittent	RPW	7	R4SB5	-	-	03010105	Banister	Pipeline ROW	61	-	427	-	10	158	-	253
S-MM8	UNT to Cherrystone Creek	Pittsylvania	36.902991	-79.466228	Perennial	RPW	6	R3UB2	-	-	03010105	Banister	Pipeline ROW	75	-	450	-	10	167	-	254
S-CC15	UNT to Cherrystone Creek	Pittsylvania	36.901841	-79.466535	Perennial	RPW	6	R3UB2	-	-	03010105	Banister	Pipeline ROW	82	-	492	-	10	182	-	254
S-CC8	UNT to Cherrystone Creek	Pittsylvania	36.899437	-79.462685	Intermittent	RPW	8	R4SB4	-	-	03010105	Banister	Pipeline ROW	21	-	168	-	3	19	-	254
S-CC5	UNT to Cherrystone Creek	Pittsylvania	36.899411	-79.462483	Perennial	RPW	12	R3UB1	-	-	03010105	Banister	Pipeline ROW	97	-	1164	-	10	431	-	254
S-CC5	UNT to Cherrystone Creek	Pittsylvania	36.899248	-79.462396	Perennial	RPW	12	R3UB1	-	-	03010105	Banister	Pipeline ROW	54	-	648	-	10	240	-	254
S-CC5 Total	UNT to Cherrystone Creek													151	-	1812	-	-	671	-	
S-CC9	UNT to Cherrystone Creek	Pittsylvania	36.897740	-79.458046	Ephemeral	NRPW	5.5	R6	-	-	03010105	Banister	Pipeline ROW	81	-	445.5	-	10	165	-	255
S-CC10	UNT to Cherrystone Creek	Pittsylvania	36.897315	-79.456119	Intermittent	RPW	9	R4SB5	-	-	03010105	Banister	Pipeline ROW	78	-	702	-	10	260	-	255
S-MM10	UNT to Cherrystone Creek	Pittsylvania	36.895915	-79.452960	Intermittent	RPW	7	R4SB3	-	-	03010105	Banister	Pipeline ROW	9	-	63	-	3	7	-	256
S-CC11	UNT to Cherrystone Creek	Pittsylvania	36.895806	-79.452920	Perennial	RPW	8	R3UB2	-	-	03010105	Banister	Pipeline ROW	87	-	696	-	10	258	-	256
S-CC1	Cherrystone Creek	Pittsylvania	36.894043	-79.445744	Perennial	RPW	15	R2UB1	-	-	03010105	Banister	Pipeline ROW	82	-	1230	-	10	456	-	257
S-CC3	UNT to Cherrystone Creek	Pittsylvania	36.893727	-79.444793	Ephemeral	NRPW	8	R6	-	-	03010105	Banister	Pipeline ROW	91	-	726	-	10	270	-	257
S-P5	UNT to Cherrystone Creek	Pittsylvania	36.892751	-79.440053	Ephemeral	NRPW	5	R6	-	-	03010105	Banister	Pipeline ROW	108	-	540	-	10	200	-	257
S-U35-EPH	UNT to Pole Bridge Branch	Pittsylvania	36.891451	-79.433781	Ephemeral	NRPW	4	R6	-	-	03010105	Banister	Pipeline ROW	171	-	684	-	10	253	-	258
S-Q4	UNT to Pole Bridge Branch	Pittsylvania	36.886114	-79.430914	Perennial	RPW	5	R3UB2	-	-	03010105	Banister	Pipeline ROW	91	-	455	-	10	169	-	259
S-Q3	Pole Bridge Branch	Pittsylvania	36.884444	-79.428220	Perennial	RPW	25	R2UB1	-	-	03010105	Banister	Pipeline ROW	75	-	1875	-	10	694	-	259
S-Q2	UNT to Pole Bridge Branch	Pittsylvania	36.884284	-79.427914	Perennial	RPW	7	R3UB3	-	-	03010105	Banister	Pipeline ROW	114	-	798	-	10	296	-	259
S-Q1	UNT to Pole Bridge Branch	Pittsylvania	36.883448	-79.425169	Ephemeral	NRPW	4	R6	-	-	03010105	Banister	Pipeline ROW	13	-	52	-	3	6	-	260

Table 2.2 Field Survey Stream Impacts

Stream ID	NHD Stream Name[1]	County	Latitude[2]	Longitude[2]	Flow Regime	Water Type[3]	Top of Bank Width (ft)	Cowardin[4]	Stream Designation[5]	RTE[6]	HUC 8	HUC 8 Name	Impact Type	Temporary Impact (linear ft)	Permanent Impact (linear ft)	Temporary Impact Area (square ft)	Permanent Impact Area (square ft)	Depth of fill (ft)	Temporary Fill (cubic yards)[7]	Permanent Fill (cubic yards)[8]	Figure
S-B6	UNT to Pole Bridge Branch	Pittsylvania	36.678063	-79.430189	Ephemeral	NRPW	10	R6	-	-	03010105	Banister	Pipeline ROW	84	-	840	-	10	311	-	260
S-B8	UNT to Pole Bridge Branch	Pittsylvania	36.677937	-79.417992	Intermittent	RPW	4	R4SB3	-	-	03010105	Banister	Pipeline ROW	82	-	328	-	10	121	-	261
S-B9	UNT to Pole Bridge Branch	Pittsylvania	36.677416	-79.416255	Perennial	RPW	7	R3UB1	-	-	03010105	Banister	Pipeline ROW	78	-	546	-	10	202	-	261
S-DD4	UNT to Mill Creek	Pittsylvania	36.871478	-79.403907	Intermittent	RPW	6	R4SB4	-	-	03010105	Banister	Pipeline ROW	41	-	246	-	10	91	-	263
S-DD4	UNT to Mill Creek	Pittsylvania	36.870963	-79.402714	Intermittent	RPW	5	R4SB4	-	-	03010105	Banister	Pipeline ROW	79	-	474	-	10	176	-	263
S-DD4 Total	UNT to Mill Creek													193		1266	-	-	467	-	
S-KL27	UNT to Mill Creek	Pittsylvania	36.868534	-79.400511	Ephemeral	NRPW	1	R6	-	-	03010105	Banister	Pipeline ROW	84	-	84	-	10	31	-	264
S-C1	Mill Creek	Pittsylvania	36.863513	-79.397914	Intermittent	RPW	6	R4SB4	-	-	03010105	Banister	Pipeline ROW	92	-	552	-	10	204	-	265
S-G2	Little Cherrystone Creek	Pittsylvania	36.851931	-79.386051	Perennial	RPW	7	R2UB2	-	-	03010105	Banister	Pipeline ROW	77	-	539	-	10	200	-	267
S-B2	UNT to Little Cherrystone Creek	Pittsylvania	36.849384	-79.377780	Ephemeral	NRPW	5	R6	-	-	03010105	Banister	Pipeline ROW	76	-	380	-	10	141	-	268
S-H55	UNT to Little Cherrystone Creek	Pittsylvania	36.843486	-79.369222	Ephemeral	NRPW	3	R6	-	-	03010105	Banister	Pipeline ROW	59	-	177	-	10	66	-	269
S-H54	UNT to Little Cherrystone Creek	Pittsylvania	36.841112	-79.366648	Perennial	RPW	12	R3UB1	-	-	03010105	Banister	Pipeline ROW	80	-	1080	-	10	400	-	270
S-GG11	UNT to Little Cherrystone Creek	Pittsylvania	36.841983	-79.366942	Perennial	RPW	8	R3UB1	-	-	03010105	Banister	Pipeline ROW	46	-	368	-	3	41	-	270
S-H3	UNT to Little Cherrystone Creek	Pittsylvania	36.834501	-79.360244	Intermittent	RPW	8	R4SB4	-	-	03010105	Banister	Pipeline ROW	18	-	108	-	3	12	-	271
S-H5	UNT to Little Cherrystone Creek	Pittsylvania	36.833412	-79.359823	Perennial	RPW	8	R3UB2	-	-	03010105	Banister	Pipeline ROW	83	-	664	-	10	246	-	271
S-OO1	UNT to Little Cherrystone Creek	Pittsylvania	36.830285	-79.356618	Intermittent	RPW	5	R4SB3	-	-	03010105	Banister	Pipeline ROW	84	-	420	-	10	156	-	271
S-H44	UNT to Little Cherrystone Creek	Pittsylvania	36.829823	-79.346016	Perennial	RPW	8	R3UB2	-	-	03010105	Banister	Pipeline ROW	120	-	960	-	10	356	-	273
S-H42	UNT to Little Cherrystone Creek	Pittsylvania	36.828993	-79.344442	Perennial	RPW	5	R3UB2	-	-	03010105	Banister	Permanent Access Road	-	39	-	195	3	-	22	273
S-H42	UNT to Little Cherrystone Creek	Pittsylvania	36.828958	-79.344315	Perennial	RPW	5	R3UB2	-	-	03010105	Banister	Pipeline ROW	52	-	260	-	3	29	-	273
S-H42 Total	UNT to Little Cherrystone Creek													52	39	260	195		29	22	
S-OO2	UNT to Little Cherrystone Creek	Pittsylvania	36.828831	-79.353849	Intermittent	RPW	5	R4SB3	-	-	03010105	Banister	Pipeline ROW	78	-	390	-	10	144	-	272
S-EF26	Little Cherrystone Creek	Pittsylvania	36.828207	-79.349814	Perennial	RPW	20	R2UB1	-	-	03010105	Banister	Pipeline ROW	79	-	1580	-	10	585	-	272
													Total	28625	478	259669	3065	-	89435	341	

Notes:

1 - For identified streams without a NHD (National Hydrography Dataset) name, the identified stream was given the name, "Unidentified Tributary (UNT)", of the first named receiving waterbody

2 - In decimal degrees

3 - RPW = Relatively Permanent Waters
- NRPW = Non-Relatively Permanent Waters
- TNW = Traditional Navigable Waters

4 - See Cowardin et al., 1979

5 - Trout Waters - Virginia Department of Environmental Quality Office of Water Monitoring and Assessment, VEGIS Dataset. http://www.deq.virginia.gov/ConnectWithDEQ/VEGIS/VEGISDatasets.aspx. 2014_Integrated_WQ_Report_Rivers. File Date: 8/2016. File download: 6/2017.
  - Wild Trout - VA DGIF Trout Stream Classification Class I-IV (VA DEQ Natural trout waters Class VI)
  - Stockable Trout - VA DGIF Trout Stream Classification Class V-VI (VA DEQ Stockable trout waters Class V)
- Tier III Exceptional Waterbodies - No Tier III Exceptional Waterbodies crossed by the Project.
  - Tier III data from: http://www.deq.virginia.gov/Programs/Water/WaterQualityInformationTMDLs/WaterQualityStandards/ExceptionalStateWaters(TierIII).aspx
- Anadromous Fish Use Areas - No Anadromous Fish Use Areas crossed by the Project.
  - Anadromous Fish Use Area data from: https://www.dgif.virginia.gov/gis/data/download/

6 - Green floater - *Lasmigona subviridis*; state threatened in Virginia
- James spinymussel - *Pleurobema collina*; federal endangered species
- Orangefin madtom - *Noturus gilberti*; state threatened in Virginia
- Roanoke logperch - *Percina rex*; federal endangered species
- Yellow lampmussel - *Lampsilis cariosa*; state species of concern in Virginia

7 - No in-stream work is anticipated for stream crossings along access roads at existing culverts; therefore, streams crossing access roads in existing culverts will not be impacted and are not included on this table.

8 - Temporary fill discharge into waters of the U.S.

9 - Permanent fill associated with the construction of permanent access road and facilities

11 - The Federal Energy Regulatory Commission (FERC) recommended in its Final Environmental Impact Statement (June 2017) that MVP use a horizontal directional drill (HDD) as the preferred method to cross the Pigg River (S-E11), which incidentally also would affect adjacent streams S-H7, S-H8, and S-N4. The proposed impacts to these waters will not occur if the FERC-recommended HDD is completed successfully. If the HDD is unsuccessful for any reason, the dry open cut method will be utilized in accordance with an HDD Contingency Plan. The temporary impacts associated with the dry open cut crossing contingency are included here.

Table 3.1 Wetland Impact Summary

Survey Type	Cowardin Class[1]	Temporary Impacts (Square Feet)[2]	Permanent Conversion Impacts (Square Feet)[3]	Permanent Fill Impacts (Square Feet)[4]	Temporary Fill (cubic yards)	Permanent Fill (cubic yards)
USACE Jurisdictional Field Identified	PEM (sq ft)	208,370	0	609	62,294	68
	PSS (sq ft)	0	97,145	0	33,039	0
	PFO (sq ft)	0	90,368	0	31,439	0
	Field Total (sq ft)	208,370	187,513	609	126,771	68
USACE Jurisdictional Desktop Identified	PEM (sq ft)	15	0	84	2	9
	PSS (sq ft)	0	0	0	0	0
	PFO (sq ft)	0	0	0	0	0
	Desktop Total (sq ft)	15	0	84	2	9
All USACE Jurisdictional Features	PEM (sq ft)	208,385	0	693	62,296	77
	PSS (sq ft)	0	97,145	0	33,039	0
	PFO (sq ft)	0	90,368	0	31,439	0
	Grand Total (sq ft)	208,385	187,513	693	126,773	77
All USACE Jurisdictional Features	PEM (acres)	4.78	0.00	0.02	1.43	0.002
	PSS (acres)	0.00	2.23	0.00	0.76	0.00
	PFO (acres)	0.00	2.07	0.00	0.72	0.00
	Grand Total (acres)	4.78	4.30	0.02	2.91	0.002
USACE Non-Jurisdictional Features	PEM (sq ft)	3,508	0	0	1,299	0
	PSS (sq ft)	0	161	0	60	0
	PFO (sq ft)	0	0	0	0	0
	Grand Total (sq ft)	3,508	161	0	1,359	0
USACE Non-Jurisdictional Features	PEM (acres)	0.08	0.00	0.00	0.03	0.00
	PSS (acres)	0.00	0.00	0.00	0.00	0.00
	PFO (acres)	0.00	0.00	0.00	0.00	0.00
	Grand Total (acres)	0.08	0.00	0.00	0.03	0.000

Notes:

1 - PEM = Palustrine Emergent
- PSS = Palustrine Scrub-Shrub
- PFO = Palustrine Forested

2 - Temporary impacts to PEM wetlands in the Temporary limit-of-disturbance

3 - Permanent conversion impacts to PSS and PFO wetlands in the temporary limit-of-disturbance

4 - Permanent fill impacts to PEM, PSS and PFO wetlands within permanent access road limit-of-disturbance

Table 3.2 Field Survey USACE Jurisdictional Wetland Impacts

Wetland ID	County	Latitude*	Longitude*	Cowardin Class*	HGM*	USACE Water Type*	HUC 6	HUC 8 Name	Impact Type	Temporary Impacts (square feet)	Permanent Conversion Impacts (square feet)	Permanent Fill Impacts (square feet)	Depth of Fill (ft)	Temporary Fill (cubic yards)*	Permanent Fill (cubic yards)*	Figure
W-HH15	Giles	37.37103	-80.738207	PEM	DEPRESSIONAL	NRPWW	05050002	Middle New	Permanent Access Road	54	-	-	3	7	-	12
W-Z11	Giles	37.346591	-80.641713	PEM	DEPRESSIONAL	NRPWW	05050002	Middle New	Pipeline ROW	1,141	1,168	-	10	423	-	26
W-Z3	Giles	37.342244	-80.620512	PSS	RIVERINE	RPWWD	05050002	Middle New	Pipeline ROW	904	-	-	10	433	-	39
W-CD12	Giles	37.319644	-80.441717	PEM	RIVERINE	RPWWD	05050002	Middle New	Temporary Access Road	1,109	-	-	3	123	-	53
W-MM10	Giles	37.298219	-80.480617	PEM	RIVERINE	RPWWD	05050002	Middle New	Pipeline ROW	766	-	-	10	284	-	55
W-RR1b	Giles	37.29807	-80.494042	PEM	RIVERINE	RPWWD	03010101	Upper Roanoke	Pipeline ROW	1,279	-	-	10	474	-	77
W-UJ46-PEM	Montgomery	37.296193	-80.387506	PEM	RIVERINE	RPWWD	3010101	Upper Roanoke	Temporary Access Road	301	-	-	3	33	-	82
W-AD4	Montgomery	37.286964	-80.330124	PEM	Slope	RPWWN	03010101	Upper Roanoke	Pipeline ROW	391	-	-	3	40	-	88
W-AN6	Montgomery	37.288174	-80.315468	PEM	SLOPE	RPWWD	03010101	Upper Roanoke	Pipeline ROW	437	-	-	3	49	-	90
W-PP8	Montgomery	37.264633	-80.306957	PEM	SLOPE	RPWWD	03010101	Upper Roanoke	Pipeline ROW	-	735	-	3	82	-	95
W-F9-PFO	Montgomery	37.258109	-80.285692	PFO	RIVERINE	RPWWD	03010101	Upper Roanoke	Pipeline ROW	-	2,278	-	3	253	-	95
W-C12	Montgomery	37.257192	-80.281548	PFO	RIVERINE	RPWWD	03010101	Upper Roanoke	Pipeline ROW	-	2,007	-	3	223	-	95
W-C11	Montgomery	37.257107	-80.281351	PSS	RIVERINE	RPWWD	03010101	Upper Roanoke	Pipeline ROW	1,977	-	-	10	732	-	96
W-C5	Montgomery	37.255605	-80.274237	PEM	SLOPE	NRPWW	03010101	Upper Roanoke	Permanent Access Road	244	-	-	3	27	-	112
W-MN11	Montgomery	37.249393	-80.207066	PEM	RIVERINE	RPWWD	03010101	Upper Roanoke	Pipeline ROW	-	3,307	-	10	1,225	-	118
W-NN8	Montgomery	37.233519	-80.197841	PFO	RIVERINE	RPWWD	03010101	Upper Roanoke	Pipeline ROW	555	-	-	10	243	-	118
W-AB7	Montgomery	37.231426	-80.198615	PEM	SLOPE	RPWWD	03010101	Upper Roanoke	Pipeline ROW	-	-	6	3	-	1	118
W-CD11	Montgomery	37.228284	-80.200066	PEM	RIVERINE	RPWWD	03010101	Upper Roanoke	Permanent Access Road	-	-	-	10	620	-	119
W-CD11	Montgomery	37.228042	-80.199959	PEM	RIVERINE	RPWWD	03010101	Upper Roanoke	Pipeline ROW	1,675	-	6	10	620	1	
W-CD11 Total										1,675	-	6		1,785	-	121
W-EF5-PFO	Montgomery	37.210948	-80.153309	PFO	RIVERINE	RPWWD	03010101	Upper Roanoke	Pipeline ROW	-	4,818	-	10	1,269	-	132
W-EF22	Roanoke	37.180936	-80.143495	PFO	RIVERINE	RPWWD	03010101	Upper Roanoke	Pipeline ROW	-	3,427	-	3	8	-	132
W-EF14	Roanoke	37.180532	-80.140139	PEM	RIVERINE	RPWWD	03010101	Upper Roanoke	Temporary Access Road	72	-	-	10	2,243	-	132
W-EF21	Roanoke	37.180089	-80.14265	PEM	SLOPE	RPWWN	03010101	Upper Roanoke	Pipeline ROW	8,055	-	-	3	61	-	132
W-EF18	Roanoke	37.179449	-80.140669	PSS	RIVERINE	RPWWD	03010101	Upper Roanoke	Temporary Access Road	-	456	-	3	192	-	132
W-EF17	Roanoke	37.179402	-80.1406	PFO	RIVERINE	RPWWD	03010101	Upper Roanoke	Temporary Access Road	-	1,725	-	10	723	-	132
W-EF19	Roanoke	37.179388	-80.141463	PSS	SLOPE	RPWWD	03010101	Upper Roanoke	Pipeline ROW	-	1,853	-	3	85	-	133
W-U93	Roanoke	37.17248	-80.138918	PEM	RIVERINE	RPWWD	03010101	Upper Roanoke	Pipeline ROW	766	-	-	3	527	-	135
W-UJ99	Roanoke	37.171817	-80.128891	PSS	RIVERINE	RPWWD	03010101	Upper Roanoke	Pipeline ROW	-	4,741	-	3	671	-	134
W-IJ94-PEM	Roanoke	37.170092	-80.138294	PEM	SLOPE	RPWWD	03010101	Upper Roanoke	Pipeline ROW	5,038	-	-	3	89	-	134
W-IJ94-PSS	Roanoke	37.169813	-80.139389	PSS	RIVERINE	RPWWD	03010101	Upper Roanoke	Pipeline ROW	-	805	-	3	700	-	135
W-IJ94 Total										5,038	805	-		14	-	135
W-IJ95-PEM	Roanoke	37.169491	-80.130376	PEM	RIVERINE	RPWWD	03010101	Upper Roanoke	Permanent Access Road	123	-	-	3	-	64	135
W-IJ95-PEM	Roanoke	37.169461	-80.130376	PEM	RIVERINE	RPWWD	03010101	Upper Roanoke	Permanent Access Road	-	579	-	3	-	2	135
W-IJ95 Total										123	579	-		14	66	135
W-IJ97	Roanoke	37.169197	-80.129448	PEM	SLOPE	RPWWD	03010101	Upper Roanoke	Permanent Access Road	-	-	22	3	-	2	135
W-IJ95-PSS	Roanoke	37.169068	-80.138278	PSS	RIVERINE	RPWWD	03010101	Upper Roanoke	Pipeline ROW	-	19,030	-	10	7,048	-	134
W-IJ102	Roanoke	37.168259	-80.138375	PFO	RIVERINE	RPWWD	03010101	Upper Roanoke	Pipeline ROW	-	610	-	3	88	-	134
W-IJ105	Roanoke	37.166929	-80.138993	PEM	RIVERINE	RPWWD	03010101	Upper Roanoke	Pipeline ROW	67	-	-	3	7	-	134
W-IJ100	Roanoke	37.166113	-80.139371	PFO	RIVERINE	RPWWD	03010101	Upper Roanoke	Pipeline ROW	-	321	-	3	36	-	134
W-IJ101	Roanoke	37.16571	-80.13958	PSS	RIVERINE	RPWWD	03010101	Upper Roanoke	Pipeline ROW	-	9	-	3	1	-	134
W-KL17	Roanoke	37.160152	-80.134774	PSS	RIVERINE	RPWWD	03010101	Upper Roanoke	Pipeline ROW	-	1,896	-	10	702	-	138
W-EF43	Roanoke	37.157611	-80.133722	PEM	SLOPE	RPWWD	03010101	Upper Roanoke	Pipeline ROW	213	-	-	3	24	-	137
W-AB8-PEM-2	Roanoke	37.156825	-80.131998	PEM	SLOPE	RPWWD	03010101	Upper Roanoke	Pipeline ROW	14,248	-	-	10	5,277	-	137
W-AB6-PFO-1	Roanoke	37.156713	-80.131681	PFO	SLOPE	RPWWD	03010101	Upper Roanoke	Pipeline ROW	-	2,691	-	10	997	-	137
W-AB6-PEM-1	Roanoke	37.15617	-80.130794	PEM	SLOPE	RPWWD	03010101	Upper Roanoke	Pipeline ROW	2,818	-	-	10	1,044	-	137
W-AB6-PSS	Roanoke	37.156034	-80.130603	PSS	SLOPE	RPWWD	03010101	Upper Roanoke	Pipeline ROW	-	265	-	3	30	-	137
W-AB6 Total										17,066	2,957	-		7,347	-	137
W-AB5	Roanoke	37.15564	-80.130227	PFO	DEPRESSIONAL	RPWWN	03010101	Upper Roanoke	Pipeline ROW	-	182	-	3	20	-	137
W-AB3-PEM-2	Roanoke	37.155664	-80.129569	PEM	SLOPE	RPWWD	03010101	Upper Roanoke	Pipeline ROW	6,737	-	-	10	2,495	-	137
W-EF46	Roanoke	37.154575	-80.129122	PSS	RIVERINE	RPWWD	03010101	Upper Roanoke	Pipeline ROW	-	11,245	-	10	4,165	-	138
W-KL48-PSS-1	Roanoke	37.152292	-80.130022	PSS	RIVERINE	RPWWD	3010101	Upper Roanoke	Pipeline ROW	-	1,978	-	10	733	-	138
W-KL48-PEM	Roanoke	37.151969	-80.130049	PEM	RIVERINE	RPWWD	3010101	Upper Roanoke	Pipeline ROW	275	-	-	3	31	-	438
W-KL48-PSS-2	Roanoke	37.150928	-80.131271	PSS	RIVERINE	RPWWD	3010101	Upper Roanoke	Pipeline ROW	-	1,152	-	3	128	-	438
W-KL48 Total										275	3,152	-		891	-	139
W-KL55	Roanoke	37.150953	-80.138062	PEM	Riverine	RPWWD	3010101	Upper Roanoke	Temporary Access Road	317	-	-	3	35	-	138
W-KL50	Roanoke	37.150728	-80.131537	PEM	Slope	RPWWN	3010101	Upper Roanoke	Pipeline ROW	1,776	-	-	10	658	-	138
W-KL49	Roanoke	37.150297	-80.132193	PEM	Slope	RPWWN	3010101	Upper Roanoke	Pipeline ROW	1,919	-	-	10	711	-	138
W-KL51-PEM	Roanoke	37.150008	-80.132403	PEM	RIVERINE	RPWWD	3010101	Upper Roanoke	Pipeline ROW	1,050	-	-	10	390	-	138
W-KL51-PSS	Roanoke	37.149879	-80.132476	PSS	RIVERINE	RPWWD	3010101	Upper Roanoke	Pipeline ROW	-	1,508	-	10	559	-	138
W-KL51 Total										5,062	1,508	-		2,353	-	138
W-EF55	Roanoke	37.149537	-80.137749	PEM	SLOPE	RPWWD	03010101	Upper Roanoke	Temporary Access Road	957	-	-	3	127	-	139
W-MN9	Roanoke	37.14933	-80.136791	PFO	Slope	RPWWD	3010101	Upper Roanoke	Temporary Access Road	1,140	-	-	3	97	-	139
W-MN8	Roanoke	37.145174	-80.135952	PEM	Slope	RPWWD	3010101	Upper Roanoke	Temporary Access Road	669	-	-	3	255	-	138
W-KL54	Roanoke	37.148761	-80.134362	PEM	Slope	RPWWN	3010101	Upper Roanoke	Temporary Access Road	2,296	-	-	3	183	-	138
W-KL54	Roanoke	37.148761	-80.134362	PEM	Slope	RPWWN	3010101	Upper Roanoke	ATWS	1,648	-	-	3	126	-	138
W-KL54 Total										3,944	-	-		254	-	138
W-KL53	Roanoke	37.148727	-80.13469	PEM	Slope	RPWWN	3010101	Upper Roanoke	Temporary Access Road	2,560	-	-	3	5	-	138
W-KL53	Roanoke	37.148727	-80.13469	PEM	Slope	RPWWN	3010101	Upper Roanoke	ATWS	2,889	-	-	3	301	-	138
W-KL53 Total										5,449	-	-		500	-	138
W-MN7-PEM	Roanoke	37.146326	-80.133901	PEM	RIVERINE	RPWWD	3010101	Upper Roanoke	Pipeline ROW	1,350	-	-	10	209	-	140
W-EF44	Roanoke	37.142977	-80.138322	PEM	SLOPE	RPWWD	03010101	Upper Roanoke	Pipeline ROW	563	-	-	10	7,053	-	141
W-U36	Roanoke	37.139922	-80.139845	PSS	RIVERINE	RPWWD	03010101	Upper Roanoke	Pipeline ROW	-	19,044	-	3	1	-	143
W-Z7	Roanoke	37.136601	-80.128216	PSS	RIVERINE	RPWWD	03010101	Upper Roanoke	Temporary Access Road	-	12	-	3	14	-	143
W-Z6	Roanoke	37.136466	-80.128238	PFO	RIVERINE	RPWWD	03010101	Upper Roanoke	Temporary Access Road	-	124	-	3	5	-	142
W-U62	Roanoke	37.135529	-80.134044	PEM	RIVERINE	RPWWD	03010101	Upper Roanoke	Temporary Access Road	3	-	-	10	563	-	142
W-Y2	Roanoke	37.134284	-80.137448	PEM	RIVERINE	RPWWD	03010101	Upper Roanoke	Pipeline ROW	1,520	-	-	3	10	-	142
W-U10	Roanoke	37.132591	-80.131744	PEM	RIVERINE	RPWWD	03010101	Upper Roanoke	Permanent Access Road	88	-	-	3	63	-	142
W-Q11	Roanoke	37.13247	-80.131639	PEM	DEPRESSIONAL	RPWWD	03010101	Upper Roanoke	Permanent Access Road	565	-	-	3	9	-	142
W-KL1	Roanoke	37.132456	-80.131463	PEM	SLOPE	RPWWN	03010101	Upper Roanoke	Permanent Access Road	79	-	-	3	4	-	145
W-KL2	Roanoke	37.128916	-80.134054	PEM	SLOPE	RPWWN	03010101	Upper Roanoke	Pipeline ROW	39	-	-	10	3,047	-	145
W-B25-PEM-1	Roanoke	37.128645	-80.133283	PEM	SLOPE	RPWWD	03010101	Upper Roanoke	Pipeline ROW	6,227	-	-	10	6,051	-	145
W-B25-PSS-2	Roanoke	37.126527	-80.132335	PSS	SLOPE	RPWWD	03010101	Upper Roanoke	Pipeline ROW	-	18,338	-	10	5,038	-	145
W-B25 Total										6,227	18,338	-		14,141	-	145
W-B24-PSS	Roanoke	37.12854	-80.130794	PSS	RIVERINE	RPWWD	03010101	Upper Roanoke	Pipeline ROW	-	7,132	-	10	2,641	-	146
W-B24-PEM	Roanoke	37.12853	-80.13106	PEM	RIVERINE	RPWWD	03010101	Upper Roanoke	Pipeline ROW	4,469	-	-	10	1,663	-	146
W-B24 Total										4,469	7,132	-		4,304	-	
W-S12-PEM	Franklin	37.125329	-80.12146	PEM	RIVERINE	RPWWD	03010101	Upper Roanoke	Pipeline ROW	4,974	-	-	10	1,842	-	147
W-RR4	Franklin	37.125117	-80.11353	PEM	RIVERINE	RPWWD	03010101	Upper Roanoke	Permanent Access Road	943	-	-	3	105	-	148
W-RR3	Franklin	37.124214	-80.114746	PEM	RIVERINE	RPWWD	03010101	Upper Roanoke	Permanent Access Road	82	-	-	3	9	-	148

Table 3.2 Field Survey USACE Jurisdictional Wetland Impacts

Wetland ID	County	Latitude[1]	Longitude[1]	Cowardin Class[2]	HGM[3]	USACE Water Type[4]	HUC 8	HUC 8 Name	Impact Type	Temporary Impacts (square feet)	Permanent Conversion Impacts (square feet)	Permanent Fill Impacts (square feet)	Depth of fill (ft)	Temporary Fill (cubic yards)[5]	Permanent Fill (cubic yards)[6]	Figure
W-KL41	Franklin	37.123851	-80.115802	PEM	RIVERINE	RPWWD	03010101	Upper Roanoke	Permanent Access Road	996	-	-	3	111	-	147
W-EF11	Franklin	37.123074	-80.07596	PEM	RIVERINE	RPWWD	03010101	Upper Roanoke	ATWS	302	-	-	3	34	-	153
W-EF11	Franklin	37.122925	-80.075883	PEM	RIVERINE	RPWWD	03010101	Upper Roanoke	Pipeline ROW	1,265	-	-	10	469	-	153
W-EF11	Franklin	37.122702	-80.075859	PEM	RIVERINE	RPWWD	03010101	Upper Roanoke	ATWS	249	-	-	3	28	-	153
W-EF11 Total										**1,816**	-	-		**642**	-	
W-D6	Franklin	37.121581	-80.084358	PFO	SLOPE	RPWWN	3010101	Upper Roanoke	Pipeline ROW	-	63	-	3	9	-	152
W-D7-PEM	Franklin	37.121558	-80.08575	PEM	RIVERINE	RPWWD	03010101	Upper Roanoke	Pipeline ROW	693	-	-	3	77	-	152
W-IJ70-PSS	Franklin	37.121351	-80.081558	PSS	SLOPE	RPWWD	3010101	Upper Roanoke	Pipeline ROW	-	1,379	-	3	153	-	153
W-IJ70-PFO-2	Franklin	37.121273	-80.081592	PFO	SLOPE	RPWWD	3010101	Upper Roanoke	Pipeline ROW	-	2,283	-	10	846	-	153
W-IJ70 Total										-	**3,662**	-		**985**	-	
W-IJ67	Franklin	37.121246	-80.08114	PEM	SLOPE	RPWWD	3010101	Upper Roanoke	Pipeline ROW	72	-	-	3	8	-	153
W-IJ71	Franklin	37.120871	-80.073447	PEM	SLOPE	RPWWN	3010101	Upper Roanoke	Pipeline ROW	793	-	-	3	88	-	153
W-EF3	Franklin	37.117734	-80.095992	PEM	SLOPE	RPWWD	03010101	Upper Roanoke	Permanent Access Road	1,153	-	-	3	128	-	151
W-IJ1	Franklin	37.092527	-80.027568	PEM	SLOPE	RPWWD	03010101	Upper Roanoke	Pipeline ROW	1,812	-	-	10	671	-	162
W-IJ2-PSS	Franklin	37.092645	-80.027176	PSS	SLOPE	RPWWD	03010101	Upper Roanoke	Pipeline ROW	-	347	-	10	129	-	162
W-IJ2-PEM	Franklin	37.092596	-80.027214	PEM	SLOPE	RPWWD	03010101	Upper Roanoke	Pipeline ROW	732	-	-	10	271	-	162
W-IJ2 Total										**732**	**347**	-		**400**	-	
W-GH2	Franklin	37.092464	-79.965162	PSS	RIVERINE	RPWWD	03010101	Upper Roanoke	Pipeline ROW	-	1,804	-	10	668	-	199
W-I8	Franklin	37.091357	-79.992006	PEM	DEPRESSIONAL	RPWWD	03010101	Upper Roanoke	Pipeline ROW	1,049	-	-	10	389	-	166
W-IJ6	Franklin	37.089156	-80.005036	PEM	RIVERINE	RPWWD	03010101	Upper Roanoke	Pipeline ROW	478	-	-	10	177	-	165
W-EF4	Franklin	37.086325	-79.94802	PEM	RIVERINE	RPWWD	03010101	Upper Roanoke	ATWS	18,235	-	-	3	2,026	-	177
W-E7	Franklin	37.084557	-79.947595	PEM	DEPRESSIONAL	RPWWD	03010101	Upper Roanoke	Pipeline ROW	1,078	-	-	10	399	-	177
W-E8	Franklin	37.082843	-79.9481	PEM	DEPRESSIONAL	RPWWD	03010101	Upper Roanoke	Pipeline ROW	3,009	-	-	10	1,114	-	177
W-EF51	Franklin	37.084781	-79.87446	PEM	RIVERINE	RPWWD	03010101	Upper Roanoke	Pipeline ROW	580	-	-	3	64	-	192
W-KL43b	Franklin	37.066608	-79.940707	PEM	RIVERINE	RPWWD	03010101	Upper Roanoke	Pipeline ROW	17	-	-	3	2	-	197
W-CD6	Franklin	37.057586	-79.915232	PEM	SLOPE	RPWWN	03010101	Upper Roanoke	Pipeline ROW	7,422	-	-	10	2,749	-	165
W-CD5	Franklin	37.055438	-79.910624	PFO	RIVERINE	RPWWN	03010101	Upper Roanoke	Pipeline ROW	-	4,949	-	10	1,833	-	165
W-EF48	Franklin	37.052142	-79.886197	PEM	RIVERINE	RPWWD	03010101	Upper Roanoke	Pipeline ROW	1,045	-	-	10	387	-	189
W-I13	Franklin	37.040378	-79.907992	PEM	DEPRESSIONAL	RPWWD	03010101	Upper Roanoke	ATWS	1,252	-	-	3	139	-	186
W-CD1	Franklin	37.047757	-79.897588	PFO	SLOPE	RPWWD	03010101	Upper Roanoke	Pipeline ROW	-	4,819	-	10	1,785	-	188
W-CD1	Franklin	37.031961	-79.788689	PEM	RIVERINE	RPWWN	03010101	Upper Roanoke	Pipeline ROW	2,179	-	-	10	807	-	207
W-A12-PFO	Franklin	37.031754	-79.788059	PFO	RIVERINE	RPWWD	03010101	Upper Roanoke	Pipeline ROW	-	173	-	3	19	-	207
W-GH16	Franklin	37.028394	-79.773243	PFO	RIVERINE	RPWWD	03010101	Upper Roanoke	Pipeline ROW	-	8,707	-	10	3,225	-	209
W-H17	Franklin	36.96939	-79.72209	PFO	DEPRESSIONAL	RPWWD	03010101	Upper Roanoke	Pipeline ROW	-	5,766	-	10	2,807	-	217
W-H11	Franklin	36.986077	-79.702603	PEM	SLOPE	RPWWD	03010101	Upper Roanoke	Pipeline ROW	2,039	-	-	10	755	-	221
W-H15	Franklin	36.986073	-79.714967	PEM	RIVERINE	RPWWD	03010101	Upper Roanoke	Pipeline ROW	1,326	-	-	3	147	-	218
W-H14	Franklin	36.988069	-79.711841	PEM	RIVERINE	RPWWD	03010101	Upper Roanoke	Pipeline ROW	267	-	-	3	30	-	219
W-A6	Franklin	36.987947	-79.700844	PEM	SLOPE	RPWWD	03010101	Upper Roanoke	Pipeline ROW	673	-	-	3	75	-	221
W-H16	Franklin	36.967938	-79.714829	PSS	RIVERINE	RPWWD	03010101	Upper Roanoke	Pipeline ROW	-	311	-	3	35	-	218
W-H9	Franklin	36.978536	-79.682057	PEM	DEPRESSIONAL	RPWWN	03010101	Upper Roanoke	Pipeline ROW	504	-	-	10	187	-	223
W-H6	Franklin	36.972189	-79.663042	PEM	RIVERINE	RPWWD	03010101	Upper Roanoke	Pipeline ROW	249	-	-	3	28	-	228
W-D3	Pittsylvania	36.965316	-79.59876	PFO	SLOPE	RPWWN	03010101	Upper Roanoke	Pipeline ROW	-	1,785	-	10	661	-	235
W-MM17	Franklin	36.964731	-79.617067	PEM	RIVERINE	RPWWD	03010101	Upper Roanoke	Pipeline ROW	297	-	-	10	110	-	239
W-B5	Pittsylvania	36.959293	-79.586201	PEM	DEPRESSIONAL	RPWWN	03010101	Upper Roanoke	Pipeline ROW	209	-	-	3	23	-	239
W-B4-PSS	Pittsylvania	36.957864	-79.583668	PSS	RIVERINE	RPWWD	03010101	Upper Roanoke	Pipeline ROW	-	205	-	3	23	-	239
W-A4[#]	Pittsylvania	36.933299	-79.537648	PEM	RIVERINE	RPWWN	03010101	Upper Roanoke	Pipeline ROW	334	-	-	-	37	-	244
W-C1	Pittsylvania	36.929954	-79.526831	PEM	DEPRESSIONAL	RPWWN	03010101	Upper Roanoke	Pipeline ROW	793	-	-	3	88	-	246
W-H5	Pittsylvania	36.924983	-79.517159	PEM	DEPRESSIONAL	RPWWD	03010101	Upper Roanoke	Pipeline ROW	9,004	-	-	10	3,335	-	247
W-B3	Pittsylvania	36.916508	-79.49236	PEM	DEPRESSIONAL	RPWWN	03010101	Upper Roanoke	Pipeline ROW	55	-	-	3	6	-	250
W-CC2-PEM	Pittsylvania	36.905418	-79.471566	PEM	RIVERINE	RPWWD	03010105	Banister	Pipeline ROW	466	-	-	3	52	-	253
W-MM5	Pittsylvania	36.903612	-79.469192	PSS	RIVERINE	RPWWD	03010105	Banister	Pipeline ROW	-	879	-	10	325	-	254
W-MM9	Pittsylvania	36.894087	-79.44811	PEM	DEPRESSIONAL	RPWWN	03010105	Banister	Pipeline ROW	684	-	-	10	253	-	257
W-MM6-PEM	Pittsylvania	36.894034	-79.445486	PEM	DEPRESSIONAL	RPWWN	03010105	Banister	Pipeline ROW	2,411	-	-	10	893	-	257
W-MM8-PFO	Pittsylvania	36.89393	-79.445461	PFO	DEPRESSIONAL	RPWWN	03010105	Banister	Pipeline ROW	1,633	-	-	10	678	-	267
W-MM8 Total										**3,651**	**1,633**	-		**1,572**	-	
W-Q2	Pittsylvania	36.884674	-79.428607	PFO	RIVERINE	RPWWD	03010105	Banister	Pipeline ROW	-	16,422	-	10	6,082	-	259
W-Q1	Pittsylvania	36.883985	-79.427305	PEM	DEPRESSIONAL	RPWWD	03010105	Banister	Pipeline ROW	638	-	-	10	235	-	259
W-G2	Pittsylvania	36.851816	-79.36593	PEM	RIVERINE	RPWWD	03010105	Banister	Pipeline ROW	5,658	-	-	10	2,096	-	287
W-H1	Pittsylvania	36.836097	-79.360695	PEM	DEPRESSIONAL	RPWWN	03010105	Banister	Pipeline ROW	481	-	-	3	53	-	270
W-EF6	Pittsylvania	36.835004	-79.339128	PFO	RIVERINE	RPWWD	03010105	Banister	Pipeline ROW	-	8,907	-	10	3,299	-	274
W-H2	Pittsylvania	36.834817	-79.360479	PEM	DEPRESSIONAL	RPWWD	03010105	Banister	Pipeline ROW	34,792	-	-	10	12,886	-	271
W-IJ21	Pittsylvania	36.834623	-79.338527	PFO	SLOPE	RPWWN	03010105	Banister	Pipeline ROW	-	463	-	3	51	-	274
W-H3	Pittsylvania	36.833741	-79.360061	PEM	DEPRESSIONAL	RPWWN	03010105	Banister	Pipeline ROW	2,219	-	-	10	821	-	271
W-MM3	Pittsylvania	36.830361	-79.350631	PSS	RIVERINE	RPWWD	03010105	Banister	Pipeline ROW	-	1,460	-	10	548	-	271
W-IJ22-PEM	Pittsylvania	36.82776	-79.350264	PEM	RIVERINE	RPWWD	03010105	Banister	Pipeline ROW	8,527	-	-	10	3,156	-	272
W-IJ22-PFO	Pittsylvania	36.827746	-79.350295	PFO	RIVERINE	RPWWD	03010105	Banister	Pipeline ROW	-	11,817	-	10	4,377	-	272
W-IJ22 Total										**8,527**	**11,817**	-		**7,533**	-	
									TOTAL	**208,370**	**157,513**	**609**	-	**126,771**	**68**	

Notes:

1 - In decimal degrees. Coordinates show wetland test pit locations

2 - PEM = Palustrine Emergent
- PSS = Palustrine Scrub-Shrub
- PFO = Palustrine Forested

3 - HGM = Hydrogeomorphic

4 - RPWWD = Wetlands directly abutting Relatively Permanent Waters (RPWs) that flow directly or indirectly into Traditional Navigable Waterways (TNWs)
- RPWWN = Wetlands adjacent but not directly abutting RPWs that flow directly or indirectly into TNWs
- NRPWW = Wetlands adjacent to non-RPWs that flow directly or indirectly into TNWs

5 - Temporary fill discharge into waters of the U.S.

6 - Permanent fill associated with the construction of permanent access road and facilities

\# - The Federal Energy Regulatory Commission (FERC) recommended in its Final Environmental Impact Statement (June 2017) that MVP use a horizontal directional drill (HDD) as the preferred method to cross the Pigg River (S-E11), which incidentally also would affect adjacent wetland W-A4. The proposed impacts to these waters will not occur if the FERC-recommended HDD is completed successfully. If the HDD is unsuccessful for any reason, the dry open cut method will be utilized in accordance with an HDD Contingency Plan. The temporary impacts associated with the dry open cut crossing contingency are included here.

Table 3.3 Field Survey Non-Jurisdictional Wetland Impacts

Wetland ID	County	Latitude[1]	Longitude[1]	Cowardin Class[2]	HGM[3]	USACE Water Type[4]	HUC 8	HUC 8 Name	Impact Type	Temporary Impacts (square feet)	Permanent Conversion Impacts (square feet)	Permanent Fill Impacts (square feet)	Depth of fill (ft)	Temporary Fill (cubic yards)[5]	Permanent Fill (cubic yards)[5]	Figure
W-KL14	Giles	37.395896	-80.680476	PSS	DEPRESSIONAL	ISOLATE	05050002	Middle New	Pipeline ROW	-	161	-	10	60	-	2
W-C6	Montgomery	37.25586	-80.275715	PEM	DEPRESSIONAL	ISOLATE	03010101	Upper Roanoke	Pipeline ROW	1,240	-	-	10	459	-	96
W-KL18	Roanoke	37.159927	-80.134257	PEM	DEPRESSIONAL	ISOLATE	03010101	Upper Roanoke	Pipeline ROW	817	-	-	10	303	-	136
W-KL15	Roanoke	37.158653	-80.133802	PEM	DEPRESSIONAL	ISOLATE	03010101	Upper Roanoke	Pipeline ROW	1,451	-	-	10	537	-	136
									TOTAL	3,508	161	0	-	1,359	0	

Notes:

1 - In decimal degrees. Coordinates show wetland test pit locations

2 - PEM = Palustrine Emergent
- PSS = Palustrine Scrub-Shrub
- PFO = Palustrine Forested

3 - HGM = Hydrogeomorphic

4 - ISOLATE = Isolated (interstate or intrastate) waters, including isolated wetlands
-The USACE has determined that these isolated features are not jurisdictional waters of the United States and therefore not subject to NWP 12. Each feature meets the six criteria necessary to be defined as an isolated wetland of minimal ecological value under the Virginia Water Protection (VWP) Permit Program Regulation, 9 VAC 25-210-10. MVP will request an appropriate VWP permit waiver pursuant to 9 VAC 25-210-220.

5 - Temporary fill discharge into waters of the U.S.

Table 3.4 Desktop Survey Wetland Impacts

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Notes:

1 - In decimal degrees. Coordinates show wetland test pit locations

2 - PEM = Palustrine Emergent
- PSS = Palustrine Scrub-Shrub
- PFO = Palustrine Forested

3 - HGM = Hydrogeomorphic

4 - RPWWD = Wetlands directly abutting Relatively Permanent Waters (RPWs) that flow directly or indirectly into Traditional Navigable Waterways (TNWs)
- RPWWN = Wetlands adjacent but not directly abutting RPWs that flow directly or indirectly into TNWs
- NRPWW = Wetlands adjacent to non-RPWs that flow directly or indirectly into TNWs
- ISOLATE = Isolated (interstate or intrastate) waters, including isolated wetlands

5 - Temporary fill discharge into waters of the U.S.

6 - Permanent fill associated with the construction of permanent access road and facilities

Table 4 Proposed Stream Mitigation

Feature	Feature Type	HUC 8 Name	HUC 8 #	Flow Regime	Impact (LF)	Mitigation Credits Required[1]	Mitigation Credits Proposed[1]	Proposed Mitigation Type[2,3]
S-PP14	Field	Middle New	05050002	Perennial	11	0	16	VARTF
S-PP15	Field	Middle New	05050002	Perennial	11	0	14	VARTF
S-PP17	Field	Middle New	05050002	Intermittent	14	0	19	VARTF
S-MN20	Field	Middle New	05050002	Intermittent	11	0	13	VARTF
S-PP18	Field	Middle New	05050002	Perennial	19	0	23	VARTF
S-PP19	Field	Middle New	05050002	Intermittent	16	0	21	VARTF
S-UU9	Field	Middle New	05050002	Perennial	11	0	15	VARTF
S-HH15	Field	Middle New	05050002	Perennial	14	0	14	VARTF
S-HH14	Field	Middle New	05050002	Intermittent	14	0	15	VARTF
S-HH13	Field	Middle New	05050002	Perennial	11	0	16	VARTF
S-HH12	Field	Middle New	05050002	Ephemeral	11	0	8	VARTF
S-SS2	Field	Middle New	05050002	Intermittent	14	0	20	VARTF
S-IJ16-a	Field	Middle New	05050002	Ephemeral	45	0	23	VARTF
S-MN34	Field	Upper Roanoke	03010101	Intermittent	57	0	74	Graham and David
S-MN33	Field	Upper Roanoke	03010101	Ephemeral	41	0	23	Graham and David
S-MN32	Field	Upper Roanoke	03010101	Perennial	55	0	74	Graham and David
S-IJ85*	Field	Upper Roanoke	03010101	Perennial	50	0	50	Graham and David
S-D17	Field	Upper Roanoke	03010101	Intermittent	34	0	23	Graham and David
S-H42	Field	Banister	03010105	Perennial	39	0	54	Graham and David
				FIELD TOTAL	**478**	**0**	**515**	
				DESKTOP TOTAL	**0**	**0**	**0**	
				GRAND TOTAL	**478**	**0**	**515**	

Notes:

1 - Ratio values for field delineated stream impacts calculated using Unified Stream Methodology. See Table 5 for details.
Ratio values for desktop identified stream impacts are 1:1 because Unified Stream Methodology has not been conducted on these features.

2 - MVP is proposing to mitigate for impacts outside of mitigation bank primary or secondary service areas through the purchase of mitigation credits through the VA Aquatic Resource Trust Fund.

3 - Proposed mitigation type based on the location of the impact and availability of mitigation credits in the impact area.

-Graham and David - Graham and David Mitigation Bank

- VARTF - Virginia Aquatic Resources Trust Fund

* - Unified Stream Methodology field evaluation has not been performed for S-IJ85. Compensatory mitigation requirement ratio of impacts : credits is assumed to be 1:1.

Table 5 Unified Stream Methodology Form 2

Unified Stream Methodology for Use in Virginia

Project #	Applicant	Date
	Mountain Valley Pipeline	2017
Evaluators	**HUC**	**Locality**
J.Cook, E.Foster	See Table 4	Virginia

Stream Name	Reach ID	Length of Impact (L_i) (feet)	Reach Condition Index (RCI)	Impact Factor (IF)	Compensation Requirement (CR) (L_i × RCI × IF)
S-PP14	S-PP14	11	1.42	1.00	16
S-PP15	S-PP15	11	1.28	1.00	14
S-PP17	S-PP17	14	1.39	1.00	19
S-MN20	S-MN20	11	1.15	1.00	13
S-PP18	S-PP18	19	1.23	1.00	23
S-PP19	S-PP19	16	1.34	1.00	21
S-UU9	S-UU9	11	1.33	1.00	15
S-HH15	S-HH15	14	1.01	1.00	14
S-HH14	S-HH14	14	1.06	1.00	15
S-HH13	S-HH13	11	1.45	1.00	16
S-HH12	S-HH12	11	0.73	1.00	8
S-SS2	S-SS2	14	1.46	1.00	20
S-IJ16-a	S-IJ16-a	45	0.52	1.00	23
S-MN34	S-MN34	57	1.29	1.00	74
S-MN33	S-MN33	41	0.55	1.00	23
S-MN32	S-MN32	55	1.35	1.00	74
S-IJ85	S-IJ85	50	1.00	1.00	50
S-D17	S-D17	34	0.69	1.00	23
S-H42	S-H42	39	1.38	1.00	54
	Total L_i	**478**		**Total CR**	**515**

Note: Round all feet & CR's to the nearest whole number.

Table 6 Proposed Wetland Mitigation

Feature	Feature Type	HUC 8	HUC 8 Name	Cowardin Class[1]	Permanent Conversion Impact (square feet)	Permanent Fill Impact (square feet)	Impact (acres)	Impact : Mitigation Ratio[2]	Mitigation Credits Required[3]	Mitigation Credits Proposed[4]	Proposed Mitigation Type[5]	Wetland Functions and Values[6]
W-Z3	Field	05050002	Middle New	PSS	1,168	-	0.027	1 : 1	0	0.027	VARTF	Groundwater Recharge/Discharge; Sediment/Toxicant/Pathogen Retention; Nutrient Removal/Retention/Transformation
W-F9-PFO	Field	03010101	Upper Roanoke	PFO	735	-	0.017	1 : 1	0	0.017	VARTF	Groundwater Recharge/Discharge; Sediment/Toxicant/Pathogen Retention; Nutrient Removal/Retention/Transformation
W-C12	Field	03010101	Upper Roanoke	PFO	2,278	-	0.052	1 : 1	0	0.052	VARTF	Groundwater Recharge/Discharge; Sediment/Toxicant/Pathogen Retention; Nutrient Removal/Retention/Transformation; Floodflow Alteration; Wildlife Habitat; Production Export
W-C11	Field	03010101	Upper Roanoke	PSS	2,007	-	0.046	1 : 1	0	0.046	VARTF	Groundwater Recharge/Discharge; Sediment/Toxicant/Pathogen Retention; Nutrient Removal/Retention/Transformation; Floodflow Alteration
W-NN8	Field	03010101	Upper Roanoke	PFO	3,307	-	0.076	1 : 1	0	0.076	VARTF	Groundwater Recharge/Discharge; Sediment/Toxicant/Pathogen Retention; Nutrient Removal/Retention/Transformation; Floodflow Alteration; Sediment/Shoreline Stabilization
W-CD11	Field	03010101	Upper Roanoke	PEM	-	8	0.0002	1 : 1	0	0.0002	VARTF	Groundwater Recharge/Discharge, Sediment/Toxicant/Pathogen Retention, Nutrient Removal/Retention/Transformation
W-EF5-PFO	Field	03010101	Upper Roanoke	PFO	4,819	-	0.111	1 : 1	0	0.111	VARTF	Groundwater Recharge/Discharge; Sediment/Toxicant/Pathogen Retention Floodflow Alteration; Wildlife Habitat
W-EF22	Field	03010101	Upper Roanoke	PFO	3,427	-	0.079	1 : 1	0	0.079	VARTF	Groundwater Recharge/Discharge; Sediment/Toxicant/Pathogen Retention; Floodflow Alteration; Wildlife Habitat
W-EF18	Field	03010101	Upper Roanoke	PSS	456	-	0.011	1 : 1	0	0.011	VARTF	Groundwater Recharge/Discharge; Sediment/Toxicant/Pathogen Retention; Nutrient Removal/Retention/Transformation; Floodflow Alteration
W-EF17	Field	03010101	Upper Roanoke	PFO	1,725	-	0.040	1 : 1	0	0.040	VARTF	Groundwater Recharge/Discharge; Sediment/Toxicant/Pathogen Retention
W-EF19	Field	03010101	Upper Roanoke	PSS	1,953	-	0.045	1 : 1	0	0.045	VARTF	Groundwater Recharge/Discharge; Sediment/Toxicant/Pathogen Retention; Nutrient Removal/Retention/Transformation; Floodflow Alteration
W-IJ99	Field	3010101	Upper Roanoke	PSS	4,741	-	0.109	1 : 1	0	0.109	VARTF	Groundwater Recharge/Discharge; Sediment/Toxicant/Pathogen Retention; Nutrient Removal/Retention/Transformation; Floodflow Alteration; Wildlife Habitat
W-IJ94-PSS	Field	3010101	Upper Roanoke	PSS	805	-	0.018	1 : 1	0	0.018	VARTF	Groundwater Recharge/Discharge; Sediment/Toxicant/Pathogen Retention; Nutrient Removal/Retention/Transformation; Floodflow Alteration; Wildlife Habitat
W-IJ96-PEM	Field	3010101	Upper Roanoke	PEM	-	579	0.013	1 : 1	0	0.013	VARTF	Groundwater Recharge/Discharge; Sediment/Toxicant/Pathogen Retention; Nutrient Removal/Retention/Transformation; Floodflow Alteration
W-IJ97	Field	3010101	Upper Roanoke	PEM	-	22	0.001	1 : 1	0	0.001	VARTF	Sediment/Toxicant/Pathogen Retention; Nutrient Removal/Retention/Transformation
W-IJ95-PSS	Field	3010101	Upper Roanoke	PSS	19,030	-	0.437	1 : 1	0	0.437	VARTF	Groundwater Recharge/Discharge; Sediment/Toxicant/Pathogen Retention; Nutrient Removal/Retention/Transformation; Floodflow Alteration; Wildlife Habitat
W-IJ102	Field	03010101	Upper Roanoke	PFO	610	-	0.014	1 : 1	0	0.014	VARTF	Groundwater Recharge/Discharge; Sediment/Toxicant/Pathogen Retention; Nutrient Removal/Retention/Transformation; Floodflow Alteration; Wildlife Habitat
W-IJ100	Field	03010101	Upper Roanoke	PFO	321	-	0.007	1 : 1	0	0.007	VARTF	Sediment/Toxicant/Pathogen Retention; Nutrient Removal/Retention/Transformation; Floodflow Alteration
W-IJ101	Field	03010101	Upper Roanoke	PSS	9	-	0.000	1 : 1	0	0.000	VARTF	Groundwater Recharge/Discharge; Sediment/Toxicant/Pathogen Retention; Nutrient Removal/Retention/Transformation; Floodflow Alteration; Wildlife Habitat
W-KL17	Field	03010101	Upper Roanoke	PSS	1,896	-	0.044	1 : 1	0	0.044	VARTF	Groundwater Recharge/Discharge; Sediment/Toxicant/Pathogen Retention; Nutrient Removal/Retention/Transformation;Wildlife Habitat; Production Export
W-AB6-PFO-1	Field	03010101	Upper Roanoke	PFO	2,691	-	0.062	1 : 1	0	0.062	VARTF	Groundwater Recharge/Discharge; Sediment/Toxicant/Pathogen Retention; Nutrient Removal/Retention/Transformation; Floodflow Alteration; Wildlife Habitat; Production Export
W-AB6-PSS	Field	03010101	Upper Roanoke	PSS	266	-	0.006	1 : 1	0	0.006	VARTF	Groundwater Recharge/Discharge; Sediment/Toxicant/Pathogen Retention; Nutrient Removal/Retention/Transformation; Floodflow Alteration
W-AB5	Field	03010101	Upper Roanoke	PFO	182	-	0.004	1 : 1	0	0.004	VARTF	Sediment/Toxicant/Pathogen Retention; Nutrient Removal/Retention/Transformation;
W-ZF46	Field	03010101	Upper Roanoke	PSS	11,245	-	0.258	1 : 1	0	0.258	VARTF	Groundwater Recharge/Discharge; Sediment/Toxicant/Pathogen Retention; Nutrient Removal/Retention/Transformation; Floodflow Alteration; Wildlife Habitat; Production Export;Sediment/Shoreline
W-KL48-PSS-1	Field	3010101	Upper Roanoke	PSS	1,978	-	0.045	1 : 1	0	0.045	VARTF	Groundwater Recharge/Discharge; Sediment/Toxicant/Pathogen Retention; Floodflow Alteration
W-KL48-PSS-2	Field	3010101	Upper Roanoke	PSS	1,152	-	0.026	1 : 1	0	0.026	VARTF	Groundwater Recharge/Discharge; Sediment/Toxicant/Pathogen Retention; Floodflow Alteration; Sediment/Shoreline Stabilization; Wildlife Habitat
W-KL51-PSS	Field	3010101	Upper Roanoke	PSS	1,508	-	0.035	1 : 1	0	0.035	VARTF	Groundwater Recharge/Discharge; Sediment/Toxicant/Pathogen Retention; Floodflow Alteration; Sediment/Shoreline Stabilization
W-MN9	Field	3010101	Upper Roanoke	PFO	1,140	-	0.026	1 : 1	0	0.026	VARTF	Groundwater Recharge/Discharge; Sediment/Toxicant/Pathogen Retention
W-IJ36	Field	03010101	Upper Roanoke	PSS	19,044	-	0.437	1 : 1	0	0.437	VARTF	Groundwater Recharge/Discharge; Sediment/Toxicant/Pathogen Retention; Nutrient Removal/Retention/Transformation; Floodflow Alteration; Wildlife Habitat; Production Export
W-Z7	Field	03010101	Upper Roanoke	PSS	12	-	0.0003	1 : 1	0	0.0003	VARTF	Groundwater Recharge/Discharge; Sediment/Toxicant/Pathogen Retention; Nutrient Removal/Retention/Transformation; Floodflow Alteration
W-Z6	Field	03010101	Upper Roanoke	PFO	124	-	0.003	1 : 1	0	0.003	VARTF	Groundwater Recharge/Discharge; Sediment/Toxicant/Pathogen Retention; Nutrient Removal/Retention/Transformation; Floodflow Alteration
W-B24-PSS	Field	03010101	Upper Roanoke	PSS	7,132	-	0.164	1 : 1	0	0.164	VARTF	Groundwater Recharge/Discharge; Sediment/Toxicant/Pathogen Retention; Nutrient Removal/Retention/Transformation; Floodflow Alteration
W-B25-PSS-2	Field	03010101	Upper Roanoke	PSS	16,338	-	0.375	1 : 1	0	0.375	VARTF	Groundwater Recharge/Discharge; Sediment/Toxicant/Pathogen Retention; Nutrient Removal/Retention/Transformation; Floodflow Alteration
W-D6	Field	3010101	Upper Roanoke	PFO	83	-	0.002	1 : 1	0	0.002	VARTF	Groundwater Recharge/Discharge
W-IJ70-PSS	Field	3010101	Upper Roanoke	PSS	1,379	-	0.032	1 : 1	0	0.032	VARTF	Groundwater Recharge/Discharge; Sediment/Toxicant/Pathogen Retention; Floodflow Alteration; Sediment/Shoreline Stabilization
W-IJ70-PFO-2	Field	3010101	Upper Roanoke	PFO	2,283	-	0.052	1 : 1	0	0.052	VARTF	Groundwater Recharge/Discharge; Sediment/Toxicant/Pathogen Retention; Floodflow Alteration; Sediment/Shoreline Stabilization
W-IJ2-PSS	Field	03010101	Upper Roanoke	PSS	347	-	0.008	1 : 1	0	0.008	Banister Bend	Groundwater Recharge/Discharge; Sediment/Toxicant/Pathogen Retention; Nutrient Removal/Retention/Transformation
W-GH2	Field	03010101	Upper Roanoke	PSS	1,804	-	0.041	1 : 1	0	0.041	Banister Bend	Groundwater Recharge/Discharge; Sediment/Toxicant/Pathogen Retention; Nutrient Removal/Retention/Transformation
W-CD5	Field	03010101	Upper Roanoke	PFO	4,949	-	0.114	1 : 1	0	0.114	Banister Bend	Groundwater Recharge/Discharge; Sediment/Toxicant/Pathogen Retention; Floodflow Alteration
W-CD1	Field	03010101	Upper Roanoke	PFO	4,819	-	0.111	1 : 1	0	0.111	Banister Bend	Groundwater Recharge/Discharge; Sediment/Toxicant/Pathogen Retention; Nutrient Removal/Retention/Transformation;
W-A12-PFO	Field	03010101	Upper Roanoke	PFO	173	-	0.004	1 : 1	0	0.004	Banister Bend	Groundwater Recharge/Discharge; Sediment/Toxicant/Pathogen Retention; Nutrient Removal/Retention/Transformation; Floodflow Alteration

Table 6 Proposed Wetland Mitigation

Feature	Feature Type	HUC 8	HUC 8 Name	Cowardin Class[1]	Permanent Conversion Impact (square feet)	Permanent Fill Impact (square feet)	Impact (acres)	Impact : Mitigation Ratio[2]	Mitigation Credits Required[2]	Mitigation Credits Proposed[2]	Proposed Mitigation Type[3]	Wetland Functions and Values[4]
W-GH16	Field	03010101	Upper Roanoke	PFO	8,707	-	0.200	1 : 1	0	0.200	Banister Bend	Groundwater Recharge/Discharge; Sediment/Toxicant/Pathogen Retention; Nutrient Removal/Retention/Transformation; Floodflow Alteration
W-H17	Field	03010101	Upper Roanoke	PFO	6,758	-	0.155	1 : 1	0	0.155	Banister Bend	Groundwater Recharge/Discharge; Sediment/Toxicant/Pathogen Retention; Nutrient Removal/Retention/Transformation; Floodflow Alteration
W-H15	Field	03010101	Upper Roanoke	PSS	311	-	0.007	1 : 1	0	0.007	Banister Bend	Groundwater Recharge/Discharge; Sediment/Toxicant/Pathogen Retention
W-D3	Field	03010101	Upper Roanoke	PFO	1,785	-	0.041	1 : 1	0	0.041	Banister Bend	Sediment/Toxicant/Pathogen Retention
W-B4-PSS	Field	03010101	Upper Roanoke	PSS	205	-	0.005	1 : 1	0	0.005	Banister Bend	Groundwater Recharge/Discharge; Sediment/Toxicant/Pathogen Retention; Nutrient Removal/Retention/Transformation;
W-MM5	Field	03010105	Banister	PSS	879	-	0.020	1 : 1	0	0.020	Banister Bend	Groundwater Recharge/Discharge; Sediment/Toxicant/Pathogen Retention; Nutrient Removal/Retention/Transformation
W-MM8-PFO	Field	03010105	Banister	PFO	1,833	-	0.042	1 : 1	0	0.042	Banister Bend	Groundwater Recharge/Discharge; Sediment/Toxicant/Pathogen Retention; Nutrient Removal/Retention/Transformation; Floodflow Alteration
W-Q2	Field	03010105	Banister	PFO	16,422	-	0.377	1 : 1	0	0.377	Banister Bend	Groundwater Recharge/Discharge; Sediment/Toxicant/Pathogen Retention; Nutrient Removal/Retention/Transformation; Floodflow Alteration; Wildlife Habitat; Production Export;Sediment/Shoreline Stabilization
W-EF6	Field	03010105	Banister	PFO	8,907	-	0.205	1 : 1	0	0.205	Banister Bend	Groundwater Recharge/Discharge; Sediment/Toxicant/Pathogen Retention; Nutrient Removal/Retention/Transformation; Floodflow Alteration
W-IJ21	Field	03010105	Banister	PFO	463	-	0.011	1 : 1	0	0.011	Banister Bend	Groundwater Recharge/Discharge; Sediment/Toxicant/Pathogen Retention; Nutrient Removal/Retention/Transformation; Floodflow Alteration
W-MM3	Field	03010105	Banister	PSS	1,480	-	0.034	1 : 1	0	0.034	Banister Bend	Groundwater Recharge/Discharge; Sediment/Toxicant/Pathogen Retention; Nutrient Removal/Retention/Transformation; Wildlife Habitat; Production Export
W-IJ22-PFO	Field	03010105	Banister	PFO	11,817	-	0.271	1 : 1	0	0.271	Banister Bend	Groundwater Recharge/Discharge; Sediment/Toxicant/Pathogen Retention; Nutrient Removal/Retention/Transformation; Floodflow Alteration; Wildlife Habitat; Production Export
TTVA-W-CD11	Desktop	03010101	Upper Roanoke	PEM	-	84	0.002	1 : 1	0	0.002	VARTF	N/A - Desktop delineated wetland
			FIELD TOTAL		187,513	609	4.32	-	0	4.32		
			DESKTOP TOTAL		0	84	0.002	-	0	0.002		
			GRAND TOTAL		187,513	693	4.32	-	0	4.32		

Notes:

1 - Field classification based on Cowardin et al. 1979, PEM - palustrine emergent wetland, PSS - palustrine scrub-shrub wetland, PFO - palustrine forested wetland

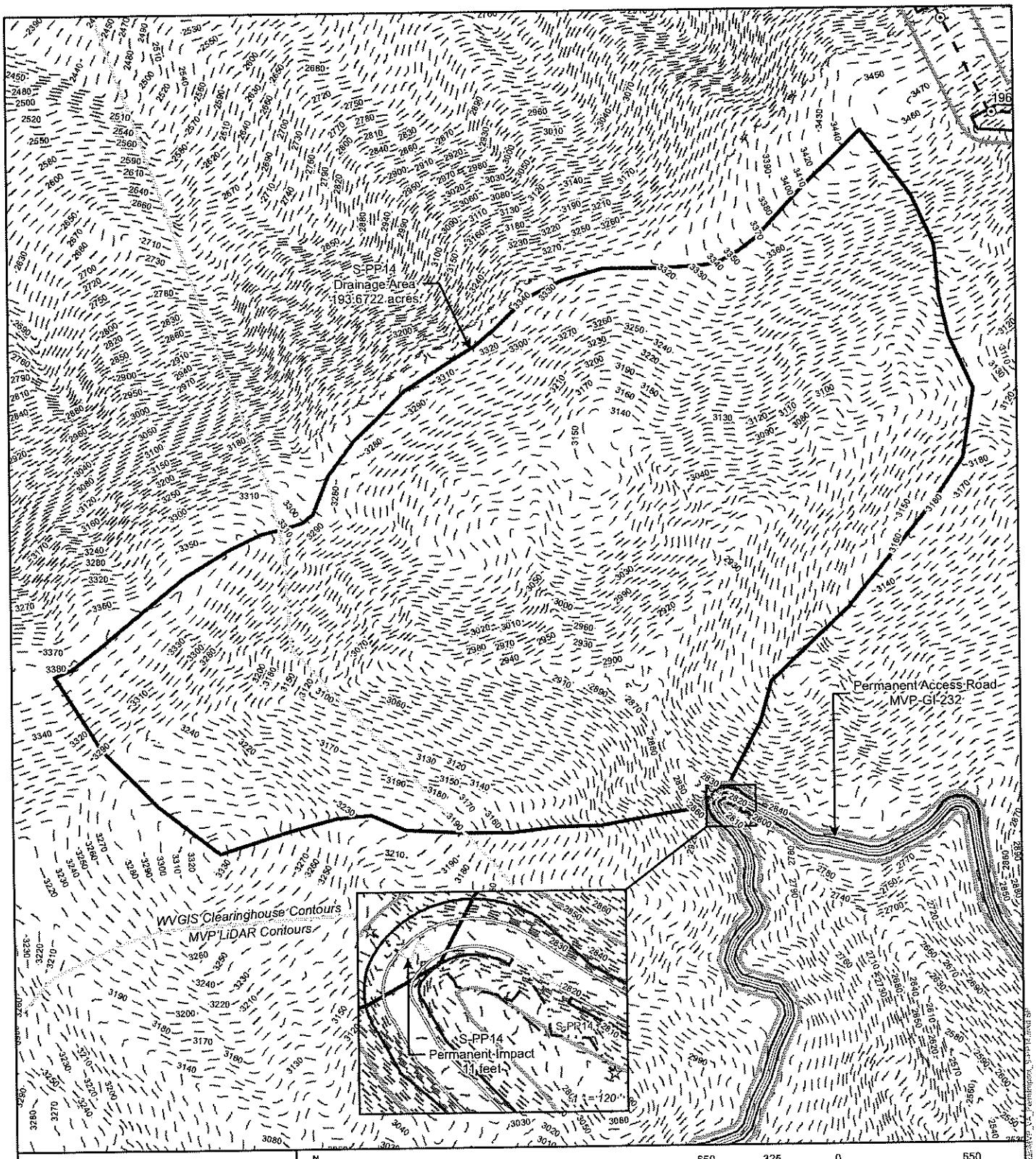
2 - Per VDEQ and USACE guidance, mitigation ratios are 1:1 for PEM fill, PSS conversion, and PFO conversion impacts. Per VDEQ and USACE guidance, mitigation ratios are 1.5:1 for PSS and 2:1 for PFO fill impacts.

3 - Proposed mitigation type based on the location of the impact and availability of mitigation credits in the impact area.
- Banister Bend - Banister Bend Mitigation Bank.
- VARTF - Virginia Aquatic Resources Trust Fund

4 - Wetland Functions and Values assessed according to the USACE Highway Method (See Attachmend H2 for details).

USM FORMS AND PERMANENT IMPACT FIGURES

S-PP14



Mountain Valley Pipeline Project

N

NAD 1983 UTM 17N

1 " = 650 '

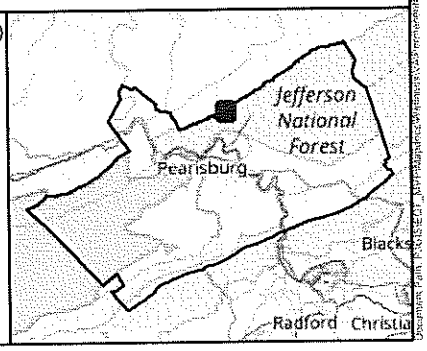
650 325 0 550 Feet

Mountain Valley PIPELINE

Figure 1:
Permanent Impacts for
Stream S-PP14
Giles County

SEPTEMBER, 2017

Milepost
Alignment Centerline
Access Road Permanent LOD
Limit of Disturbance
Preliminary Jurisdictional Determination Boundary
Unified Stream Method (USM) Survey Reach
Stream Permanant Impact
Perennial Stream
Drainage Area



Data Sources: ESRI Streaming Data © 2014
Elevation data derived from LiDAR provided by EQT 2016 and from the West Virginia GIS Clearinghouse.

Photograph Number: 1 **Feature Name:** S-PP14 **Flow Regime:** Perennial

Direction: NW **Date:** 10/16/2015

STREAM ID S-PP14	**STREAM NAME** Kimballton Branch
LAT 37.392676 **LONG** -80.693871	**DATE** 10/16/2015
CLIENT MVP	**PROJECT NAME** MVP
INVESTIGATORS D. Hadersbeck, T. Woods, D. McCollough	
FLOW REGIME Perennial ✓ Intermittent ___ Ephemeral ___	**WATER TYPE** TNW ___ RPW ✓ NRPW ___

CHANNEL FEATURES

Estimate Measurements
Top of Bank Width: 14 ft
Top of Bank Height:
LB 1.0 ft RB 10.0 in
Water Depth: 8.00 in
Water Width: 5.0 ft
High Water Mark: 8.0 in
Flow Direction: Southeast

Stream Erosion
✓ None ___ Moderate ___ Heavy

Artificial, Modified or Channelized
✓ Yes ___ No

Dam Present ___ Yes ✓ No

Sinuosity ___ Low ✓ Medium ✓ High

Gradient
___ Flat (0.5/100 ft) ✓ Moderate (2 ft/100 ft) ___ Severe (10 ft/100 ft)

FLOW CHARACTERISTICS

Water Present
___ No water, stream bed dry
___ Stream bed moist
___ Standing water
✓ Flowing water

Velocity
___ Fast ✓ Moderate
___ Slow

Proportion of Reach Represented by Stream Morphology Types
Riffle 30 % Run 50 %
Pool 20 %

Turbidity
✓ Clear ___ Slightly turbid ___ Turbid
___ Opaque ___ Stained
___ Other ___

INORGANIC SUBSTRATE COMPONENTS (should add up to 100%)

Substrate Type	Diameter	% Composition in Sampling Reach
Bedrock		
Boulder	> 256 mm (10")	20
Cobble	64-256 mm (2.5"-10")	30
Gravel	2-64 mm (0.1"-2.5")	30
Sand	0.06-2mm (gritty)	20
Silt	0.004-0.06 mm	
Clay	< 0.004 mm (slick)	

ORGANIC SUBSTRATE COMPONENTS (does not necessarily add up to 100%)

Substrate Type	Characteristic	% Composition in Sampling Area
Detritus	sticks, wood, coarse plant materials (CPOM)	55
Muck-Mud	black, very fine organic (FPOM)	
Marl	grey, shell fragments	

WATERSHED FEATURES

Predominant Surrounding Landuse
✓ Forest ___ Commercial
___ Field/Pasture ___ Industrial
___ Agricultural ___ Residential
___ Other:

Canopy Cover
✓ Partly open ___ Partly shaded
___ Shaded ___ Open

Indicate the dominant type (Check one)
✓ Trees ___ Shrubs
___ Grasses ___ Herbaceous

Floodplain Width
___ Wide > 30ft ✓ Moderate 15-30ft
___ Narrow <16ft

Wetland Present ___ Yes ✓ No
Wetland ID

AQUATIC VEGETATION

Indicate the dominant type and record the dominant species present
___ Rooted emergent ___ Rooted submergent ___ Rooted floating ___ Free floating
___ Floating algae ✓ Attached algae

MACROINVERTEBRATES OR OTHER WILDLIFE OBSERVED/OTHER OBSERVATIONS AND NOTES

Stream traverses a culvert under the road. Huge culvert observed to have two holes in the top portion allowing sunlight to observed in the culvert under the road

Stream Assessment Form (Form 1)

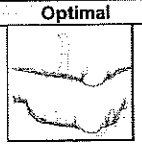
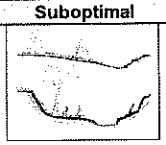
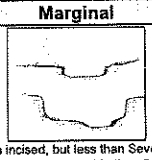
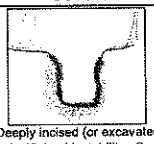
Unified Stream Methodology for use in Virginia

For use in wadeable channels classified as intermittent or perennial

Project #	Project Name	Locality	Cowardin Class.	HUC	Date	SAR #	Impact/SAR length	Impact Factor
	Mountain Valley Pipeline	Giles	R2RB1	050500020602	10/25/2016		11	1

Name(s) of Evaluator(s)	Stream Name and Information
J.Cook, E.Foster	S-PP14, Perrenial, MVP-GI-232

1. Channel Condition: Assess the cross-section of the stream and prevailing condition (erosion, aggradation)

	Conditional Category					
	Optimal	Suboptimal	Marginal	Poor	Severe	
						
Channel Condition	Very little incision or active erosion; 80-100% stable banks. Vegetative surface protection or natural rock, prominent (80-100%). AND/OR Stable point bars/bankfull benches are present. Access to their original floodplain or fully developed wide bankfull benches. Mid-channel bars, and transverse bars few. Transient sediment deposition covers less than 10% of bottom.	Slightly incised, few areas of active erosion or unprotected banks. Majority of banks are stable (60-80%). Vegetative protection or natural rock prominent (60-80%) AND/OR Depositional features contribute to stability. The bankfull and low flow channels are well defined. Stream likely has access to bankfull benches, or newly developed floodplains along portions of the reach. Transient sediment covers 10-40% of the stream bottom.	Often incised, but less than Severe or Poor. Banks more stable than Severe or Poor due to lower bank slopes. Erosion may be present on 40-60% of both banks. Vegetative protection on 40-60% of banks. Streambanks may bevertical or undercut. AND/OR 40-60% of stream is covered by sediment. Sediment may be temporary/transient, contribute instability. Deposition that contribute to stability, may be forming/present. AND/OR V-shaped channels have vegetative protection on > 40% of the banks and depositional features which contribute to stability.	Overwidened/incised. Vertically/laterally unstable. Likely to widen further. Majority of both banks are near vertical. Erosion present on 60-80% of banks. Vegetative protection present on 20-40% of banks, and is insufficient to prevent erosion. AND/OR 60-80% of the stream is covered by sediment. Sediment is temporary/transient in nature, and contributing to instability. AND/OR V-shaped channels have vegetative protection is present on > 40% of the banks and stable sediment deposition is absent.	Deeply incised (or excavated), vertical/lateral instability. Severe incision, flow contained within the banks. Streambed below average rooting depth, majority of banks vertical/undercut. Vegetative protection present on less than 20% of banks, is not preventing erosion. Obvious bank sloughing present. Erosion/raw banks on 80-100%. AND/OR Aggrading channel. Greater than 80% of stream bed is covered by deposition, contributing to instability. Multiple threed channels and/or subterranean flow.	CI
Score	3	2.4	2	1.6	1	3.0

NOTES>> Stable, rocky banks with dense rhododendron on banks

2. RIPARIAN BUFFERS: Assess both bank's 100 foot riparian areas along the entire SAR. (rough measurements of length & width may be acceptable)

	Conditional Category							
	Optimal	Suboptimal		Marginal		Poor		
Riparian Buffers	Tree stratum (dbh > 3 inches) present, with > 60% tree canopy cover and a non-maintained understory. Wetlands located within the riparian areas.	High Suboptimal: Riparian areas with tree stratum (dbh > 3 inches) present, with 30% to 60% tree canopy cover and containing both herbaceous and shrub layers or a non-maintained understory.	Low Suboptimal: Riparian areas with tree stratum (dbh > 3 inches) present, with > 30% tree canopy cover and a maintained understory. Recent cutover (dense vegetation).	High Marginal: Non-maintained, dense herbaceous vegetation with either a shrub layer or a tree layer (dbh > 3 inches) present, with <30% tree canopy cover.	Low Marginal: Non-maintained, dense herbaceous vegetation, riparian areas lacking shrub and tree stratum, hay production, ponds, open water. If present, tree stratum (dbh >3 inches) present, with <30% tree canopy cover with maintained understory.	High Poor: Lawns, mowed, and maintained areas, nurseries; no-till cropland; actively grazed pasture, sparsely vegetated non-maintained area, recently seeded and stabilized, or other comparable condition.	Low Poor: Impervious surfaces, mine spoil lands, denuded surfaces, row crops, active feed lots, trails, or other comparable conditions.	
		High	Low	High	Low	High	Low	
Condition Scores	1.5	1.2	1.1	0.85	0.75	0.6	0.5	

NOTES>> Predominately hardwood forest. Some mowed/maintained roadside and gravel. Pocohantas road.

1. Delineate riparian areas along each stream bank into Condition Categories and Condition Scores using the descriptors.
2. Determine square footage for each by measuring or estimating length and width. Calculators are provided for you below.
3. Enter the % Riparian Area and Score for each riparian category in the blocks below.

Ensure the sums of % Riparian Blocks equal 100

Right Bank	% Riparian Area>	80%	10%	10%				100%	
	Score >	1.5	0.6	0.5					
Left Bank	% Riparian Area>	80%	10%	10%				100%	
	Score >	1.5	0.6	0.5					

CI= (Sum % RA * Scores*0.01)/2

Rt Bank CI >	1.31	CI
Lt Bank CI >	1.31	1.31

3. INSTREAM HABITAT: Varied substrate sizes, water velocity and depths; woody and leafy debris; stable substrate; low embededness; shade; undercut banks; root mats; SAV; riffle poole complexes, stable features.

	Conditional Category			
	Optimal	Suboptimal	Marginal	Poor
Instream Habitat/ Available Cover	Habitat elements are typically present in greater than 50% of the reach.	Stable habitat elements are typically present in 30-50% of the reach and are adequate for maintenance of populations.	Stable habitat elements are typically present in 10-30% of the reach and are adequate for maintenance of populations.	Habitat elements listed above are lacking or are unstable. Habitat elements are typically present in less than 10% of the reach.
Score	1.5	1.2	0.9	0.5

NOTES>> Large perennial, varied rock substrate, strong flow as of 10/25/2016

CI
1.50

Stream Impact Assessment Form Page 2

Project #	Applicant	Locality	Cowardin Class	HUC	Date	Data Point	SAR length	Impact Factor
	Mountain Valley Pipeline	Giles		050500020602	10/25/2016	S-PP14	500	1

4. CHANNEL ALTERATION: Stream crossings, riprap, concrete, gabions, or concrete blocks, straightening of channel, channelization, embankments, spoil piles, constrictions, livestock

NOTES>> Culvert. Road is blown out over culvert, forming deep holes in road. Need improvement.

	Conditional Category						
	Negligible	Minor		Moderate		Severe	
Channel Alteration	Channelization, dredging, alteration, or hardening absent. Stream has an unaltered pattern or has naturalized.	Less than 20% of the stream reach is disrupted by any of the channel alterations listed in the parameter guidelines.	20-40% of the stream reach is disrupted by any of the channel alterations listed in the parameter guidelines.	40 - 60% of reach is disrupted by any of the channel alterations listed in the parameter guidelines. If stream has been channelized, normal stable stream meander pattern has not recovered.	60 - 80% of reach is disrupted by any of the channel alterations listed in the parameter guidelines. If stream has been channelized, normal stable stream meander pattern has not recovered.	Greater than 80% of reach is disrupted by any of the channel alterations listed in the parameter guidelines AND/OR 80% of banks shored with gabion, riprap, or cement.	
SCORE	1.5	1.3	1.1	0.9	0.7	0.5	1.30

REACH CONDITION INDEX and STREAM CONDITION UNITS FOR THIS REACH

NOTE: The CIs and RCI should be rounded to 2 decimal places. The CR should be rounded to a whole number.

THE REACH CONDITION INDEX (RCI) >>	1.42

RCI= (Sum of all CI's)/5

COMPENSATION REQUIREMENT (CR) >>	16

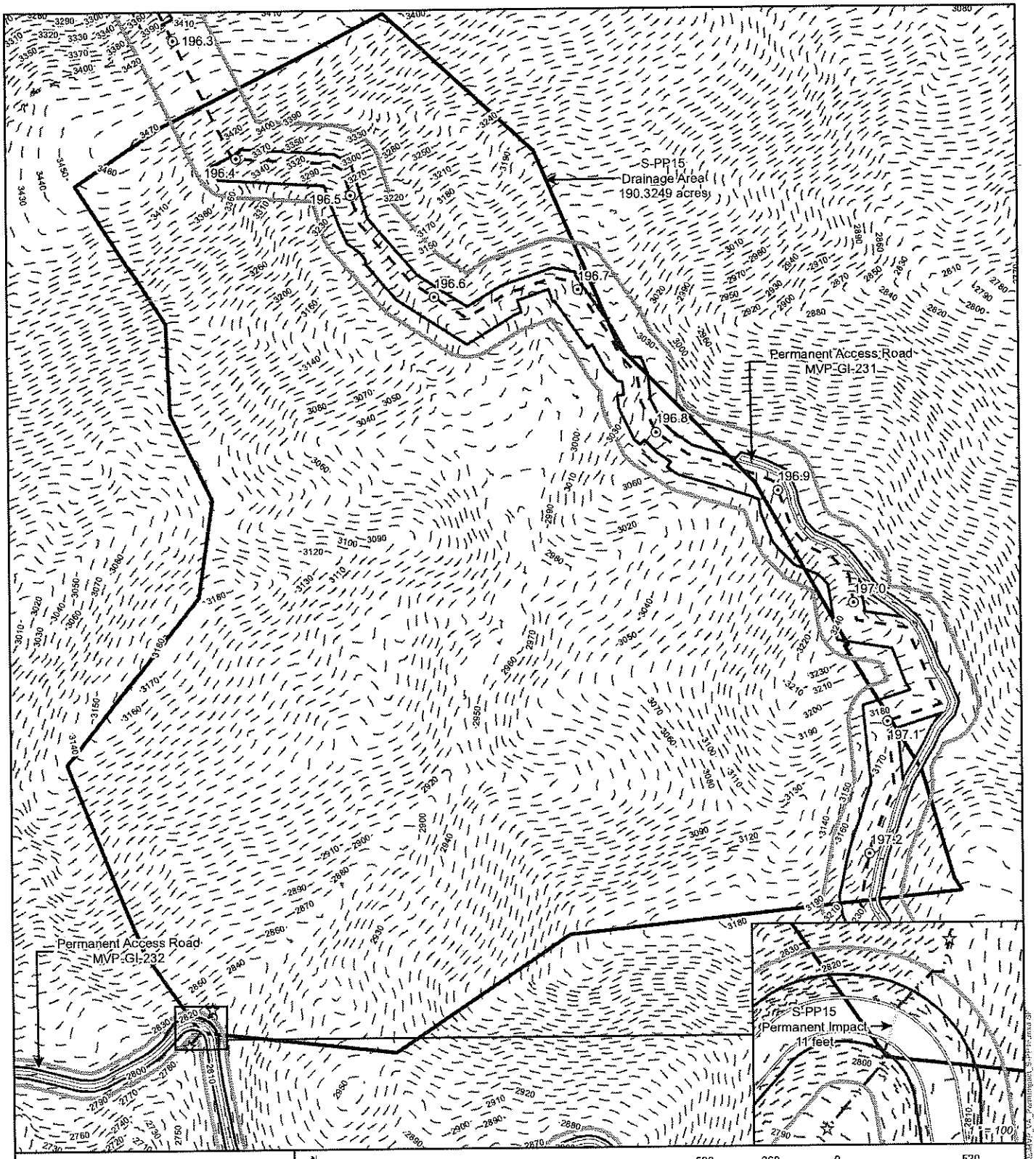
CR = RCI X LF X IF

INSERT PHOTOS:

DESCRIBE PROPOSED IMPACT:

Large perrenial strea. Mostly optimal in all categories.

S-PP15



Mountain Valley Pipeline Project

N

NAD 1983 UTM 17N

1 " = 520 '

520 260 0 520 Feet

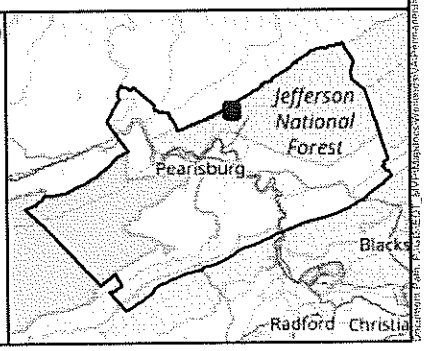
Mountain Valley PIPELINE

Figure 1:
Permanent Impacts for
Stream S-PP15
Giles County

SEPTEMBER, 2017

Data Sources: ESRI Streaming Data © 2014
Elevation data derived from LiDAR provided by EQT 2016
and from the West Virginia GIS Clearinghouse.

- Milepost
- Alignment Centerline
- Access Road Permanent LOD
- Limit of Disturbance
- Preliminary Jurisdictional Determination Boundary
- Unified Stream Method (USM) Survey Reach
- Stream Permanent Impact
- Perennial Stream
- Drainage Area



Photograph Number: 1 **Feature Name:** S-PP15 **Flow Regime:** Perennial

Direction: NNE **Date:** 10/16/2015

STREAM ID S-PP15	**STREAM NAME** UNT to Kimballton Branch
LAT 37.392628 **LONG** -80.690067	**DATE** 10/16/2015
CLIENT MVP	**PROJECT NAME** MVP
INVESTIGATORS D. Hadersbeck, T. Woods, D. McCollough	
FLOW REGIME Perennial ✔ Intermittent ___ Ephemeral ___	**WATER TYPE** TNW ___ RPW ✔ NRPW ___

CHANNEL FEATURES

Estimate Measurements
Top of Bank Width: 6 ft
Top of Bank Height:
LB 6.0 in RB 6.0 in
Water Depth: 6.00 in
Water Width: 3.0 ft
High Water Mark: 8.0 in
Flow Direction: Southwest

Stream Erosion
✔ None ___ Moderate ___ Heavy

Artificial, Modified or Channelized
✔ Yes ___ No

Dam Present ___ Yes ✔ No

Sinuosity ___ Low ✔ Medium ✔ High

Gradient
___ Flat (0.5/100 ft) ✔ Moderate (2 ft/100 ft) ___ Severe (10 ft/100 ft)

FLOW CHARACTERISTICS

Water Present
___ No water, stream bed dry
___ Stream bed moist
___ Standing water
✔ Flowing water

Velocity
___ Fast ✔ Moderate
___ Slow

Proportion of Reach Represented by Stream Morphology Types
Riffle 30 % Run 50 %
Pool 20 %

Turbidity
✔ Clear ___ Slightly turbid ___ Turbid
___ Opaque ___ Stained
___ Other_____

INORGANIC SUBSTRATE COMPONENTS (should add up to 100%)			ORGANIC SUBSTRATE COMPONENTS (does not necessarily add up to 100%)		
Substrate Type	Diameter	% Composition in Sampling Reach	Substrate Type	Characteristic	% Composition in Sampling Area
Bedrock			Detritus	sticks, wood, coarse plant materials (CPOM)	65
Boulder	> 256 mm (10")	20			
Cobble	64-256 mm (2.5"-10")	30	Muck-Mud	black, very fine organic (FPOM)	
Gravel	2-64 mm (0.1"-2.5")	30			
Sand	0.06-2mm (gritty)	20	Marl	grey, shell fragments	
Silt	0.004-0.06 mm				
Clay	< 0.004 mm (slick)				

WATERSHED FEATURES

Predominant Surrounding Landuse
✔ Forest ___ Commercial
___ Field/Pasture ___ Industrial
___ Agricultural ___ Residential
___ Other:

Canopy Cover
✔ Partly open ___ Partly shaded
___ Shaded ___ Open

Indicate the dominant type (Check one)
✔ Trees ___ Shrubs
___ Grasses ___ Herbaceous

Floodplain Width
___ Wide > 30ft ✔ Moderate 15-30ft
___ Narrow <16ft

Wetland Present ___ Yes ✔ No
Wetland ID

AQUATIC VEGETATION

Indicate the dominant type and record the dominant species present
___ Rooted emergent ___ Rooted submergent ___ Rooted floating ___ Free floating
___ Floating algae ✔ Attached algae

MACROINVERTEBRATES OR OTHER WILDLIFE OBSERVED/OTHER OBSERVATIONS AND NOTES

Stream traverses a culvert under the road.

Stream Assessment Form (Form 1)

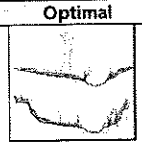
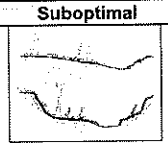
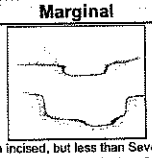
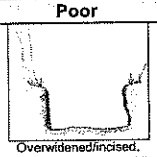
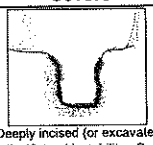
Unified Stream Methodology for use in Virginia

For use in wadeable channels classified as intermittent or perennial

Project #	Project Name	Locality	Cowardin Class.	HUC	Date	SAR #	Impact/SAR length	Impact Factor
	Mountain Valley Pipeline	Giles	R3UB1	050500020602	10/25/2016		11	1

Name(s) of Evaluator(s)	Stream Name and Information
J.Cook, E.Foster	S-PP15 (NHD), Perrenial, MVP-GI-232

1. Channel Condition: Assess the cross-section of the stream and prevailing condition (erosion, aggradation)

	Conditional Category					
	Optimal	Suboptimal	Marginal	Poor	Severe	
Channel Condition	 Very little incision or active erosion; 80-100% stable banks. Vegetative surface protection or natural rock, prominent (80-100%). AND/OR Stable point bars/bankfull benches are present. Access to their original floodplain or fully developed wide bankfull benches. Mid-channel bars, and transverse bars few. Transient sediment deposition covers less than 10% of bottom.	 Slightly incised, few areas of active erosion or unprotected banks. Majority of banks are stable (60-80%). Vegetative protection or natural rock prominent (60-80%) AND/OR Depositional features contribute to stability. The bankfull and low flow channels are well defined. Stream likely has access to bankfull benches, or newly developed floodplains along portions of the reach. Transient sediment covers 10-40% of the stream bottom.	 Often incised, but less than Severe or Poor. Banks more stable than Severe or Poor due to lower bank slopes. Erosion may be present on 40-60% of both banks. Vegetative protection on 40-60% of banks. Streambanks may beverlical or undercut. AND/OR 40-60% of stream is covered by sediment. Sediment may be temporary/transient, contribute instability. Deposition that contribute to stability, may be forming/present. AND/OR V-shaped channels have vegetative protection on > 40% of the banks and depositional features which contribute to stability.	 Overwidened/incised. Vertically/laterally unstable. Likely to widen further. Majority of both banks are near vertical. Erosion present on 60-80% of banks. Vegetative protection present on 20-40% of banks, and is insufficient to prevent erosion. AND/OR 60-80% of the stream is covered by sediment. Sediment is temporary/transient in nature, and contributing to instability. AND/OR V-shaped channels have vegetative protection is present on > 40% of the banks and stable sediment deposition is absent.	 Deeply incised (or excavated), vertical/lateral instability. Severe incision, flow contained within the banks. Streambed below average rooting depth, majority of banks vertical/undercut. Vegetative protection present on less than 20% of banks, is not preventing erosion. Obvious bank sloughing present. Erosion/raw banks on 80-100%. AND/OR Aggrading channel. Greater than 80% of stream bed is covered by deposition, contributing to instability. Multiple thread channels and/or subterranean flow.	CI
Score	3	2.4	2	1.6	1	2.4
NOTES>>	Slight incision					

2. RIPARIAN BUFFERS: Assess both bank's 100 foot riparian areas along the entire SAR. (rough measurements of length & width may be acceptable)

	Conditional Category							NOTES>>
	Optimal	Suboptimal		Marginal		Poor		
Riparian Buffers	Tree stratum (dbh > 3 inches) present, with > 60% tree canopy cover and a non-maintained understory. Wetlands located within the riparian areas.	**High Suboptimal:** Riparian areas with tree stratum (dbh > 3 inches) present, with 30% to 60% tree canopy cover and containing both herbaceous and shrub layers or a non-maintained understory.	**Low Suboptimal:** Riparian areas with tree stratum (dbh > 3 inches) present, with > 30% tree canopy cover and a maintained understory. Recent cutover (dense vegetation).	**High Marginal:** Non-maintained, dense herbaceous vegetation with either a shrub layer or a tree layer (dbh > 3 inches) present, with <30% tree canopy cover.	**Low Marginal:** Non-maintained, dense herbaceous vegetation, riparian areas lacking shrub and tree stratum, hay production, ponds, open water. If present, tree stratum (dbh >3 inches) present, with <30% tree canopy cover with maintained understory.	**High Poor:** Lawns, mowed, and maintained areas, nurseries; no-till cropland; actively grazed pasture, sparsely vegetated non-maintained area, recently seeded and stabilized, or other comparable condition.	**Low Poor:** Impervious surfaces, mine spoil lands, denuded surfaces, row crops, active feed lots, trails, or other comparable conditions.	
		High	Low	High	Low	High	Low	
Condition Scores	1.5	1.2	1.1	0.85	0.75	0.6	0.5	

1. Delineate riparian areas along each stream bank into Condition Categories and Condition Scores using the descriptors.
2. Determine square footage for each by measuring or estimating length and width. Calculators are provided for you below.
3. Enter the % Riparian Area and Score for each riparian category in the blocks below.

Ensure the sums of % Riparian Blocks equal 100

Right Bank	% Riparian Area>	100%						100%	
	Score >	1.5							
									CI= (Sum % RA * Scores*0.01)/2
Left Bank	% Riparian Area>	100%						100%	Rt Bank CI > 1.50
	Score >	1.5							Lt Bank CI > 1.50

CI
1.50

3. INSTREAM HABITAT: Varied substrate sizes, water velocity and depths; woody and leafy debris; stable substrate; low embededness; shade; undercut banks; root mats; SAV; riffle pools complexes, stable features.

NOTES>> Varying substrate, shade and undercut

	Conditional Category			
	Optimal	Suboptimal	Marginal	Poor
Instream Habitat/ Available Cover	Habitat elements are typically present in greater than 50% of the reach.	Stable habitat elements are typically present in 30-50% of the reach and are adequate for maintenance of populations.	Stable habitat elements are typically present in 10-30% of the reach and are adequate for maintenance of populations.	Habitat elements listed above are lacking or are unstable. Habitat elements are typically present in less than 10% of the reach.
Score	1.5	1.2	0.9	0.5

CI
1.20

Stream Impact Assessment Form Page 2

Project #	Applicant	Locality	Cowardin Class.	HUC	Date	Data Point	SAR length	Impact Factor
	Mountain Valley Pipeline	Giles		050500020602	10/25/2016	S-:P15	500	1

4. CHANNEL ALTERATION: Stream crossings, riprap, concrete, gabions, or concrete blocks, straightening of channel, channelization, embankments, spoil piles, constrictions, livestock

NOTES>> Extensive culvert

	Conditional Category						
	Negligible	Minor		Moderate		Severe	
Channel Alteration	Channelization, dredging, alteration, or hardening absent. Stream has an unaltered pattern or has naturalized.	Less than 20% of the stream reach is disrupted by any of the channel alterations listed in the parameter guidelines.	20-40% of the stream reach is disrupted by any of the channel alterations listed in the parameter guidelines.	40 - 60% of reach is disrupted by any of the channel alterations listed in the parameter guidelines. If stream has been channelized, normal stable stream meander pattern has not recovered.	60 - 80% of reach is disrupted by any of the channel alterations listed in the parameter guidelines. If stream has been channelized, normal stable stream meander pattern has not recovered.	Greater than 80% of reach is disrupted by any of the channel alterations listed in the parameter guidelines AND/OR 80% of banks shored with gabion, riprap, or cement.	
SCORE	1.5	1.3	1.1	0.9	0.7	0.5	1.30

REACH CONDITION INDEX and STREAM CONDITION UNITS FOR THIS REACH

NOTE: The CIs and RCI should be rounded to 2 decimal places. The CR should be rounded to a whole number.

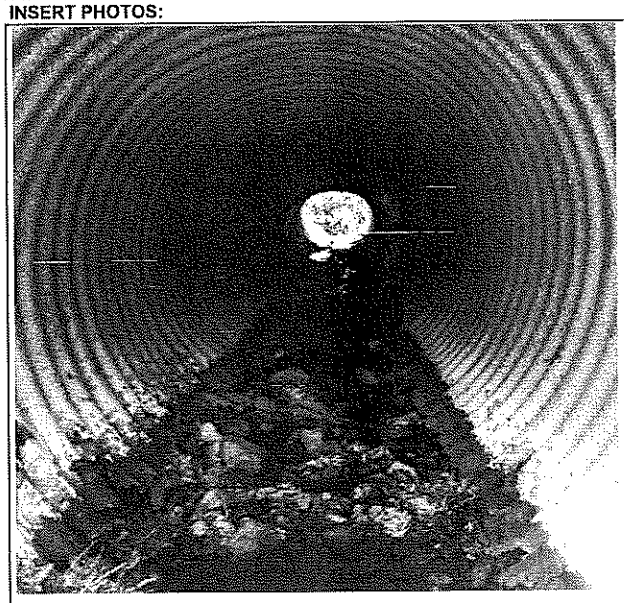
THE REACH CONDITION INDEX (RCI) >>	1.28

RCI= (Sum of all CI's)/5

COMPENSATION REQUIREMENT (CR) >>	14

CR = RCI X LF X IF

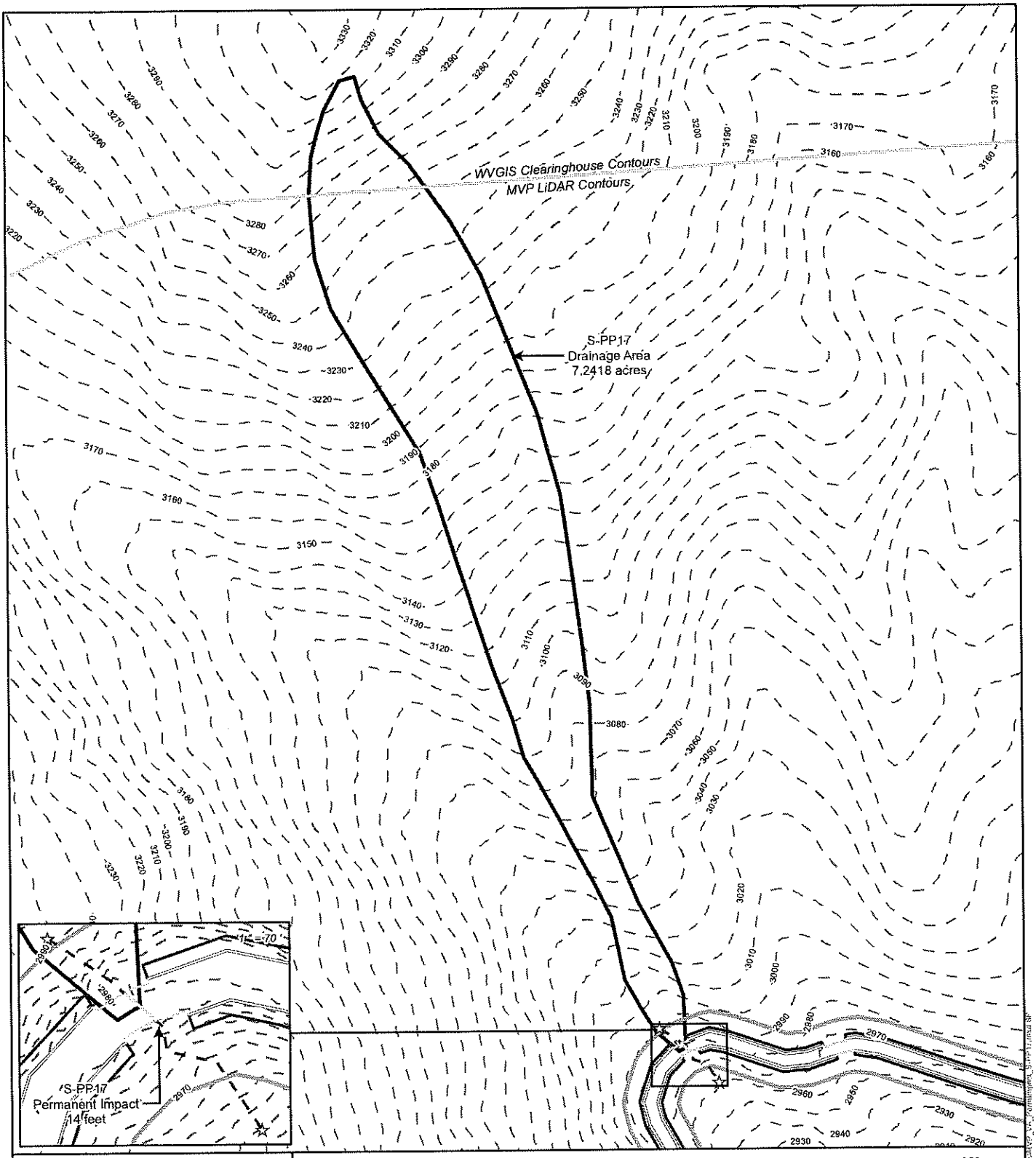
INSERT PHOTOS:



DESCRIBE PROPOSED IMPACT:

Entire culvert will need to be replaced.

S-PP17



Mountain Valley Pipeline Project

N

NAD 1983 UTM 17N

1 " = 250 '

250 125 0 250 Feet

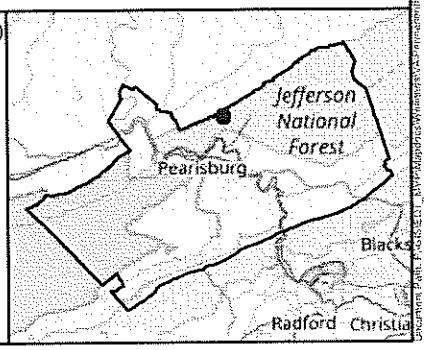
Mountain Valley PIPELINE

Figure 1:
Permanent Impacts for
Stream S-PP17
Giles County

SEPTEMBER, 2017

Data Sources: ESRI Streaming Data © 2014
Elevation data derived from LiDAR provided by EQT 2016
and from the West Virginia GIS Clearinghouse.

- Access Road Permanent LOD
- Limit of Disturbance
- Preliminary Jurisdictional Determination Boundary
- Unified Stream Method (USM) Survey Reach
- Stream Permanent Impact
- Intermittent Stream
- Drainage Area



Photograph Number: 1 **Feature Name:** S-PP17 **Flow Regime:** Intermittent

Direction: SE **Date:** 10/16/2015

STREAM ID S-PP17	**STREAM NAME** UNT to New River
LAT 37.386744 **LONG** -80.700408	**DATE** 10/16/2015
CLIENT MVP	**PROJECT NAME** MVP
INVESTIGATORS D. Hadersbeck, T. Woods, D. McCollough	
FLOW REGIME Perennial ___ Intermittent ✓ Ephemeral ___	**WATER TYPE** TNW ___ RPW ✓ NRPW ___

CHANNEL FEATURES	**Estimate Measurements** Top of Bank Width: 2 ft Top of Bank Height: LB 6.0 in RB 6.0 in Water Depth: 3.00 in Water Width: 1.0 ft High Water Mark: 6.0 in Flow Direction: South	**Stream Erosion** ✓ None ___ Moderate ___ Heavy **Artificial, Modified or Channelized** ✓ Yes ___ No **Dam Present** ___ Yes ✓ No **Sinuosity** ___ Low ✓ Medium ✓ High **Gradient** ___ Flat (0.5/100 ft) ✓ Moderate (2 ft/100 ft) ___ Severe (10 ft/100 ft)
FLOW CHARACTERISTICS	**Water Present** ___ No water, stream bed dry ___ Stream bed moist ___ Standing water ✓ Flowing water **Velocity** ___ Fast ___ Moderate ✓ Slow	**Proportion of Reach Represented by Stream Morphology Types** Riffle 20 % Run 60 % Pool 20 % **Turbidity** ___ Clear ✓ Slightly turbid ___ Turbid ___ Opaque ___ Stained ___ Other ___

INORGANIC SUBSTRATE COMPONENTS (should add up to 100%)			ORGANIC SUBSTRATE COMPONENTS (does not necessarily add up to 100%)		
Substrate Type	Diameter	% Composition in Sampling Reach	Substrate Type	Characteristic	% Composition in Sampling Area
Bedrock		20	Detritus	sticks, wood, coarse plant materials (CPOM)	80
Boulder	> 256 mm (10")	20			
Cobble	64-256 mm (2.5"-10")	30	Muck-Mud	black, very fine organic (FPOM)	
Gravel	2-64 mm (0.1"-2.5")	30			
Sand	0.06-2mm (gritty)		Marl	grey, shell fragments	
Silt	0.004-0.06 mm				
Clay	< 0.004 mm (slick)				

WATERSHED FEATURES	**Predominant Surrounding Landuse** ✓ Forest ___ Commercial ___ Field/Pasture ___ Industrial ___ Agricultural ___ Residential ___ Other: **Canopy Cover** ✓ Partly open ___ Partly shaded ___ Shaded ___ Open	**Indicate the dominant type (Check one)** ✓ Trees ___ Shrubs ___ Grasses ___ Herbaceous **Floodplain Width** ___ Wide > 30ft ✓ Moderate 15-30ft ___ Narrow <16ft **Wetland Present** ___ Yes ✓ No **Wetland ID**
AQUATIC VEGETATION	**Indicate the dominant type and record the dominant species present** ___ Rooted emergent ___ Rooted submergent ___ Rooted floating ___ Free floating ___ Floating algae ___ Attached algae	

MACROINVERTEBRATES OR OTHER WILDLIFE OBSERVED/OTHER OBSERVATIONS AND NOTES	Stream emerges from high side of road from black plastic tubing then traverses a culvert under the road.

Stream Assessment Form (Form 1)

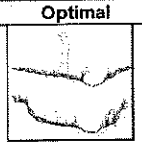
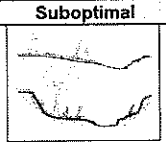
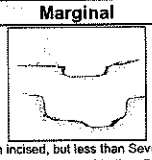
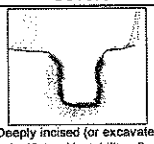
Unified Stream Methodology for use in Virginia

For use in wadeable channels classified as intermittent or perennial

Project #	Project Name	Locality	Cowardin Class.	HUC	Date	SAR #	Impact/SAR length	Impact Factor
	Mountain Valley Pipeline	Giles	R4SB3	050500020602	10/25/2016		14	1

Name(s) of Evaluator(s)	Stream Name and Information
J.Cook, E.Foster	S-PP17, Intermittent, MVP-GI-232

1. Channel Condition: Assess the cross-section of the stream and prevailing condition (erosion, aggradation)

	Conditional Category					
	Optimal	Suboptimal	Marginal	Poor	Severe	
						
Channel Condition	Very little incision or active erosion; 80-100% stable banks. Vegetative surface protection or natural rock, prominent (80-100%). AND/OR Stable point bars/bankfull benches are present. Access to their original floodplain or fully developed wide bankfull benches. Mid-channel bars, and transverse bars few. Transient sediment deposition covers less than 10% of bottom.	Slightly incised, few areas of active erosion or unprotected banks. Majority of banks are stable (60-80%). Vegetative protection or natural rock prominent (60-80%) AND/OR Depositional features contribute to stability. The bankfull and low flow channels are well defined. Stream likely has access to bankfull benches, or newly developed floodplains along portions of the reach. Transient sediment covers 10-40% of the stream bottom.	Often incised, but less than Severe or Poor. Banks more stable than Severe or Poor due to lower bank slopes. Erosion may be present on 40-60% of both banks. Vegetative protection on 40-60% of banks. Streambanks may beverfical or undercut. AND/OR 40-60% of stream is covered by sediment. Sediment may be temporary/transient, contribute instability. Deposition that contribute to stability, may be forming/present. AND/OR V-shaped channels have vegetative protection on > 40% of the banks and depositional features which contribute to stability.	Overwidened/incised. Vertically/laterally unstable. Likely to widen further. Majority of both banks are near vertical. Erosion present on 60-80% of banks. Vegetative protection present on 20-40% of banks, and is insufficient to prevent erosion. AND/OR 60-80% of the stream is covered by sediment. Sediment is temporary/transient in nature, and contributing to instability. AND/OR V-shaped channels have vegetative protection is present on > 40% of the banks and stable sediment deposition is absent.	Deeply incised (or excavated), vertical/lateral instability. Severe incision, flow contained within the banks. Streambed below average rooting depth, majority of banks vertical/undercut. Vegetative protection present on less than 20% of banks, is not preventing erosion. Obvious bank sloughing present. Erosion/raw banks on 80-100%. AND/OR Aggrading channel. Greater than 80% of stream bed is covered by deposition, contributing to instability. Multiple thread channels and/or subterranean flow.	CI
Score	3	2.4	2	1.6	1	3.0

NOTES>> Predominately natural rock -> Bedrock/boulders form majority of channel

2. RIPARIAN BUFFERS: Assess both bank's 100 foot riparian areas along the entire SAR. (rough measurements of length & width may be acceptable)

	Conditional Category							
	Optimal	Suboptimal		Marginal		Poor		
Riparian Buffers	Tree stratum (dbh > 3 inches) present, with > 60% tree canopy cover and a non-maintained understory. Wetlands located within the riparian areas.	**High Suboptimal:** Riparian areas with tree stratum (dbh > 3 inches) present, with 30% to 60% tree canopy cover and containing both herbaceous and shrub layers or a non-maintained understory.	**Low Suboptimal:** Riparian areas with tree stratum (dbh > 3 inches) present, with > 30% tree canopy cover and a maintained understory. Recent cutover (dense vegetation).	**High Marginal:** Non-maintained, dense herbaceous vegetation with either a shrub layer or a tree layer (dbh > 3 inches) present, with <30% tree canopy cover.	**Low Marginal:** Non-maintained, dense herbaceous vegetation, riparian areas lacking shrub and tree stratum, hay production, ponds, open water. If present, tree stratum (dbh >3 inches) present, with <30% tree canopy cover with maintained understory.	**High Poor:** Lawns, mowed, and maintained areas, nurseries; no-till cropland; actively grazed pasture, sparsely vegetated non-maintained area, recently seeded and stabilized, or other comparable condition.	**Low Poor:** Impervious surfaces, mine spoil lands, denuded surfaces, row crops, active feed lots, trails, or other comparable conditions.	
		High	Low	High	Low	High	Low	
Condition Scores	1.5	1.2	1.1	0.85	0.75	0.6	0.5	

NOTES>> Hardwood forest predominately

1. Delineate riparian areas along each stream bank into Condition Categories and Condition Scores using the descriptors.
2. Determine square footage for each by measuring or estimating length and width. Calculators are provided for you below.
3. Enter the % Riparian Area and Score for each riparian category in the blocks below.

Ensure the sums of % Riparian Blocks equal 100

Right Bank	% Riparian Area>	95%	5%					100%	
	Score >	1.5	0.6						
Left Bank	% Riparian Area>	95%	5%					100%	
	Score >	1.5	0.6						

CI= (Sum % RA * Scores*0.01)/2

Rt Bank CI >	1.46	CI
Lt Bank CI >	1.46	1.46

3. INSTREAM HABITAT: Varied substrate sizes, water velocity and depths; woody and leafy debris; stable substrate; low embededness; shade; undercut banks; root mats; SAV; riffle pools complexes, stable features.

	Conditional Category			
	Optimal	Suboptimal	Marginal	Poor
Instream Habitat/ Available Cover	Habitat elements are typically present in greater than 50% of the reach.	Stable habitat elements are typically present in 30-50% of the reach and are adequate for maintenance of populations.	Stable habitat elements are typically present in 10-30% of the reach and are adequate for maintenance of populations.	Habitat elements listed above are lacking or are unstable. Habitat elements are typically present in less than 10% of the reach.
Score	1.5	1.2	0.9	0.5

NOTES>> No flowing water as of 10/25/2016. Some dripping from seep under boulder.

CI
1.20

Stream Impact Assessment Form Page 2

Project #	Applicant	Locality	Cowardin Class.	HUC	Date	Data Point	SAR length	Impact Factor
	Mountain Valley Pipeline	Giles		050500020802	10/25/2016		500	1

4. CHANNEL ALTERATION: Stream crossings, riprap, concrete, gabions, or concrete blocks, straightening of channel, channelization, embankments, spoil piles, constrictions, livestock

NOTES>> Roadside ditch and culvert, slightly alter flow/channel

	Conditional Category						
	Negligible	Minor		Moderate		Severe	
Channel Alteration	Channelization, dredging, alteration, or hardening absent. Stream has an unaltered pattern or has naturalized.	Less than 20% of the stream reach is disrupted by any of the channel alterations listed in the parameter guidelines.	20-40% of the stream reach is disrupted by any of the channel alterations listed in the parameter guidelines.	40 - 60% of reach is disrupted by any of the channel alterations listed in the parameter guidelines. If stream has been channelized, normal stable stream meander pattern has not recovered.	60 - 80% of reach is disrupted by any of the channel alterations listed in the parameter guidelines. If stream has been channelized, normal stable stream meander pattern has not recovered.	Greater than 80% of reach is disrupted by any of the channel alterations listed in the parameter guidelines AND/OR 80% of banks shored with gabion, riprap, or cement.	
SCORE	1.5	1.3	1.1	0.9	0.7	0.5	1.30

REACH CONDITION INDEX and STREAM CONDITION UNITS FOR THIS REACH

NOTE: The CIs and RCI should be rounded to 2 decimal places. The CR should be rounded to a whole number.

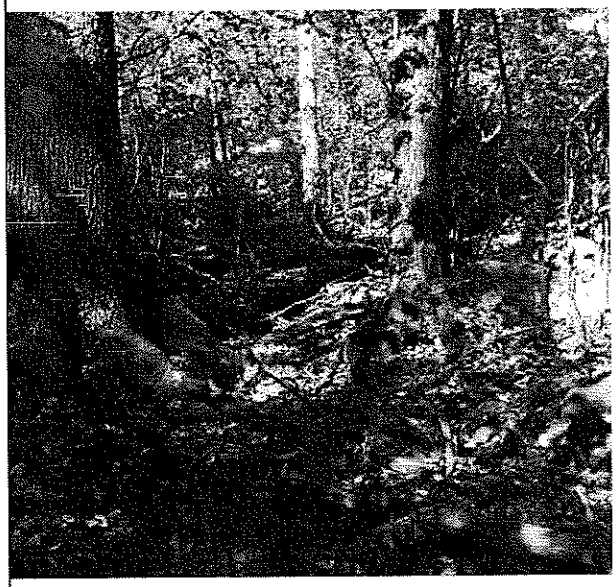
THE REACH CONDITION INDEX (RCI) >>	1.39

RCI= (Sum of all CI's)/5

COMPENSATION REQUIREMENT (CR) >>	19

CR = RCI X LF X IF

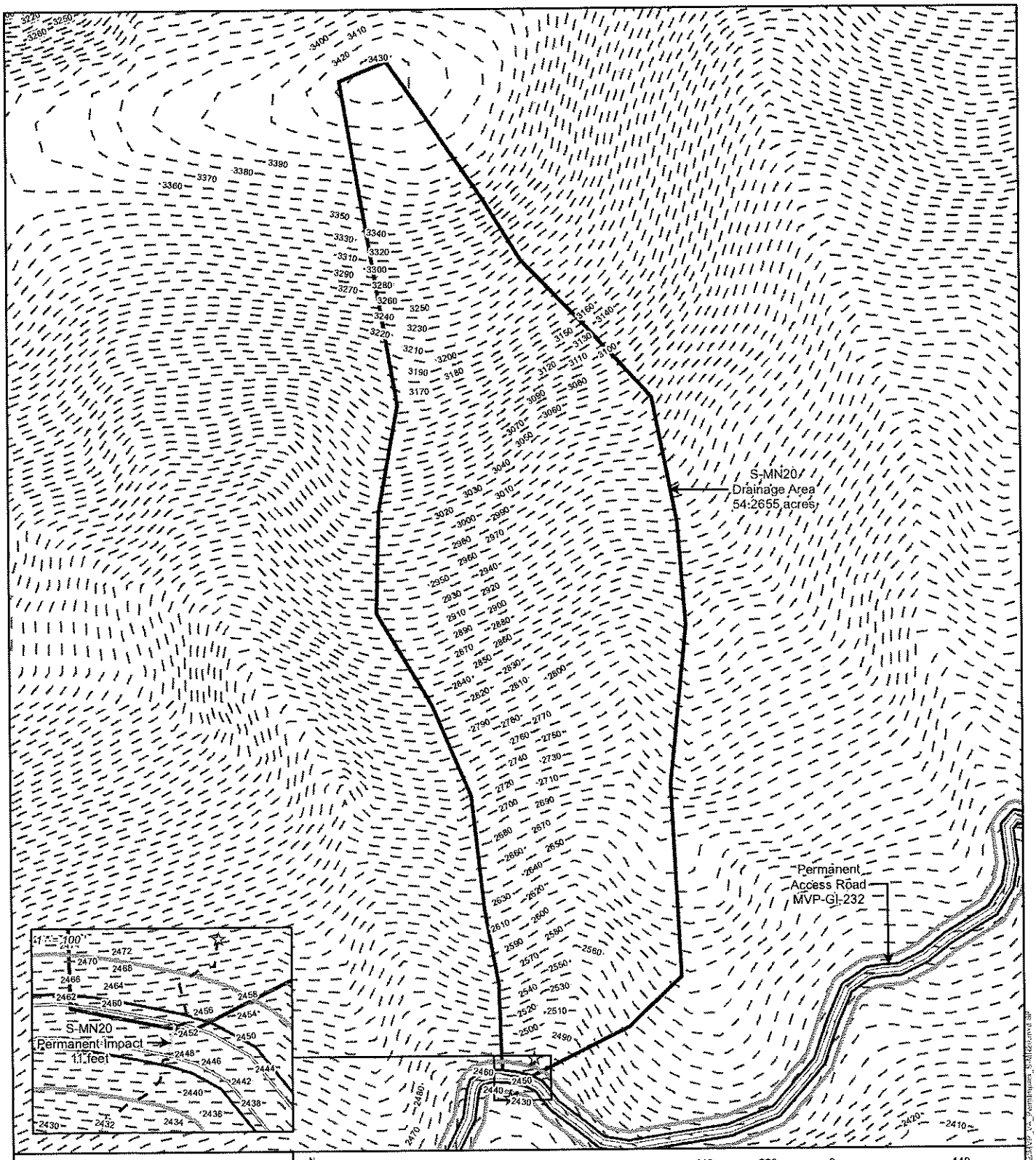
INSERT PHOTOS:



DESCRIBE PROPOSED IMPACT:

S-PP17 appears to be Old streambed with no visible flow. Subterranean water emerges from seeps in one or more locations, notably upstream of culvert from underneath a large boulder. Channel may be historical. NHD mapping present for this stream.

S-MN20



Mountain Valley Pipeline Project

NAD 1983 UTM 17N

1 " = 457 '

440 220 0 440 Feet

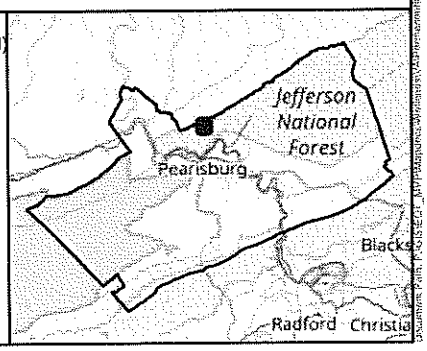
Mountain Valley PIPELINE

Figure 1:
Permanent Impacts for
Stream S-MN20
Giles County

SEPTEMBER, 2017

Data Sources: ESRI Streaming Data © 2014
Elevation data derived from LiDAR provided by EQT 2016
and from the West Virginia GIS Clearinghouse.

- Access Road Permanent LOD
- Limit of Disturbance
- Preliminary Jurisdictional Determination Boundary
- Unified Stream Method (USM) Survey Reach
- Stream Permanent Impact
- Intermittent Stream
- Drainage Area



Photograph Number: 1 **Feature Name:** S-MN20 **Flow Regime:** Intermittent

Direction: NE **Date:** 5/10/2017

STREAM ID S-MN20	**STREAM NAME** UNT to Clendennin Creek
CLIENT MVP	**PROJECT NAME** MVP
LAT 37.373901 **LONG** -80.731631	**DATE** 05/10/2017 **COUNTY** Giles
INVESTIGATORS S Ryan, K Pulver, H Phelan	
WATER TYPE TNW ☐ RPW ☑ NRPW ☐	**FLOW REGIME** Perennial ☐ Intermittent ☑ Ephemeral ☐

CHANNEL FEATURES

Estimate Measurements
Top of Bank Width: 4.0 ft
Top of Bank Height:
LB 1.0 ft RB 1.0 ft
Water Depth: 3.00 in
Water Width: 2.0 ft
Ordinary High Water Mark (Width): 2.0 ft
Ordinary High Water Mark (Height): 3.0 in
Flow Direction: South

Sinuosity ___ Low ___ Medium ✔ High

Gradient ___ Flat (0.5/100 ft) ✔ Moderate (2 ft/100 ft) ___ Severe (10 ft/100 ft)

Stream Erosion
✔ None ___ Moderate ___ Heavy

Artificial, Modified or Channelized
___ Yes ✔ No

Within Roadside Ditch
___ Yes ✔ No

Culvert Present ✔ Yes ___ No
Culvert Material: Corrugated Metal
Culvert Size: 16 in

FLOW CHARACTERISTICS

Water Present
___ No water, stream bed dry
___ Stream bed moist
___ Standing water
✔ Flowing water

Velocity
✔ Fast ___ Moderate
___ Slow

Proportion of Reach Represented by Stream Morphology Types (Only enter if water present)
Riffle 80 % Run %
Pool 20 %

Turbidity
✔ Clear ___ Slightly turbid ___ Turbid
___ Other_____

INORGANIC SUBSTRATE COMPONENTS (should add up to 100%) 100

Substrate Type	Diameter	% Composition in Sampling Reach
Bedrock		
Boulder	> 256 mm (10")	25
Cobble	64-256 mm (2.5"-10")	40
Gravel	2-64 mm (0.1"-2.5")	20
Sand	0.06-2mm (gritty)	10
Silt	0.004-0.06 mm	5
Clay	< 0.004 mm (slick)	

ORGANIC SUBSTRATE COMPONENTS (does not necessarily add up to 100%)

Substrate Type	Characteristic	% Composition in Sampling Area
Detritus	sticks, wood, coarse plant materials (CPOM)	15
Muck-Mud	black, very fine organic (FPOM)	0
Marl	grey, shell fragments	0

WATERSHED FEATURES

Predominant Surrounding Landuse
✔ Forest ___ Commercial
___ Field/Pasture ___ Industrial
___ Agricultural ___ Residential
___ ROW ___ Other:

Canopy Cover
___ Open ___ Partly shaded
✔ Shaded

Floodplain Width
___ Wide > 30ft ___ Moderate 15-30ft
✔ Narrow <15ft

MACROINVERTEBRATES/OTHER WILDLIFE OBSERVED OR OTHER NOTES AND OBSERVATIONS

Flows through culvert and joins S-MN17 outside of survey area. Heavy overnight rains.

Stream Assessment Form (Form 1)

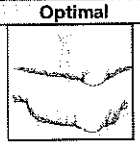
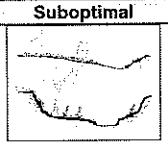
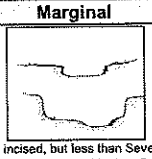
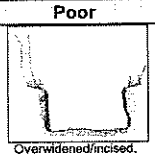
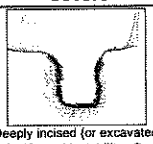
Unified Stream Methodology for use in Virginia

For use in wadeable channels classified as intermittent or perennial

Project #	Project Name	Locality	Cowardin Class.	HUC	Date	SAR #	Impact/SAR length	Impact Factor
	Mountain Valley Pipeline	Giles	R4SB3	050500020602	5/10/17		11	1

Name(s) of Evaluator(s)	Stream Name and Information
S Ryan, K Pulver, H Phelan	S-MN20, Intermittent, MVP-GI-232

1. Channel Condition: Assess the cross-section of the stream and prevailing condition (erosion, aggradation)

	Conditional Category					
	Optimal	Suboptimal	Marginal	Poor	Severe	
Channel Condition	 Very little incision or active erosion; 80-100% stable banks. Vegetative surface protection or natural rock, prominent (80-100%). AND/OR Stable point bars/bankfull benches are present. Access to their original floodplain or fully developed wide bankfull benches. Mid-channel bars, and transverse bars few. Transient sediment deposition covers less than 10% of bottom.	 Slightly incised, few areas of active erosion or unprotected banks. Majority of banks are stable (60-80%). Vegetative protection or natural rock prominent (60-80%) AND/OR Depositional features contribute to stability. The bankfull and low flow channels are well defined. Stream likely has access to bankfull benches, or newly developed floodplains along portions of the reach. Transient sediment covers 10-40% of the stream bottom.	 Often incised, but less than Severe or Poor. Banks more stable than Severe or Poor due to lower bank slopes. Erosion may be present on 40-60% of both banks. Vegetative protection on 40-60% of banks. Streambanks may bevertical or undercut. AND/OR 40-60% of stream is covered by sediment. Sediment may be temporary/transient, contribute instability. Deposition that contribute to stability, may be forming/present. AND/OR V-shaped channels have vegetative protection on > 40% of the banks and depositional features which contribute to stability.	 Overwidened/incised. Vertically/laterally unstable. Likely to widen further. Majority of beth banks are near vertical. Erosion present on 60-80% of banks. Vegetative protection present on 20-40% of banks, and is insufficient to prevent erosion. AND/OR 00-80% of the stream is covered by sediment. Sediment is temporary/transient in nature, and contributing to instability. AND/OR V-shaped channels have vegetative protection is present on > 40% of the banks and stable sediment deposition is absent.	 Deeply incised (or excavated), vertical/lateral instability. Severe incision, flow contained within the banks. Streambed below average rooting depth, majority of banks vertical/undercut. Vegetative protection present on less than 20% of banks, is not preventing erosion. Obvious bank sloughing present. Erosion/raw benks on 80-100%. AND/OR Aggrading channel. Greater than 80% of stream bed is covered by deposition, contributing to instability. Multiple thread channels and/or subterranean flow.	CI
Score	3	2.4	2	1.6	1	2.4
NOTES>>	-Slightly incised, but stable, rocky substrate					

2. RIPARIAN BUFFERS: Assess both bank's 100 foot riparian areas along the entire SAR. (rough measurements of length & width may be acceptable)

	Conditional Category						
	Optimal	Suboptimal		Marginal		Poor	
Riparian Buffers	Tree stratum (dbh > 3 inches) present, with > 60% tree canopy cover and a non-maintained understory. Wetlands located within the riparian areas.	**High Suboptimal: Riparian areas with tree stratum (dbh > 3 inches) present, with 30% to 60% tree canopy cover and containing both herbaceous and shrub layers or a non-maintained understory.**	**Low Suboptimal:** Riparian areas with tree stratum (dbh > 3 inches) present, with > 30% tree canopy cover and a maintained understory. Recent culover (dense vegetation).	**High Marginal:** Non-maintained, dense herbaceous vegetation with either a shrub layer or a tree layer (dbh > 3 inches) present, with <30% tree canopy cover.	**Low Marginal:** Non-maintained, dense herbaceous vegetation, riparian areas lacking shrub and tree stratum, hay production, ponds, open water. If present, tree stratum (dbh >3 inches) present, with <30% tree canopy cover with maintained understory.	**High Poor:** Lawns, mowed, and maintained areas, nurseries; no-till cropland; actively grazed pasture, sparsely vegetated non-maintained area, recently seeded and stabilized, or other comparable condition.	**Low Poor:** Impervious surfaces, mine spoil lands, denuded surfaces, row crops, active feed lots, trails, or other comparable conditions.
		High	Low	High	Low	High	Low
Condition Scores	1.5	1.2	1.1	0.85	0.75	0.6	0.5

Hardwood forest bisected by gravel road with small maintained roadside. Canopy composition is L tulipifera, and Q. montana with average DBH > 8". Understory is rhododendron and H. virginiana. Canopy closure near 100%, excluding road clearing. No wetlands in riparian

1. Delineate riparian areas along each stream bank into Condition Categories and Condition Scores using the descriptors.
2. Determine square footage for each by measuring or estimating length and width. Calculators are provided for you below.
3. Enter the % Riparian Area and Score for each riparian category in the blocks below.

Ensure the sums of % Riparian Blocks equal 100

Right Bank	% Riparian Area>	75%	15%	10%				100%
	Score >	1.2	0.6	0.5				
Left Bank	% Riparian Area>	75%	15%	10%				100%
	Score >	1.2	0.6	0.5				

CI= (Sum % RA * Scores*0.01)/2

Rt Bank CI >	1.04	CI
Lt Bank CI >	1.04	1.04

3. INSTREAM HABITAT: Varied substrate sizes, water velocity and depths; woody and leafy debris; stable substrate; low embeddedness; shade; undercut banks; root mats; SAV; riffle pools complexes, stable features.

	Conditional Category			
	Optimal	Suboptimal	Marginal	Poor
Instream Habitat/ Available Cover	Habitat elements are typically present in greater than 50% of the reach.	Stable habitat elements are typically present in 30-50% of the reach and are adequate for maintenance of populations.	Stable habitat elements are typically present in 10-30% of the reach and are adequate for maintenance of populations.	Habitat elements listed above are lacking or are unstable. Habitat elements are typically present in less than 10% of the reach.
Score	1.5	1.2	0.9	0.5

NOTES>> Stable habitat elements present. High flow during survey as a result of recent rains masks riffle/pool composition.

CI
1.20

Stream Impact Assessment Form Page 2

Project #	Applicant	Locality	Cowardin Class	HUC	Date	Data Point	SAR length	Impact Factor
	Mountain Valley Pipeline	Giles		050500020602	10/25/2016	S-HH16	500	1

4. CHANNEL ALTERATION: Stream crossings, riprap, concrete, gabions, or concrete blocks, straightening of channel, channelization, embankments, spoil piles, constrictions, livestock

NOTES>> Stream flows under road through culvert.

	Conditional Category						
	Negligible	Minor		Moderate		Severe	
Channel Alteration	Channelization, dredging, alteration, or hardening absent. Stream has an unaltered pattern or has naturalized.	Less than 20% of the stream reach is disrupted by any of the channel alterations listed in the parameter guidelines.	20-40% of the stream reach is disrupted by any of the channel alterations listed in the parameter guidelines.	40 - 60% of reach is disrupted by any of the channel alterations listed in the parameter guidelines. If stream has been channelized, normal stable stream meander pattern has not recovered.	60 - 80% of reach is disrupted by any of the channel alterations listed in the parameter guidelines. If stream has been channelized, normal stable stream meander pattern has not recovered.	Greater than 80% of reach is disrupted by any of the channel alterations listed in the parameter guidelines AND/OR 80% of banks shored with gabion, riprap, or cement.	
SCORE	1.5	1.3	1.1	0.9	0.7	0.5	1.10

REACH CONDITION INDEX and STREAM CONDITION UNITS FOR THIS REACH

NOTE: The CIs and RCI should be rounded to 2 decimal places. The CR should be rounded to a whole number.

THE REACH CONDITION INDEX (RCI) >>	1.15

RCI= (Sum of all CI's)/5

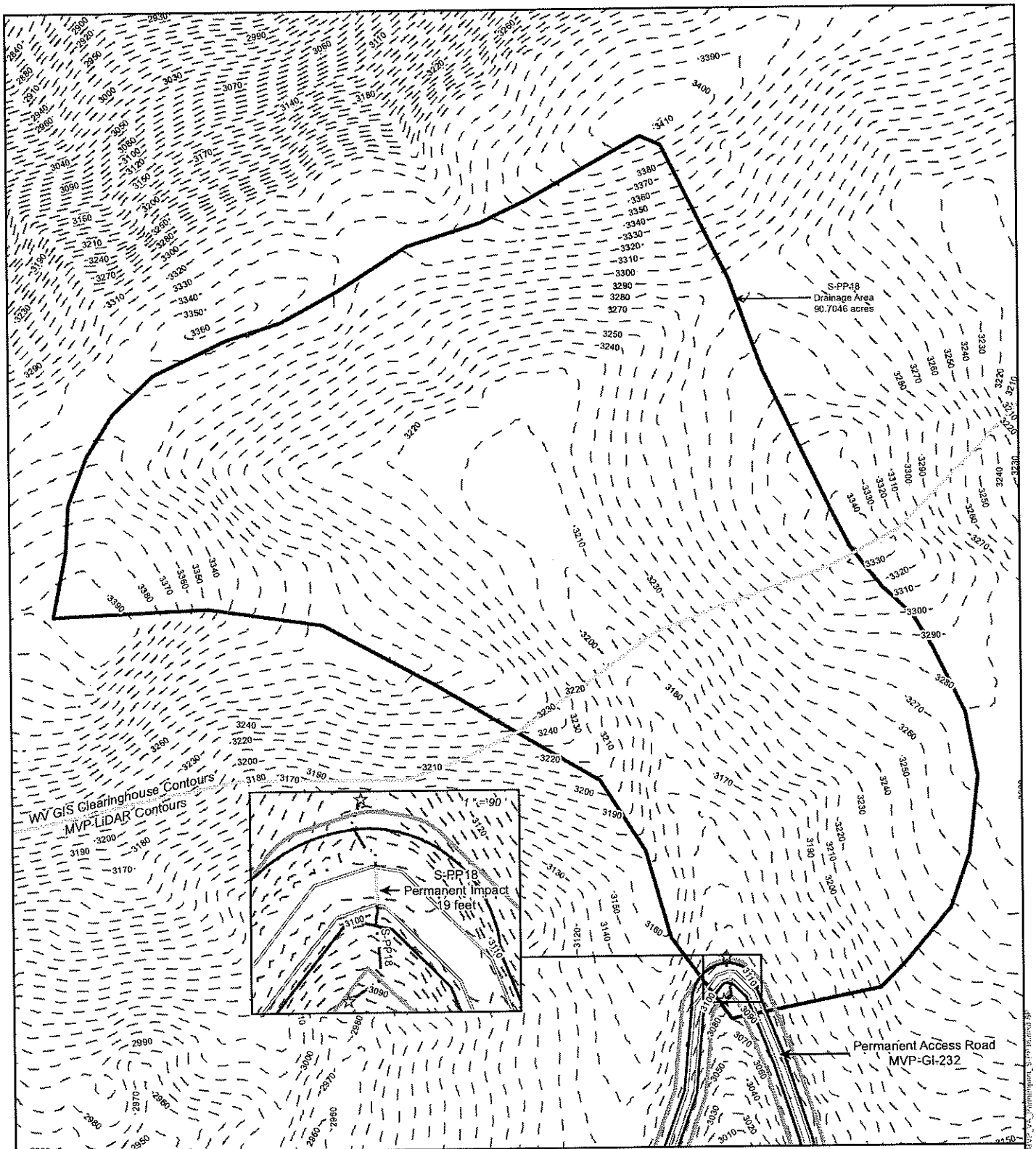
COMPENSATION REQUIREMENT (CR) >>	13

CR = RCI X LF X IF

INSERT PHOTOS:

DESCRIBE PROPOSED IMPACT:

S-PP18



Mountain Valley Pipeline Project

N

NAD 1983 UTM 17N

1" = 420'

420 210 0 420 Feet

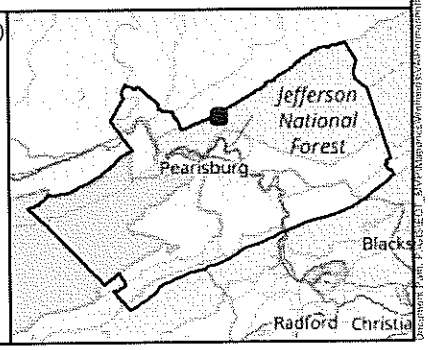
Mountain Valley PIPELINE

Figure 1:
Permanent Impacts for Stream S-PP18
Giles County

SEPTEMBER, 2017

Data Sources: ESRI Streaming Data © 2014
Elevation data derived from LiDAR provided by EQT 2016 and from the West Virginia GIS Clearinghouse.

- Access Road Permanent LOD
- Limit of Disturbance
- Preliminary Jurisdictional Determination Boundary
- Unified Stream Method (USM) Survey Reach
- Stream Permanent Impact
- Perennial Stream
- Drainage Area



Photograph Number: 1 **Feature Name:** S-PP18 **Flow Regime:** Perennial

Direction: W **Date:** 10/16/2015

STREAM ID S-PP18	**STREAM NAME** Curve Branch
LAT 37.385499 **LONG** -80.708750	**DATE** 10/16/2015
CLIENT MVP	**PROJECT NAME** MVP
INVESTIGATORS D. Hadersbeck, T. Woods, D. McCollough	
FLOW REGIME Perennial ✓ Intermittent___ Ephemeral___	**WATER TYPE** TNW ___ RPW ✓ NRPW ___

CHANNEL FEATURES

Estimate Measurements
Top of Bank Width: 4 ft
Top of Bank Height:
LB 6.0 in RB 6.0 in
Water Depth: 3.00 in
Water Width: 1.0 ft
High Water Mark: 6.0 in
Flow Direction: Southwest

Stream Erosion
✓ None ___ Moderate ___ Heavy

Artificial, Modified or Channelized
✓ Yes ___ No

Dam Present ___ Yes ✓ No

Sinuosity ___ Low ✓ Medium ✓ High

Gradient
___ Flat (0.5/100 ft) ✓ Moderate (2 ft/100 ft) ___ Severe (10 ft/100 ft)

FLOW CHARACTERISTICS

Water Present
___ No water, stream bed dry
___ Stream bed moist
___ Standing water
✓ Flowing water

Velocity
___ Fast ___ Moderate
✓ Slow

Proportion of Reach Represented by Stream Morphology Types
Riffle 20 % Run 60 %
Pool 20 %

Turbidity
___ Clear ✓ Slightly turbid ___ Turbid
___ Opaque ___ Stained
___ Other_____

INORGANIC SUBSTRATE COMPONENTS (should add up to 100%)

Substrate Type	Diameter	% Composition in Sampling Reach
Bedrock		20
Boulder	> 256 mm (10")	20
Cobble	64-256 mm (2.5"-10")	30
Gravel	2-64 mm (0.1"-2.5")	30
Sand	0.06-2mm (gritty)	
Silt	0.004-0.06 mm	
Clay	< 0.004 mm (slick)	

ORGANIC SUBSTRATE COMPONENTS (does not necessarily add up to 100%)

Substrate Type	Characteristic	% Composition in Sampling Area
Detritus	sticks, wood, coarse plant materials (CPOM)	80
Muck-Mud	black, very fine organic (FPOM)	
Marl	grey, shell fragments	

WATERSHED FEATURES

Predominant Surrounding Landuse
✓ Forest ___ Commercial
___ Field/Pasture ___ Industrial
___ Agricultural ___ Residential
___ Other:

Canopy Cover
✓ Partly open ___ Partly shaded
___ Shaded ___ Open

Indicate the dominant type (Check one)
✓ Trees ___ Shrubs
___ Grasses ___ Herbaceous

Floodplain Width
___ Wide > 30ft ✓ Moderate 15-30ft
___ Narrow <16ft

Wetland Present ___ Yes ✓ No
Wetland ID

AQUATIC VEGETATION

Indicate the dominant type and record the dominant species present
___ Rooted emergent ___ Rooted submergent ___ Rooted floating ___ Free floating
___ Floating algae ___ Attached algae

MACROINVERTEBRATES OR OTHER WILDLIFE OBSERVED/OTHER OBSERVATIONS AND NOTES

Stream emerges from high side of road from black plastic tubing then traverses a culvert under the road.

Stream Assessment Form (Form 1)

Unified Stream Methodology for use in Virginia

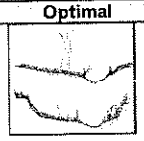
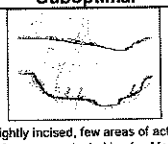
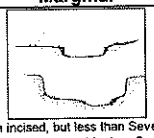
For use in wadeable channels classified as intermittent or perennial

Project #	Project Name	Locality	Cowardin Class.	HUC	Date	SAR #	Impact/SAR length	Impact Factor
	Mountain Valley Pipeline	Giles	R4SB3	050500020602	10/25/2016		19	1

Name(s) of Evaluator(s)	Stream Name and Information
J.Cook, E.Foster	S-PP18, Intermittent, MVP-GI-232

1. Channel Condition: Assess the cross-section of the stream and prevailing condition (erosion, aggradation)

Conditional Category

	Optimal	Suboptimal	Marginal	Poor	Severe	
Channel Condition	 Very little incision or active erosion; 80-100% stable banks. Vegetative surface protection or natural rock, prominent (80-100%). AND/OR Stable point bars/bankfull benches are present. Access to their original floodplain or fully developed wide bankfull benches. Mid-channel bars, and transverse bars few. Transient sediment deposition covers less than 10% of bottom.	 Slightly incised, few areas of active erosion or unprotected banks. Majority of banks are stable (60-80%). Vegetative protection or natural rock prominent (60-80%) AND/OR Depositional features contribute to stability. The bankfull and low flow channels are well defined. Stream likely has access to bankfull benches, or newly developed floodplains along portions of the reach. Transient sediment covers 10-40% of the stream bottom.	 Often incised, but less than Severe or Poor. Banks more stable than Severe or Poor due to lower bank slopes. Erosion may be present on 40-60% of both banks. Vegetative protection on 40-60% of banks. Streambanks may bevertical or undercut. AND/OR 40-60% of stream is covered by sediment. Sediment may be temporary/transient, contribute instability. Deposition that contribute to stability, may be forming/present. AND/OR V-shaped channels have vegetative protection on > 40% of the banks and depositional features which contribute to stability.	Overwidened/incised. Vertically/laterally unstable. Likely to widen further. Majority of both banks are near vertical. Erosion present on 60-80% of banks. Vegetative protection present on 20-40% of banks, and is insufficient to prevent erosion. AND/OR 60-80% of the stream is covered by sediment. Sediment is temporary/transient in nature, and contributing to instability. AND/OR V-shaped channels have vegetative protection is present on > 40% of the banks and stable sediment deposition is absent.	Deeply incised (or excavated), vertical/lateral instability. Severe incision, flow contained within the banks. Streambed below average rooting depth, majority of banks vertical/undercut. Vegetative protection present on less than 20% of banks, is not preventing erosion. Obvious bank sloughing present. Erosion/raw banks on 80-100%. AND/OR Aggrading channel. Greater than 80% of stream bed is covered by deposition, contributing to instability. Multiple thread channels and/or subterranean flow.	CI
Score	3	2.4	2	1.6	1	2.4
NOTES>>	Stable banks, boulders, dense shrubs adding stability					

2. RIPARIAN BUFFERS: Assess both bank's 100 foot riparian areas along the entire SAR. (rough measurements of length & width may be acceptable)

Conditional Category

	Optimal	Suboptimal		Marginal		Poor	
Riparian Buffers	Tree stratum (dbh > 3 inches) present, with > 60% tree canopy cover and a non-maintained understory. Wetlands located within the riparian areas.	High Suboptimal: Riparian areas with tree stratum (dbh > 3 inches) present, with 30% to 60% tree canopy cover and containing both herbaceous and shrub layers or a non-maintained understory.	Low Suboptimal: Riparian areas with tree stratum (dbh > 3 inches) present, with > 30% tree canopy cover and a maintained understory. Recent cutover (dense vegetation).	High Marginal: Non-maintained, dense herbaceous vegetation with either a shrub layer or a tree layer (dbh > 3 inches) present, with <30% tree canopy cover.	Low Marginal: Non-maintained, dense herbaceous vegetation, riparian areas lacking shrub and tree stratum, hay production, ponds, open water. If present, tree stratum (dbh >3 inches) present, with <30% tree canopy cover with maintained understory.	High Poor: Lawns, mowed, and maintained areas, nurseries; no-till cropland; actively grazed pasture, sparsely vegetated non-maintained area, recently seeded and stabilized, or other comparable condition.	Low Poor: Impervious surfaces, mine spoil lands, denuded surfaces, row crops, active feed lots, trails, or other comparable conditions.
		High	Low	High	Low	High	Low
Condition Scores	1.5	1.2	1.1	0.85	0.75	0.6	0.5

NOTES>> Predominately hardwood forests and mowed roadside

1. Delineate riparian areas along each stream bank into Condition Categories and Condition Scores using the descriptors.
2. Determine square footage for each by measuring or estimating length and width. Calculators are provided for you below.
3. Enter the % Riparian Area and Score for each riparian category in the blocks below.

Ensure the sums of % Riparian Blocks equal 100

Right Bank	% Riparian Area>	65%	35%					100%	
	Score >	1.5	0.5						
Left Bank	% Riparian Area>	85%	15%					100%	
	Score >	1.5	0.5						

CI= (Sum % RA * Scores*0.01)/2

Rt Bank CI >	1.15	CI
Lt Bank CI >	1.35	1.25

3. INSTREAM HABITAT: Varied substrate sizes, water velocity and depths; woody and leafy debris; stable substrate; low embededness; shade; undercut banks; root mats; SAV; riffle pools complexes, stable features.

Conditional Category

	Optimal	Suboptimal	Marginal	Poor	
Instream Habitat/ Available Cover	Habitat elements are typically present in greater than 50% of the reach.	Stable habitat elements are typically present in 30-50% of the reach and are adequate for maintenance of populations.	Stable habitat elements are typically present in 10-30% of the reach and are adequate for maintenance of populations.	Habitat elements listed above are lacking or are unstable. Habitat elements are typically present in less than 10% of the reach.	CI
Score	1.5	1.2	0.9	0.5	1.20

NOTES>> Variable substrate. No flow downstream of culvert as of 10/25/2016. Flow emerges from seep upstream, then becomes subterranean.

Stream Impact Assessment Form Page 2

Project #	Applicant	Locality	Cowardin Class.	HUC	Date	Data Point	SAR length	Impact Factor
	Mountain Valley Pipeline	Giles	R4SB3	050500020602	10/25/2016	S-PP18	500	1

4. CHANNEL ALTERATION: Stream crossings, riprap, concrete, gabions, or concrete blocks, straightening of channel, channelization, embankments, spoil piles, constrictions, livestock

NOTES>> Culvert

	Conditional Category						
	Negligible	Minor		Moderate		Severe	
Channel Alteration	Channelization, dredging, alteration, or hardening absent. Stream has an unaltered pattern or has naturalized.	Less than 20% of the stream reach is disrupted by any of the channel alterations listed in the parameter guidelines.	20-40% of the stream reach is disrupted by any of the channel alterations listed in the parameter guidelines.	40 - 60% of reach is disrupted by any of the channel alterations listed in the parameter guidelines. If stream has been channelized, normal stable stream meander pattern has not recovered.	60 - 80% of reach is disrupted by any of the channel alterations listed in the parameter guidelines. If stream has been channelized, normal stable stream meander pattern has not recovered.	Greater than 80% of reach is disrupted by any of the channel alterations listed in the parameter guidelines AND/OR 80% of banks shored with gabion, riprap, or cement.	
SCORE	1.5	1.3	1.1	0.9	0.7	0.5	1.30

REACH CONDITION INDEX and STREAM CONDITION UNITS FOR THIS REACH

NOTE: The CIs and RCI should be rounded to 2 decimal places. The CR should be rounded to a whole number.

THE REACH CONDITION INDEX (RCI) >>	1.23

RCI= (Sum of all CI's)/5

COMPENSATION REQUIREMENT (CR) >>	23

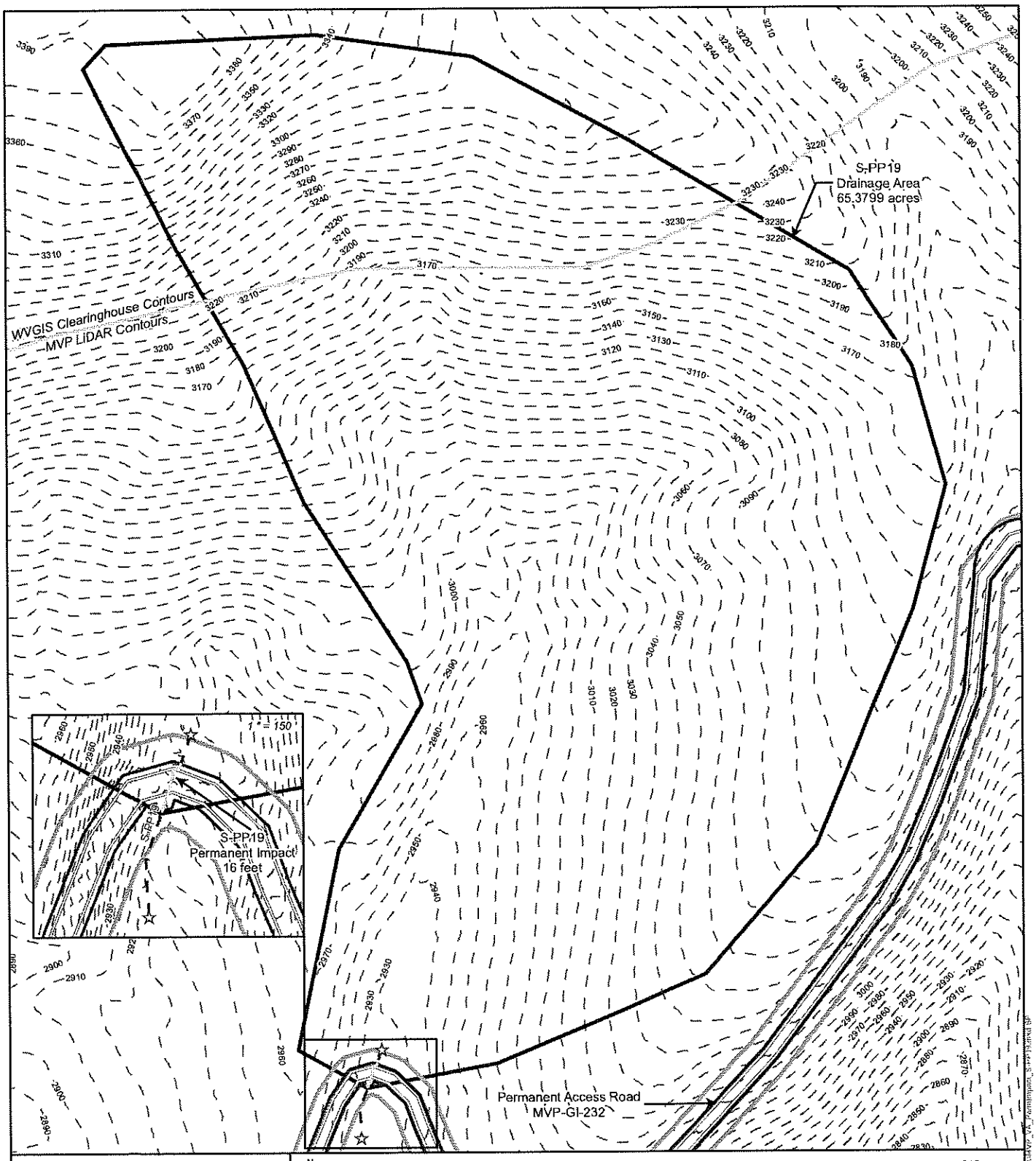
CR = RCI X LF X IF

INSERT PHOTOS:

DESCRIBE PROPOSED IMPACT:

Culvert replacement. See attached figure.

S-PP19



Mountain Valley Pipeline Project

N

NAD 1983 UTM 17N

1" = 310'

310 155 0 310 Feet

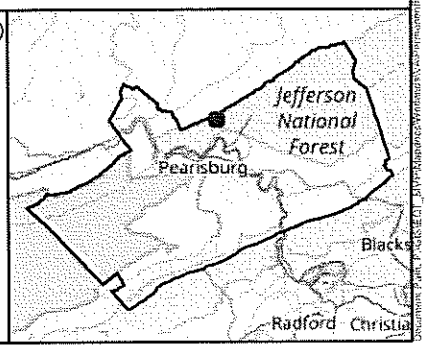
Mountain Valley PIPELINE

Figure 1:
Permanent Impacts for
Stream S-PP19
Giles County

SEPTEMBER, 2017

Data Sources: ESRI Streaming Data © 2014
Elevation data derived from LiDAR provided by EQT 2016
and from the West Virginia GIS Clearinghouse.

- Access Road Permanent LOD
- Limit of Disturbance
- Preliminary Jurisdictional Determination Boundary
- Unified Stream Method (USM) Survey Reach
- Stream Permanent Impact
- Intermittent Stream
- Drainage Area



Photograph Number: 1 **Feature Name:** S-PP19 **Flow Regime:** Intermittent

Direction: S **Date:** 10/16/2015

STREAM ID S-PP19	**STREAM NAME** UNT to Curve Branch
LAT 37.382048 **LONG** -80.714071	**DATE** 10/16/2015
CLIENT MVP	**PROJECT NAME** MVP
INVESTIGATORS D. Hadersbeck, T. Woods, D. McCollough	
FLOW REGIME Perennial ___ Intermittent ✓ Ephemeral ___	**WATER TYPE** TNW ___ RPW ✓ NRPW ___

CHANNEL FEATURES

Estimate Measurements
Top of Bank Width: 3 ft
Top of Bank Height:
LB 1.0 ft RB 1.0 ft
Water Depth: 3.00 in
Water Width: 2.5 ft
High Water Mark: 1.0 ft
Flow Direction: South

Stream Erosion
✓ None ___ Moderate ___ Heavy

Artificial, Modified or Channelized
✓ Yes ___ No

Dam Present ___ Yes ✓ No

Sinuosity ___ Low ✓ Medium ✓ High

Gradient
___ Flat (0.5/100 ft) ✓ Moderate (2 ft/100 ft) ___ Severe (10 ft/100 ft)

FLOW CHARACTERISTICS

Water Present
___ No water, stream bed dry
___ Stream bed moist
___ Standing water
✓ Flowing water

Velocity
___ Fast ___ Moderate
✓ Slow

Proportion of Reach Represented by Stream Morphology Types
Riffle % Run 80 %
Pool 20 %

Turbidity
✓ Clear ___ Slightly turbid ___ Turbid
___ Opaque ___ Stained
___ Other_____

INORGANIC SUBSTRATE COMPONENTS (should add up to 100%)

Substrate Type	Diameter	% Composition in Sampling Reach
Bedrock		
Boulder	> 256 mm (10")	10
Cobble	64-256 mm (2.5"-10")	20
Gravel	2-64 mm (0.1"-2.5")	20
Sand	0.06-2mm (gritty)	10
Silt	0.004-0.06 mm	40
Clay	< 0.004 mm (slick)	

ORGANIC SUBSTRATE COMPONENTS (does not necessarily add up to 100%)

Substrate Type	Characteristic	% Composition in Sampling Area
Detritus	sticks, wood, coarse plant materials (CPOM)	70
Muck-Mud	black, very fine organic (FPOM)	
Marl	grey, shell fragments	

WATERSHED FEATURES

Predominant Surrounding Landuse
✓ Forest ___ Commercial
___ Field/Pasture ___ Industrial
___ Agricultural ___ Residential
___ Other:

Canopy Cover
✓ Partly open ___ Partly shaded
___ Shaded ___ Open

Indicate the dominant type (Check one)
✓ Trees ___ Shrubs
___ Grasses ___ Herbaceous

Floodplain Width
___ Wide > 30ft ✓ Moderate 15-30ft
___ Narrow <16ft

Wetland Present ___ Yes ✓ No
Wetland ID

AQUATIC VEGETATION

Indicate the dominant type and record the dominant species present
___ Rooted emergent ___ Rooted submergent ___ Rooted floating ___ Free floating
___ Floating algae ___ Attached algae

MACROINVERTEBRATES OR OTHER WILDLIFE OBSERVED/OTHER OBSERVATIONS AND NOTES

Stream traverses a culvert under the road.

Stream Assessment Form (Form 1)

Unified Stream Methodology for use in Virginia

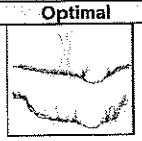
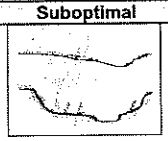
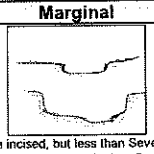
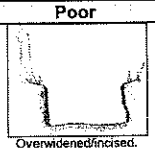
For use in wadeable channels classified as intermittent or perennial

Project #	Project Name	Locality	Cowardin Class.	HUC	Date	SAR #	Impact/SAR length	Impact Factor
	Mountain Valley Pipeline	Giles	R4SB5	050500020602	10/25/2016		16	1

Name(s) of Evaluator(s)	Stream Name and Information
J.Cook, E.Foster	S-PP19, Intermittent, MVP-GI-232

1. Channel Condition: Assess the cross-section of the stream and prevailing condition (erosion, aggradation)

Conditional Category

	Optimal	Suboptimal	Marginal	Poor	Severe	
Channel Condition	 Very little incision or active erosion; 80-100% stable banks. Vegetative surface protection or natural rock, prominent (80-100%). AND/OR Stable point bars/bankfull benches are present. Access to their original floodplain or fully developed wide bankfull benches. Mid-channel bars, and transverse bars few. Transient sediment deposition covers less than 10% of bottom.	 Slightly incised, few areas of active erosion or unprotected banks. Majority of banks are stable (60-80%). Vegetative protection or natural rock prominent (60-80%) AND/OR Depositional features contribute to stability. The bankfull and low flow channels are well defined. Stream likely has access to bankfull benches, or newly developed floodplains along portions of the reach. Transient sediment covers 10-40% of the stream bottom.	 Often incised, but less than Severe or Poor. Banks more stable than Severe or Poor due to lower bank slopes. Erosion may be present on 40-60% of both banks. Vegetative protection on 40-60% of banks. Streambanks may bevertical or undercut. AND/OR 40-60% of stream is covered by sediment. Sediment may be temporary/transient, contribute instability. Deposition that contribute to stability, may be forming/present. AND/OR V-shaped channels have vegetative protection on > 40% of the banks and depositional features which contribute to stability.	 Overwidened/incised. Vertically/laterally unstable. Likely to widen further. Majority of both banks are near vertical. Erosion present on 60-80% of banks. Vegetative protection present on 20-40% of banks, and is insufficient to prevent erosion. AND/OR 60-80% of the stream is covered by sediment. Sediment is temporary/transient in nature, and contributing to instability. AND/OR V-shaped channels have vegetative protection is present on > 40% of the banks and stable sediment deposition is absent.	Deeply incised (or channelized), vertical/lateral instability. Severe incision, flow contained within the banks. Streambed below average rooting depth, majority of banks vertical/undercut. Vegetative protection present on less than 20% of banks, is not preventing erosion. Obvious bank sloughing present. Erosion/raw banks on 80-100%. AND/OR Aggrading channel. Greater than 80% of stream bed is covered by deposition, contributing to instability. Multiple thread channels and/or subterranean flow.	CI
Score	3	2.4	2	1.6	1	3.0
NOTES>>	Stable channel and banks					

2. RIPARIAN BUFFERS: Assess both bank's 100 foot riparian areas along the entire SAR. (rough measurements of length & width may be acceptable)

Conditional Category

	Optimal	Suboptimal		Marginal		Poor	
Riparian Buffers	Tree stratum (dbh > 3 inches) present, with > 60% tree canopy cover and a non-maintained understory. Wetlands located within the riparian areas.	High Suboptimal: Riparian areas with tree stratum (dbh > 3 inches) present, with 30% to 60% tree canopy cover and containing both herbaceous and shrub layers or a non-maintained understory.	Low Suboptimal: Riparian areas with tree stratum (dbh > 3 inches) present, with > 30% tree canopy cover and a maintained understory. Recent cutover (dense vegetation).	High Marginal: Non-maintained, dense herbaceous vegetation with either a shrub layer or a tree layer (dbh > 3 inches) present, with <30% tree canopy cover.	Low Marginal: Non-maintained, dense herbaceous vegetation, riparian areas lacking shrub and tree stratum, hay production, ponds, open water. If present, tree stratum (dbh >3 inches) present, with <30% tree canopy cover with maintained understory.	High Poor: Lawns, mowed, and maintained areas, nurseries; no-till cropland; actively grazed pasture, sparsely vegetated non-maintained area, recently seeded and stabilized, or other comparable condition.	Low Poor: Impervious surfaces, mine spoil lands, denuded surfaces, row crops, active feed lots, trails, or other comparable conditions.
		High	Low	High	Low	High	Low
Condition Scores	1.5	1.2	1.1	0.85	0.75	0.6	0.5

NOTES>>

1. Delineate riparian areas along each stream bank into Condition Categories and Condition Scores using the descriptors.
2. Determine square footage for each by measuring or estimating length and width. Calculators are provided for you below.
3. Enter the % Riparian Area and Score for each riparian category in the blocks below.

Ensure the sums of % Riparian Blocks equal 100

Right Bank	% Riparian Area>	90%	10%					100%
	Score >	1.5	0.6					
Left Bank	% Riparian Area>	90%	10%					100%
	Score >	1.5	0.6					

CI= (Sum % RA * Scores*0.01)/2

Rt Bank CI >	1.41	CI
Lt Bank CI >	1.41	1.41

3. INSTREAM HABITAT: Varied substrate sizes, water velocity and depths; woody and leafy debris; stable substrate; low embededness; shade; undercut banks; root mats; SAV; riffle pools complexes, stable features.

NOTES>> No flowing water as of 10/25/2016

Conditional Category

	Optimal	Suboptimal	Marginal	Poor	
Instream Habitat/ Available Cover	Habitat elements are typically present in greater than 50% of the reach.	Stable habitat elements are typically present in 30-50% of the reach and are adequate for maintenance of populations.	Stable habitat elements are typically present in 10-30% of the reach and are adequate for maintenance of populations.	Habitat elements listed above are lacking or are unstable. Habitat elements are typically present in less than 10% of the reach.	CI
Score	1.5	1.2	0.9	0.5	1.20

Stream Impact Assessment Form Page 2

Project #	Applicant	Locality	Cowardin Class.	HUC	Date	Data Point	SAR length	Impact Factor
	Mountain Valley Pipeline	Giles		050500020602	10/25/2016	S-PP19	500	1

4. CHANNEL ALTERATION: Stream crossings, riprap, concrete, gabions, or concrete blocks, straightening of channel, channelization, embankments, spoil piles, constrictions, livestock

NOTES>>

	Conditional Category						
	Negligible	Minor		Moderate		Severe	
Channel Alteration	Channelization, dredging, alteration, or hardening absent. Stream has an unaltered pattern or has naturalized.	Less than 20% of the stream reach is disrupted by any of the channel alterations listed in the parameter guidelines.	20-40% of the stream reach is disrupted by any of the channel alterations listed in the parameter guidelines.	40 - 60% of reach is disrupted by any of the channel alterations listed in the parameter guidelines. If stream has been channelized, normal stable stream meander pattern has not recovered.	60 - 80% of reach is disrupted by any of the channel alterations listed in the parameter guidelines. If stream has been channelized, normal stable stream meander pattern has not recovered.	Greater than 80% of reach is disrupted by any of the channel alterations listed in the parameter guidelines AND/OR 80% of banks shored with gabion, riprap, or cement.	
SCORE	1.5	1.3	1.1	0.9	0.7	0.5	1.10

REACH CONDITION INDEX and STREAM CONDITION UNITS FOR THIS REACH

NOTE: The CIs and RCI should be rounded to 2 decimal places. The CR should be rounded to a whole number.

THE REACH CONDITION INDEX (RCI) >>	1.34

RCI= (Sum of all CI's)/5

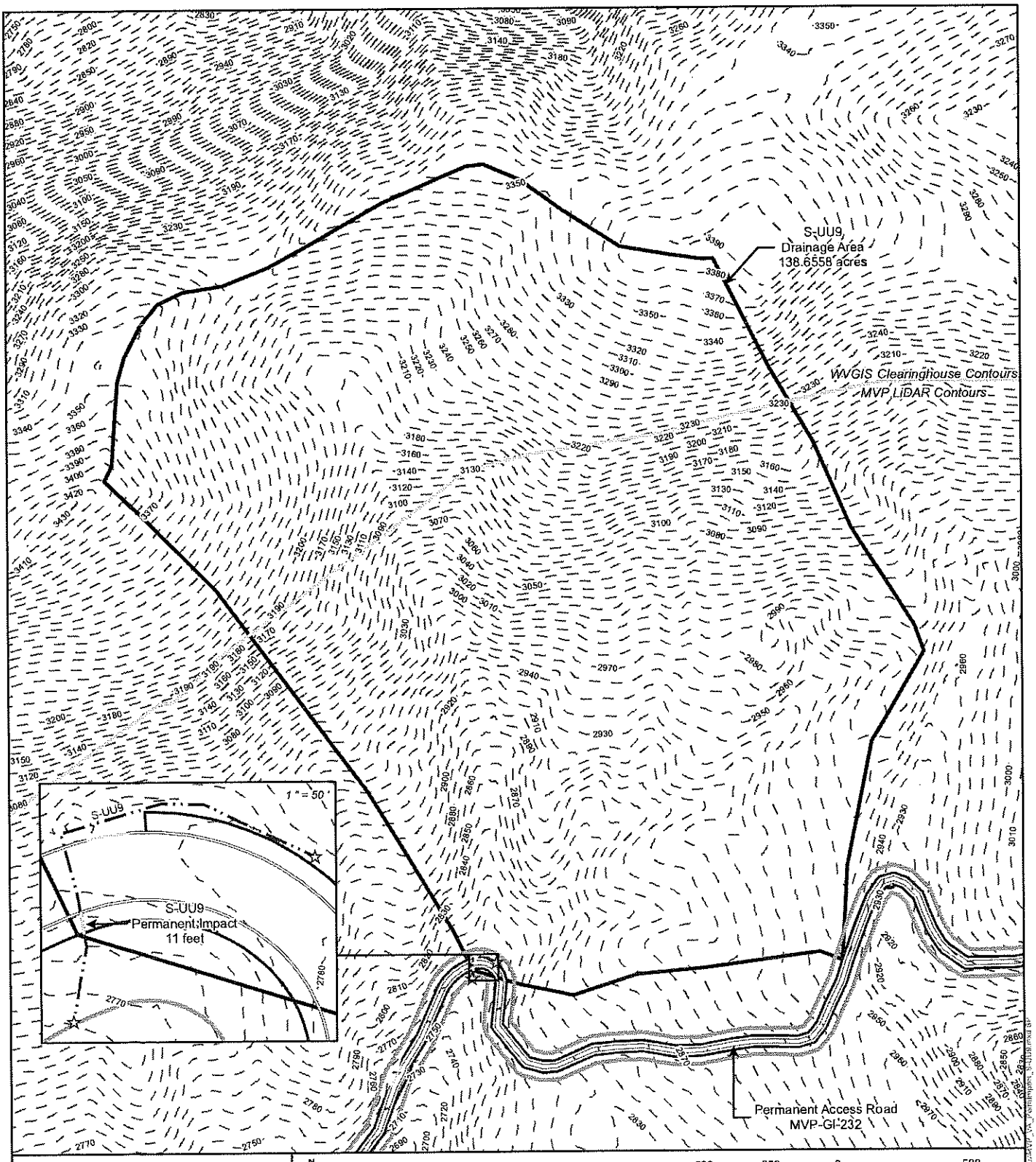
COMPENSATION REQUIREMENT (CR) >>	21

CR = RCI X LF X IF

INSERT PHOTOS:

DESCRIBE PROPOSED IMPACT:

S-UU9



Mountain Valley Pipeline Project

N

NAD 1983 UTM 17N

1" = 500'

500 250 0 500 Feet

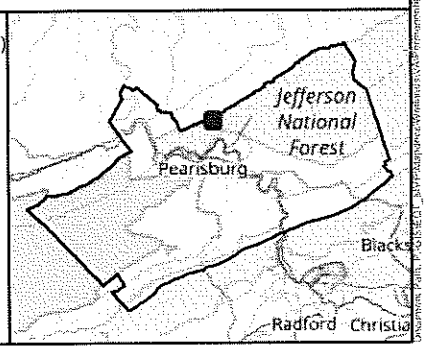
Mountain Valley PIPELINE

Figure 1:
Permanent Impacts for
Stream S-UU9
Giles County

SEPTEMBER, 2017

Data Sources: ESRI Streaming Data © 2014
Elevation data derived from LiDAR provided by EQT 2016
and from the West Virginia GIS Clearinghouse.

Access Road Permanent LOD
Limit of Disturbance
Preliminary Jurisdictional Determination Boundary
Unified Stream Method (USM) Survey Reach
Stream Permanent Impact
Perennial Stream
Drainage Area



Photograph Number: 1 **Feature Name:** S-UU9 **Flow Regime:** Perennial

Direction: SSW **Date:** 10/16/2015

STREAM ID S-UU9	**STREAM NAME** Clendennin Creek
LAT 37.381405 **LONG** -80.719414	**DATE** 10/16/2015
CLIENT MVP	**PROJECT NAME** MVP
INVESTIGATORS S. Townsend, A. Hatfield	
FLOW REGIME Perennial ✓ Intermittent ___ Ephemeral ___	**WATER TYPE** TNW ___ RPW ✓ NRPW ___

CHANNEL FEATURES	**Estimate Measurements** Top of Bank Width: 5 ft Top of Bank Height: LB 1.5 ft RB 3.0 ft Water Depth: 2.00 in Water Width: 3.5 ft High Water Mark: 1.5 ft Flow Direction: West	**Stream Erosion** ✓ None ___ Moderate ___ Heavy **Artificial, Modified or Channelized** ✓ Yes ___ No **Dam Present** ___ Yes ✓ No **Sinuosity** ___ Low ✓ Medium ✓ High **Gradient** ✓ Flat (0.5/100 ft ✓ Moderate (2 ft/100 ft) ___ Severe (10 ft/100 ft)
FLOW CHARACTERISTICS	**Water Present** ___ No water, stream bed dry ___ Stream bed moist ___ Standing water ✓ Flowing water **Velocity** ___ Fast ___ Moderate ✓ Slow	**Proportion of Reach Represented by Stream Morphology Types** Riffle 100 % Run % Pool % **Turbidity** ✓ Clear ___ Slightly turbid ___ Turbid ___ Opaque ___ Stained ___ Other_____

INORGANIC SUBSTRATE COMPONENTS (should add up to 100%)			**ORGANIC SUBSTRATE COMPONENTS (does not necessarily add up to 100%)**		
Substrate Type	Diameter	% Composition in Sampling Reach	Substrate Type	Characteristic	% Composition in Sampling Area
Bedrock		15	Detritus	sticks, wood, coarse plant materials (CPOM)	5
Boulder	> 256 mm (10")	5			
Cobble	64-256 mm (2.5"-10")	45	Muck-Mud	black, very fine organic (FPOM)	
Gravel	2-64 mm (0.1"-2.5")	15			
Sand	0.06-2mm (gritty)	15	Marl	grey, shell fragments	
Silt	0.004-0.06 mm	5			
Clay	< 0.004 mm (slick)				

WATERSHED FEATURES	**Predominant Surrounding Landuse** ✓ Forest ___ Commercial ___ Field/Pasture ___ Industrial ___ Agricultural ___ Residential ___ Other: **Canopy Cover** ___ Partly open ✓ Partly shaded ___ Shaded ___ Open	**Indicate the dominant type (Check one)** ✓ Trees ___ Shrubs ___ Grasses ___ Herbaceous **Floodplain Width** ___ Wide > 30ft ___ Moderate 15-30ft ✓ Narrow <16ft **Wetland Present** ___ Yes ✓ No **Wetland ID**
AQUATIC VEGETATION	**Indicate the dominant type and record the dominant species present** ___ Rooted emergent ___ Rooted submergent ___ Rooted floating ___ Free floating ___ Floating algae ___ Attached algae	

MACROINVERTEBRATES OR OTHER WILDLIFE OBSERVED/OTHER OBSERVATIONS AND NOTES	

Stream Assessment Form (Form 1)

Unified Stream Methodology for use in Virginia

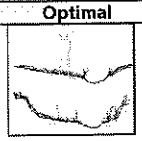
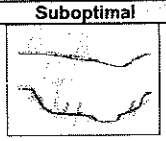
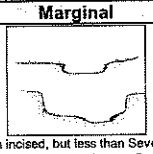
For use in wadeable channels classified as intermittent or perennial

Project #	Project Name	Locality	Cowardin Class.	HUC	Date	SAR #	Impact/SAR length	Impact Factor
	Mountain Valley Pipeline	Giles	R2UB1	050500020602	10/25/2016		11	1

Name(s) of Evaluator(s)	Stream Name and Information
J.Cook, E.Foster	S-UU9, Perennial, MVP-GI-232

1. Channel Condition: Assess the cross-section of the stream and prevailing condition (erosion, aggradation)

Conditional Category

	Optimal	Suboptimal	Marginal	Poor	Severe	
						
Channel Condition	Very little incision or active erosion; 80-100% stable banks. Vegetative surface protection or natural rock, prominent (80-100%). AND/OR Stable point bars/bankfull benches are present. Access to their original floodplain or fully developed wide bankfull benches. Mid-channel bars, and transverse bars few. Transient sediment deposition covers less than 10% of bottom.	Slightly incised, few areas of active erosion or unprotected banks. Majority of banks are stable (60-80%). Vegetative protection or natural rock prominent (60-80%) AND/OR Depositional features contribute to stability. The bankfull and low flow channels are well defined. Stream likely has access to bankfull benches, or newly developed floodplains along portions of the reach. Transient sediment covers 10-40% of the stream bottom.	Often incised, but less than Severe or Poor. Banks more stable than Severe or Poor due to lower bank slopes. Erosion may be present on 40-60% of both banks. Vegetative protection on 40-60% of banks. Streambanks may beverticai or undercut. AND/OR 40-60% of stream is covered by sediment. Sediment may be temporary/transient, contribute instability. Deposition that contribute to stability, may be forming/present. AND/OR V-shaped channels have vegetative protection on > 40% of the banks and depositional features which contribute to stability.	Overwidened/incised. Vertically/laterally unstable. Likely to widen further. Majority of both banks are near vertical. Erosion present on 60-80% of banks. Vegetative protection present on 20-40% of banks, and is insufficient to prevent erosion. AND/OR 60-80% of the stream is covered by sediment. Sediment is temporary/transient in nature, and contributing to instability. AND/OR V-shaped channels have vegetative protection is present on > 40% of the banks and stable sediment deposition is absent.	Deeply incised (or overwidened), vertical/lateral instability. Severe incision, flow contained within the banks. Streambed below average rooting depth, majority of banks vertical/undercut. Vegetative protection present on less than 20% of banks, is not preventing erosion. Obvious bank sloughing present. Erosion/raw banks on 80-100%. AND/OR Aggrading channel. Greater than 80% of stream bed is covered by deposition, contributing to instabiliiy. Multiple thread channels and/or subterranean flow.	CI
Score	3	2.4	2	1.6	1	3.0
NOTES>>	-Stable channel condition					

2. RIPARIAN BUFFERS: Assess both bank's 100 foot riparian areas along the entire SAR. (rough measurements of length & width may be acceptable)

Conditional Category

	Optimal	Suboptimal		Marginal		Poor	
Riparian Buffers	Tree stratum (dbh > 3 inches) present, with > 60% tree canopy cover and a non-maintained understory. Wetlands located within the riparian areas.	High Suboptimal: Riparian areas with tree stratum (dbh > 3 inches) present, with 30% to 60% tree canopy cover and containing both herbaceous and shrub layers or a non-maintained understory.	Low Suboptimal: Riparian areas with tree stratum (dbh > 3 inches) present, with > 30% tree canopy cover and a maintained understory. Recent cutover (dense vegetation).	High Marginal: Non-maintained, dense herbaceous vegetation with either a shrub layer or a tree layer (dbh > 3 inches) present, with <30% tree canopy cover.	Low Marginal: Non-maintained, dense herbaceous vegetation, riparian areas lacking shrub and tree stratum, hay production, ponds, open water. If present, tree stratum (dbh >3 inches) present, with <30% tree canopy cover with maintained understory.	High Poor: Lawns, mowed, and maintained areas, nurseries; no-till cropland; actively grazed pasture, sparsely vegetated non-maintained area, recently seeded and stabilized, or other comparable condition.	Low Poor: Impervious surfaces, mine spoil lands, denuded surfaces, row crops, active feed lots, trails, or other comparable conditions.
		High	Low	High	Low	High	Low
Condition Scores	1.5	1.2	1.1	0.85	0.75	0.6	0.5

NOTES>> Mostly woods with mowed area and road mixed in

1. Delineate riparian areas along each stream bank into Condition Categories and Condition Scores using the descriptors.
2. Determine square footage for each by measuring or estimating length and width. Calculators are provided for you below.
3. Enter the % Riparian Area and Score for each riparian category in the blocks below.

Ensure the sums of % Riparian Blocks equal 100

Right Bank	% Riparian Area>	10%	90%					100%	
	Score >	0.5	1.5						
Left Bank	% Riparian Area>	10%	10%	80%				100%	
	Score >	0.5	0.6	1.5					

CI= (Sum % RA * Scores*0.01)/2

Rt Bank CI >	1.40	CI
Lt Bank CI >	1.31	1.36

3. INSTREAM HABITAT: Varied substrate sizes, water velocity and depths; woody and leafy debris; stable substrate; low embededness; shade; undercut banks; root mats; SAV; riffle pools complexes, stable features.

NOTES>> Plenty of stream variability

Conditional Category

	Optimal	Suboptimal	Marginal	Poor	
Instream Habitat/ Available Cover	Habitat elements are typically present in greater than 50% of the reach.	Stable habitat elements are typically present in 30-50% of the reach and are adequate for maintenance of populations.	Stable habitat elements are typically present in 10-30% of the reach and are adequate for maintenance of populations.	Habitat elements listed above are lacking or are unstable. Habitat elements are typically present in less than 10% of the reach.	CI
Score	1.5	1.2	0.9	0.5	1.20

Stream Impact Assessment Form Page 2

Project #	Applicant	Locality	Cowardin Class.	HUC	Date	Data Point	SAR length	Impact Factor
	Mountain Valley Pipeline	Giles		050500020602	10/25/2016	S-UU9	500	1

4. CHANNEL ALTERATION: Stream crossings, riprap, concrete, gabions, or concrete blocks, straightening of channel, channelization, embankments, spoil piles, constrictions, livestock

NOTES>> Culvert, Impacted road

	Conditional Category						
	Negligible	Minor		Moderate		Severe	
Channel Alteration	Channelization, dredging, alteration, or hardening absent. Stream has an unaltered pattern or has naturalized.	Less than 20% of the stream reach is disrupted by any of the channel alterations listed in the parameter guidelines.	20-40% of the stream reach is disrupted by any of the channel alterations listed in the parameter guidelines.	40 - 60% of reach is disrupted by any of the channel alterations listed in the parameter guidelines. If stream has been channelized, normal stable stream meander pattern has not recovered.	60 - 80% of reach is disrupted by any of the channel alterations listed in the parameter guidelines. If stream has been channelized, normal stable stream meander pattern has not recovered.	Greater than 80% of reach is disrupted by any of the channel alterations listed in the parameter guidelines AND/OR 80% of banks shored with gabion, riprap, or cement.	
SCORE	1.5	1.3	1.1	0.9	0.7	0.5	1.10

REACH CONDITION INDEX and STREAM CONDITION UNITS FOR THIS REACH

NOTE: The CIs and RCI should be rounded to 2 decimal places. The CR should be rounded to a whole number.

THE REACH CONDITION INDEX (RCI) >>	1.33

RCI= (Sum of all CI's)/5

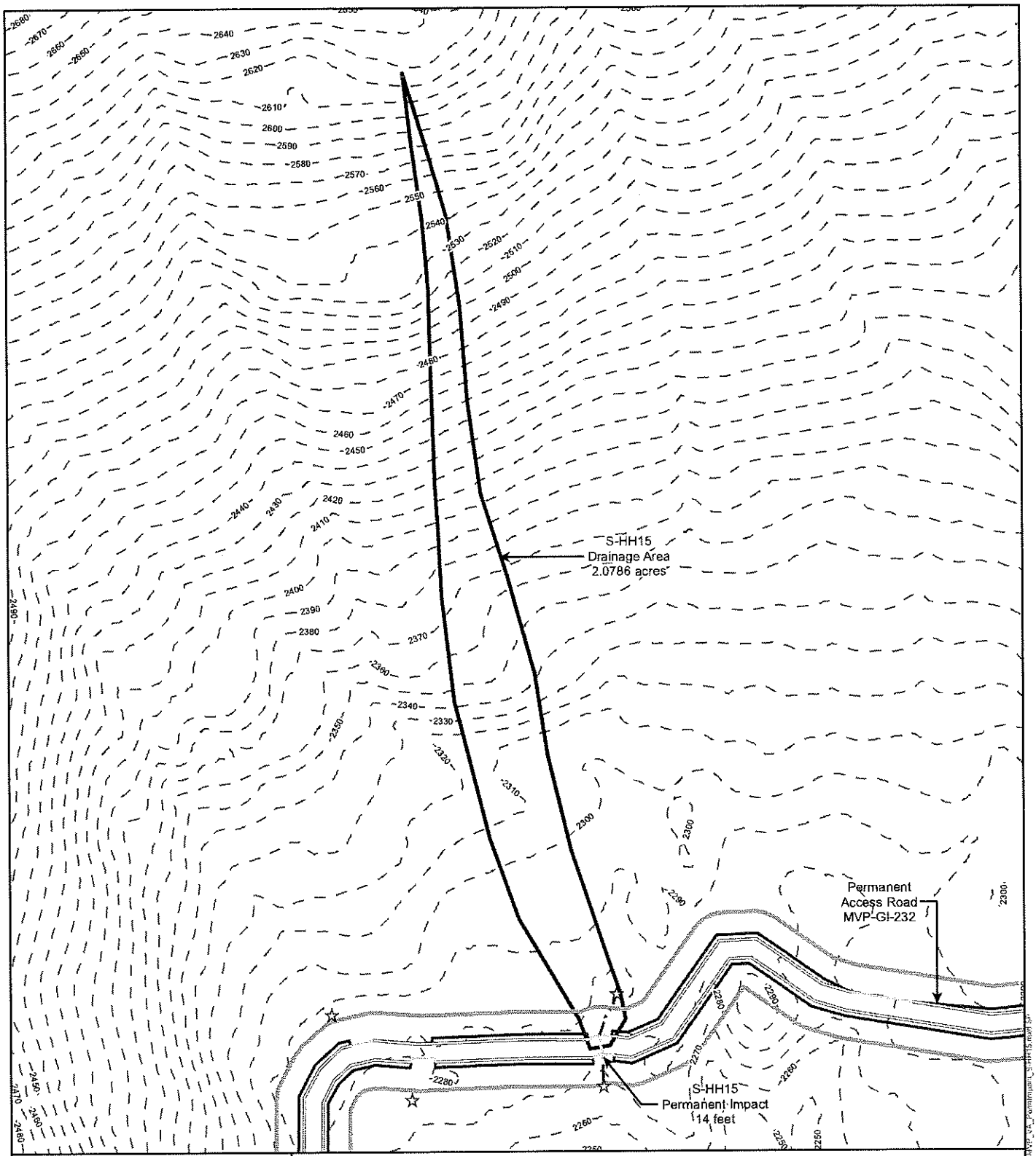
COMPENSATION REQUIREMENT (CR) >>	15

CR = RCI X LF X IF

INSERT PHOTOS:

DESCRIBE PROPOSED IMPACT:

S-HH15



Mountain Valley Pipeline Project

N

NAD 1983 UTM 17N

1 " = 180 '

180 90 0 180 Feet

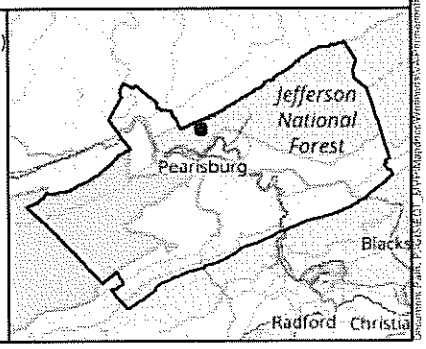
Mountain Valley PIPELINE

Figure 1:
Permanent Impacts for
Stream S-HH15
Giles County

SEPTEMBER, 2017

Data Sources: ESRI Streaming Data © 2014
Elevation data derived from LiDAR provided by EQT 2016
and from the West Virginia GIS Clearinghouse.

Access Road Permanent LOD
Limit of Disturbance
Preliminary Jurisdictional Determination Boundary
Unified Stream Method (USM) Survey Reach
Stream Permanent Impact
Perennial Stream
Drainage Area



Photograph Number: 1 **Feature Name:** S-HH15 **Flow Regime:** Perennial

Direction: S **Date:** 10/16/2015

STREAM ID S-HH15	**STREAM NAME** UNT to Clendennin Creek
LAT 37.370798 **LONG** -80.737186	**DATE** 10/16/2015
CLIENT MVP	**PROJECT NAME** MVP
INVESTIGATORS S Ryan, A Larson, M Whitten	
FLOW REGIME Perennial ✓ Intermittent ___ Ephemeral ___	**WATER TYPE** TNW ___ RPW ✓ NRPW ___

CHANNEL FEATURES

Estimate Measurements
Top of Bank Width: 5 ft
Top of Bank Height:
LB 1.5 ft RB 1.5 ft
Water Depth: 1.00 in
Water Width: 2.0 ft
High Water Mark: 4.0 in
Flow Direction: South

Stream Erosion
✓ None ___ Moderate ___ Heavy

Artificial, Modified or Channelized
___ Yes ✓ No

Dam Present ___ Yes ✓ No

Sinuosity ___ Low ✓ Medium ✓ High

Gradient
___ Flat (0.5/100 ft) ✓ Moderate (2 ft/100 ft) ___ Severe (10 ft/100 ft)

FLOW CHARACTERISTICS

Water Present
___ No water, stream bed dry
___ Stream bed moist
___ Standing water
✓ Flowing water

Velocity
___ Fast ✓ Moderate
___ Slow

Proportion of Reach Represented by Stream Morphology Types
Riffle 70 % Run %
Pool 30 %

Turbidity
✓ Clear ___ Slightly turbid ___ Turbid
___ Opaque ___ Stained
___ Other_____

INORGANIC SUBSTRATE COMPONENTS (should add up to 100%)

Substrate Type	Diameter	% Composition in Sampling Reach
Bedrock		
Boulder	> 256 mm (10")	
Cobble	64-256 mm (2.5"-10")	30
Gravel	2-64 mm (0.1"-2.5")	10
Sand	0.06-2mm (gritty)	40
Silt	0.004-0.06 mm	20
Clay	< 0.004 mm (slick)	

ORGANIC SUBSTRATE COMPONENTS (does not necessarily add up to 100%)

Substrate Type	Characteristic	% Composition in Sampling Area
Detritus	sticks, wood, coarse plant materials (CPOM)	75
Muck-Mud	black, very fine organic (FPOM)	
Marl	grey, shell fragments	

WATERSHED FEATURES

Predominant Surrounding Landuse
✓ Forest ___ Commercial
___ Field/Pasture ___ Industrial
___ Agricultural ___ Residential
___ Other:

Canopy Cover
___ Partly open ___ Partly shaded
✓ Shaded ___ Open

Indicate the dominant type (Check one)
✓ Trees ___ Shrubs
___ Grasses ___ Herbaceous

Floodplain Width
___ Wide > 30ft ___ Moderate 15-30ft
✓ Narrow <16ft

Wetland Present ✓ Yes ___ No
Wetland ID W-HH14

AQUATIC VEGETATION

Indicate the dominant type and record the dominant species present
___ Rooted emergent ___ Rooted submergent ___ Rooted floating ___ Free floating
___ Floating algae ___ Attached algae

MACROINVERTEBRATES OR OTHER WILDLIFE OBSERVED/OTHER OBSERVATIONS AND NOTES

Stream enters survey area and crosses AR via culvert and flows south out of survey area. W-HH14 drains into stream north of AR.

Stream Assessment Form (Form 1)

Unified Stream Methodology for use in Virginia

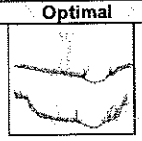
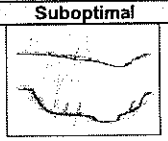
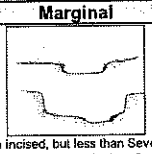
For use in wadeable channels classified as intermittent or perennial

Project #	Project Name	Locality	Cowardin Class.	HUC	Date	SAR #	Impact/SAR length	Impact Factor
	Mountain Valley Pipeline	Giles	R3UB1	050500020602	10/25/2016		14	1

Name(s) of Evaluator(s)	Stream Name and Information
J.Cook, E.Foster	S-HH15, Perennial, MVP-Gi-232

1. Channel Condition: Assess the cross-section of the stream and prevailing condition (erosion, aggradation)

Conditional Category

	Optimal	Suboptimal	Marginal	Poor	Severe	
Channel Condition	 Very little incision or active erosion; 80-100% stable banks. Vegetative surface protection or naturel rock, prominent (80-100%). AND/OR Stable point bars/bankfull benches are present. Access to their original floodplain or fully developed wide bankfull benches. Mid-channel bars, and transverse bars few. Transient sediment deposition covers less than 10% of bottom.	 Slightly incised, few areas of active erosion or unprotected banks. Majority of banks are stable (60-80%). Vegetative protection or natural rock prominent (60-80%) AND/OR Depositional features contribute to stability. The bankfull and low flow channels are well defined. Stream likely has access to bankfull benches, or newly developed floodplains along portions of the reach. Transient sediment covers 10-40% of the stream bottom.	 Often incised, but less than Severe or Poor. Banks more stable than Severe or Poor due to lower bank slopes. Erosion may be present on 40-60% of both banks. Vegetative protection on 40-60% of banks. Streambanks may beverlical or undercut. AND/OR 40-60% of stream is covered by sediment. Sediment may be temporary/transient, contribute instability. Deposition that contribute to stability, may be forming/present. AND/OR V-shaped channels have vegetative protection on > 40% of the banks and depositional features which contribute to stability.	Overwidened/incised. Vertically/laterally unstable. Likely to widen further. Majority of both banks are near vertical. Erosion present on 60-80% of banks. Vegetative protection present on 20-40% of banks, and is insufficient to prevent erosion. AND/OR 60-80% of the stream is covered by sediment. Sediment is temporary/transient in nature, and contributing to instability. AND/OR V-shaped channels have vegetative protection is present on > 40% of the banks and stable sediment deposition is absent.	Deeply incised (or excavated), vertical/lateral instability. Severe incision, flow contained within the banks. Streambed below average rooting depth, majority of banks vertical/undercut. Vegetative protection present on less than 20% of banks, is not preventing erosion. Obvious bank sloughing present. Erosion/raw banks on 80-100%. AND/OR Aggrading channel. Greater than 80% of stream bed is covered by deposition, contributing to instability. Multiple thread channels and/or subterranean flow.	CI
Score	3	2.4	2	1.6	1	2.4
NOTES>>						

2. RIPARIAN BUFFERS: Assess both bank's 100 foot riparian areas along the entire SAR. (rough measurements of length & width may be acceptable)

Conditional Category

	Optimal	Suboptimal		Marginal		Poor	
Riparian Buffers	Tree stratum (dbh > 3 inches) present, with > 00% tree canopy cover and a non-maintained understory. Wetlands located within the riparian areas.	**High Suboptimal:** Riparian areas with tree stratum (dbh > 3 inches) present, with 30% to 60% tree canopy cover and containing both herbaceous and shrub layers or a non-maintained understory.	**Low Suboptimal:** Riparian areas with tree stratum (dbh > 3 inches) present, with > 30% tree canopy cover and a maintained understory. Recent culover (dense vegetation).	**High Marginal:** Non-maintained, dense herbaceous vegetation with either a shrub layer or a tree layer (dbh > 3 inches) present, with <30% tree canopy cover.	**Low Marginal:** Non-maintained, dense herbaceous vegetation, riparian areas lacking shrub and tree stratum, hay production, ponds, open water. If present, tree stratum (dbh >3 inches) present, with <30% tree canopy cover with maintained understory.	**High Poor:** Lawns, mowed, and maintained areas, nurseries; no-till cropland; actively grazed pasture, sparsely vegetated non-maintained area, recently seeded and stabilized, or other comparable condition.	**Low Poor:** Impervious surfaces, mine spoil lands, denuded surfaces, row crops, active feed lots, trails, or other comparable conditions.
		High	Low	High	Low	High	Low
Condition Scores	1.5	1.2	1.1	0.85	0.75	0.6	0.5

NOTES>>

1. Delineate riparian areas along each stream bank into Condition Categories and Condition Scores using the descriptors.
2. Determine square footage for each by measuring or estimating length and width. Calculators are provided for you below.
3. Enter the % Riparian Area and Score for each riparian category in the blocks below.

Ensure the sums of % Riparian Blocks equal 100

Right Bank	% Riparian Area>	55%	10%	35%				100%	
	Score >	0.85	0.5	1.5					
Left Bank	% Riparian Area>	50%	10%	40%				100%	
	Score >	0.85	0.5	1.5					

CI= (Sum % RA * Scores*0.01)/2

Rt Bank CI >	1.04	CI
Lt Bank CI >	1.08	1.06

3. INSTREAM HABITAT: Varied substrate sizes, water velocity and depths; woody and leafy debris; stable substrate; low embeddedness; shade; undercut banks; root mats; SAV; riffle pools complexes, stable features.

NOTES>> Most of stream runs through easement

Conditional Category

	Optimal	Suboptimal	Marginal	Poor	
Instream Habitat/ Available Cover	Habitat elements are typically present in greater than 50% of the reach.	Stable habitat elements are typically present in 30-50% of the reach and are adequate for maintenance of populations.	Stable habitat elements are typically present in 10-30% of the reach and are adequate for maintenance of populations.	Habitat elements listed above are lacking or are unstable. Habitat elements are typically present in less than 10% of the reach.	CI
Score	1.5	1.2	0.9	0.5	0.90

Stream Impact Assessment Form Page 2

Project #	Applicant	Locality	Cowardin Class.	HUC	Date	Data Point	SAR length	Impact Factor
	Mountain Valley Pipeline	Giles		050500020602	10/25/2016	~~S-HH15~~	500	1

4. CHANNEL ALTERATION: Stream crossings, riprap, concrete, gabions, or concrete blocks, straightening of channel, channelization, embankments, spoil piles, constrictions, livestock

NOTES>> Culvert and active easement

	Conditional Category						
	Negligible	Minor		Moderate		Severe	
Channel Alteration	Channelization, dredging, alteration, or hardening absent. Stream has an unaltered pattern or has naturalized.	Less than 20% of the stream reach is disrupted by any of the channel alterations listed in the parameter guidelines.	20-40% of the stream reach is disrupted by any of the channel alterations listed in the parameter guidelines.	40 - 60% of reach is disrupted by any of the channel alterations listed in the parameter guidelines. If stream has been channelized, normal stable stream meander pattern has not recovered.	60 - 80% of reach is disrupted by any of the channel alterations listed in the parameter guidelines. If stream has been channelized, normal stable stream meander pattern has not recovered.	Greater than 80% of reach is disrupted by any of the channel alterations listed in the parameter guidelines AND/OR 80% of banks shored with gabion, riprap, or cement.	
SCORE	1.5	1.3	1.1	0.9	0.7	0.5	0.70

REACH CONDITION INDEX and STREAM CONDITION UNITS FOR THIS REACH

NOTE: The CIs and RCI should be rounded to 2 decimal places. The CR should be rounded to a whole number.

THE REACH CONDITION INDEX (RCI) >>	1.01

RCI= (Sum of all CI's)/5

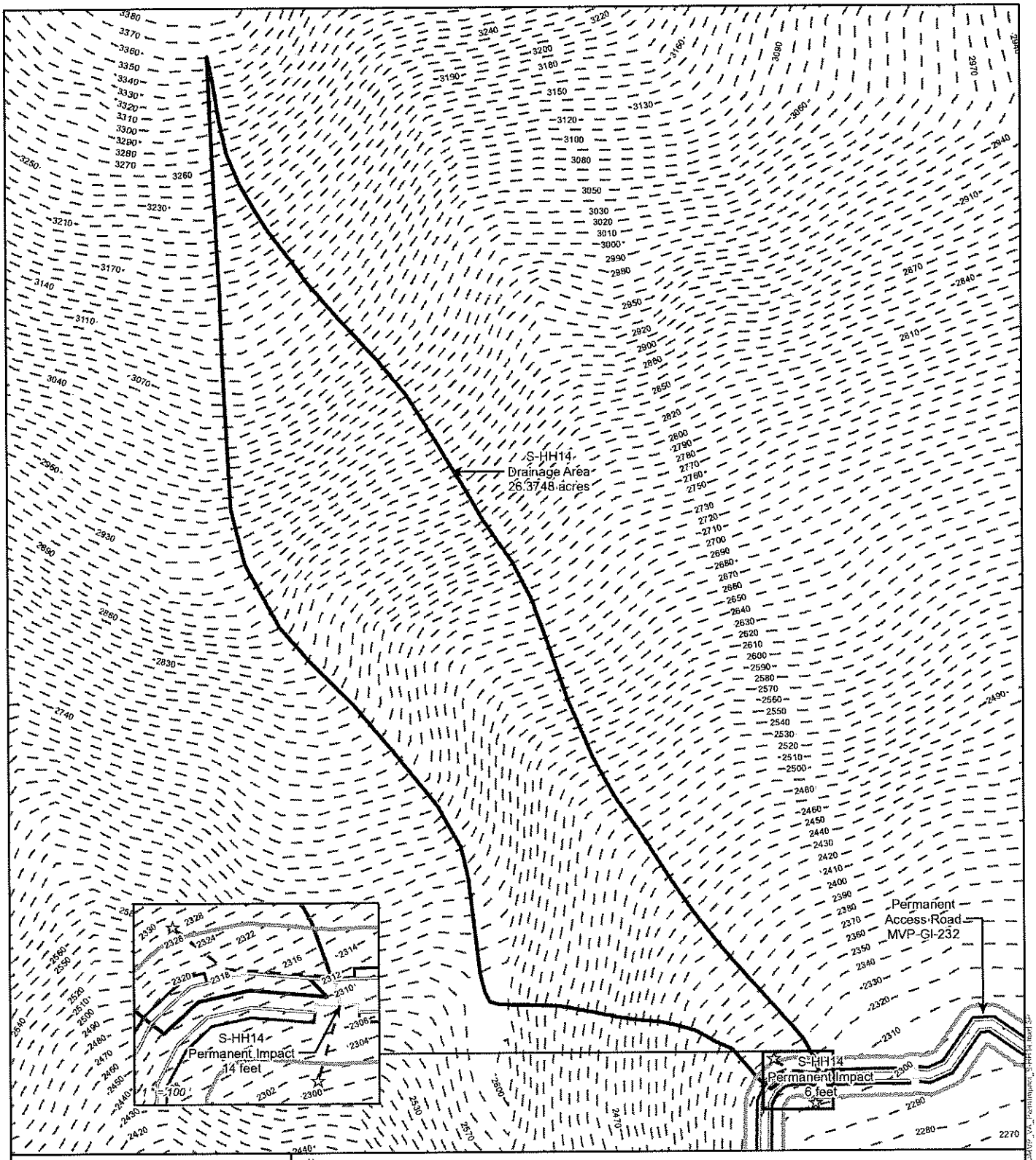
COMPENSATION REQUIREMENT (CR) >>	14

CR = RCI X LF X IF

INSERT PHOTOS:

DESCRIBE PROPOSED IMPACT:

S-HH14



Mountain Valley Pipeline Project

N

NAD 1983 UTM 17N

1" = 350'

350 175 0 350 Feet

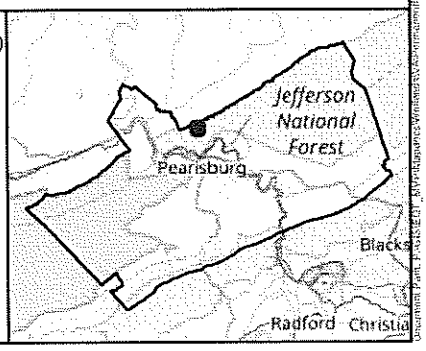
Mountain Valley PIPELINE

Figure 1:
Permanent Impacts for
Stream S-HH14
Giles County

SEPTEMBER, 2017

Data Sources: ESRI Streaming Data © 2014
Elevation data derived from LiDAR provided by EQT 2016
and from the West Virginia GIS Clearinghouse.

- Access Road Permanent LOD
- Limit of Disturbance
- Preliminary Jurisdictional Determination Boundary
- Unified Stream Method (USM) Survey Reach
- Stream Permanent Impact
- Intermittent Stream
- Drainage Area



Photograph Number: 1 **Feature Name:** S-HH14 **Flow Regime:** Intermittent

Direction: S **Date:** 10/16/2015

STREAM ID S-HH14	**STREAM NAME** UNT to Clendennin Creek
LAT 37.370790 **LONG** -80.738127	**DATE** 10/16/2015
CLIENT MVP	**PROJECT NAME** MVP
INVESTIGATORS S Ryan, A Larson, M Whitten	
FLOW REGIME Perennial ___ Intermittent ✓ Ephemeral ___	**WATER TYPE** TNW ___ RPW ✓ NRPW ___

CHANNEL FEATURES

Estimate Measurements
Top of Bank Width: 3 ft
Top of Bank Height:
LB 1.5 ft RB 1.5 ft
Water Depth: 0.00 ft
Water Width: 0.0 ft
High Water Mark: 3.0 in
Flow Direction: Southwest

Stream Erosion
✓ None ___ Moderate ___ Heavy

Artificial, Modified or Channelized
___ Yes ✓ No

Dam Present ___ Yes ✓ No

Sinuosity ___ Low ✓ Medium ✓ High

Gradient
___ Flat (0.5/100 ft) ✓ Moderate (2 ft/100 ft) ___ Severe (10 ft/100 ft)

FLOW CHARACTERISTICS

Water Present
___ No water, stream bed dry
✓ Stream bed moist
___ Standing water
___ Flowing water

Velocity
___ Fast ___ Moderate
___ Slow

Proportion of Reach Represented by Stream Morphology Types
Riffle % Run %
Pool %

Turbidity
___ Clear ___ Slightly turbid ___ Turbid
___ Opaque ___ Stained
___ Other_____

INORGANIC SUBSTRATE COMPONENTS (should add up to 100%)

Substrate Type	Diameter	% Composition in Sampling Reach
Bedrock		
Boulder	> 256 mm (10")	
Cobble	64-256 mm (2.5"-10")	
Gravel	2-64 mm (0.1"-2.5")	10
Sand	0.06-2mm (gritty)	10
Silt	0.004-0.06 mm	80
Clay	< 0.004 mm (slick)	

ORGANIC SUBSTRATE COMPONENTS (does not necessarily add up to 100%)

Substrate Type	Characteristic	% Composition in Sampling Area
Detritus	sticks, wood, coarse plant materials (CPOM)	90
Muck-Mud	black, very fine organic (FPOM)	
Marl	grey, shell fragments	

WATERSHED FEATURES

Predominant Surrounding Landuse
✓ Forest ___ Commercial
___ Field/Pasture ___ Industrial
___ Agricultural ___ Residential
___ Other:

Canopy Cover
___ Partly open ___ Partly shaded
✓ Shaded ___ Open

Indicate the dominant type (Check one)
✓ Trees ___ Shrubs
___ Grasses ___ Herbaceous

Floodplain Width
___ Wide > 30ft ___ Moderate 15-30ft
✓ Narrow <16ft

Wetland Present ___ Yes ✓ No
Wetland ID

AQUATIC VEGETATION

Indicate the dominant type and record the dominant species present
___ Rooted emergent ___ Rooted submergent ___ Rooted floating ___ Free floating
___ Floating algae ___ Attached algae

MACROINVERTEBRATES OR OTHER WILDLIFE OBSERVED/OTHER OBSERVATIONS AND NOTES

Stream begins in survey area then parallels AR before crossing AR via culvert then exits survey area flowing SW.

Stream Assessment Form (Form 1)

Unified Stream Methodology for use in Virginia

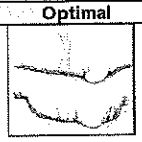
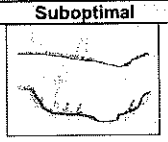
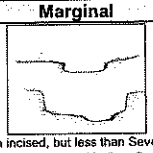
For use in wadeable channels classified as intermittent or perennial

Project #	Project Name	Locality	Cowardin Class.	HUC	Date	SAR #	Impact/SAR length	Impact Factor
	Mountain Valley Pipeline	Giles	R4SB5	050500020602	10/25/2017		14	1

Name(s) of Evaluator(s)	Stream Name and Information
J.Cook, E.Foster	S-HH14, Intermittent, MVP-GI-232

1. Channel Condition: Assess the cross-section of the stream and prevailing condition (erosion, aggradation)

Conditional Category

	Optimal	Suboptimal	Marginal	Poor	Severe	
						
Channel Condition	Very little incision or active erosion; 80-100% stable banks. Vegetative surface protection or natural rock, prominent (80-100%). AND/OR Stable point bars/bankfull benches are present. Access to their original floodplain or fully developed wide bankfull benches. Mid-channel bars, and transverse bars few. Transient sediment deposition covers less than 10% of bottom.	Slightly incised, few areas of active erosion or unprotected banks. Majority of banks are stable (60-80%). Vegetative protection or natural rock prominent (60-80%) AND/OR Depositional features contribute to stability. The bankfull and low flow channels are well defined. Stream likely has access to bankfull benches, or newly developed floodplains along portions of the reach. Transient sediment covers 10-40% of the stream bottom.	Often incised, but less than Severe or Poor. Banks more stable than Severe or Poor due to lower bank slopes. Erosion may be present on 40-60% of both banks. Vegetative protection on 40-60% of banks. Streambanks may bevertical or undercut. AND/OR 40-60% of stream is covered by sediment. Sediment may be temporary/transient, contribute instability. Deposition that contribute to stability, may be forming/present. AND/OR V-shaped channels have vegetative protection on > 40% of the banks and depositional features which contribute to stability.	Overwidened/incised. Vertically/laterally unstable. Likely to widen further. Majority of both banks are near vertical. Erosion present on 60-80% of banks. Vegetative protection present on 20-40% of banks, and is insufficient to prevent erosion. AND/OR 60-80% of the stream is covered by sediment. Sediment is temporary/transient in nature, and contributing to instability. AND/OR V-shaped channels have vegetative protection is present on > 40% of the banks and stable sediment deposition is absent.	Deeply incised (or excavated), vertical/lateral instability. Severe incision, flow contained within the banks. Streambed below average rooting depth, majority of banks vertical/undercut. Vegetative protection present on less than 20% of banks, is not preventing erosion. Obvious bank sloughing present. Erosion/raw banks on 80-100%. AND/OR Aggrading channel. Greater than 80% of stream bed is covered by deposition, contributing to instability. Multiple thread channels and/or subterranean flow.	CI
Score	3	2.4	2	1.6	1	2.4
NOTES>>	Some incision though minimal erosion with clear bank stability					

2. RIPARIAN BUFFERS: Assess both bank's 100 foot riparian areas along the entire SAR. (rough measurements of length & width may be acceptable)

Conditional Category

	Optimal	Suboptimal		Marginal		Poor		NOTES>>
Riparian Buffers	Tree stratum (dbh > 3 inches) present, with > 60% tree canopy cover and a non-maintained understory. Wetlands located within the riparian areas.	High Suboptimal: Riparian areas with tree stratum (dbh > 3 inches) present, with 30% to 60% tree canopy cover and containing both herbaceous and shrub layers or a non-maintained understory.	Low Suboptimal: Riparian areas with tree stratum (dbh > 3 inches) present, with > 30% tree canopy cover and a maintained understory. Recent cutover (dense vegetation).	High Marginal: Non-maintained, dense herbaceous vegetation with either a shrub layer or a tree layer (dbh > 3 inches) present, with <30% tree canopy cover.	Low Marginal: Non-maintained, dense herbaceous vegetation, riparian areas lacking shrub and tree stratum, hay production, ponds, open water. If present, tree stratum (dbh >3 inches) present, with <30% tree canopy cover with maintained understory.	High Poor: Lawns, mowed, and maintained areas, nurseries; no-till cropland; actively grazed pasture, sparsely vegetated non-maintained area, recently seeded and stabilized, or other comparable condition.	Low Poor: Impervious surfaces, mine spoil lands, denuded surfaces, row crops, active feed lots, trails, or other comparable conditions.	
		High	Low	High	Low	High	Low	
Condition Scores	1.5	1.2	1.1	0.85	0.75	0.6	0.5	

1. Delineate riparian areas along each stream bank into Condition Categories and Condition Scores using the descriptors.
2. Determine square footage for each by measuring or estimating length and width. Calculators are provided for you below.
3. Enter the % Riparian Area and Score for each riparian category in the blocks below.

Ensure the sums of % Riparian Blocks equal 100

Right Bank	% Riparian Area>	45%	45%	10%				100%		
	Score >	1.5	0.85	0.6						
									CI= (Sum % RA * Scores*0.01)/2	
Left Bank	% Riparian Area>	45%	45%	10%				100%	Rt Bank CI > 1.12	CI
	Score >	1.5	0.85	0.6					Lt Bank CI > 1.12	1.12

3. INSTREAM HABITAT: Varied substrate sizes, water velocity and depths; woody and leafy debris; stable substrate; low embededness; shade; undercut banks; root mats; SAV; riffle pools complexes, stable features.

NOTES>> Stream has minimal habitat with low shelf development

Conditional Category

	Optimal	Suboptimal	Marginal	Poor	
Instream Habitat/ Available Cover	Habitat elements are typically present in greater than 50% of the reach.	Stable habitat elements are typically present in 30-50% of the reach and are adequate for maintenance of populations.	Stable habitat elements are typically present in 10-30% of the reach and are adequate for maintenance of populations.	Habitat elements listed above are lacking or are unstable. Habitat elements are typically present in less than 10% of the reach.	CI
Score	1.5	1.2	0.9	0.5	0.90

Stream Impact Assessment Form Page 2

Project #	Applicant	Locality	Cowardin Class.	HUC	Date	Data Point	SAR length	Impact Factor
	Mountain Valley Pipeline			050500020602	10/25/2017		500	1

4. CHANNEL ALTERATION: Stream crossings, riprap, concrete, gabions, or concrete blocks, straightening of channel, channelization, embankments, spoil piles, constrictions, livestock

NOTES>> Stream is impac

	Conditional Category						
	Negligible	Minor		Moderate		Severe	
Channel Alteration	Channelization, dredging, alteration, or hardening absent. Stream has an unaltered pattern or has naturalized.	Less than 20% of the stream reach is disrupted by any of the channel alterations listed in the parameter guidelines.	20-40% of the stream reach is disrupted by any of the channel alterations listed in the parameter guidelines.	40 - 60% of reach is disrupted by any of the channel alterations listed in the parameter guidelines. If stream has been channelized, normal stable stream meander pattern has not recovered.	60 - 80% of reach is disrupted by any of the channel alterations listed in the parameter guidelines. If stream has been channelized, normal stable stream meander pattern has not recovered.	Greater than 80% of reach is disrupted by any of the channel alterations listed in the parameter guidelines AND/OR 80% of banks shored with gabion, riprap, or cement.	
SCORE	1.5	1.3	1.1	0.9	0.7	0.5	0.90

REACH CONDITION INDEX and STREAM CONDITION UNITS FOR THIS REACH

NOTE: The CIs and RCI should be rounded to 2 decimal places. The CR should be rounded to a whole number.

THE REACH CONDITION INDEX (RCI) >>	1.06

RCI= (Sum of all CI's)/5

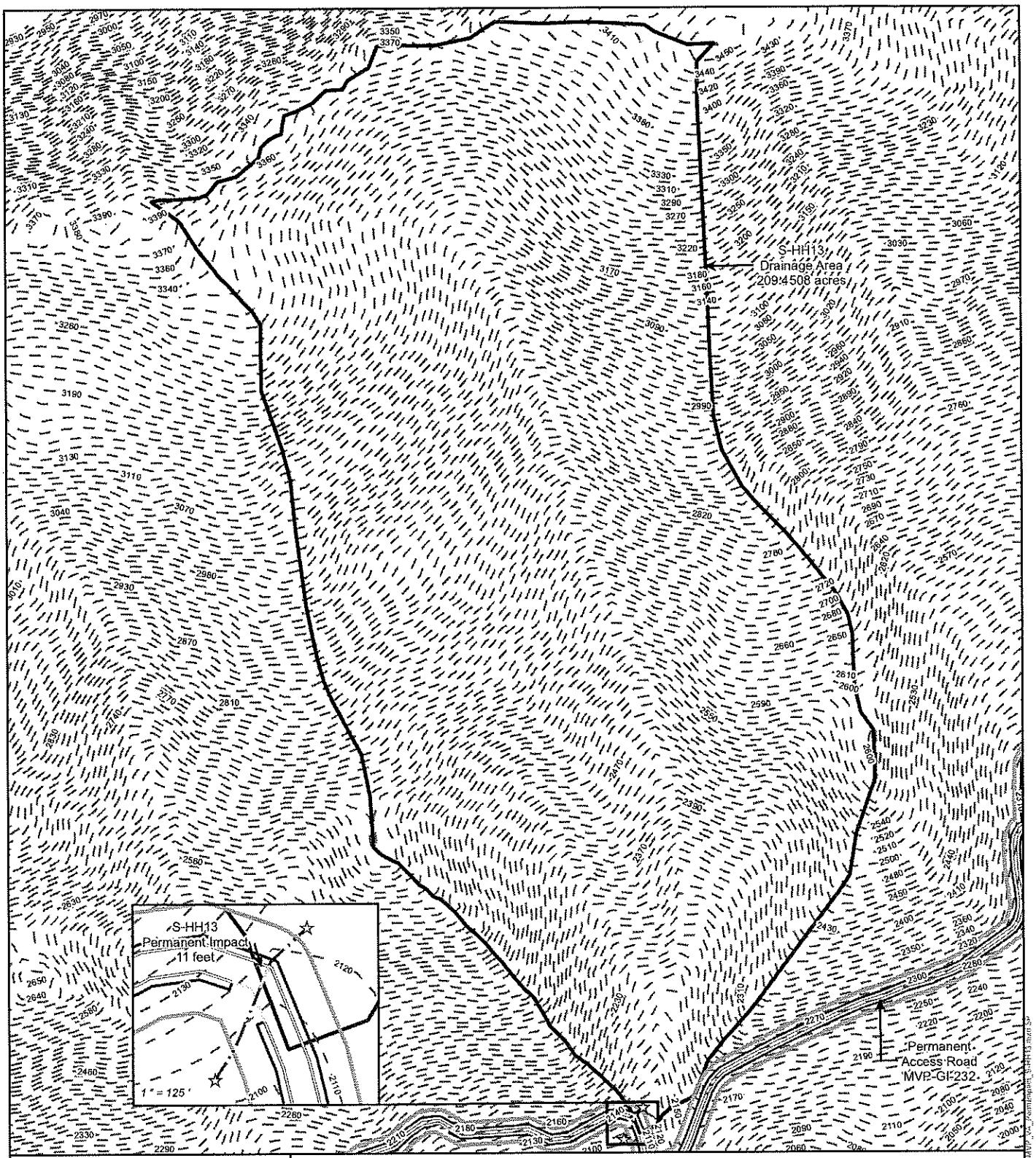
COMPENSATION REQUIREMENT (CR) >>	15

CR = RCI X LF X IF

INSERT PHOTOS:

DESCRIBE PROPOSED IMPACT:

S-HH13



Mountain Valley Pipeline Project

N

NAD 1983 UTM 17N

1" = 600'

600 300 0 600 Feet

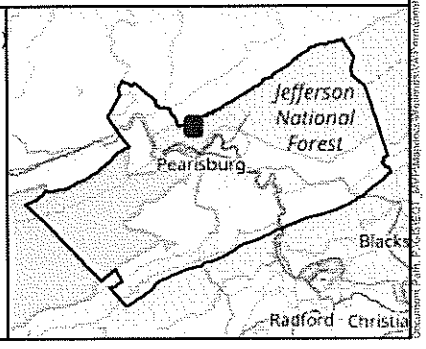
Mountain Valley PIPELINE

Figure 1:
Permanent Impacts for
Stream S-HH13
Giles County

SEPTEMBER, 2017

Data Sources: ESRI Streaming Data © 2014
Elevation data derived from LiDAR provided by EQT 2016
and from the West Virginia GIS Clearinghouse.

- Access Road Permanent LOD
- Limit of Disturbance
- Preliminary Jurisdictional Determination Boundary
- Unified Stream Method (USM) Survey Reach
- Stream Permanent Impact
- Perennial Stream
- Drainage Area



Photograph Number: 1 **Feature Name:** S-HH13 **Flow Regime:** Perennial

Direction: SSW **Date:** 10/16/2015

STREAM ID S-HH13	**STREAM NAME** UNT to Clendennin Creek
LAT 37.366221 **LONG** -80.744635	**DATE** 10/16/2015
CLIENT MVP	**PROJECT NAME** MVP
INVESTIGATORS S Ryan, A Larson, M Whitten	
FLOW REGIME Perennial ✓ Intermittent___ Ephemeral___	**WATER TYPE** TNW___ RPW ✓ NRPW___

CHANNEL FEATURES	**Estimate Measurements** Top of Bank Width: 8 ft Top of Bank Height: LB 2.0 ft RB 2.0 ft Water Depth: 2.00 in Water Width: 8.0 ft High Water Mark: 7.0 in Flow Direction: Southwest	**Stream Erosion** ✓ None ___Moderate ___Heavy **Artificial, Modified or Channelized** ___ Yes ✓ No **Dam Present** ___Yes ✓ No **Sinuosity** ___ Low ✓ Medium ✓ High **Gradient** ___ Flat (0.5/100 ft ✓ Moderate (2 ft/100 ft) ___Severe (10 ft/100 ft)
FLOW CHARACTERISTICS	**Water Present** ___ No water, stream bed dry ___ Stream bed moist ___ Standing water ✓ Flowing water **Velocity** ___Fast ✓ Moderate ___ Slow	**Proportion of Reach Represented by Stream Morphology Types** Riffle 75 % Run 15 % Pool 10 % **Turbidity** ✓ Clear ___Slightly turbid ___Turbid ___ Opaque ___Stained ___Other_____

INORGANIC SUBSTRATE COMPONENTS (should add up to 100%)			**ORGANIC SUBSTRATE COMPONENTS (does not necessarily add up to 100%)**		
Substrate Type	Diameter	% Composition in Sampling Reach	Substrate Type	Characteristic	% Composition in Sampling Area
Bedrock			Detritus	sticks, wood, coarse plant materials (CPOM)	25
Boulder	> 256 mm (10")	10			
Cobble	64-256 mm (2.5"-10")	50	Muck-Mud	black, very fine organic (FPOM)	
Gravel	2-64 mm (0.1"-2.5")	25			
Sand	0.06-2mm (gritty)	15	Marl	grey, shell fragments	
Silt	0.004-0.06 mm				
Clay	< 0.004 mm (slick)				

WATERSHED FEATURES	**Predominant Surrounding Landuse** ✓ Forest ___ Commercial ___ Field/Pasture ___Industrial ___ Agricultural ___ Residential ___ Other: **Canopy Cover** ___Partly open ___Partly shaded ✓ Shaded ___ Open	**Indicate the dominant type (Check one)** ✓ Trees ___ Shrubs ___ Grasses ___ Herbaceous **Floodplain Width** ___ Wide > 30ft ___ Moderate 15-30ft ✓ Narrow <16ft **Wetland Present** ___Yes ✓ No **Wetland ID**
AQUATIC VEGETATION	**Indicate the dominant type and record the dominant species present** ___ Rooted emergent ___Rooted submergent ___Rooted floating ___Free floating ___ Floating algae ___Attached algae	

MACROINVERTEBRATES OR OTHER WILDLIFE OBSERVED/OTHER OBSERVATIONS AND NOTES	Crosses AR via culvert then exits survey area flowing SW. Pools listed above are mainly the result of minor flow interruption related to the culvert.

Stream Assessment Form (Form 1)

Unified Stream Methodology for use in Virginia

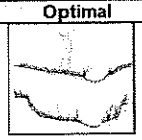
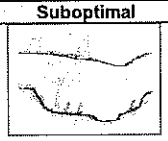
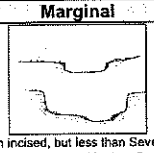
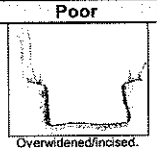
For use in wadeable channels classified as intermittent or perennial

Project #	Project Name	Locality	Cowardin Class.	HUC	Date	SAR #	Impact/SAR length	Impact Factor
	Mountain Valley Pipeline	Giles	R3RB2	050500020602	10/25/2016		11	1

Name(s) of Evaluator(s)	Stream Name and Information
J.Cook, E.Foster	S-HH13, Perennial, MVP-GI-232

1. Channel Condition: Assess the cross-section of the stream and prevailing condition (erosion, aggradation)

Conditional Category

	Optimal	Suboptimal	Marginal	Poor	Severe	
						
Channel Condition	Very little incision or active erosion; 80-100% stable banks. Vegetative surface protection or natural rock, prominent (80-100%). AND/OR Stable point bars/bankfull benches are present. Access to their original floodplain or fully developed wide bankfull benches. Mid-channel bars, and transverse bars few. Transient sediment deposition covers less than 10% of bottom.	Slightly incised, few areas of active erosion or unprotected banks. Majority of banks are stable (60-80%). Vegetative protection or natural rock prominent (60-80%) AND/OR Depositional features contribute to stability. The bankfull and low flow channels are well defined. Stream likely has access to bankfull benches, or newly developed floodplains along portions of the reach. Transient sediment covers 10-40% of the stream bottom.	Often incised, but less than Severe or Poor. Banks more stable than Severe or Poor due to lower bank slopes. Erosion may be present on 40-60% of both banks. Vegetative protection on 40-60% of banks. Streambanks may bevertical or undercut. AND/OR 40-60% of stream is covered by sediment. Sediment may be temporary/transient, contribute instability. Deposition that contribute to stability, may be forming/present. AND/OR V-shaped channels have vegetative protection on > 40% of the banks and depositional features which contribute to stability.	Overwidened/incised. Vertically/laterally unstable. Likely to widen further. Majority of both banks are near vertical. Erosion present on 60-80% of banks. Vegetative protection present on 20-40% of banks, and is insufficient to prevent erosion. AND/OR 60-80% of the stream is covered by sediment. Sediment is temporary/transient in nature, and contributing to instability. AND/OR V-shaped channels have vegetative protection is present on > 40% of the banks and stable sediment deposition is absent.	Deeply incised (or entrenched), vertical/lateral instability. Severe incision, flow contained within the banks. Streambed below average rooting depth, majority of banks vertical/undercut. Vegetative protection present on less than 20% of banks, is not preventing erosion. Obvious bank sloughing present. Erosion/raw banks on 80-100%. AND/OR Aggrading channel. Greater than 80% of stream bed is covered by deposition, contributing to instability. Multiple thread channels and/or subterranean flow.	CI
Score	3	2.4	2	1.6	1	3.0
NOTES>>						

2. RIPARIAN BUFFERS: Assess both bank's 100 foot riparian areas along the entire SAR. (rough measurements of length & width may be acceptable)

Conditional Category

	Optimal	Suboptimal		Marginal		Poor		NOTES>> Mostly optimal woods
Riparian Buffers	Tree stratum (dbh > 3 inches) present, with > 60% tree canopy cover and a non-maintained understory. Wetlands located within the riparian areas.	High Suboptimal: Riparian areas with tree stratum (dbh > 3 inches) present, with 30% to 60% tree canopy cover and containing both herbaceous and shrub layers or a non-maintained understory.	Low Suboptimal: Riparian areas with tree stratum (dbh > 3 inches) present, with > 30% tree canopy cover and a maintained understory. Recent cutover (dense vegetation).	High Marginal: Non-maintained, dense herbaceous vegetation with either a shrub layer or a tree layer (dbh > 3 inches) present, with <30% tree canopy cover.	Low Marginal: Non-maintained, dense herbaceous vegetation, riparian areas lacking shrub and tree stratum, hay production, ponds, open water. If present, tree stratum (dbh >3 inches) present, with <30% tree canopy cover with maintained understory.	High Poor: Lawns, mowed, and maintained areas, nurseries; no-till cropland; actively grazed pasture, sparsely vegetated non-maintained area, recently seeded and stabilized, or other comparable condition.	Low Poor: Impervious surfaces, mine spoil lands, denuded surfaces, row crops, active feed lots, trails, or other comparable conditions.	
		High	Low	High	Low	High	Low	
Condition Scores	1.5	1.2	1.1	0.85	0.75	0.6	0.5	

1. Delineate riparian areas along each stream bank into Condition Categories and Condition Scores using the descriptors.
2. Determine square footage for each by measuring or estimating length and width. Calculators are provided for you below.
3. Enter the % Riparian Area and Score for each riparian category in the blocks below.

Ensure the sums of % Riparian Blocks equal 100

Right Bank	% Riparian Area>	5%	95%					100%		
	Score >	0.6	1.5							
									CI= (Sum % RA * Scores*0.01)/2	
Left Bank	% Riparian Area>	10%	90%					100%	Rt Bank CI > 1.46	CI
	Score >	0.6	1.5						Lt Bank CI > 1.41	1.43

3. INSTREAM HABITAT: Varied substrate sizes, water velocity and depths; woody and leafy debris; stable substrate; low embededness; shade; undercut banks; root mats; SAV; riffle pools complexes, stable features.

NOTES>> Varying substrate and functional shade for habitat

Conditional Category

	Optimal	Suboptimal	Marginal	Poor	
Instream Habitat/ Available Cover	Habitat elements are typically present in greater than 50% of the reach.	Stable habitat elements are typically present in 30-50% of the reach and are adequate for maintenance of populations.	Stable habitat elements are typically present in 10-30% of the reach and are adequate for maintenance of populations.	Habitat elements listed above are lacking or are unstable. Habitat elements are typically present in less than 10% of the reach.	CI
Score	1.5	1.2	0.9	0.5	1.50

Stream Impact Assessment Form Page 2

Project #	Applicant	Locality	Cowardin Class.	HUC	Date	Data Point	SAR length	Impact Factor
	Mountain Valley Pipeline	Giles		050500020602	10/25/2016	S-HH13	500	1

4. CHANNEL ALTERATION: Stream crossings, riprap, concrete, gabions, or concrete blocks, straightening of channel, channelization, embankments, spoil piles, constrictions, livestock

NOTES>> Culvert

	Conditional Category						
	Negligible	Minor		Moderate		Severe	
Channel Alteration	Channelization, dredging, alteration, or hardening absent. Stream has an unaltered pattern or has naturalized.	Less than 20% of the stream reach is disrupted by any of the channel alterations listed in the parameter guidelines.	20-40% of the stream reach is disrupted by any of the channel alterations listed in the parameter guidelines.	40 - 60% of reach is disrupted by any of the channel alterations listed in the parameter guidelines. If stream has been channelized, normal stable stream meander pattern has not recovered.	60 - 80% of reach is disrupted by any of the channel alterations listed in the parameter guidelines. If stream has been channelized, normal stable stream meander pattern has not recovered.	Greater than 80% of reach is disrupted by any of the channel alterations listed in the parameter guidelines AND/OR 80% of banks shored with gabion, riprap, or cement.	
SCORE	1.5	1.3	1.1	0.9	0.7	0.5	1.30

REACH CONDITION INDEX and STREAM CONDITION UNITS FOR THIS REACH

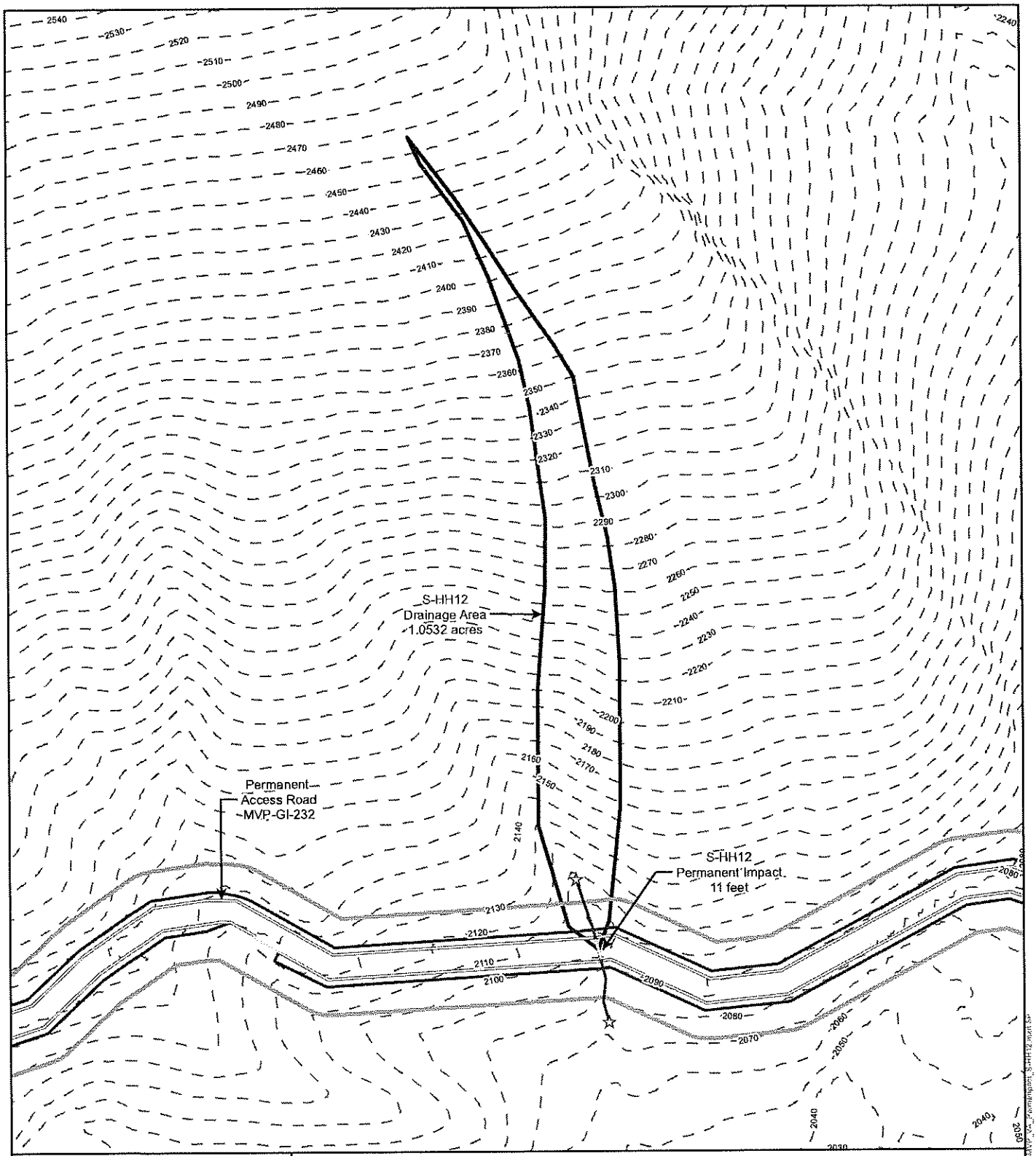
NOTE: The CIs and RCI should be rounded to 2 decimal places. The CR should be rounded to a whole number.

THE REACH CONDITION INDEX (RCI) >>	1.45
RCI= (Sum of all CI's)/5	
COMPENSATION REQUIREMENT (CR) >>	16
CR = RCI X LF X IF	

INSERT PHOTOS:

DESCRIBE PROPOSED IMPACT:

S-HH12



Mountain Valley Pipeline Project

N

NAD 1983 UTM 17N

1 " = 140 '

140 70 0 140 Feet

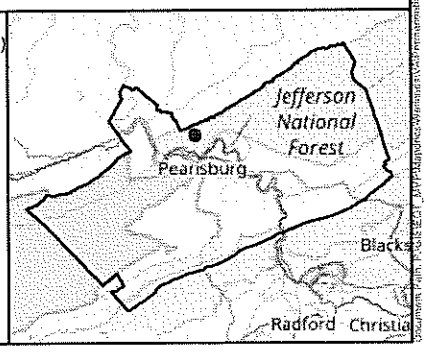
Mountain Valley PIPELINE

Figure 1:
Permanent Impacts for
Stream S-HH12
Giles County

SEPTEMBER, 2017

Data Sources: ESRI Streaming Data © 2014
Elevation data derived from LiDAR provided by EQT 2016
and from the West Virginia GIS Clearinghouse.

- Access Road Permanent LOD
- Limit of Disturbance
- Preliminary Jurisdictional Determination Boundary
- Unified Stream Method (USM) Survey Reach
- Stream Permanent Impact
- Ephemeral Stream
- Drainage Area



Photograph Number: 1 **Feature Name:** S-HH12 **Flow Regime:** Ephemeral

Direction: N **Date:** 10/16/2015

STREAM ID S-HH12	**STREAM NAME** UNT to Clendennin Creek
LAT 37.366134 **LONG** -80.746301	**DATE** 10/16/2015
CLIENT MVP	**PROJECT NAME** MVP
INVESTIGATORS S Ryan, A Larson, M Whitten	
FLOW REGIME Perennial ___ Intermittent ___ Ephemeral ✓	**WATER TYPE** TNW ___ RPW ___ NRPW ✓

CHANNEL FEATURES	**Estimate Measurements** Top of Bank Width: 3 ft Top of Bank Height: LB 1.0 ft RB 1.0 ft Water Depth: 0.00 ft Water Width: 0.0 ft High Water Mark: 3.0 in Flow Direction: South	**Stream Erosion** ✓ None ___ Moderate ___ Heavy **Artificial, Modified or Channelized** ___ Yes ✓ No **Dam Present** ___ Yes ✓ No **Sinuosity** ___ Low ✓ Medium ✓ High **Gradient** ___ Flat (0.5/100 ft ✓ Moderate (2 ft/100 ft) ___ Severe (10 ft/100 ft)
FLOW CHARACTERISTICS	**Water Present** ___ No water, stream bed dry ✓ Stream bed moist ___ Standing water ___ Flowing water **Velocity** ___ Fast ___ Moderate ___ Slow	**Proportion of Reach Represented by Stream Morphology Types** Riffle % Run % Pool % **Turbidity** ___ Clear ___ Slightly turbid ___ Turbid ___ Opaque ___ Stained ___ Other_____

INORGANIC SUBSTRATE COMPONENTS (should add up to 100%)			**ORGANIC SUBSTRATE COMPONENTS (does not necessarily add up to 100%)**		
Substrate Type	Diameter	% Composition in Sampling Reach	Substrate Type	Characteristic	% Composition in Sampling Area
Bedrock			Detritus	sticks, wood, coarse plant materials (CPOM)	100
Boulder	> 256 mm (10")				
Cobble	64-256 mm (2.5"-10")	10	Muck-Mud	black, very fine organic (FPOM)	
Gravel	2-64 mm (0.1"-2.5")	20			
Sand	0.06-2mm (gritty)	35	Marl	grey, shell fragments	
Silt	0.004-0.06 mm	35			
Clay	< 0.004 mm (slick)				

WATERSHED FEATURES	**Predominant Surrounding Landuse** ✓ Forest ___ Commercial ___ Field/Pasture ___ Industrial ___ Agricultural ___ Residential ___ Other: **Canopy Cover** ___ Partly open ✓ Partly shaded ___ Shaded ___ Open	**Indicate the dominant type (Check one)** ✓ Trees ___ Shrubs ___ Grasses ___ Herbaceous **Floodplain Width** ___ Wide > 30ft ___ Moderate 15-30ft ✓ Narrow <16ft **Wetland Present** ___ Yes ✓ No **Wetland ID**
AQUATIC VEGETATION	**Indicate the dominant type and record the dominant species present** ___ Rooted emergent ___ Rooted submergent ___ Rooted floating ___ Free floating ___ Floating algae ___ Attached algae	

MACROINVERTEBRATES OR OTHER WILDLIFE OBSERVED/OTHER OBSERVATIONS AND NOTES	Crosses AR via culvert then exits survey area to the S. Marginal bed/bank characteristics within majority of survey area, with better defined bed/bank near southern survey boundary and outside survey area to south.

Ephemeral Stream Assessment Form (Form 1a)

Unified Stream Methodology for use in Virginia

For use in ephemeral streams

Project #	Project Name	Locality	Cowardin Class.	HUC	Date	SAR #	Impact/SAR length	Impact Factor
	Mountain Valley Pipeline	Giles	R6	050500020602	10/25/2016		11	1

Name(s) of Evaluator(s)	Stream Name and Information
J.Cook, E.Foster	S-HH12, Ephemeral, MVP-GI-232

2. RIPARIAN BUFFERS: Assess both bank's 100 foot riparian areas along the entire SAR. (rough measurements of length & width may be acceptable)

	Conditional Category							NOTES>>
	Optimal	Suboptimal		Marginal		Poor		
Riparian Buffers	Tree stratum (dbh > 3 inches) present, with > 60% tree canopy cover and an non-maintained understory. Wetlands areas.	High Suboptimal: Riparian areas with tree stratum (dbh > 3 inches) present, with 30% to 60% tree canopy cover and containing both herbaceous and shrub layers or a non-maintained understory.	Low Suboptimal: Riparian areas with tree stratum (dbh > 3 inches) present, with >30% tree canopy cover and a maintained understory. Recent cutover (dense vegetation).	High Marginal: Non-maintained, dense herbaceous vegetation with either a shrub layer or a tree layer (dbh > 3 inches) present, with <30% tree canopy cover.	Low Marginal: Non-maintained, dense herbaceous vegetation, riparian areas lacking shrub and tree stratum, hay production, ponds, open water. If present, tree stratum (dbh >3 inches) present, with <30% tree canopy cover with maintained understory.	High Poor: Lawns, mowed, and maintained areas, nurseries; no-till cropland; actively grazed pasture, sparsely vegetated non-maintained area, recently seeded and stabilized, or other comparable condition.	Low Poor: Impervious surfaces, mine spoil lands, denuded surfaces, row crops, active feed lots, trails, or other comparable conditions.	
		High	Low	High	Low	High	Low	
Condition Scores	1.5	1.2	1.1	0.85	0.75	0.6	0.5	

1. Delineate riparian areas along each stream bank into Condition Categories and Condition Scores using the descriptors.
2. Determine square footage for each by measuring or estimating length and width. Calculators are provided for you below.
3. Enter the % Riparian Area and Score for each riparian category in the blocks below.

Ensure the sums of % Riparian Blocks equal 100

Right Bank	% Riparian Area>	5%	95%					100%			
	Score >	0.6	1.5								
									CI= (Sum % RA * Scores*0.01)/2		
Left Bank	% Riparian Area>	5%	95%					100%	Rt Bank CI >	1.46	CI
	Score >	0.6	1.5						Lt Bank CI >	1.46	1.46

REACH CONDITION INDEX and STREAM CONDITION UNITS FOR THIS REACH

NOTE: The CIs and RCI should be rounded to 2 decimal places. The CR should be rounded to a whole number.

THE REACH CONDITION INDEX (RCI) >>	0.73

RCI= (Riparian CI)/2

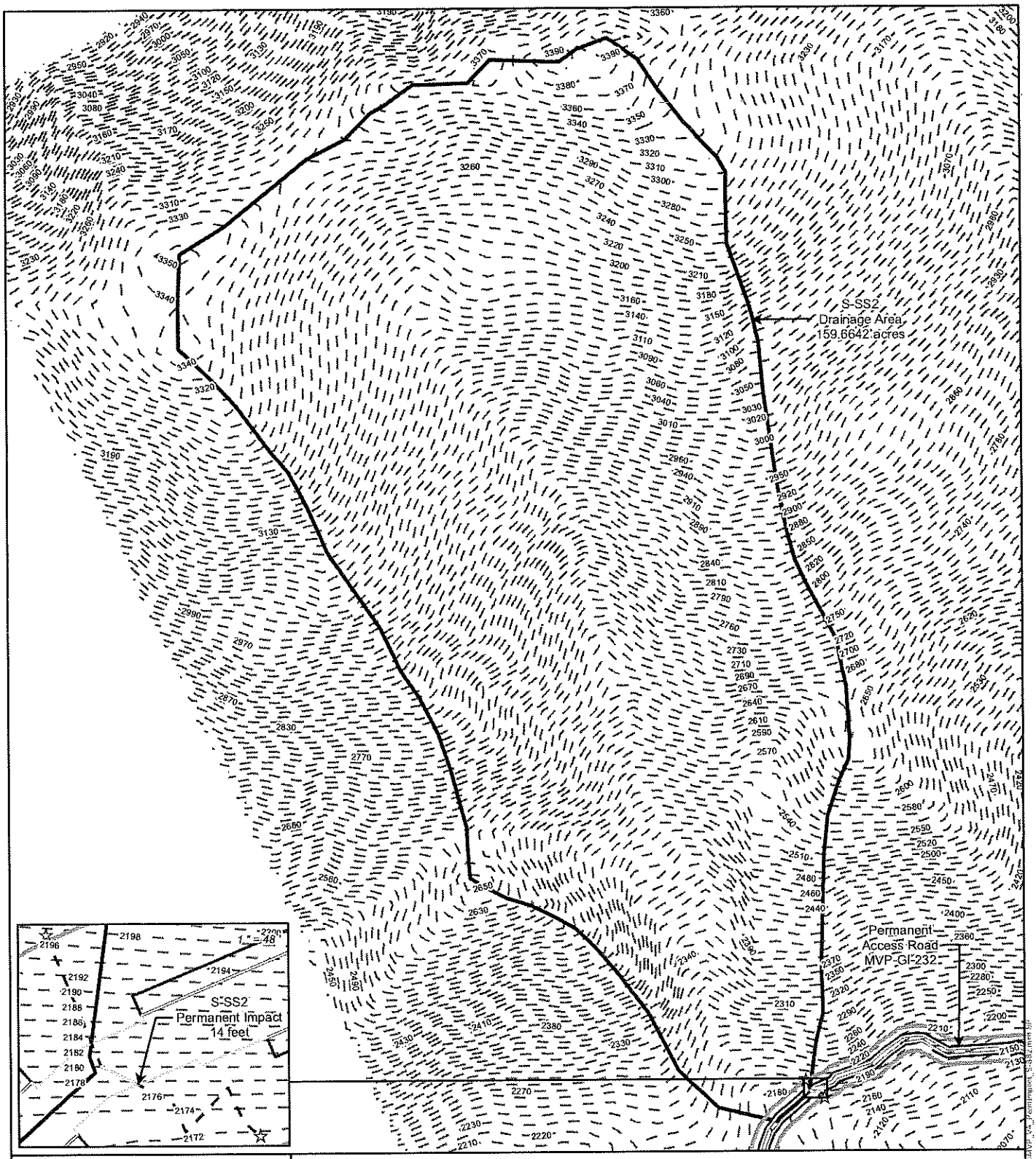
COMPENSATION REQUIREMENT (CR) >>	8

CR = RCI X LF X IF

INSERT PHOTOS:

DESCRIBE PROPOSED IMPACT:

S-SS2



Mountain Valley Pipeline Project

N

NAD 1983 UTM 17N

1 " = 550 '

550 275 0 550 Feet

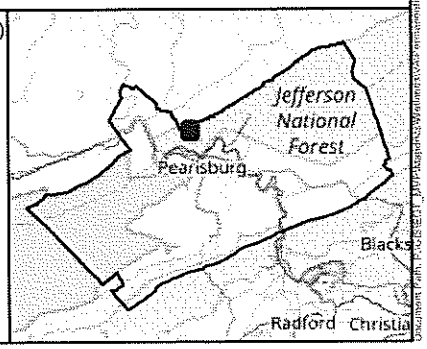
Mountain Valley PIPELINE

Figure 1:
Permanent Impacts for
Stream S-SS2
Giles County

SEPTEMBER, 2017

Data Sources: ESRI Streaming Data © 2014
Elevation data derived from LiDAR provided by EQT 2016
and from the West Virginia GIS Clearinghouse.

Access Road Permanent LOD
Limit of Disturbance
Preliminary Jurisdictional Determination Boundary
Unified Stream Method (USM) Survey Reach
Stream Permanent Impact
Intermittent Stream
Drainage Area



Photograph Number: 23 **Feature Name:** S-SS2 **Flow Regime:** Intermittent

Direction: SSE **Date:** 9/11/2015

STREAM ID S-SS2	**STREAM NAME** UNT to Clendennin Creek
LAT 37.365645 **LONG** -80.749167	**DATE** 09/11/2015
CLIENT MVP	**PROJECT NAME** MVP
INVESTIGATORS L. Canty, E. Foster, A. Carrano	
FLOW REGIME Perennial ___ Intermittent ✓ Ephemeral ___	**WATER TYPE** TNW ___ RPW ✓ NRPW ___

CHANNEL FEATURES	**Estimate Measurements** Top of Bank Width: 10 ft Top of Bank Height: LB 20.0 in RB 10.0 in Water Depth: 0.00 in Water Width: 0.0 ft High Water Mark: 4.0 in Flow Direction: South	**Stream Erosion** ___ None ✓ Moderate ___ Heavy **Artificial, Modified or Channelized** ___ Yes ✓ No **Dam Present** ___ Yes ✓ No **Sinuosity** ✓ Low ___ Medium ✓ High **Gradient** ___ Flat (0.5/100 ft ✓ Moderate (2 ft/100 ft) ___ Severe (10 ft/100 ft)
FLOW CHARACTERISTICS	**Water Present** ✓ No water, stream bed dry ___ Stream bed moist ___ Standing water ___ Flowing water **Velocity** ___ Fast ___ Moderate ___ Slow	**Proportion of Reach Represented by Stream Morphology Types** Riffle % Run % Pool % **Turbidity** ___ Clear ___ Slightly turbid ___ Turbid ___ Opaque ___ Stained ___ Other_____

INORGANIC SUBSTRATE COMPONENTS (should add up to 100%)			**ORGANIC SUBSTRATE COMPONENTS (does not necessarily add up to 100%)**		
Substrate Type	Diameter	% Composition in Sampling Reach	Substrate Type	Characteristic	% Composition in Sampling Area
Bedrock			Detritus	sticks, wood, coarse plant materials (CPOM)	15
Boulder	> 256 mm (10")	25			
Cobble	64-256 mm (2.5"-10")	25	Muck-Mud	black, very fine organic (FPOM)	
Gravel	2-64 mm (0.1"-2.5")	30			
Sand	0.06-2mm (gritty)		Marl	grey, shell fragments	
Silt	0.004-0.06 mm	10			
Clay	< 0.004 mm (slick)	10			

WATERSHED FEATURES	**Predominant Surrounding Landuse** ✓ Forest ___ Commercial ___ Field/Pasture ___ Industrial ___ Agricultural ___ Residential ___ Other: **Canopy Cover** ✓ Partly open ___ Partly shaded ___ Shaded ___ Open	**Indicate the dominant type (Check one)** ✓ Trees ___ Shrubs ___ Grasses ___ Herbaceous **Floodplain Width** ___ Wide > 30ft ___ Moderate 15-30ft ✓ Narrow <16ft **Wetland Present** ___ Yes ✓ No **Wetland ID**
AQUATIC VEGETATION	**Indicate the dominant type and record the dominant species present** ___ Rooted emergent ___ Rooted submergent ___ Rooted floating ___ Free floating ___ Floating algae ___ Attached algae	

MACROINVERTEBRATES OR OTHER WILDLIFE OBSERVED/OTHER OBSERVATIONS AND NOTES	

Stream Assessment Form (Form 1)

Unified Stream Methodology for use in Virginia

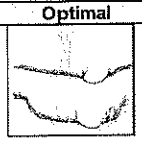
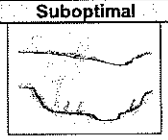
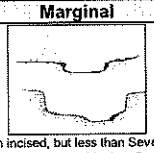
For use in wadeable channels classified as intermittent or perennial

Project #	Project Name	Locality	Cowardin Class.	HUC	Date	SAR #	Impact/SAR length	Impact Factor
	Mountain Valley Pipeline	Giles	R4SB3	050500020602	10/25/2016		14	1

Name(s) of Evaluator(s)	Stream Name and Information
J.Cook, E.Foster	S-SS2, Intermittent, MVP-GI-232

1. Channel Condition: Assess the cross-section of the stream and prevailing condition (erosion, aggradation)

Conditional Category

	Optimal	Suboptimal	Marginal	Poor	Severe	
						
Channel Condition	Very little incision or active erosion; 80-100% stable banks. Vegetative surface protection or natural rock, prominent (80-100%). AND/OR Stable point bars/bankfull benches are present. Access to their original floodplain or fully developed wide bankfull benches. Mid-channel bars, and transverse bars few. Transient sediment deposition covers less than 10% of bottom.	Slightly incised, few areas of active erosion or unprotected banks. Majority of banks are stable (60-80%). Vegetative protection or natural rock prominent (60-80%) AND/OR Depositional features contribute to stability. The bankfull and low flow channels are well defined. Stream likely has access to bankfull benches, or newly developed floodplains along portions of the reach. Transient sediment covers 10-40% of the stream bottom.	Often incised, but less than Severe or Poor. Banks more stable than Severe or Poor due to lower bank slopes. Erosion may be present on 40-60% of both banks. Vegetative protection on 40-60% of banks. Streambanks may bevertical or undercut. AND/OR 40-60% of stream is covered by sediment. Sediment may be temporary/transient, contribute instability. Deposition that contribute to stability, may be forming/present. AND/OR V-shaped channels have vegetative protection on > 40% of the banks and depositional features which contribute to stability.	Overwidened/incised. Vertically/laterally unstable. Likely to widen further. Majority of both banks are near vertical. Erosion present on 60-80% of banks. Vegetative protection present on 20-40% of banks, and is insufficient to prevent erosion. AND/OR 60-80% of the stream is covered by sediment. Sediment is temporary/transient in nature, and contributing to instability. AND/OR V-shaped channels have vegetative protection is present on > 40% of the banks and stable sediment deposition is absent.	Deeply incised (or aggraded), vertical/lateral instability. Severe incision, flow contained within the banks. Streambed below average rooting depth, majority of banks vertical/undercut. Vegetative protection present on less than 20% of banks, is not preventing erosion. Obvious bank sloughing present. Erosion/raw banks on 80-100%. AND/OR Aggrading channel. Greater than 80% of stream bed is covered by deposition, contributing to instability. Multiple thread channels and/or subterranean flow.	CI
Score	3	2.4	2	1.6	1	3.0
NOTES>>	Stable channel condition					

2. RIPARIAN BUFFERS: Assess both bank's 100 foot riparian areas along the entire SAR. (rough measurements of length & width may be acceptable)

Conditional Category

	Optimal	Suboptimal		Marginal		Poor	
Riparian Buffers	Tree stratum (dbh > 3 inches) present, with > 60% tree canopy cover and a non-maintained understory. Wetlands located within the riparian areas.	High Suboptimal: Riparian areas with tree stratum (dbh > 3 inches) present, with 30% to 60% tree canopy cover and containing both herbaceous and shrub layers or a non-maintained understory.	Low Suboptimal: Riparian areas with tree stratum (dbh > 3 inches) present, with > 30% tree canopy cover and a maintained understory. Recent culover (dense vegetation).	High Marginal: Non-maintained, dense herbaceous vegetation with either a shrub layer or a tree layer (dbh > 3 inches) present, with <30% tree canopy cover.	Low Marginal: Non-maintained, dense herbaceous vegetation, riparian areas lacking shrub and tree stratum, hay production, ponds, open water. If present, tree stratum (dbh >3 inches) present, with <30% tree canopy cover with maintained understory.	High Poor: Lawns, mowed, and maintained areas, nurseries; no-till cropland; actively grazed pasture, sparsely vegetated non-maintained area, recently seeded and stabilized, or other comparable condition.	Low Poor: Impervious surfaces, mine spoil lands, denuded surfaces, row crops, active feed lots, trails, or other comparable conditions.
		High	Low	High	Low	High	Low
Condition Scores	1.5	1.2	1.1	0.85	0.75	0.6	0.5

NOTES>>

1. Delineate riparian arees along each stream bank into Condition Categories and Condition Scores using the descriptors.
2. Determine square footage for each by measuring or estimating length and width. Calculators are provided for you below.
3. Enter the % Riparian Area and Score for each riparian category in the blocks below.

Ensure the sums of % Riparian Blocks equal 100

Right Bank	% Riparian Area>	100%						100%	
	Score >	1.5							
Left Bank	% Riparian Area>	100%						100%	
	Score >	1.5							

CI= (Sum % RA * Scores*0.01)/2

Rt Bank CI >	1.50	CI
Lt Bank CI >	1.50	1.50

3. INSTREAM HABITAT: Varied substrate sizes, water velocity and depths, woody and leafy debris; stable substrate; low embededness; shade; undercut banks; root mats; SAV; riffle pools complexes; stable features.

Conditional Category

	Optimal	Suboptimal	Marginal	Poor	
Instream Habitat/ Available Cover	Habitat elements are typically present in greater than 50% of the reach.	Stable habitat elements are typically present in 30-50% of the reach and are adequate for maintenance of populations.	Stable habitat elements are typically present in 10-30% of the reach and are adequate for maintenance of populations.	Habitat elements listed above are lacking or are unstable. Habitat elements are typically present in less than 10% of the reach.	CI
Score	1.5	1.2	0.9	0.5	1.50

NOTES>>

Stream Impact Assessment Form Page 2

Project #	Applicant	Locality	Cowardin Class.	HUC	Date	Data Point	SAR length	Impact Factor
	Mountain Valley Pipeline	Giles		050500020602	10/25/2016		500	1

4. CHANNEL ALTERATION: Stream crossings, riprap, concrete, gabions, or concrete blocks, straightening of channel, channelization, embankments, spoil piles, constrictions, livestock

NOTES>> Culverted

	Conditional Category						
	Negligible	Minor		Moderate		Severe	
Channel Alteration	Channelization, dredging, alteration, or hardening absent. Stream has an unaltered pattern or has naturalized.	Less than 20% of the stream reach is disrupted by any of the channel alterations listed in the parameter guidelines.	20-40% of the stream reach is disrupted by any of the channel alterations listed in the parameter guidelines.	40 - 60% of reach is disrupted by any of the channel alterations listed in the parameter guidelines. If stream has been channelized, normal stable stream meander pattern has not recovered.	60 - 80% of reach is disrupted by any of the channel alterations listed in the parameter guidelines. If stream has been channelized, normal stable stream meander pattern has not recovered.	Greater than 80% of reach is disrupted by any of the channel alterations listed in the parameter guidelines AND/OR 80% of banks shored with gabion, riprap, or cement.	
SCORE	1.5	1.3	1.1	0.9	0.7	0.5	1.30

REACH CONDITION INDEX and STREAM CONDITION UNITS FOR THIS REACH

NOTE: The CIs and RCI should be rounded to 2 decimal places. The CR should be rounded to a whole number.

THE REACH CONDITION INDEX (RCI) >>	1.46

RCI= (Sum of all CI's)/5

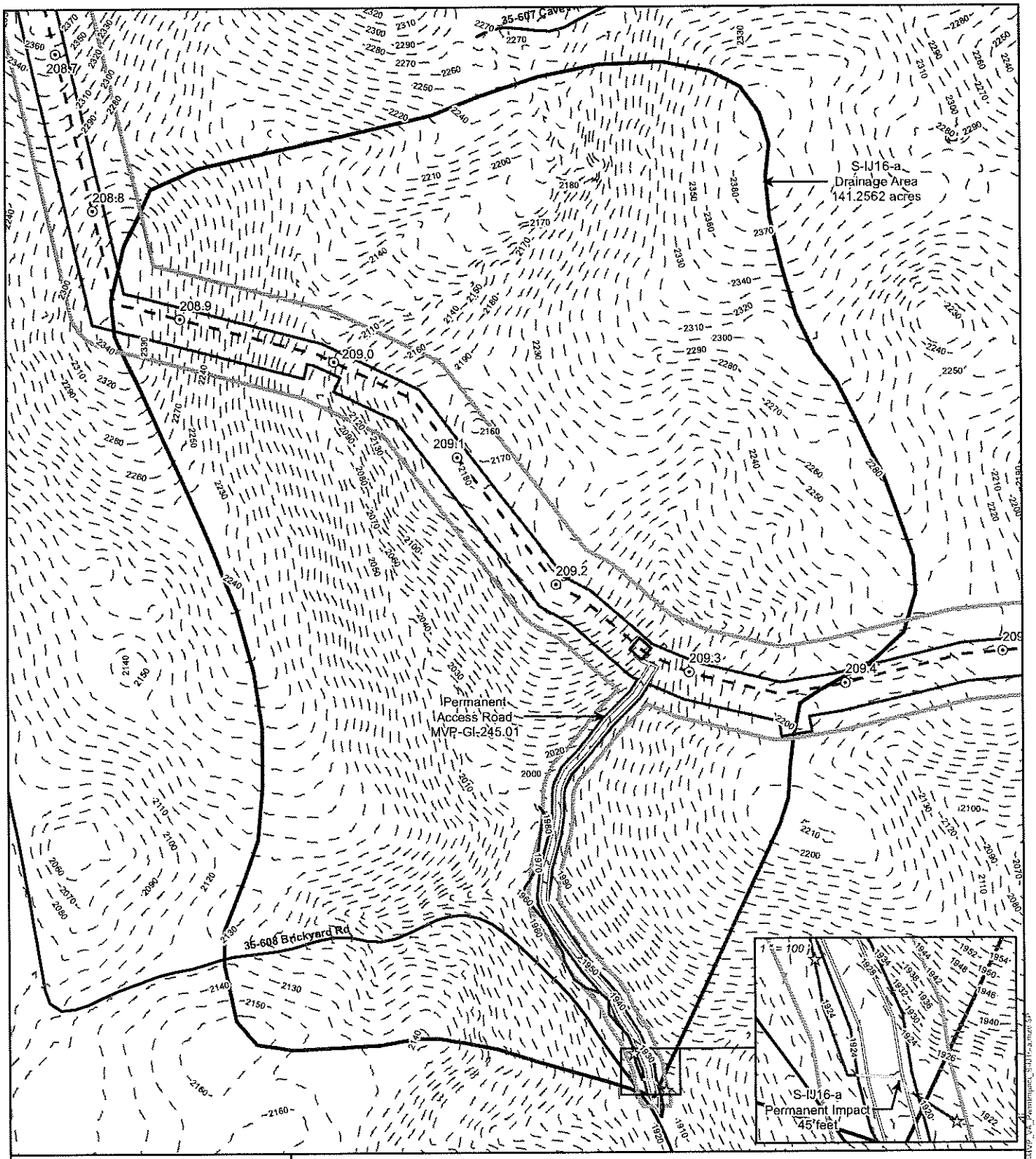
COMPENSATION REQUIREMENT (CR) >>	20

CR = RCI X LF X IF

INSERT PHOTOS:

DESCRIBE PROPOSED IMPACT:

S-IJ16a



Mountain Valley Pipeline Project

N

NAD 1983 UTM 17N

1" = 440'

440 220 0 440 Feet

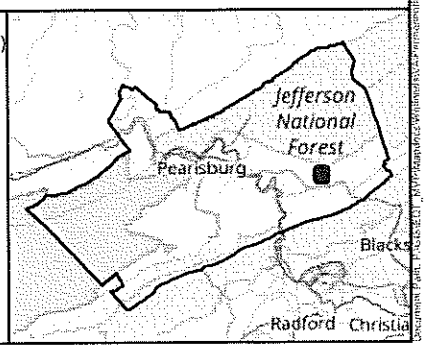
Mountain Valley PIPELINE

Figure 1:
Permanent Impacts for
Stream S-IJ16-a
Giles County

SEPTEMBER, 2017

Data Sources: ESRI Streaming Data © 2014
Elevation data derived from LiDAR provided by EQT 2016
and from the West Virginia GIS Clearinghouse.

- Milepost
- Alignment Centerline
- Permanent Facility
- Access Road Permanent LOD
- Limit of Disturbance
- Preliminary Jurisdictional Determination Boundary
- Unified Stream Method (USM) Survey Reach
- Stream Permanent Impact
- Ephemeral Stream
- Drainage Area



Photograph Number: 1 **Feature Name:** S-IJ16-a **Flow Regime:** Ephemeral

Direction: SE **Date:** 4/14/2016

STREAM ID S-IJ16-a	**STREAM NAME** UNT to Sinking Creek
CLIENT MVP	**PROJECT NAME** MVP
LAT 37.312740 **LONG** -80.545017	**DATE** 04/14/2016 **COUNTY** Giles
INVESTIGATORS E. Foster, S. Lieb, J. Niergarth	
WATER TYPE TNW ☐ RPW ☐ NRPW ☑	**FLOW REGIME** Perennial ☐ Intermittent ☐ Ephemeral ☑

CHANNEL FEATURES

Estimate Measurements
Top of Bank Width: 7.0 ft
Top of Bank Height:
LB 2.0 ft RB 2.0 ft
Water Depth: 0.00 in
Water Width: 0.0 ft
Ordinary High Water Mark (Width): 4.0 ft
Ordinary High Water Mark (Height): 6.0 in
Flow Direction: South

Sinuosity __ Low ✓ Medium __ High

Gradient ✓ Flat (0.5/100 ft) __ Moderate (2 ft/100 ft) __ Severe (10 ft/100 ft)

Stream Erosion
__ None ✓ Moderate __ Heavy

Artificial, Modified or Channelized
✓ Yes __ No

Within Roadside Ditch
__ Yes ✓ No

Culvert Present ✓ Yes __ No
Culvert Material: Corrugated Metal
Culvert Size: 24 in

FLOW CHARACTERISTICS

Water Present
✓ No water, stream bed dry
__ Stream bed moist
__ Standing water
__ Flowing water

Velocity
__ Fast __ Moderate
__ Slow

Proportion of Reach Represented by Stream Morphology Types (Only enter if water present)
Riffle % Run %
Pool %

Turbidity
__ Clear __ Slightly turbid __ Turbid
__ Other_____

INORGANIC SUBSTRATE COMPONENTS (should add up to 100%) 100

Substrate Type	Diameter	% Composition in Sampling Reach
Bedrock		
Boulder	> 256 mm (10")	40
Cobble	64-256 mm (2.5"-10")	20
Gravel	2-64 mm (0.1"-2.5")	20
Sand	0.06-2mm (gritty)	10
Silt	0.004-0.06 mm	10
Clay	< 0.004 mm (slick)	

ORGANIC SUBSTRATE COMPONENTS (does not necessarily add up to 100%)

Substrate Type	Characteristic	% Composition in Sampling Area
Detritus	sticks, wood, coarse plant materials (CPOM)	15
Muck-Mud	black, very fine organic (FPOM)	
Marl	grey, shell fragments	

WATERSHED FEATURES

Predominant Surrounding Landuse
✓ Forest __ Commercial
__ Field/Pasture __ Industrial
__ Agricultural __ Residential
__ ROW __ Other:

Canopy Cover
__ Open ✓ Partly shaded
__ Shaded

Floodplain Width
__ Wide > 30ft __ Moderate 15-30ft
✓ Narrow <15ft

MACROINVERTEBRATES/OTHER WILDLIFE OBSERVED OR OTHER NOTES AND OBSERVATIONS

Ephemeral Stream Assessment Form (Form 1a)

Unified Stream Methodology for use in Virginia

For use in ephemeral streams

Project #	Project Name	Locality	Cowardin Class.	HUC	Date	SAR #	Impact/SAR length	Impact Factor
	Mountain Valley Pipeline	Giles	R6	05050002	8/23/2017		45	1

Name(s) of Evaluator(s)	Stream Name and Information
James Cook, Emily Foster	S-IJ16-a

2. RIPARIAN BUFFERS: Assess both bank's 100 foot riparian areas along the entire SAR. (rough measurements of length & width may be acceptable)

	Conditional Category						
	Optimal	Suboptimal		Marginal		Poor	
Riparian Buffers	Tree stratum (dbh > 3 inches) present, with > 60% tree canopy cover and an non-maintained understory. Wetlands areas.	High Suboptimal: Riparian areas with tree stratum (dbh > 3 inches) present, with 30% to 60% tree canopy cover and containing both herbaceous and shrub layers or a non-maintained understory.	Low Suboptimal: Riparian areas with tree stratum (dbh > 3 inches) present, with >30% tree canopy cover and a maintained understory. Recent cutover (dense vegetation).	High Marginal: Non-maintained, dense herbaceous vegetation with either a shrub layer or a tree layer (dbh > 3 inches) present, with <30% tree canopy cover.	Low Marginal: Non-maintained, dense herbaceous vegetation, riparian areas lacking shrub and tree stratum, hay production, ponds, open water. If present, tree stratum (dbh >3 inches) present, with <30% tree canopy cover with maintained understory.	High Poor: Lawns, mowed, and maintained areas, nurseries; no-till cropland; actively grazed pasture, sparsely vegetated non-maintained area, recently seeded and stabilized, or other comparable condition.	Low Poor: Impervious surfaces, mine spoil lands, denuded surfaces, row crops, active feed lots, trails, or other comparable conditions.
		High	Low	High	Low	High	Low
Condition Scores	1.5	1.2	1.1	0.85	0.75	0.6	0.5

NOTES>> Majority of the impact area is outside of the permanent road, though it does cross perpandicular to the asset. Bed was dry during the early spring. At area of impact, the majority of the canopy is low suboptimal to high marginal, with the right ripairan buffer extends into an impermeable road surface.

1. Delineate riparian areas along each stream bank into Condition Categories and Condition Scores using the descriptors.
2. Determine square footage for each by measuring or estimating length and width. Calculators are provided for you below.
3. Enter the % Riparian Area and Score for each riparian category in the blocks below.

Ensure the sums of % Riparian Blocks equal 100

Right Bank	% Riparian Area>	80%	20%					100%			
	Score >	1.2	0.5								
									CI= (Sum % RA * Scores*0.01)/2		
Left Bank	% Riparian Area>	70%	30%					100%	Rt Bank CI >	1.06	CI
	Score >	1.1	0.85						Lt Bank CI >	1.03	1.04

REACH CONDITION INDEX and STREAM CONDITION UNITS FOR THIS REACH

NOTE: The CIs and RCI should be rounded to 2 decimal places. The CR should be rounded to a whole number.

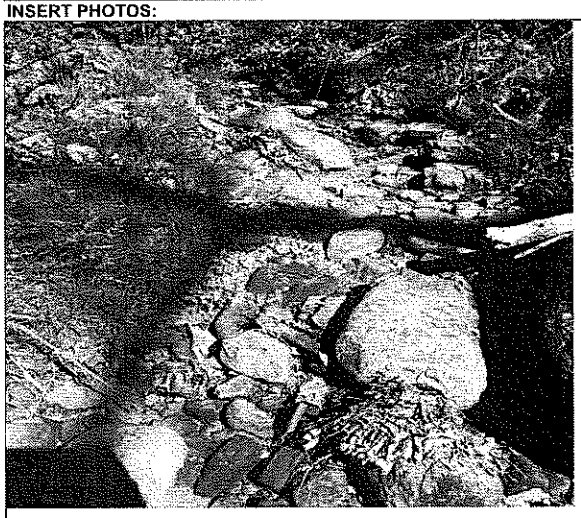
THE REACH CONDITION INDEX (RCI) >>	0.52

RCI= (Riparian CI)/2

COMPENSATION REQUIREMENT (CR) >>	23

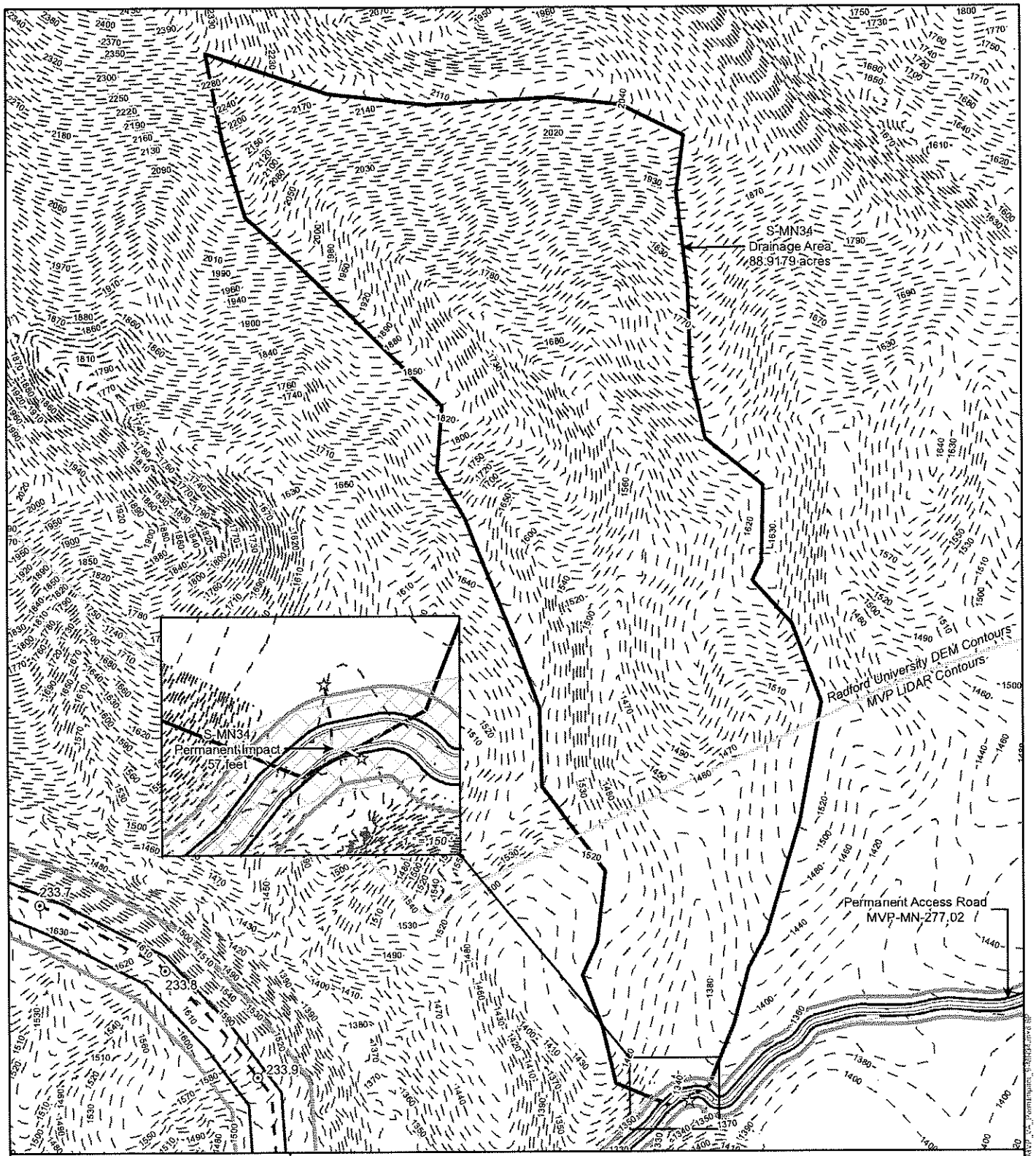
CR = RCI X LF X IF

INSERT PHOTOS:



DESCRIBE PROPOSED IMPACT:

S-MN34



Mountain Valley Pipeline Project

N

NAD 1983 UTM 17N

1 " = 150 '

500 250 0 500 Feet

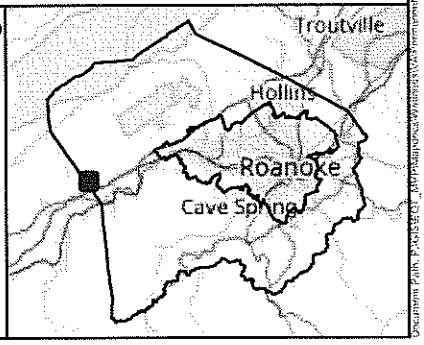
Mountain Valley PIPELINE

Figure 1:
Permanent Impacts for
Stream S-MN34
Roanoke County

SEPTEMBER, 2017

Data Sources: ESRI Streaming Data © 2014
Elevation data derived from LiDAR provided by EQT 2016
and from Radford University DEM files.

- Milepost
- Alignment Centerline
- Access Road Permanent LOD
- Limit of Disturbance
- Preliminary Jurisdictional Determination Boundary
- Unsurveyed Areas
- Unified Stream Method (USM) Survey Reach
- Stream Permanent Impact
- Intermittent Stream
- Drainage Area



Photograph Number: 1 **Feature Name:** S-MN34 **Flow Regime:** Intermittent

Direction: NW **Date:** 6/5/2017

STREAM ID S-MN34	**STREAM NAME** UNT to Roanoke River
CLIENT MVP	**PROJECT NAME** MVP
LAT 37.250481 **LONG** -80.204971	**DATE** 06/05/2017 **COUNTY** Montgomery
INVESTIGATORS S Ryan, S Pilcher	
WATER TYPE TNW ☐ RPW ☑ NRPW ☐	**FLOW REGIME** Perennial ☐ Intermittent ☑ Ephemeral ☐

CHANNEL FEATURES

Estimate Measurements
Top of Bank Width: 5.0 ft
Top of Bank Height:
LB 1.0 ft RB 1.0 ft
Water Depth: 3.00 in
Water Width: 5.0 ft
Ordinary High Water Mark (Width): 4.5 ft
Ordinary High Water Mark (Height): 6.0 in
Flow Direction: Southeast

Sinuosity ✓ Low ___ Medium ___ High

Gradient ___ Flat (0.5/100 ft) ✓ Moderate (2 ft/100 ft) ___ Severe (10 ft/100 ft)

Stream Erosion
✓ None ___ Moderate ___ Heavy

Artificial, Modified or Channelized
___ Yes ✓ No

Within Roadside Ditch
___ Yes ✓ No

Culvert Present ___ Yes ✓ No
Culvert Material: _____
Culvert Size: _____ in

FLOW CHARACTERISTICS

Water Present
___ No water, stream bed dry
___ Stream bed moist
___ Standing water
✓ Flowing water

Velocity
___ Fast ✓ Moderate
___ Slow

Proportion of Reach Represented by Stream Morphology Types (Only enter if water present)
Riffle 60 % Run 20 %
Pool 20 %

Turbidity
✓ Clear ___ Slightly turbid ___ Turbid
___ Other _____

INORGANIC SUBSTRATE COMPONENTS (should add up to 100%) 100			**ORGANIC SUBSTRATE COMPONENTS (does not necessarily add up to 100%)**		
Substrate Type	Diameter	% Composition in Sampling Reach	Substrate Type	Characteristic	% Composition in Sampling Area
Bedrock			Detritus	sticks, wood, coarse plant materials (CPOM)	10
Boulder	> 256 mm (10")	20			
Cobble	64-256 mm (2.5"-10")	20	Muck-Mud	black, very fine organic (FPOM)	0
Gravel	2-64 mm (0.1"-2.5")	40			
Sand	0.06-2mm (gritty)	20	Marl	grey, shell fragments	0
Silt	0.004-0.06 mm				
Clay	< 0.004 mm (slick)				

WATERSHED FEATURES

Predominant Surrounding Landuse
✓ Forest ___ Commercial
___ Field/Pasture ___ Industrial
___ Agricultural ___ Residential
___ ROW ___ Other:

Canopy Cover
___ Open ___ Partly shaded
✓ Shaded

Floodplain Width
___ Wide > 30ft ___ Moderate 15-30ft
✓ Narrow <15ft

MACROINVERTEBRATES/OTHER WILDLIFE OBSERVED OR OTHER NOTES AND OBSERVATIONS

Stream crosses existing road through eroded depression to join S-MN12.

Stream Assessment Form (Form 1)

Unified Stream Methodology for use in Virginia

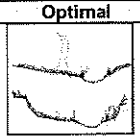
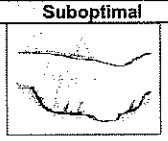
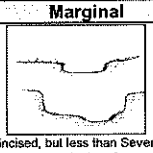
For use in wadeable channels classified as intermittent or perennial

Project #	Project Name	Locality	Cowardin Class.	HUC	Date	SAR #	Impact/SAR length	Impact Factor
	Mountain Valley Pipeline	Montgomery	R4SB3	030101010301	06/05/2017		57	1

Name(s) of Evaluator(s)	Stream Name and Information
Stephen Ryan, Stephen Pilcher	S-MN34 Intermittent

1. Channel Condition: Assess the cross-section of the stream and prevailing condition (erosion, aggradation)

Conditional Category

	Optimal	Suboptimal	Marginal	Poor	Severe	
						
Channel Condition	Very little incision or active erosion; 80-100% stable banks. Vegetative surface protection or natural rock, prominent (80-100%). AND/OR Stable point bars/bankfull benches are present. Access to their original floodplain or fully developed wide bankfull benches. Mid-channel bars, and transverse bars few. Transient sediment deposition covers less than 10% of bottom.	Slightly incised, few areas of active erosion or unprotected banks. Majority of banks are stable (60-80%). Vegetative protection or natural rock prominent (60-80%) AND/OR Depositional features contribute to stability. The bankfull and low flow channels are well defined. Stream likely has access to bankfull benches, or newly developed floodplains along portions of the reach. Transient sediment covers 10-40% of the stream bottom.	Often incised, but less than Severe or Poor. Banks more stable than Severe or Poor due to lower bank slopes. Erosion may be present on 40-60% of both banks. Vegetative protection on 40-60% of banks. Streambanks may bevertical or undercut. AND/OR 40-60% of stream is covered by sediment. Sediment may be temporary/transient, contribute instability. Deposition that contribute to stability, may be forming/present. AND/OR V-shaped channels have vegetative protection on > 40% of the banks and depositional features which contribute to stability.	Overwidened/incised. Vertically/laterally unstable. Likely to widen further. Majority of both banks are near vertical. Erosion present on 60-80% of banks. Vegetative protection present on 20-40% of banks, and is insufficient to prevent erosion. AND/OR 60-80% of the stream is covered by sediment. Sediment is temporary/transient in nature, and contributing to instability. AND/OR V-shaped channels have vegetative protection is present on > 40% of the banks and stable sediment deposition is absent.	Deeply incised (or excavated), vertical/lateral instability. Severe incision, flow contained within the banks. Streambed below average rooting depth, majority of banks vertical/undercut. Vegetative protection present on less than 20% of banks, is not preventing erosion. Obvious bank sloughing present. Erosion/raw banks on 80-100%. AND/OR Aggrading channel. Greater than 80% of stream bed is covered by deposition, contributing to instability. Multiple thread channels and/or subterranean flow.	CI
Score	3	2.4	2	1.6	1	3.0

NOTES>> Little to no incision with apparently stable channel and natural rock stability along majority of banks.

2. RIPARIAN BUFFERS: Assess both bank's 100 foot riparian areas along the entire SAR. (rough measurements of length & width may be acceptable)

Conditional Category

	Optimal	Suboptimal		Marginal		Poor	
Riparian Buffers	Tree stratum (dbh > 3 inches) present, with > 60% tree canopy cover and a non-maintained understory. Wetlands located within the riparian areas.	**High Suboptimal:** Riparian areas with tree stratum (dbh > 3 inches) present, with 30% to 60% tree canopy cover and containing both herbaceous and shrub layers or a non-maintained understory.	**Low Suboptimal:** Riparian areas with tree stratum (dbh > 3 inches) present, with > 30% tree canopy cover and a maintained understory. Recent cutover (dense vegetation).	**High Marginal:** Non-maintained, dense herbaceous vegetation with either a shrub layer or a tree layer (dbh > 3 inches) present, with <30% tree canopy cover.	**Low Marginal:** Non-maintained, dense herbaceous vegetation, riparian areas lacking shrub and tree stratum, hay production, ponds, open water. If present, tree stratum (dbh >3 inches) present, with <30% tree canopy cover with maintained understory.	High Poor: Lawns, mowed, and maintained areas, nurseries; no-till cropland; actively grazed pasture, sparsely vegetated non-maintained area, recently seeded and stabilized, or other comparable condition.	**Low Poor:** Impervious surfaces, mine spoil lands, denuded surfaces, row crops, active feed lots, trails, or other comparable conditions.
		High	Low	High	Low	High	Low
Condition Scores	1.5	1.2	1.1	0.85	0.75	0.6	0.5

NOTES>> **Riparian area consists primarily of a hardwood canopy with a moderate mid-story and understory. Existing access road crosses stream channel. No culvert present (over-road flow). The percentages described represent the riparian area along the approximately 100ft delineated reach only (90% forest, 10% road)**

1. Delineate riparian areas along each stream bank into Condition Categories and Condition Scores using the descriptors.
2. Determine square footage for each by measuring or estimating length and width. Calculators are provided for you below.
3. Enter the % Riparian Area and Score for each riparian category in the blocks below.

Ensure the sums of % Riparian Blocks equal 100

Right Bank	% Riparian Area>	90%	10%						100%
	Score >	1.2	0.5						
Left Bank	% Riparian Area>	90%	10%						100%
	Score >	1.2	0.5						

CI= (Sum % RA * Scores*0.01)/2

Rt Bank CI >	1.13	CI
Lt Bank CI >	1.13	1.13

3. INSTREAM HABITAT: Varied substrate sizes, water velocity and depths; woody and leafy debris; stable substrate; low embededness; shade; undercut banks; root mats; SAV; riffle pools complexes; stable features.

Conditional Category

	Optimal	Suboptimal	Marginal	Poor	
Instream Habitat/ Available Cover	Habitat elements are typically present in greater than 50% of the reach.	Stable habitat elements are typically present in 30-50% of the reach and are adequate for maintenance of populations.	Stable habitat elements are typically present in 10-30% of the reach and are adequate for maintenance of populations.	Habitat elements listed above are lacking or are unstable. Habitat elements are typically present in less than 10% of the reach.	CI
Score	1.5	1.2	0.9	0.5	1.20

NOTES>> **Low to moderate riffle/pool complexity. Substrate realtively high in sand but also contains a cobble/gravel/boulder component.**

Stream Impact Assessment Form Page 2

Project #	Applicant	Locality	Cowardin Class.	HUC	Date	Data Point	SAR length	Impact Factor
	Mountain Valley Pipeline	Montgomery		030101010301	06/05/2017		500	1

4. CHANNEL ALTERATION: Stream crossings, riprap, concrete, gabions, or concrete blocks, straightening of channel, channelization, embankments, spoil piles, constrictions, livestock

NOTES>> Road crosses unculverted stream channel.

	Conditional Category						
	Negligible	Minor		Moderate		Severe	
Channel Alteration	Channelization, dredging, alteration, or hardening absent. Stream has an unaltered pattern or has naturalized.	Less than 20% of the stream reach is disrupted by any of the channel alterations listed in the parameter guidelines.	20-40% of the stream reach is disrupted by any of the channel alterations listed in the parameter guidelines.	40 - 60% of reach is disrupted by any of the channel alterations listed in the parameter guidelines. If stream has been channelized, normal stable stream meander pattern has not recovered.	60 - 80% of reach is disrupted by any of the channel alterations listed in the parameter guidelines. If stream has been channelized, normal stable stream meander pattern has not recovered.	Greater than 80% of reach is disrupted by any of the channel alterations listed in the parameter guidelines AND/OR 80% of banks shored with gabion, riprap, or cement.	
SCORE	1.5	1.3	1.1	0.9	0.7	0.5	1.10

REACH CONDITION INDEX and STREAM CONDITION UNITS FOR THIS REACH

NOTE: The CIs and RCI should be rounded to 2 decimal places. The CR should be rounded to a whole number.

THE REACH CONDITION INDEX (RCI) >>	1.29

RCI= (Sum of all CI's)/5

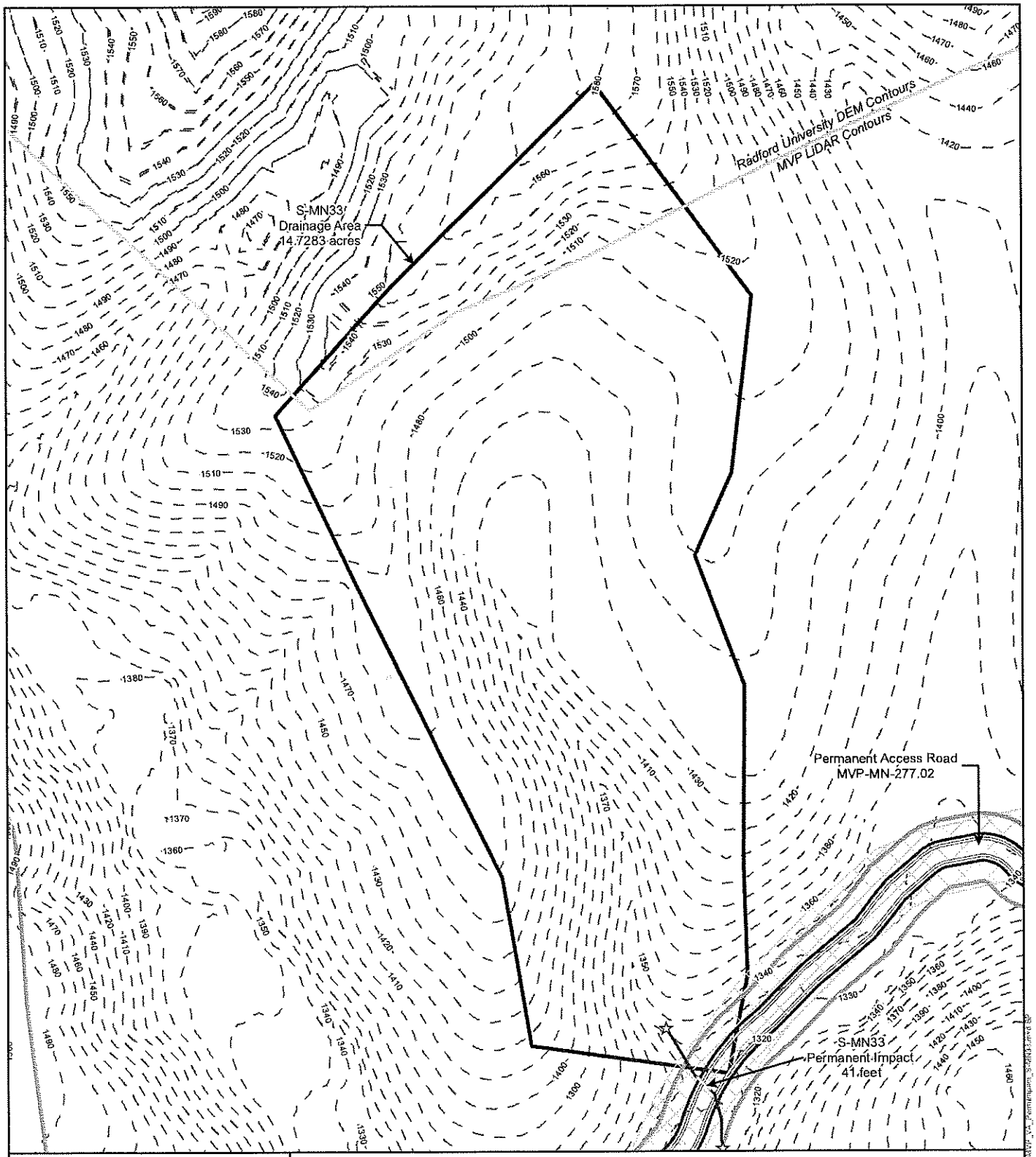
COMPENSATION REQUIREMENT (CR) >>	74

CR = RCI X LF X IF

INSERT PHOTOS:

DESCRIBE PROPOSED IMPACT:

S-MN33



Mountain Valley Pipeline Project

N

NAD 1983 UTM 17N

1 " = 200 '

200 100 0 200 Feet

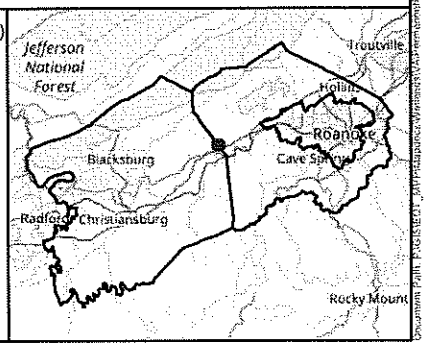
Mountain Valley PIPELINE

Figure 1:
Permanent Impacts for
Stream S-MN32
Roanoke County

SEPTEMBER, 2017

Data Sources: ESRI Streaming Data © 2014
Elevation data derived from LiDAR provided by EQT 2016
and from Radford University DEM files.

- Access Road Permanent LOD
- Limit of Disturbance
- Preliminary Jurisdictional Determination Boundary
- Unsurveyed Areas
- Unified Stream Method (USM) Survey Reach
- Stream Permanent Impact
- Ephemeral Stream
- Drainage Area



Photograph Number: 69 **Feature Name:** S-MN33 **Flow Regime:** Ephemeral

Direction: S **Date:** 6/5/2017

STREAM ID S-MN33	**STREAM NAME** UNT to Roanoke River
CLIENT MVP	**PROJECT NAME** MVP
LAT 37.249537 **LONG** -80.206186	**DATE** 06/05/2017 **COUNTY** Montgomery
INVESTIGATORS S Ryan, S Pilcher	
WATER TYPE TNW ☐ RPW ☐ NRPW ☑	**FLOW REGIME** Perennial ☐ Intermittent ☐ Ephemeral ☑

CHANNEL FEATURES

Estimate Measurements
Top of Bank Width: 5.0 ft
Top of Bank Height:
LB 2.0 ft RB 2.0 ft
Water Depth: 2.00 in
Water Width: 1.0 ft
Ordinary High Water Mark (Width): 4.0 ft
Ordinary High Water Mark (Height): 6.0 in
Flow Direction: Southeast

Sinuosity ✓ Low ___ Medium ___ High

Gradient ___ Flat (0.5/100 ft) ___ Moderate (2 ft/100 ft) ✓ Severe (10 ft/100 ft)

Stream Erosion
✓ None ___ Moderate ___ Heavy

Artificial, Modified or Channelized
___ Yes ✓ No

Within Roadside Ditch
___ Yes ✓ No

Culvert Present ___ Yes ✓ No
Culvert Material: _____
Culvert Size: _____ in

FLOW CHARACTERISTICS

Water Present
___ No water, stream bed dry
___ Stream bed moist
___ Standing water
✓ Flowing water

Velocity
___ Fast ✓ Moderate
___ Slow

Proportion of Reach Represented by Stream Morphology Types (Only enter if water present)
Riffle 60 % Run 20 %
Pool 20 %

Turbidity
✓ Clear ___ Slightly turbid ___ Turbid
___ Other _____

INORGANIC SUBSTRATE COMPONENTS (should add up to 100%) 100

Substrate Type	Diameter	% Composition in Sampling Reach
Bedrock		20
Boulder	> 256 mm (10")	10
Cobble	64-256 mm (2.5"-10")	10
Gravel	2-64 mm (0.1"-2.5")	40
Sand	0.06-2mm (gritty)	20
Silt	0.004-0.06 mm	
Clay	< 0.004 mm (slick)	

ORGANIC SUBSTRATE COMPONENTS (does not necessarily add up to 100%)

Substrate Type	Characteristic	% Composition in Sampling Area
Detritus	sticks, wood, coarse plant materials (CPOM)	20
Muck-Mud	black, very fine organic (FPOM)	0
Marl	grey, shell fragments	0

WATERSHED FEATURES

Predominant Surrounding Landuse
✓ Forest ___ Commercial
___ Field/Pasture ___ Industrial
___ Agricultural ___ Residential
___ ROW ___ Other:

Canopy Cover
___ Open ___ Partly shaded
✓ Shaded

Floodplain Width
___ Wide > 30ft ___ Moderate 15-30ft
✓ Narrow <15ft

MACROINVERTEBRATES/OTHER WILDLIFE OBSERVED OR OTHER NOTES AND OBSERVATIONS

Leaf debris suggests recent heavy flow. Stream crosses existing road through eroded depression.

Ephemeral Stream Assessment Form (Form 1a)

Unified Stream Methodology for use in Virginia

For use in ephemeral streams

Project #	Project Name	Locality	Cowardin Class.	HUC	Date	SAR #	Impact/SAR length	Impact Factor
	Mountain Valley Pipeline	Montgomery	R6	030101010301	6/5/17		41	1

Name(s) of Evaluator(s)	Stream Name and Information
Stephen Ryan, Stephen Pilcher	S-MN33 Ephemeral

2. RIPARIAN BUFFERS: Assess both bank's 100 foot riparian areas along the entire SAR. (rough measurements of length & width may be acceptable)

	Conditional Category							NOTES>>
	Optimal	Suboptimal		Marginal		Poor		Riparian area consists primarily of a hardwood canopy with little understory north of access road (score of 1.2). Canopy similar on south side of access road but understory increases (score of 1.1). Existing access road crosses stream channel (score of 0.5). No culvert present (over-road flow).
Riparian Buffers	Tree stratum (dbh > 3 inches) present, with > 60% tree canopy cover and an non-maintained understory. Wetlands areas.	High Suboptimal: Riparian areas with tree stratum (dbh > 3 inches) present, with 30% to 60% tree canopy cover and containing both herbaceous and shrub layers or a non-maintained understory.	Low Suboptimal: Riparian arees with tree stratum (dbh > 3 inches) present, with >30% tree canopy cover and a maintained understory. Recent cutover (dense vegetation).	High Marginal: Non-maintained, dense herbaceous vegetation with either a shrub layer or a tree layer (dbh > 3 inches) present, with <30% tree canopy cover.	Low Marginal: Non-maintained, dense herbaceous vegetation, riparian areas lacking shrub and tree stratum, hay production, ponds, open water. If present, tree stratum (dbh >3 inches) present, with <30% tree canopy cover with maintained understory.	High Poor: Lawns, mowed, and maintained areas; nurseries; no-till cropland; actively grazed pasture, sparsely vegetated non-maintained area, recently seeded and stabilized, or other comparable condition.	Low Poor: Impervious surfaces, mine spoil lands, denuded surfaces, row crops, active feed lots, trails, or other comparable conditions.	
		High	Low	High	Low	High	Low	
Condition Scores	1.5	1.2	1.1	0.85	0.75	0.6	0.5	

1. Delineate riparian areas along each stream bank into Condition Categories and Condition Scores using the descriptors.
2. Determine square footage for each by measuring or estimating length and width. Calculators are provided for you below.
3. Enter the % Riparian Area and Score for each riparian category in the blocks below.

Ensure the sums of % Riparian Blocks equal 100

Right Bank	% Riparian Area>	45%	45%	10%				100%			
	Score >	1.2	1.1	0.5							
									CI= (Sum % RA * Scores*0.01)/2		
Left Bank	% Riparian Area>	45%	45%	10%				100%	Rt Bank CI >	1.09	CI
	Score >	1.2	1.1	0.5					Lt Bank CI >	1.09	1.09

REACH CONDITION INDEX and STREAM CONDITION UNITS FOR THIS REACH

NOTE: The CIs and RCI should be rounded to 2 decimal places. The CR should be rounded to a whole number.

THE REACH CONDITION INDEX (RCI) >>	0.55

RCI= (Riparian CI)/2

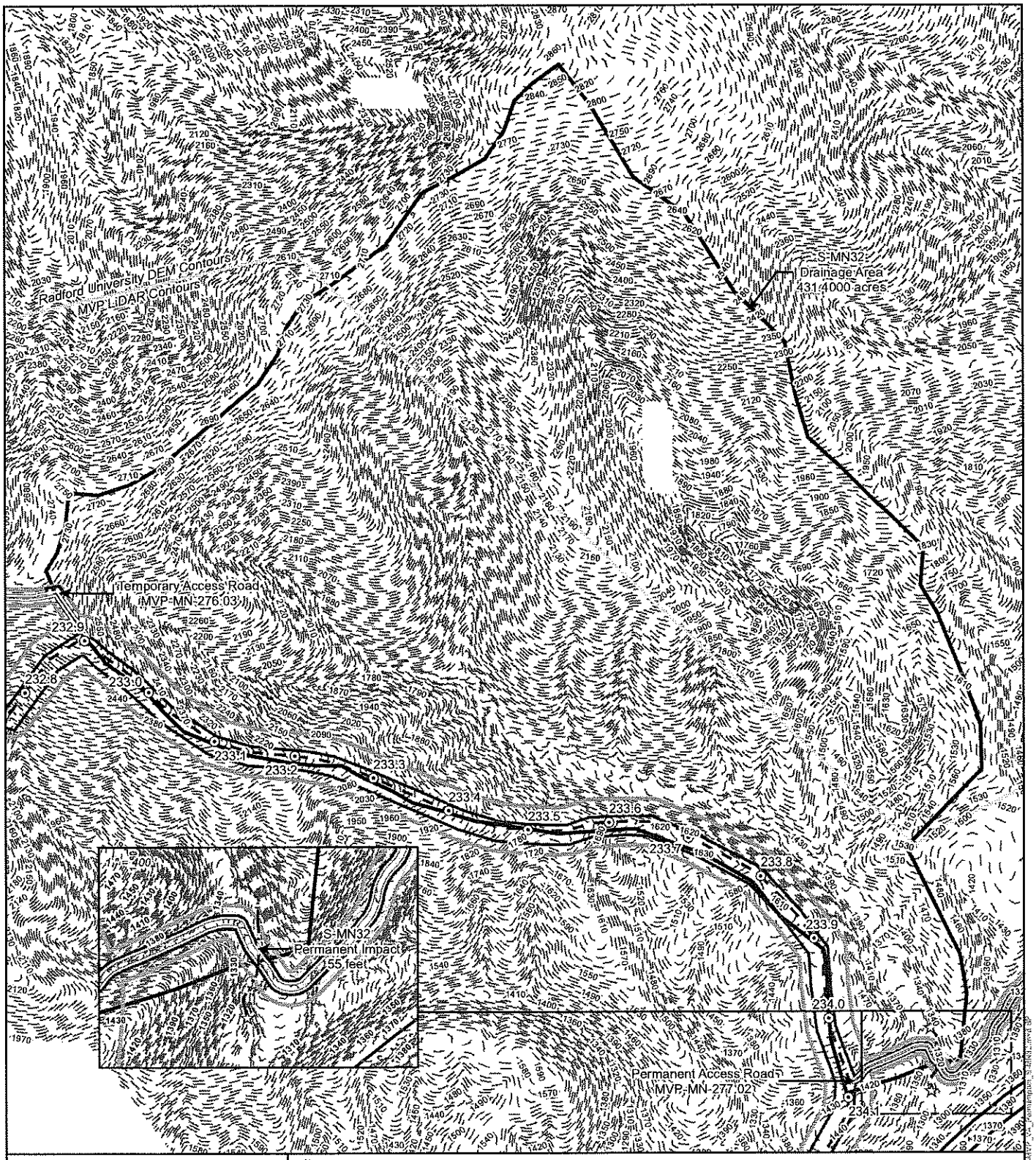
COMPENSATION REQUIREMENT (CR) >>	23

CR = RCI X LF X IF

INSERT PHOTOS:

DESCRIBE PROPOSED IMPACT:

S-MN32



Mountain Valley Pipeline Project

NAD 1983 UTM 17N

1 " = 860 '

860 430 0 860 Feet

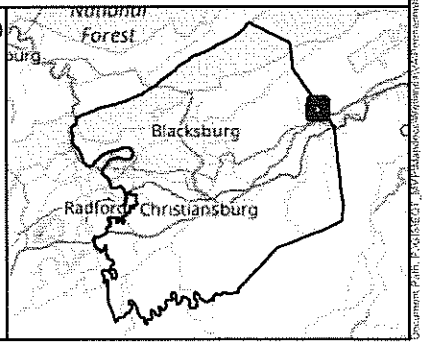
Mountain Valley PIPELINE

Figure 1:
Permanent Impacts for Stream S-MN32
Montgomery County

SEPTEMBER, 2017

Data Sources: ESRI Streaming Data © 2014
Elevation data derived from LiDAR provided by EQT 2016 and from Radford University DEM files.

- Milepost
- Alignment Centerline
- Access Road Temporary LOD
- Access Road Permanent LOD
- Limit of Disturbance
- Preliminary Jurisdictional Determination Boundary
- Unsurveyed Areas
- Unified Stream Method (USM) Survey Reach
- Stream Permanent Impact
- Perennial Stream
- Drainage Area



Photograph Number: 1 **Feature Name:** S-MN32 **Flow Regime:** Perennial

Direction: N **Date:** 6/5/2017

STREAM ID S-MN32	**STREAM NAME** UNT to Roanoke River
CLIENT MVP	**PROJECT NAME** MVP
LAT 37.248563 **LONG** -80.207761	**DATE** 06/05/2017 **COUNTY** Montgomery
INVESTIGATORS S Ryan, S Pilcher	
WATER TYPE TNW ☐ RPW ☑ NRPW ☐	**FLOW REGIME** Perennial ☑ Intermittent ☐ Ephemeral ☐

CHANNEL FEATURES	**Estimate Measurements** Top of Bank Width: 11.0 ft Top of Bank Height: LB 3.0 ft RB 3.0 ft Water Depth: 5.00 in Water Width: 5.0 ft Ordinary High Water Mark (Width): 8.0 ft Ordinary High Water Mark (Height): 8.0 in Flow Direction: South	**Sinuosity** ___ Low ✓ Medium ___ High **Gradient** ___ Flat (0.5/100 ft) ✓ Moderate (2 ft/100 ft) ___ Severe (10 ft/100 ft) **Stream Erosion** ✓ None ___ Moderate ___ Heavy **Artificial, Modified or Channelized** ___ Yes ✓ No **Within Roadside Ditch** ___ Yes ✓ No **Culvert Present** ___ Yes ✓ No Culvert Material: _____ Culvert Size: _____ in
FLOW CHARACTERISTICS	**Water Present** ___ No water, stream bed dry ___ Stream bed moist ___ Standing water ✓ Flowing water **Velocity** ___ Fast ✓ Moderate ___ Slow	**Proportion of Reach Represented by Stream Morphology Types** (Only enter if water present) Riffle 35 % Run 35 % Pool 30 % **Turbidity** ✓ Clear ___ Slightly turbid ___ Turbid ___ Other _____

INORGANIC SUBSTRATE COMPONENTS (should add up to 100%) 100			**ORGANIC SUBSTRATE COMPONENTS (does not necessarily add up to 100%)**		
Substrate Type	Diameter	% Composition in Sampling Reach	Substrate Type	Characteristic	% Composition in Sampling Area
Bedrock		25	Detritus	sticks, wood, coarse plant materials (CPOM)	15
Boulder	> 256 mm (10")	10			
Cobble	64-256 mm (2.5"-10")	25	Muck-Mud	black, very fine organic (FPOM)	0
Gravel	2-64 mm (0.1"-2.5")	25			
Sand	0.06-2mm (gritty)	15	Marl	grey, shell fragments	0
Silt	0.004-0.06 mm				
Clay	< 0.004 mm (slick)				

WATERSHED FEATURES	**Predominant Surrounding Landuse** ✓ Forest ___ Commercial ___ Field/Pasture ___ Industrial ___ Agricultural ___ Residential ___ ROW ___ Other: **Canopy Cover** ___ Open ___ Partly shaded ✓ Shaded	**Floodplain Width** ___ Wide > 30ft ___ Moderate 15-30ft ✓ Narrow <15ft

MACROINVERTEBRATES/OTHER WILDLIFE OBSERVED OR OTHER NOTES AND OBSERVATIONS

Stream flows over existing road, which was built up causing a 5' waterfall. Minnows present in stream.

Stream Assessment Form (Form 1)

Unified Stream Methodology for use in Virginia

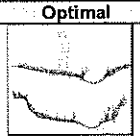
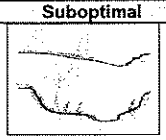
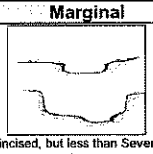
For use in wadeable channels classified as intermittent or perennial

Project #	Project Name	Locality	Cowardin Class.	HUC	Date	SAR #	Impact/SAR length	Impact Factor
	Mountain Valley Pipeline	Montgomery	R3UB1	030101010301	06/05/2017		55	1

Name(s) of Evaluator(s)	Stream Name and Information
Stephen Ryan, Stephen Pilcher	S-MN32 perennial

1. Channel Condition: Assess the cross-section of the stream and prevailing condition (erosion, aggradation)

Conditional Category

	Optimal	Suboptimal	Marginal	Poor	Severe	
Channel Condition	 Very little incision or active erosion; 80-100% stable banks. Vegetative surface protection or natural rock, prominent (80-100%). AND/OR Stable point bars/bankfull benches are present. Access to their original floodplain or fully developed wide bankfull benches. Mid-channel bars, and transverse bars few. Transient sediment deposition covers less than 10% of bottom.	 Slightly incised, few areas of active erosion or unprotected banks. Majority of banks are stable (60-80%). Vegetative protection or natural rock prominent (60-80%) AND/OR Depositional features contribute to stability. The bankfull and low flow channels are well defined. Stream likely has access to bankfull benches, or newly developed floodplains along portions of the reach. Transient sediment covers 10-40% of the stream bottom.	 Often incised, but less than Severe or Poor. Banks more stable than Severe or Poor due to lower bank slopes. Erosion may be present on 40-60% of both banks. Vegetative protection on 40-60% of banks. Streambanks may bevertical or undercut. AND/OR 40-60% of stream is covered by sediment. Sediment may be temporary/transient, contribute instability. Deposition that contribute to stability, may be forming/present. AND/OR V-shaped channels have vegetative protection on > 40% of the banks and depositional features which contribute to stability.	Overwidened/incised. Vertically/laterally unstable. Likely to widen further. Majority of both banks are near vertical. Erosion present on 60-80% of banks. Vegetative protection present on 20-40% of banks, and is insufficient to prevent erosion. AND/OR 60-80% of the stream is covered by sediment. Sediment is temporary/transient in nature, and contributing to instability. AND/OR V-shaped channels have vegetative protection is present on > 40% of the banks and stable sediment deposition is absent.	[illegible], vertical/lateral instability. Severe incision, flow contained within the banks. Streambed below average rooting depth, majority of banks vertical/undercut. Vegetative protection present on less than 20% of banks, is not preventing erosion. Obvious bank sloughing present. Erosion/raw banks on 80-100%. AND/OR Aggrading channel. Greater than 80% of stream bed is covered by deposition, contributing to instability. Multiple thread channels and/or subterranean flow.	CI
Score	3	2.4	2	1.6	1	3.0

NOTES>> Little to no incision with apparently stable channel and natural rock stability along majority of banks.

2. RIPARIAN BUFFERS: Assess both bank's 100 foot riparian areas along the entire SAR. (rough measurements of length & width may be acceptable)

Conditional Category

	Optimal	Suboptimal		Marginal		Poor	
Riparian Buffers	Tree stratum (dbh > 3 inches) present. with > 60% tree canopy cover and a non-maintained understory. Wetlands located within the riparian areas.	**High Suboptimal:** Riparian areas with tree stratum (dbh > 3 inches) present, with 30% to 60% tree canopy cover and containing both herbaceous and shrub layers or a non-maintained understory.	**Low Suboptimal:** Riparian areas with tree stratum (dbh > 3 inches) present, with > 30% tree canopy cover and a maintained understory. Recent cutover (dense vegetation).	**High Marginal:** Non-maintained, dense herbaceous vegetation with either a shrub layer or a tree layer (dbh > 3 inches) present, with <30% tree canopy cover.	**Low Marginal:** Non-maintained, dense herbaceous vegetation, riparian areas lacking shrub and tree stratum, hay production, ponds, open water. If present, tree stratum (dbh >3 inches) present, with <30% tree canopy cover with maintained understory.	**High Poor:** Lawns, mowed, and maintained areas, nurseries; no-till cropland; actively grazed pasture, sparsely vegetated non-maintained area, recently seeded and stabilized, or other comparable condition.	**Low Poor:** Impervious surfaces, mine spoil lands, denuded surfaces, row crops, active feed lots, trails, or other comparable conditions.
		High	Low	High	Low	High	Low
Condition Scores	1.5	1.2	1.1	0.85	0.75	0.6	0.5

NOTES>> Riparian area consists primarily of a hardwood canopy with a moderate mid-story and understory. Existing access road crosses stream channel. No culvert present (over-road flow). The percentages described represent the riparian area along the approximately 100ft delineated reach only (90% forest, 10% road)

1. Delineate riparian areas along each stream bank into Condition Categories and Condition Scores using the descriptors.
2. Determine square footage for each by measuring or estimating length and width. Calculators are provided for you below.
3. Enter the % Riparian Area and Score for each riparien category in the blocks below.

Ensure the sums of % Riparian Blocks equel 100

Right Bank	% Riparian Area>	90%	10%					100%	
	Score >	1.2	0.5						
Left Bank	% Riparian Area>	90%	10%					100%	
	Score >	1.2	0.5						

CI= (Sum % RA * Scores*0.01)/2

Rt Bank CI >	1.13	CI
Lt Bank CI >	1.13	1.13

3. INSTREAM HABITAT: Varied substrate sizes, water velocity and depths; woody and leafy debris; stable substrate; low embededness; shade; undercut banks; root mats; SAV; riffle pools complexes, stable features.

Conditional Category

	Optimal	Suboptimal	Marginal	Poor	
Instream Habitat/ Available Cover	Habitat elements are typically present in greater than 50% of the reach.	Stable habitat elements are typically present in 30-50% of the reach and are adequate for maintenance of populations.	Stable habital elements are typically present in 10-30% of the reach and are adequate for maintenance of populations.	Habitat elements listed above are lacking or are unstable. Habital elements are typically present in less than 10% of the reach.	CI
Score	1.5	1.2	0.9	0.5	1.50

NOTES>> Riffle/pool mosaic through most of delineated reach.Habitat elements appear stable and present in greater than 50% of reach.

Stream Impact Assessment Form Page 2

Project #	Applicant	Locality	Cowardin Class.	HUC	Date	Data Point	SAR length	Impact Factor
	Mountain Valley Pipeline	Montgomery		030101010301	06/05/2017		500	1

4. CHANNEL ALTERATION: Stream crossings, riprap, concrete, gabions, or concrete blocks, straightening of channel, channelization, embankments, spoil piles, constrictions, livestock

NOTES>> Road crosses unculvertad channel and man-made timber dam present just south of road crossing. Remainder of reach is unaltered.

	Conditional Category						
	Negligible	Minor		Moderate		Severe	
Channel Alteration	Channelization, dredging, alteration, or hardening absent. Stream has an unaltered pattern or has naturalized.	Less than 20% of the stream reach is disrupted by any of the channel alterations listed in the parameter guidelines.	20-40% of the stream reach is disrupted by any of the channel alterations listed in the parameter guidelines.	40 - 60% of reach is disrupted by any of the channel alterations listed in the parameter guidelines. If stream has been channelized, normal stable stream meander pattern has not recovered.	60 - 80% of reach is disrupted by any of the channel alterations listed in the parameter guidelines. If stream has been channelized, normal stable stream meander pattern has not recovered.	Greater than 80% of reach is disrupted by any of the channel alterations listed in the parameter guidelines AND/OR 80% of banks shored with gabion, riprap, or cement.	
SCORE	1.5	1.3	1.1	0.9	0.7	0.5	1.10

REACH CONDITION INDEX and STREAM CONDITION UNITS FOR THIS REACH

NOTE: The CIs and RCI should be rounded to 2 decimal places. The CR should be rounded to a whole number.

THE REACH CONDITION INDEX (RCI) >>	1.35

RCI= (Sum of all CI's)/5

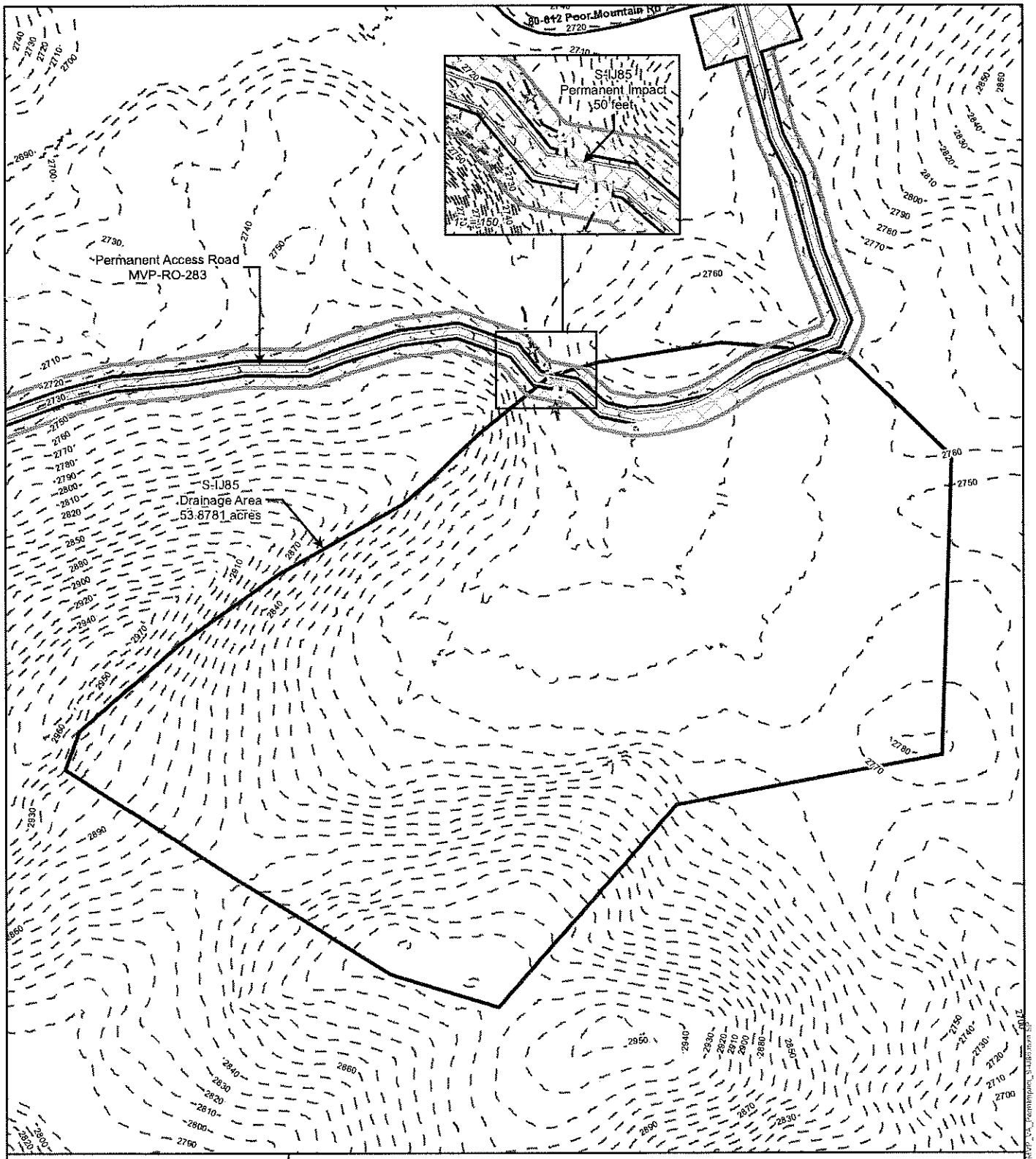
COMPENSATION REQUIREMENT (CR) >>	74

CR = RCI X LF X IF

INSERT PHOTOS:

DESCRIBE PROPOSED IMPACT:

S-IJ85



Mountain Valley Pipeline Project

N

NAD 1983 UTM 17N

1 " = 350 '

350 175 0 350 Feet

Mountain Valley PIPELINE

Figure 1:
Permanent Impacts for
Stream S-IJ85
Roanoke County

SEPTEMBER, 2017

Access Road Permanent LOD

Limit of Disturbance

Preliminary Jurisdictional Determination Boundary

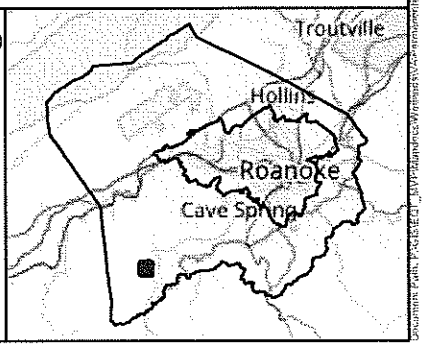
Unsurveyed Areas

Unified Stream Method (USM) Survey Reach

Stream Permanent Impact

Perennial Stream

Drainage Area



Data Sources: ESRI Streaming Data © 2014
Elevation data derived from LiDAR provided by EQT 2016

Photograph Number: 1 **Feature Name:** S-IJ85 **Flow Regime:** Perennial

Direction: NNW **Date:** 8/29/2017

STREAM ID S-IJ85	**STREAM NAME** UNT to Bottom Creek
CLIENT MVP	**PROJECT NAME** MVP
LAT 37.169583 **LONG** -80.130428	**DATE** 08/29/2017 **COUNTY** Roanoke
INVESTIGATORS E. Foster, K. Pulver, S. Pilcher	
WATER TYPE TNW ☐ RPW ☑ NRPW ☐	**FLOW REGIME** Perennial ☑ Intermittent ☐ Ephemeral ☐

CHANNEL FEATURES

Estimate Measurements
Top of Bank Width: 8.0 ft
Top of Bank Height:
LB 1.5 ft RB 1.5 ft
Water Depth: 2.00 in
Water Width: 4.0 ft
Ordinary High Water Mark (Width): 5.0 ft
Ordinary High Water Mark (Height): 4.0 in
Flow Direction: South

Sinuosity __ Low ✓ Medium __ High

Gradient __ Flat (0.5/100 ft) ✓ Moderate (2 ft/100 ft) __ Severe (10 ft/100 ft)

Stream Erosion
__ None __ Moderate __ Heavy

Artificial, Modified or Channelized
__ Yes ✓ No

Within Roadside Ditch
__ Yes ✓ No

Culvert Present __ Yes ✓ No
Culvert Material: _____
Culvert Size: _____ in

FLOW CHARACTERISTICS

Water Present
__ No water, stream bed dry
__ Stream bed moist
__ Standing water
✓ Flowing water

Velocity
__ Fast ✓ Moderate
__ Slow

Proportion of Reach Represented by Stream Morphology Types (Only enter if water present)
Riffle 25 % Run 60 %
Pool 15 %

Turbidity
__ Clear ✓ Slightly turbid __ Turbid
__ Other _____

INORGANIC SUBSTRATE COMPONENTS (should add up to 100%) 100

Substrate Type	Diameter	% Composition in Sampling Reach
Bedrock		
Boulder	> 256 mm (10")	
Cobble	64-256 mm (2.5"-10")	
Gravel	2-64 mm (0.1"-2.5")	20
Sand	0.06-2mm (gritty)	70
Silt	0.004-0.06 mm	10
Clay	< 0.004 mm (slick)	

ORGANIC SUBSTRATE COMPONENTS (does not necessarily add up to 100%)

Substrate Type	Characteristic	% Composition in Sampling Area
Detritus	sticks, wood, coarse plant materials (CPOM)	
Muck-Mud	black, very fine organic (FPOM)	
Marl	grey, shell fragments	

WATERSHED FEATURES

Predominant Surrounding Landuse
✓ Forest __ Commercial
__ Field/Pasture __ Industrial
__ Agricultural __ Residential
__ ROW ✓ Other: Unimproved road

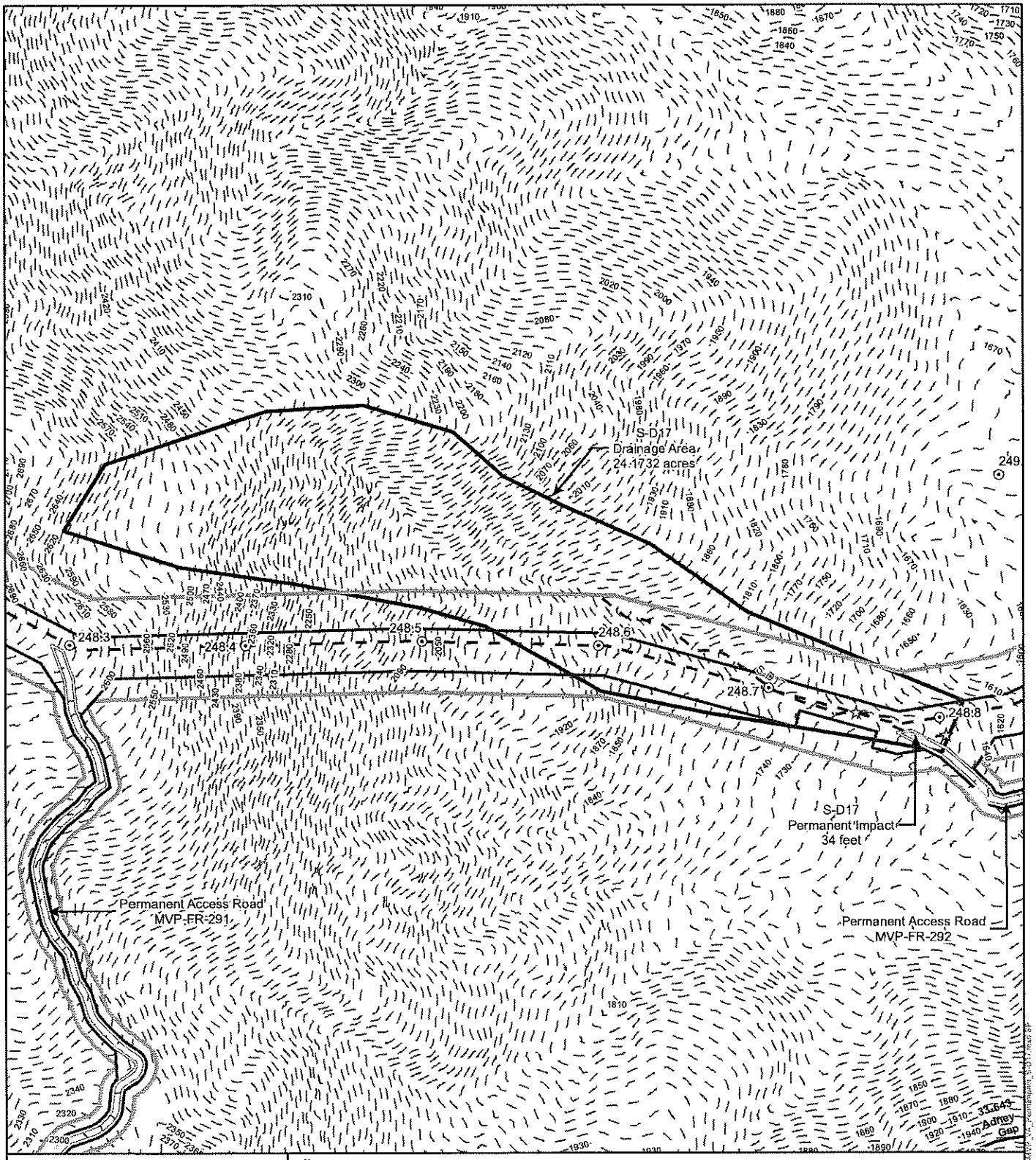
Floodplain Width
✓ Wide > 30ft __ Moderate 15-30ft
__ Narrow <15ft

Canopy Cover
__ Open __ Partly shaded
__ Shaded

MACROINVERTEBRATES/OTHER WILDLIFE OBSERVED OR OTHER NOTES AND OBSERVATIONS

No macros. Small fish in pools

S-D17



Mountain Valley Pipeline Project

N

NAD 1983 UTM 17N

1 " = 400 '

400 200 0 400 Feet

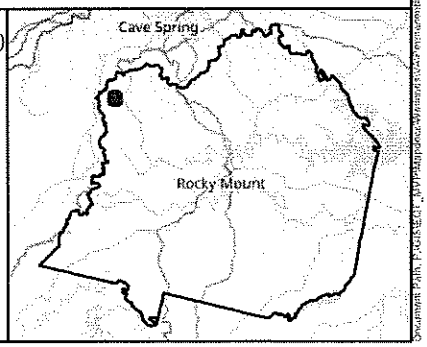
Mountain Valley PIPELINE

Figure 1:
Permanent Impacts for
Stream S-D17
Franklin County

SEPTEMBER, 2017

Data Sources: ESRI Streaming Data © 2014
Elevation data derived from LiDAR provided by EQT 2016

- Milepost
- Alignment Centerline
- Access Road Permanent LOD
- Limit of Disturbance
- Preliminary Jurisdictional Determination Boundary
- Unified Stream Method (USM) Survey Reach
- Stream Permanent Impact
- Intermittent Stream
- Drainage Area



Photograph Number: 1 **Feature Name:** S-D17 **Flow Regime:** Intermittent

Direction: SSE **Date:** 4/7/2015

STREAM ID S-D17	**STREAM NAME** UNT to North Fork Blackwater River
LAT 37.121529 **LONG** -80.088575	**DATE** 04/07/2015
CLIENT MVP	**PROJECT NAME** MVP
INVESTIGATORS A. Bensted, J. Kraus, A. Larson	
FLOW REGIME Perennial ___ Intermittent ✓ Ephemeral ___	**WATER TYPE** TNW ___ RPW ✓ NRPW ___

CHANNEL FEATURES

Estimate Measurements
Top of Bank Width: 7 ft
Top of Bank Height:
LB 6.0 in RB 6.0 in
Water Depth: 1.00 in
Water Width: 4.0 ft
High Water Mark: 2.0 in
Flow Direction: Southeast

Stream Erosion
✓ None ___ Moderate ___ Heavy

Artificial, Modified or Channelized
___ Yes ✓ No

Dam Present ___ Yes ✓ No

Sinuosity ___ Low ✓ Medium ___ High

Gradient
___ Flat (0.5/100 ft) ___ Moderate (2 ft/100 ft) ✓ Severe (10 ft/100 ft)

FLOW CHARACTERISTICS

Water Present
___ No water, stream bed dry
___ Stream bed moist
___ Standing water
✓ Flowing water

Velocity
___ Fast ___ Moderate
✓ Slow

Proportion of Reach Represented by Stream Morphology Types
Riffle 100 % Run %
Pool %

Turbidity
✓ Clear ___ Slightly turbid ___ Turbid
___ Opaque ___ Stained
___ Other_____

INORGANIC SUBSTRATE COMPONENTS (should add up to 100%)			ORGANIC SUBSTRATE COMPONENTS (does not necessarily add up to 100%)		
Substrate Type	Diameter	% Composition in Sampling Reach	Substrate Type	Characteristic	% Composition in Sampling Area
Bedrock			Detritus	sticks, wood, coarse plant materials (CPOM)	25
Boulder	> 256 mm (10")	20			
Cobble	64-256 mm (2.5"-10")	20	Muck-Mud	black, very fine organic (FPOM)	
Gravel	2-64 mm (0.1"-2.5")	20			
Sand	0.06-2mm (gritty)	20	Marl	grey, shell fragments	
Silt	0.004-0.06 mm	15			
Clay	< 0.004 mm (slick)	5			

WATERSHED FEATURES

Predominant Surrounding Landuse
✓ Forest ___ Commercial
___ Field/Pasture ___ Industrial
___ Agricultural ___ Residential
___ Other:

Canopy Cover
___ Partly open ✓ Partly shaded
___ Shaded ___ Open

Indicate the dominant type (Check one)
✓ Trees ___ Shrubs
___ Grasses ___ Herbaceous

Floodplain Width
✓ Wide > 30ft ___ Moderate 15-30ft
___ Narrow <16ft

Wetland Present ___ Yes ✓ No
Wetland ID

AQUATIC VEGETATION

Indicate the dominant type and record the dominant species present
___ Rooted emergent ___ Rooted submergent ___ Rooted floating ___ Free floating
___ Floating algae ___ Attached algae

MACROINVERTEBRATES OR OTHER WILDLIFE OBSERVED/OTHER OBSERVATIONS AND NOTES

Stream begins just upslope of project boundary, at a small seep. Water level likely high due to rain the day of the survey. Flow goes subsurface before leaving the project corridor.

Stream Assessment Form (Form 1)

Unified Stream Methodology for use in Virginia

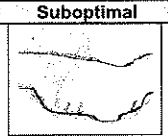
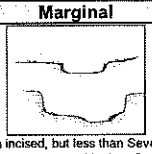
For use in wadeable channels classified as intermittent or perennial

Project #	Project Name	Locality	Cowardin Class.	HUC	Date	SAR #	Impact/SAR length	Impact Factor
	Mountain Valley Pipeline	Franklin	R4RB3	030101010501	11/15/2016		34	1

Name(s) of Evaluator(s)	Stream Name and Information
J.Cook, E.Foster	S-D17, Franklin County, FR-292

1. Channel Condition: Assess the cross-section of the stream and prevailing condition (erosion, aggradation)

Conditional Category

	Optimal	Suboptimal	Marginal	Poor	Severe	
Channel Condition	Very little incision or active erosion; 80-100% stable banks. Vegetative surface protection or natural rock, prominent (80-100%). AND/OR Stable point bars/bankfull benches are present. Access to their original floodplain or fully developed wide bankfull benches. Mid-channel bars, and transverse bars few. Transient sediment deposition covers less than 10% of bottom.	 Slightly incised, few areas of active erosion or unprotected banks. Majority of banks are stable (60-80%). Vegetative protection or natural rock prominent (60-80%) AND/OR Depositional features contribute to stability. The bankfull and low flow channels are well defined. Stream likely has access to bankfull benches, or newly developed floodplains along portions of the reach. Transient sediment covers 10-40% of the stream bottom.	 Often incised, but less than Severe or Poor. Banks more stable than Severe or Poor due to lower bank slopes. Erosion may be present on 40-60% of both banks. Vegetative protection on 40-60% of banks. Streambanks may beverlical or undercut. AND/OR 40-60% of stream is covered by sediment. Sediment may be temporary/transient, contribute instability. Deposition that contribute to stability, may be forming/present. AND/OR V-shaped channels have vegetative protection on > 40% of the banks and depositional features which contribute to stability.	Overwidened/incised. Vertically/laterally unstable. Likely to widen further. Majority of both banks are near vertical. Erosion present on 60-80% of banks. Vegetative protection present on 20-40% of banks, and is insufficient to prevent erosion. AND/OR 60-80% of the stream is covered by sediment. Sediment is temporary/transient in nature, and contributing to instability. AND/OR V-shaped channels have vegetative protection is present on > 40% of the banks and stable sediment deposition is absent.	D[illegible]a), vertical/lateral instability. Severe incision, flow contained within the banks. Streambed below average rooting depth, majority of banks vertical/undercut. Vegetative protection present on less than 20% of banks, is not preventing erosion. Obvious bank sloughing present. Erosion/raw banks on 80-100%. AND/OR Aggrading channel. Greater than 80% of stream bed is covered by deposition, contributing to instability. Multiple thread channels and/or subterranean flow.	CI
Score	3	2.4	2	1.6	1	1.6

NOTES>> Crossing is eroded portion of the road, water upstream may have gone subsurface.

2. RIPARIAN BUFFERS: Assess both bank's 100 foot riparian areas along the entire SAR. (rough measurements of length & width may be acceptable)

Conditional Category

	Optimal	Suboptimal		Marginal		Poor	
Riparian Buffers	Tree stratum (dbh > 3 inches) present, with > 60% tree canopy cover and a non-maintained understory. Wetlands located within the riparian areas.	High Suboptimal: Riparian areas with tree stratum (dbh > 3 inches) present, with 30% to 60% tree canopy cover and containing both herbaceous and shrub layers or a non-maintained understory.	Low Suboptimal: Riparian areas with tree stratum (dbh > 3 inches) present, with > 30% tree canopy cover and a maintained understory. Recent cutover (dense vegetation).	High Marginal: Non-maintained, dense herbaceous vegetation with either a shrub layer or a tree layer (dbh > 3 inches) present, with <30% tree canopy cover.	Low Marginal: Non-maintained, dense herbaceous vegetation, riparian areas lacking shrub and tree stratum, hay production, ponds, open water. If present, tree stratum (dbh >3 inches) present, with <30% tree canopy cover with maintained understory.	High Poor: Lawns, mowed, and maintained areas, nurseries; no-till cropland; actively grazed pasture, sparsely vegetated non-maintained area, recently seeded and stabilized, or other comparable condition.	Low Poor: Impervious surfaces, mine spoil lands, denuded surfaces, row crops, active feed lots, trails, or other comparable conditions.
		High	Low	High	Low	High	Low
Condition Scores	1.5	1.2	1.1	0.85	0.75	0.6	0.5

NOTES>>

1. Delineate riparian areas along each stream bank into Condition Categories and Condition Scores using the descriptors.
2. Determine square footage for each by measuring or estimating length and width. Calculators are provided for you below.
3. Enter the % Riparian Area and Score for each riparian category in the blocks below.

Ensure the sums of % Riparian Blocks equal 100

Right Bank	% Riparian Area>	90%	10%					100%	
	Score >	0.85	0.6						
Left Bank	% Riparian Area>	90%	10%					100%	
	Score >	0.85	0.6						

CI= (Sum % RA * Scores*0.01)/2

Rt Bank CI >	0.83	CI
Lt Bank CI >	0.83	0.83

3. INSTREAM HABITAT: Varied substrate sizes, water velocity and depths; woody and leafy debris; stable substrate; low embededness; shade; undercut banks; root mats; SAV; riffle pools complexes, stable features.

Conditional Category

	Optimal	Suboptimal	Marginal	Poor	
Instream Habitat/ Available Cover	Habitat elements are typically present in greater than 50% of the reach.	Stable habitat elements are typically present in 30-50% of the reach and are adequate for maintenance of populations.	Stable habitat elements are typically present in 10-30% of the reach and are adequate for maintenance of populations.	Habitat elements listed above are lacking or are unstable. Habitat elements are typically present in less than 10% of the reach.	CI
Score	1.5	1.2	0.9	0.5	0.50

NOTES>>

Stream Impact Assessment Form Page 2

Project #	Applicant	Locality	Cowardin Class.	HUC	Date	Data Point	SAR length	Impact Factor
							500	1

4. CHANNEL ALTERATION: Stream crossings, riprap, concrete, gabions, or concrete blocks, straightening of channel, channelization, embankments, spoil piles, constrictions, livestock

NOTES>>

	Conditional Category						
	Negligible	Minor		Moderate		Severe	
Channel Alteration	Channelization, dredging, alteration, or hardening absent. Stream has an unaltered pattern or has naturalized.	Less than 20% of the stream reach is disrupted by any of the channel alterations listed in the parameter guidelines.	20-40% of the stream reach is disrupted by any of the channel alterations listed in the parameter guidelines.	40 - 60% of reach is disrupted by any of the channel alterations listed in the parameter guidelines. If stream has been channelized, normal stable stream meander pattern has not recovered.	60 - 80% of reach is disrupted by any of the channel alterations listed in the parameter guidelines. If stream has been channelized, normal stable stream meander pattern has not recovered.	Greater than 80% of reach is disrupted by any of the channel alterations listed in the parameter guidelines AND/OR 80% of banks shored with gabion, riprap, or cement.	
SCORE	1.5	1.3	1.1	0.9	0.7	0.5	0.50

REACH CONDITION INDEX and STREAM CONDITION UNITS FOR THIS REACH

NOTE: The CIs and RCI should be rounded to 2 decimal places. The CR should be rounded to a whole number.

THE REACH CONDITION INDEX (RCI) >>	0.69

RCI= (Sum of all CI's)/5

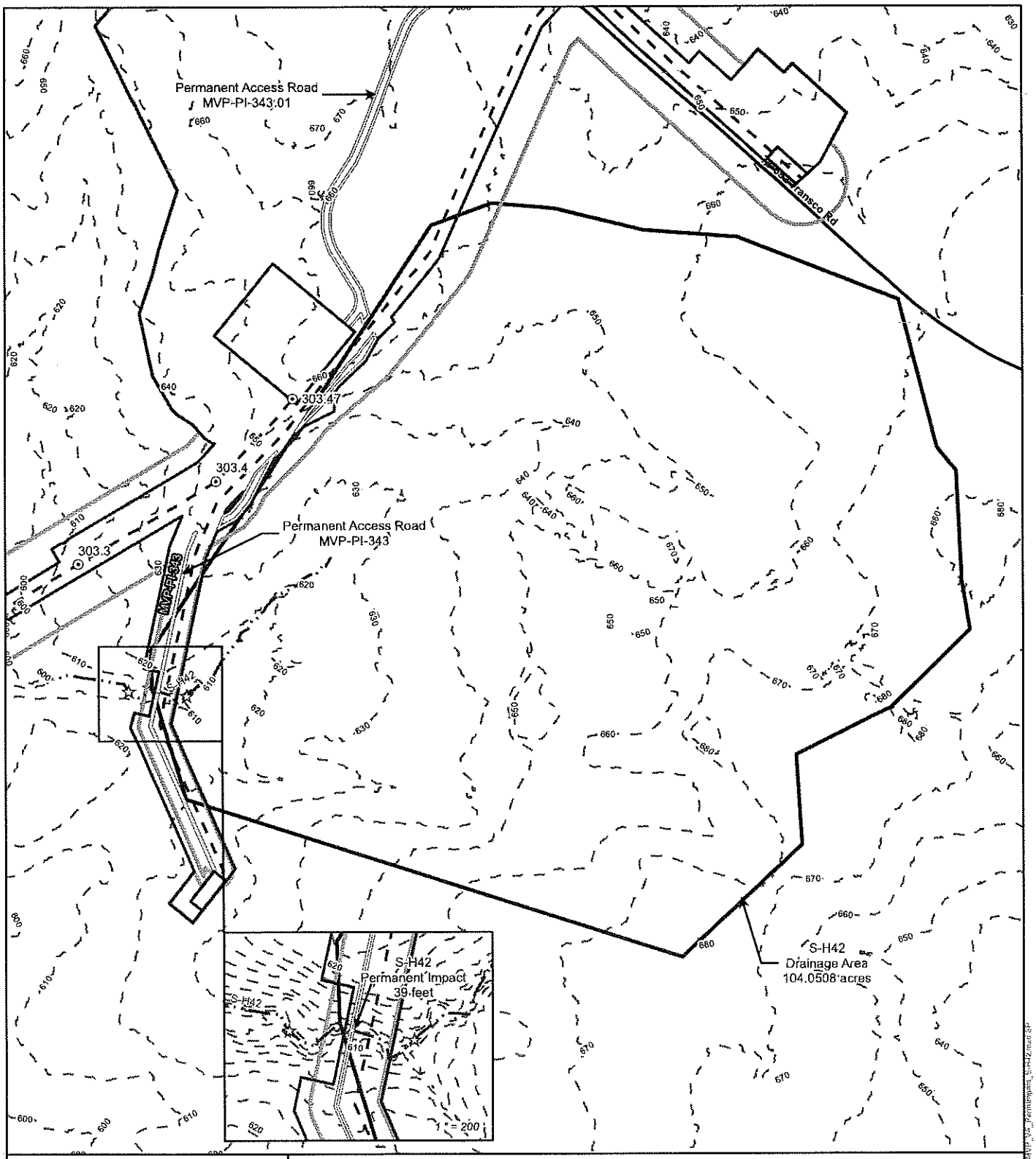
COMPENSATION REQUIREMENT (CR) >>	23

CR = RCI X LF X IF

INSERT PHOTOS:

DESCRIBE PROPOSED IMPACT:

S-H42



Mountain Valley Pipeline Project

N

NAD 1983 UTM 17N

1" = 440'

440 220 0 440 Feet

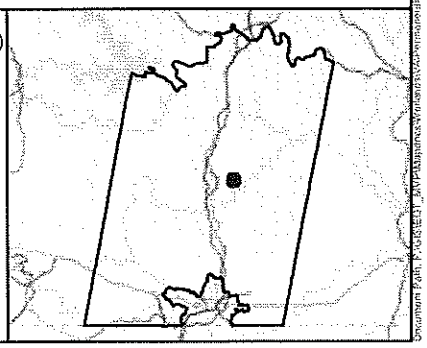
Mountain Valley PIPELINE

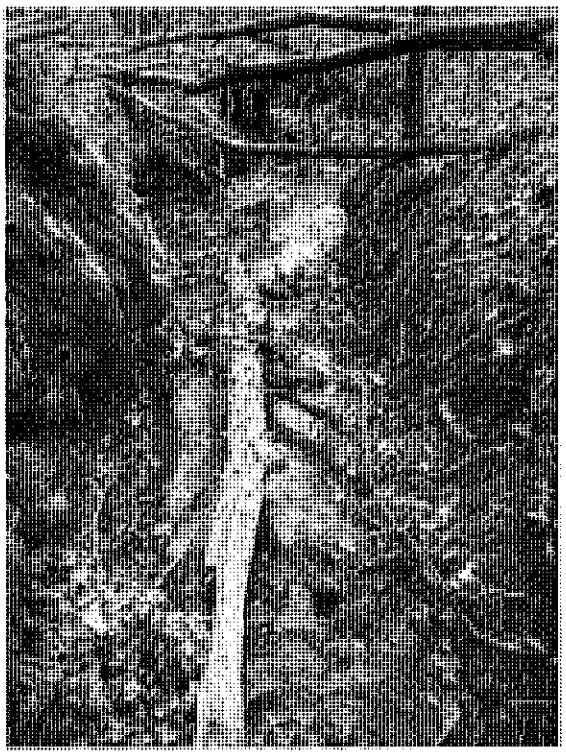
Figure 1:
Permanent Impacts for
Stream S-H42
Pittsylvania County

SEPTEMBER, 2017

Data Sources: ESRI Streaming Data © 2014
Elevation data derived from LiDAR provided by EQT 2016

- Milepost
- Alignment Centerline
- Permanent Facility
- Access Road Permanent LOD
- Limit of Disturbance
- Preliminary Jurisdictional Determination Boundary
- Unified Stream Method (USM) Survey Reach
- Stream Permanent Impact
- Perennial Stream
- Drainage Area





Photograph Number: 1 **Feature Name:** S-H42 **Flow Regime:** Perennial

Direction: NE **Date:** 4/6/2015

STREAM ID S-H42	**STREAM NAME** UNT to Little Cherrystone Creek
LAT 36.829057 **LONG** -79.343877	**DATE** 04/06/2015
CLIENT MVP	**PROJECT NAME** MVP
INVESTIGATORS A.Stott, A.Grech, H.Heist	
FLOW REGIME Perennial ✓ Intermittent ___ Ephemeral ___	**WATER TYPE** TNW ___ RPW ✓ NRPW ___

CHANNEL FEATURES	**Estimate Measurements** Top of Bank Width: 7.0 ft Top of Bank Height: LB 3.0 ft RB 4.0 ft Water Depth: 4.00 in Water Width: 5.0 ft High Water Mark: 2.0 ft Flow Direction: South	**Stream Erosion** ___ None ✓ Moderate ___ Heavy **Artificial, Modified or Channelized** ___ Yes ✓ No **Dam Present** ___ Yes ✓ No **Sinuosity** ✓ Low ___ Medium ___ High **Gradient** ___ Flat (0.5/100 ft) ✓ Moderate (2 ft/100 ft) ___ Severe (10 ft/100 ft)
FLOW CHARACTERISTICS	**Water Present** ___ No water, stream bed dry ___ Stream bed moist ___ Standing water ✓ Flowing water **Velocity** ___ Fast ✓ Moderate ___ Slow	**Proportion of Reach Represented by Stream Morphology Types** Riffle 25 % Run 25 % Pool 50 % **Turbidity** ___ Clear ✓ Slightly turbid ___ Turbid ___ Opaque ___ Stained ___ Other_____

INORGANIC SUBSTRATE COMPONENTS (should add up to 100%)			**ORGANIC SUBSTRATE COMPONENTS (does not necessarily add up to 100%)**		
Substrate Type	Diameter	% Composition in Sampling Reach	Substrate Type	Characteristic	% Composition in Sampling Area
Bedrock			Detritus	sticks, wood, coarse plant materials (CPOM)	15
Boulder	> 256 mm (10")	5			
Cobble	64-256 mm (2.5"-10")	5	Muck-Mud	black, very fine organic (FPOM)	0
Gravel	2-64 mm (0.1"-2.5")	10			
Sand	0.06-2mm (gritty)	50	Marl	grey, shell fragments	
Silt	0.004-0.06 mm	15			
Clay	< 0.004 mm (slick)	15			

WATERSHED FEATURES	**Predominant Surrounding Landuse** ✓ Forest ___ Commercial ___ Field/Pasture ___ Industrial ___ Agricultural ___ Residential ✓ Other: **Canopy Cover** ___ Partly open ✓ Partly shaded ___ Shaded ___ Open	**Indicate the dominant type (Check one)** ✓ Trees ___ Shrubs ___ Grasses ___ Herbaceous **Floodplain Width** ___ Wide > 30ft ___ Moderate 15-30ft ✓ Narrow <16ft **Wetland Present** ___ Yes ✓ No **Wetland ID**
AQUATIC VEGETATION	**Indicate the dominant type and record the dominant species present** ___ Rooted emergent ___ Rooted submergent ___ Rooted floating ___ Free floating ___ Floating algae ___ Attached algae	

MACROINVERTEBRATES OR OTHER WILDLIFE OBSERVED/OTHER OBSERVATIONS AND NOTES	

Stream Assessment Form (Form 1)

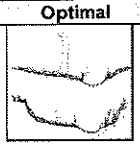
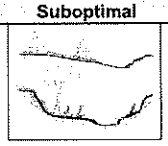
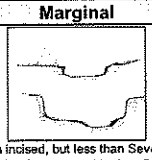
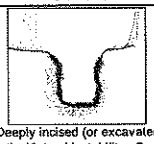
Unified Stream Methodology for use in Virginia

For use in wadeable channels classified as intermittent or perennial

Project #	Project Name	Locality	Cowardin Class.	HUC	Date	SAR #	Impact/SAR length	Impact Factor
	Mountain Valley Pipeline	Pittsylvania		030101050104	11/16/2016		39	1

Name(s) of Evaluator(s)	Stream Name and Information
J.Cook, E.Foster	S-H42, Permanent Easement (Transco), Perennial

1. Channel Condition: Assess the cross-section of the stream and prevailing condition (erosion, aggradation)

	Conditional Category					
	Optimal	Suboptimal	Marginal	Poor	Severe	
						
Channel Condition	Very little incision or active erosion; 80-100% stable banks. Vegetative surface protection or natural rock, prominent (80-100%). AND/OR Stable point bars/bankfull benches are present. Access to their original floodplain or fully developed wide bankfull benches. Mid-channel bars, and transverse bars few. Transient sediment deposition covers less than 10% of bottom.	Slightly incised, few areas of active erosion or unprotected banks. Majority of banks are stable (60-80%). Vegetative protection or natural rock prominent (60-80%) AND/OR Depositional features contribute to stability. The bankfull and low flow channels are well defined. Stream likely has access to bankfull benches, or newly developed floodplains along portions of the reach. Transient sediment covers 10-40% of the stream bottom.	Often incised, but less than Severe or Poor. Banks more stable than Severe or Poor due to lower bank slopes. Erosion may be present on 40-60% of both banks. Vegetative protection on 40 60% of banks. Streambanks may beverlical or undercut. AND/OR 40-60% of stream is covered by sediment. Sediment may be temporary/transient, contribute instability. Deposition that contribute to stability, may be forming/present. AND/OR V-shaped channels have vegetative protection on > 40% of the banks and depositional features which contribute to stability.	Overwidened/incised. Vertically/laterally unstable. Likely to widen further. Majority of both banks are near vertical. Erosion present on 60-80% of banks. Vegetative protection present on 20-40% of banks, and is insufficient to prevent erosion. AND/OR 60-80% of the stream is covered by sediment. Sediment is temporary/transient in nature, and contributing to instability. AND/OR V-shaped channels have vegetative protection is present on > 40% of the banks and stable sediment deposition is absent.	Deeply incised (or excavated), vertical/lateral instability. Severe incision, flow contained within the banks. Streambed below average rooting depth, majority of banks vertical/undercut. Vegetative protection present on less than 20% of banks, is not preventing erosion. Obvious bank sloughing present. Erosion/raw banks on 80-100%. AND/OR Aggrading channel. Greater than 80% of stream bed is covered by deposition, contributing to instability. Multiple thread channels and/or subterranean flow.	CI
Score	3	2.4	2	1.6	1	2.4

NOTES>> Immature forest, some pine saplings, Dense invasive vegetation, tree of heaven and microstegium vimineum

2. RIPARIAN BUFFERS: Assess both bank's 100 foot riparian areas along the entire SAR. (rough measurements of length & width may be acceptable)

	Conditional Category							NOTES>>
	Optimal	Suboptimal		Marginal		Poor		
Riparian Buffers	Tree stratum (dbh > 3 inches) present, with > 60% tree canopy cover and a non-maintained understory. Wetlands located within the riparian areas.	High Suboptimal: Riparian areas with tree stratum (dbh > 3 inches) present, with 30% to 60% tree canopy cover and containing both herbaceous and shrub layers or a non-maintained understory.	Low Suboptimal: Riparian areas with tree stratum (dbh > 3 inches) present, with > 30% tree canopy cover and a maintained understory. Recent cutover (dense vegetation).	High Marginal: Non-maintained, dense herbaceous vegetation with either a shrub layer or a tree layer (dbh > 3 inches) present, with <30% tree canopy cover.	Low Marginal: Non-maintained, dense herbaceous vegetation, riparian areas lacking shrub and tree stratum, hay production, ponds, open water. If present, tree stratum (dbh >3 inches) present, with <30% tree canopy cover with maintained understory.	High Poor: Lawns, mowed, and maintained areas, nurseries; no-till cropland; actively grazed pasture, sparsely vegetated non-maintained area, recently seeded and stabilized, or other comparable condition.	Low Poor: Impervious surfaces, mine spoil lands, denuded surfaces, row crops, active feed lots, trails, or other comparable conditions.	
		High	Low	High	Low	High	Low	
Condition Scores	1.5	1.2	1.1	0.85	0.75	0.6	0.5	

1. Delineate riparian areas along each stream bank into Condition Categories and Condition Scores using the descriptors.
2. Determine square footage for each by meesuring or estimating length and width. Calculators are provided for you below.
3. Enter the % Riparian Area and Score for each riparian category in the blocks below.

Ensure the sums of % Riparian Blocks equal 100

Right Bank	% Riparian Area>	100%						100%			
	Score >	1.5									
									CI= (Sum % RA * Scores*0.01)/2		
Left Bank	% Riparian Area>	100%						100%	Rt Bank CI >	1.50	CI
	Score >	1.5							Lt Bank CI >	1.50	1.50

3. INSTREAM HABITAT: Varied substrate sizes, water velocity and depths; woody and leafy debris; stable substrate; low embededness; shade; undercut banks; root mats; SAV; riffle pool complexes, stable features.

	Conditional Category				
	Optimal	Suboptimal	Marginal	Poor	
Instream Habitat/ Available Cover	Habitat elements are typically present in greater than 50% of the reach.	Stable habitat elements are typically present in 30-50% of the reach and are adequate for maintenance of populations.	Stable habitat elements are typically present in 10-30% of the reach and are adequate for maintenance of populations.	Habitat elements listed above are lacking or are unstable. Habitat elements are typically present in less than 10% of the reach.	
Score	1.5	1.2	0.9	0.5	

Undercut banks and roots, stable. Varied water velocity and depths. Riffle-pool complexes.

CI
1.50

Stream Impact Assessment Form Page 2

Project #	Applicant	Locality	Cowardin Class.	HUC	Date	Data Point	SAR length	Impact Factor
							500	1

4. CHANNEL ALTERATION: Stream crossings, riprap, concrete, gabions, or concrete blocks, straightening of channel, channelization, embankments, spoil piles, constrictions, livestock

No current channel alterations.

	Conditional Category						
	Negligible	Minor		Moderate		Severe	
Channel Alteration	Channelization, dredging, alteration, or hardening absent. Stream has an unaltered pattern or has naturalized.	Less than 20% of the stream reach is disrupted by any of the channel alterations listed in the parameter guidelines.	20-40% of the stream reach is disrupted by any of the channel alterations listed in the parameter guidelines.	40 - 60% of reach is disrupted by any of the channel alterations listed in the parameter guidelines. If stream has been channelized, normal stable stream meander pattern has not recovered.	60 - 80% of reach is disrupted by any of the channel alterations listed in the parameter guidelines. If stream has been channelized, normal stable stream meander pattern has not recovered.	Greater than 80% of reach is disrupted by any of the channel alterations listed in the parameter guidelines AND/OR 80% of banks shored with gabion, riprap, or cement.	
SCORE	1.5	1.3	1.1	0.9	0.7	0.5	1.50

REACH CONDITION INDEX and STREAM CONDITION UNITS FOR THIS REACH

NOTE: The CIs and RCI should be rounded to 2 decimal places. The CR should be rounded to a whole number.

THE REACH CONDITION INDEX (RCI) >>	1.38

RCI= (Sum of all CI's)/5

COMPENSATION REQUIREMENT (CR) >>	54

CR = RCI X LF X IF

INSERT PHOTOS:

DESCRIBE PROPOSED IMPACT:

W-Z3

Mountain Valley Pipeline Project

Standard JPA-NWP12 Pre-Construction Notification, Virginia

Attachment H-2: Wetlands and Waterbodies Impact Analysis and Compensatory Mitigation Plan

September 2017

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ATTACHMENT H-2: IMPACT ANALYSIS AND COMPENSATORY MITIGATION PLAN

1.0 IMPACT ANALYSIS

MVP is committed to avoiding and minimizing impacts to sensitive resources such as wetlands and waterbodies. MVP conducted comprehensive alternatives analysis (Attachment I) to avoid and minimize environmental impacts.

Where wetlands and waterbodies cannot be avoided, MVP will seek to minimize impacts by reducing to a 75-foot construction limit-of-disturbance (LOD) along the pipeline right-of-way (ROW) and reducing to a 25-foot construction LOD along access roads where practicable, and through the use of wetland and waterbody-specific construction procedures. See Attachment I for a detailed description of impact avoidance and minimization measures undertaken. In addition, pipeline and access road crossing methods are described in Attachment I. Crossing details are provided in Attachment H-4 for all stream and wetland crossings. Stream and wetland crossing typicals are provided in Attachment H-4 for non-Virginia Marine Resource Commission (VMRC)-jurisdictional streams. For VMRC-jurisdictional streams (see Attachment H-5, Table 1), specific crossing plans and cross sections are provided in Attachment H-5.

The anticipated number of stream and wetland crossings are summarized in Table 1. Anticipated impacts to streams and wetlands are summarized in Tables 2.1 and 3.1, respectively.

For impact calculations, anticipated permanent impacts include:

- Streams without existing culverts that will be impacted by new culvert installation within the LOD of permanent access roads
- Scour protection within stream channels will extend from the culvert outlet to the edge of LOD. Scour protection (i.e., riprap) will be sized to withstand the tailwater velocity and shear corresponding to the design flow event. The length of stream receiving scour protection is considered to be permanently impacted.
- Streams with existing culverts that require replacement by a new culvert of greater length. For impact calculations, the length of stream previously culverted is considered to have no impact due to culvert replacement by a culvert of the same length. The length of stream that was previously not culverted is considered to be permanently impacted by culvert installation.
- Palustrine emergent (PEM) wetlands that will be impacted by the placement of fill within the LOD of permanent access roads
- Conversion of palustrine forested (PFO) or palustrine scrub-shrub (PSS) wetlands to PEM wetlands within the LOD of the pipeline ROW or temporary access roads. No permanent fill will be placed in these PFO or PSS wetlands; however, woody vegetation will be cut and temporary crossing structures will be placed in these wetlands during construction

Temporary impacts include:

- Streams that will be impacted within the LOD of the pipeline ROW, temporary access roads, Additional Temporary Workspace (ATWS), or Laydown Yards
- PEM wetlands that will be impacted by the placement of temporary crossing structures within the LOD of the pipeline ROW, ATWS, or Laydown Yards during construction

Streams crossing the LOD in an existing culvert or under an existing bridge, where no culvert replacement is anticipated, will not be impacted. Tags have been added to the Detail Map in Attachment H-3 at these locations to note that there will be no impact at these existing culverted/bridged waterbody crossings.

The Detail Figures in Attachment H-3 include tags which identify wetlands and streams that are protected and either have no impact or only a temporary impact for permanent access roads and ATWS/Laydown Yards. The resource-specific tags include the following:

- Existing culvert/bridge, no impact

- Culvert/bridge replacements are not anticipated for features with this tag; therefore, these features will not be impacted.

- Temporary stream crossing structure to be placed at existing crossing during construction. May include temporary in-stream work. Temporary impact.
  - This tag is for permanent access roads with existing ford crossings - temporary crossing structures will be utilized to cross streams during construction. These features will not be permanently impacted by the placement of fill or new culverts; all impacts will be temporary.
- Erosion and Sediment (E&S) Best Management Practices (BMP) protections. No impact
  - This tag is for wetlands and streams in access roads, ATWS, and laydown yards with no timber mat crossing and with compost filter sock or other E&S protection. These features will be protected by E&S BMPs and will not be impacted by project activities.
- Timber mat crossing in wetlands during construction.
  - For PEM wetlands in access roads, ATWS, or pipeline construction area with timber mat crossings. Timber mats will be utilized during construction to cross wetlands, resulting in temporary impacts.

Wetlands and waterbodies mapped outside the LOD of either access roads or pipeline corridors will not be impacted.

The results of the stream and wetland impact analysis for field identified features are provided in Tables 2.2 and 3.2, respectively. These tables provide feature impact locations, impact type (e.g. Pipeline ROW, Temporary Access Road), general feature characteristics, and anticipated impact calculations.

Desktop surveys have identified two potential impacts on unsurveyed properties that have not been field-verified (Table 3.3 for wetlands). MVP will provide supplemental impact analyses for the desktop evaluated wetland impacts after survey access is granted and these areas are field-verified.

Wetland functions and values were assessed for all wetlands located within the proposed Project LOD using the USACE Highway Methodology (USACE 1999). The USACE Highway Methodology is a well-established and effective methodology for evaluating wetland functions and values. In accordance with the method, eight functions and five values were assessed for each permanently impacted wetland. The suitability of the wetland to provide the function or value is assessed. Those determined to not provide the function or value or provide it at an insignificant level were considered not to be providing the function and were not listed. Wetland delineation data sheets, pictures, topographical maps, soils maps, aerial maps, wetland and stream delineations, agency information (e.g., endangered species presence), other field survey information (e.g., threatened and endangered species), and best professional judgement were used during each evaluation. The results are presented in Table 6 and list only the principle functions provided. MVP anticipates compensatory mitigation at mitigation banks or VARTF will likely add functional uplift for many of the permanent wetland impacts.

The Compensatory Mitigation Plan for permanent impacts is presented in Section 4.0, below.

2.0 PROJECT CONSTRUCTION

2.1 TEMPORARY EROSION CONTROL AND SEDIMENT CONTROL

Sediment barriers will be installed immediately after initial disturbance of the waterbody or adjacent upland. Sediment barriers will be properly maintained throughout construction and reinstalled as necessary (such as after backfilling of the trench) until replaced by permanent erosion controls or restoration of adjacent upland areas is complete. Sediment barriers will be installed across the entire construction LOD at all waterbody crossings. Where waterbodies are adjacent to the construction LOD, sediment barriers will be installed along the edge of the construction LOD as necessary to contain spoil and sediment within the ROW. Trench plugs will be used at all non-flumed waterbody crossings to prevent diversion of water into upland portions of the pipeline trench and to keep any accumulated trench water out of the waterbody. Trench plugs will be of sufficient size to withstand upslope water pressure.

2.2 EQUIPMENT BRIDGES

Only rubber tubing clearing equipment may cross waterbodies before installation of equipment bridges. The number of such crossings of each waterbody will be limited. Soil will not be used to construct or stabilize equipment bridges. Equipment bridges will be constructed using one of the following methods:

1. Equipment pads and culvert(s);
2. Clean rockfill and culvert(s) that conforms to the requirements in VESCH STD and Spec. 3.24-2; or
3. Flexi-float or portable bridges.

Each equipment bridge will be designed and maintained to withstand and pass the highest flow that would occur while the bridge is in place and prevent soil from entering the waterbody. Equipment bridges will be removed as soon as possible after permanent seeding unless it is authorized to remain as a permanent bridge. If there will be more than one month between final cleanup and the beginning of permanent seeding and reasonable alternative access to the ROW is available, equipment bridges will be removed as soon as possible after final cleanup.

2.3 TRENCHING

Trenching will begin after grading is completed. If trenching of adjacent upland areas has been completed but will not be backfilled before the waterbody or wetland crossing is trenched, a trench plug will be left in place at the end of the waterbody or wetland crossing to prevent storm water runoff from entering the waterbody or wetland by way of the trench.

Any water that must be removed from the work area will be discharged through a dewatering structure. Discharge points will be located in an upland area, including the buffer, whenever possible. The discharge will be carefully monitored to prevent erosion and sedimentation in the waterbody or wetland, and in such a manner that no heavily silt-laden water flows into any waterbody.

A minimum of the top one foot of topsoil will be conserved from over the trench in wetlands without standing water or saturated soil.

No aboveground facilities will be located in any wetland, except where the location of such facilities outside of wetlands would prohibit compliance with U.S. Department of Transportation regulations.

If standing water or saturated soils are present, low-ground-weight construction equipment will be used or normal equipment will be operated on temporary wetland crossing structures such as timber mats, prefabricated equipment mats, or geotextile fabric overlain with gravel. Geotextile fabric used for this purpose must be strong enough to allow removal of all gravel and fabric from the wetland.

2.4 Spoil Pile Placement and Control

All spoil from minor and intermediate waterbody crossings, and upland spoil from major waterbody crossings, will be placed in the construction LOD at least 10 feet from the water's edge or in additional extra work area. Sediment barriers will be used to prevent the flow of spoil into any waterbody.

Whenever practicable, excavated material will be placed on a Corps confirmed upland site. However, when it is not practicable to place excavated material on an upland site, any excavated material stockpiled in vegetated wetland areas will be placed on a matted straw layer, for use as a semi-permeable surface.

2.5 Backfilling

Backfilling will begin promptly after pipe installation is completed. Permanent trench breakers will be installed in the banks of stream channels and at the ends of wetlands. In designated trout streams, the top 12 inches of backfill will be made with clean one-inch diameter stone.

2.6 Final Grading and ROW Maintenance

Final grading will begin after backfilling is completed. Disturbed areas will be restored to pre-construction contours, and in wetlands, topsoil will be replaced last. Sediment barriers at the edge of the wetland or edge of the water will be repaired or replaced as necessary. Permanent ROW diversions (interceptor diversions) will be installed at the edge of the buffer area or base of the slope nearest the waterbody and wetland. All materials used to stabilize the equipment work area will be removed (e.g. timber riprap or timber mats).

Temporarily disturbed waters and wetlands will be restored to their pre-construction contours within 12 months of commencing the temporary impact. After restored to their natural contours, soil will be mechanically loosened to a depth of 12 inches and wetland areas will be seeded with appropriate native vegetation. If soil and weather conditions do not allow for a true final grade to be established (e.g. if the permit specified a winter construction window), best possible grade will be established, erosion and sediment control measures will be restored or replaced as needed, and temporary stabilization will be applied.

Vegetation maintenance adjacent to waterbodies will be limited to allow a riparian strip at least 35-feet wide, as measured from the waterbody's ordinary high water mark, to permanently revegetate with native plant species across the entire ROW. However, to facilitate periodic pipeline corrosion/leak surveys, a corridor centered on the pipeline and up to 10 feet wide will be mowed annually and may be maintained in an herbaceous state. In addition, trees that are located within 15 feet of the pipeline and are greater than 15 feet in height may be cut and removed from the ROW. See Project Specific Standards and Specifications For Virginia for more details.

2.7 Detailed Project Construction Plans

The Erosion and Sediment Control Plan (ESCP) provides a detailed description of construction materials, methods, and sequence. The ESCP also provides typical plans and cross sections of the proposed wetland and stream crossings. The ESCP can be provided upon request.

3.0 TEMPORARY IMPACT RESTORATION

3.1 Stream Restoration

It is anticipated that the Project will have impacts on field identified stream crossing locations and will not have impacts on desktop identified streams (Table 2.2). Table 2.2 identifies all anticipated field-identified stream impacts, stream flow regime, and stream Waters Type. It is anticipated that all stream impacts within the pipeline LOD will be temporary, occurring during pipeline construction activities. It is anticipated that temporary waterbody impacts will not result in the adverse impact of water quality, physical habitat, or aquatic species within the Project Area because of the short duration of stream crossing construction activities, implementation of best management practices and erosion and sedimentation control measures, and the temporary nature of the impacts.

Construction across waterbodies will be performed in a manner that minimizes the amount of time that the pipeline trenches will be left open. Construction methods at waterbody crossings are described in Attachment I: Alternatives Analysis.

The pipeline will be installed to provide a minimum of three feet of cover from the waterbody bottom to the top of the pipeline. Trench spoil will be placed on the bank above the high water mark for use as backfill.

MVP will follow the FERC Wetland and Waterbody Procedures (FERC 2013) to limit water quality and aquatic resource impacts during and following construction. Construction activities will be scheduled so that the pipeline trench is excavated immediately prior to pipe laying activities. In accordance with the FERC Wetland and Waterbody Procedures (FERC 2013), the duration of construction will be limited to 24 hours across minor waterbodies (10 feet wide or less) and 48 hours across intermediate waterbodies (between 10 and 100 feet wide) when blasting or extensive rock excavation is not required.

In accordance with the FERC Wetland and Waterbody Procedures (FERC 2013), normal backfill cover requirements will be met. Compaction percentage of backfill will be equal to or above that of the adjacent undisturbed areas. Ditch plugs of crushed stone, sandbags, or dry soil may also be used to keep backfill from sloughing in toward the center of the waterbody. All waterbody banks will be restored to their original grades and foreign objects will be removed from the waterbody. Excavated material not required for backfill will be removed and disposed of at an upland site.

Cleanup and restoration will commence as soon as practicable following the completion of backfilling and testing. Cleanup and restoration activities include replacing grade cuts to original contours, seeding, fertilizing, and mulching to restore ground cover, minimize erosion, and stabilize stream banks for their natural reversion toward their previous state. Original streambed and bank contours will be re-established for surface water and groundwater flow, and mulch, jute thatching, or bonded fiber blankets will be installed on the stream banks.

Seeding of disturbed stream approaches will be completed in accordance with FERC Wetland and Waterbody Procedures (FERC 2013) after final grading, weather and soil conditions permitting. MVP is committed to increase conservation and biodiversity in the region by using native grasses and wildflowers. Slope breakers will be installed adjacent to stream banks to minimize the potential for erosion. Sediment barriers, such as silt fence and/or straw bales will be maintained across the ROW until permanent vegetation is established. Temporary equipment bridges will be removed following construction. All temporary stream impacts will be restored to their pre-construction contours within 12 months of commencing construction.

3.2 WETLAND RESTORATION

While significant effort was made to avoid wetland and waterbody impacts, some impacts to wetlands and waterbodies are unavoidable due to the constraints of siting and constructing a 303-mile linear project. It is anticipated that the Project will have impacts on both field and desktop delineated wetland crossing locations (Tables 3.1 and 3.2).

Where wetlands cannot be avoided, MVP will minimize impacts through the use of wetland construction procedures. Techniques to avoid or minimize impacts include top soil conservation, construction neck downs, avoiding placement of workspaces in critical habitats, revegetation, backfilling and grading, and open-cut/conventional lay or dry ditch crossing methods. Crossing of jurisdictional wetlands will be completed in accordance with USACE Nationwide Permit (NWP) 12 conditions, the FERC Wetland and Waterbody Procedures (FERC 2013), and the Final Environmental Impact Statement (June 2017). Restoration and monitoring of wetland crossings will be conducted in accordance with the FERC Wetland and Waterbody Procedures (FERC 2013) to ensure successful wetland revegetation.

Per USACE NWP 12 regional requirement, clearing of wetlands will be minimized to the maximum extent practicable. Grubbing and removal of vegetation would be limited to the permanent easement.

The majority of impacts are anticipated to be temporary impacts to PEM wetlands in the temporary work areas and permanent ROW. Temporary construction impacts in wetlands may include loss of herbaceous vegetation; soil disturbance associated with grading, trenching, and stump removal; soil compaction;

sedimentation and turbidity increases; and hydrological profile changes. Wetland soils (hydric soils) are susceptible to compaction with operation of construction equipment over wet soils, thereby reducing the porosity and moisture-holding capacity of the soils and interfering with the hydrology of the wetland. MVP will segregate the topsoil up to one foot in depth in wetlands where hydrologic conditions permit this practice. Any excavated material stockpiled in vegetated wetland areas will be placed on a matted straw layer, for use as a semi-permeable surface. Segregated topsoil will be placed in the trench following subsoil backfilling. In order to minimize compaction, MVP will limit construction traffic to only that required to accomplish the task. Low-ground-pressure equipment will be used, or temporary equipment mats will be installed to allow passage of equipment with minimal disturbance of the surface soils and vegetation. Compacted areas will be tilled as necessary.

Original surface hydrology will be re-established in wetlands by backfilling the pipe trench and grading the surface with backhoes operating from equipment mats or low ground-pressure tracked vehicles working in the spoil pile, depending upon the ambient water level, degree of soil saturation, and the bearing capacity of the soils. All excess excavated material will be removed from wetlands within 30 days. Roots and stumps will have been removed only in the areas of the pipe trench, allowing existing vegetation to recover more rapidly in the remainder of the ROW once the equipment mats and spoil piles have been removed.

Wetlands along the proposed pipeline are expected to exhibit varying degrees of saturation and water elevation, requiring a variety of plant species to be re-established. In unsaturated wetlands, most vegetation will be replaced by seeding. Due to low success rates of revegetation from seeding in saturated soils, saturated wetlands will typically be allowed to re-vegetate naturally. Wetland revegetation will be considered successful when the cover of herbaceous species is at least 70 percent of the cover of the vegetation in adjacent wetland areas that were not disturbed by construction. Revegetation efforts will continue until wetland revegetation is successful. All temporary wetland impacts will be restored to their pre-construction contours within 12 months of commencing construction.

Crossing of the pipeline through PFO and PSS wetlands has been minimized to the maximum extent practicable through project siting placement. Measures taken to avoidance of PFO fragmentation are discussed further in Attachment I: Alternatives Analysis. Impacts to PFO and PSS wetlands may include long-term conversion to emergent wetland types as a result of tree and/or shrub removal within the construction and operational ROW. Clearing for construction within PFO and PSS wetlands and vegetation maintenance during pipeline operation will be limited per the FERC Wetland and Waterbody Procedures (FERC 2013), such that only the minimum width needed for pipeline protection and surveillance is maintained, in an effort to reduce permanent impacts to PFO and PSS wetlands. In compliance with USACE NWP 12 conditions, any unavoidable permanent loss that may occur to wetlands will be kept under 0.5 acres of cumulative impacts per single and complete project.

4.0 COMPENSATORY MITIGATION PLAN

Compensatory mitigation is *required* on a one-to-one basis for any single and complete project that meets one of the two following criteria:

- Permanent loss of a wetland exceeds 1/10 acre and preconstruction notification (PCN) is required. NWP Gen. Cond. 23(c); NWP Reg. Cond. 10.
- Permanent loss of a stream exceeds 300 linear feet. NWP Reg. Cond. 10

Compensatory mitigation *may* be required for any single and complete project in any of the following circumstances if the district engineer determines that compensatory mitigation is necessary to ensure that the activity results in only minimal adverse individual or cumulative environmental effects:

- Permanent loss of a wetland less than 1/10 acre that requires PCN. NWP Gen. Cond. 23(c).
- Permanent loss of a stream that requires PCN. NWP Gen. Cond. 23(d).
- Permanent conversion of a wetland from one form to another. NWP Gen. Cond. 23(3); NWP 12 Reg. Cond. 3.vi.

No single and complete project proposed in this application has an associated impact that exceeds the thresholds in NWP Gen. Cond. 23(c) or NWP Reg. Cond. 10 for requiring compensatory mitigation. For reference, no single proposed wetland loss exceeds 0.44 acre and no single proposed stream loss exceeds 57 linear feet. (Tables 2.2 and 3.2). Nevertheless, in accordance with NWP Sec. D.3, MVP proposes to minimize the individual and cumulative effects of the Project by implementing compensatory mitigation for all proposed permanent impacts, including stream losses less than 300 feet, wetland losses less than 1/10 acre, and any permanent conversions of PFO or PSS wetlands to PEM wetlands. As described below, MVP proposes to mitigate all proposed permanent stream and wetland impacts (loss or conversion) on a one-to-one ratio through the purchase of mitigation bank credits if such credits are available.

Some of the proposed impacts fall outside the service area of approved mitigation banks, leaving the VA Aquatic Resources Trust Fund (VARTF) as the only available source of credits. Credits will be purchased from the VARTF for these impacts at a one-to-one ratio if they are made available. In the event those credits are not available, MVP proposes to further mitigate the cumulative impacts of the project by obtaining credits on a two-to-one ratio from a a bank whose service area includes portions of the pipeline route.

4.1 Stream Mitigation

Proposed permanent stream impacts will result only from the culverting of streams crossing proposed permanent access roads. Credit requirements for field delineated streams were determined using the Unified Stream Methodology (USM) assessment tool, as presented in Table 5 (VDEQ 2007). USM forms for individual streams are provided in this attachment.

It is anticipated that the Virginia segment of the project will have unavoidable permanent impacts on a total of 478 feet of field identified streams, for which MVP proposes to purchase 515 compensatory mitigation credits (Table 4). MVP is proposing to purchase approximately 298 credits from the Graham and David Mitigation Bank (31,528 credits available) for mitigation of field identified stream impacts located in the Graham and David Mitigation Bank primary service area covering the following HUC 8 Watersheds: Banister (03010105), Upper Roanoke (03010101), Middle Roanoke (03010102), and Upper Dan (03010103) (USACE 2017). In addition to the Graham and David Mitigation Bank, stream credits are available for stream impacts in the Project area at the Banister Bend Mitigation Bank (2,408 credits available) in the following HUC 8 watersheds: Banister (03010105), Upper Roanoke (03010101), Middle Roanoke (03010102), Lower Dan (03010104), and Upper Dan (03010103). Credit availability letters for Graham and David and Bannister Bend Mitigation Banks are provided in this attachment. MVP is proposing to purchase 217 credits from the VARTF for Project impacts in the Middle New Watershed (HUC 05050002), located outside of the service areas of approved mitigation banks (Table 4). The VARTF has 5,000 Advanced Stream Credits available in the New River Basin. If the VARTF administrator refuses to make these credits available for purchase, however, MVP proposes in the alternative to purchase 434 credits (2x 217, previously proposed from VARTF) from a bank able to serve the Middle New (05050002). In order to further reduce the cumulative impacts to the project.

It is anticipated that the Virginia segment of the project will not have any permanent impacts on desktop identified streams.

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[1] As published in the Federal Register on April 10, 2008 (73 F.R. 19594), effective June 9, 2008.

4.2 Wetland Mitigation

It is anticipated that the Virginia segment of the project will have the following unavoidable permanent impacts:

- 693 square feet of PEM wetland permanent fill impact (of which 84 square feet is desktop identified)

- 97,306 square feet of PSS wetland conversion impact, and
- 90,368 square feet of PFO wetland conversion impact (Table 3.1).

In accordance with USACE Norfolk District and Virginia Department of Environmental Quality (VDEQ) guidance, the following ratios were used to calculate proposed mitigation credits for each acre of permanent wetland impact:

- 1 to 1 for PEM wetland fill impacts,
- 1 to 1 for PSS wetland conversion impacts,
- 1.5 to 1 for PSS wetland fill impacts,
- 1 to 1 for PFO wetland conversion impacts, and
- 2 to 1 for PFO wetland fill impacts.

It is anticipated that the Project will not have any permanent fill impacts to PSS and PFO wetlands. All permanent PSS and PFO impacts are anticipated to be conversion impacts. Accordingly, a one-to-one ratio is used for all proposed wetland mitigation credits.

Based on the anticipated impact acreage and mitigation credit ratios, the total proposed credit mitigation for wetland impacts is 4.32 (Table 6). MVP is proposing to purchase approximately 1.65 credits from the Banister Bend Mitigation Bank (42.758 credits available) for mitigation of wetland impacts located in the Banister Bend Mitigation Bank service area covering the following HUC 8 Watersheds: Banister (03010105), Upper Roanoke (03010101), Middle Roanoke (03010102), Lower Dan (03010104), and Upper Dan (03010103) (USACE 2017). A credit availability letter for the Banister Bend Mitigation Bank is provided in this attachment. MVP is proposing to purchase 2.68 credits from the VARTF for Project impacts in the Upper Roanoke Watershed (HUC 03010101), and the Middle New Watersheds (HUC 05050002), located outside of the service areas of approved mitigation banks (Table 6). The VARTF has 5 Advanced Wetland Credits available in the Roanoke River Basin and 5 Advanced Wetland Credits available in the New River Basin. If the VARTF administrator refuses to make these credits available for purchase, however, MVP proposes in the alternative to purchase 5.36 (2x 2.68, previously proposed from VARTF) from a bank able to serve the Middle New (05050002) and Upper Roanoke (03010101). In order to further reduce the cumulative impacts to the project.

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1 As published in the Federal Register on April 10, 2008 (73 F.R. 19594), effective June 9, 2008.

MVP will provide updated impact information for the desktop delineated wetland permanent impacts once these areas are surveyed. It is anticipated that these estimated impact numbers will actually decrease once the field surveys are complete. MVP anticipates purchasing mitigation credits from the VARTF for impacts that may occur outside of the service area of approved mitigation banks. Based on the estimated impact acreage and mitigation credit ratios from USACE Norfolk District and VDEQ, the total credit requirement for estimated permanent impacts to desktop delineated wetlands is 0.002. This credit amount has been included in the total credits to be purchased referenced above.

5.0 REFERENCES

FERC (Federal Energy Regulatory Commission). 2013. Wetland and Waterbody Construction and Mitigation Procedures. Office of Energy Projects. May 2013.

VDEQ (Virginia) Department of Environmental Quality. 2007. Unified Stream Methodology for use in Virginia. Available online at: http://www.deq.virginia.gov/Portals/0/DEQ/Water/WetlandsStreams/USMFinal_01-18-07.pdf. Accessed January 2015.

USACE (United States Army Corps of Engineers). 2017. Regulatory In-lieu Fee and Bank Information Tracking Systems (RIBITS). Available online at: https://ribits.usace.army.mil/. Accessed January 2017.

USACE (United States Army Corps of Engineers). 1999. The Highway Methodology Workbook Supplement. NAEEP-360-1-30a.

TABLES

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Table 3.2	Field Survey Jurisdictional Wetland Impacts
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Table 4	Proposed Stream Mitigation
Table 5	Unified Stream Methodology Form 2
Table 6	Proposed Wetland Mitigation

Table 1 Stream and Wetland Crossing Summary

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Streams	Temporary Crossings	366	0	366
	Permanent Crossings	19	0	19
	Total Stream Crossings	385	0	385
Wetlands	Temporary Crossings	89	1	90
	Permanent Conversion Crossings	50	0	50
	Permanent Fill Crossings	3	1	4
	Total Wetland Crossings	142	2	144

Table 2.1 Stream Impact Summary

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Field Identified	Ephemeral	6,078	97	9,501	61
	Intermittent	9,643	160	18,932	89
	Perennial	13,105	221	61,002	190
	Field Total	28,826	478	89,436	341
Desktop Identified	Ephemeral	0	0	0	0
	Intermittent	0	0	0	0
	Perennial	0	0	0	0
	Desktop Total	0	0	0	0
All Features	Ephemeral	6,078	97	9,501	61
	Intermittent	9,643	160	18,932	89
	Perennial	13,105	221	61,002	190
	Grand Total	28,826	478	89,436	341

Table 2.2 Field Survey Stream Impacts

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
S-PP14	Kimballton Branch	Giles	37.382798	-80.594250	Perennial	RPW	14	R2RB1	-	-	05050002	Middle New	Permanent Access Road	50	11	700	154	3	78	17	6
S-Q13	Kimballton Branch	Giles	37.374377	-80.652030	Perennial	RPW	16	R2UB1	-	-	05050002	Middle New	Pipeline ROW	90	-	1350	-	10	500	-	17
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
S-PP15	UNT to Kimballton Branch	Giles	37.382640	-80.590052	Perennial	RPW	8	R3UB1	-	-	05050002	Middle New	Permanent Access Road	15	11	90	66	3	10	7	5
S-PP17	UNT to New River	Giles	37.386777	-80.70045	Intermittent	RPW	2	R4SB3	-	-	05050002	Middle New	Permanent Access Road	-	14	-	28	3	-	3	7
S-MN20	UNT to New River	Giles	37.386744	-80.700409	Intermittent	RPW	2	R4SB3	-	-	05050002	Middle New	Permanent Access Road	-	11	-	22	3	-	2	12
S-PP18	Curve Branch	Giles	37.365584	-80.708762	Perennial	RPW	4	R2UB1	-	-	05050002	Middle New	Permanent Access Road	-	19	-	76	3	-	5	9
S-PP19	UNT to Curve Branch	Giles	37.362172	-80.714021	Intermittent	RPW	3	R4SB5	-	-	05050002	Middle New	Permanent Access Road	-	16	-	48	3	-	5	9
S-UU6	Clendennin Creek	Giles	37.361343	-80.719468	Perennial	RPW	5	R2UB1	-	-	05050002	Middle New	Permanent Access Road	-	11	-	55	3	-	5	10
S-HH15	UNT to Clendennin Creek	Giles	37.375518	-80.725811	Intermittent	RPW	6	R4SB2	-	-	05050002	Middle New	Permanent Access Road	55	-	279	-	3	31	-	11
S-Q12	UNT to Kimballton Branch	Giles	37.375311	-80.730675	Ephemeral	NRPW	4	R6	-	-	05050002	Middle New	Pipeline ROW	86	-	344	-	10	127	-	16
S-NN17	UNT to Clendennin Creek	Giles	37.375641	-80.733093	Intermittent	RPW	3	R4SB3	-	-	05050002	Middle New	Permanent Access Road	42	-	126	-	3	14	-	12
S-HH16	UNT to Clendennin Creek	Giles	37.370772	-80.737181	Perennial	RPW	5	R3UB1	-	-	05050002	Middle New	Permanent Access Road	-	14	-	70	3	-	6	13
S-HH14	UNT to Clendennin Creek	Giles	37.370761	-80.73801	Intermittent	RPW	3	R4SB5	-	-	05050002	Middle New	Permanent Access Road	-	14	-	42	3	-	6	13
S-HH13	UNT to Clendennin Creek	Giles	37.366272	-80.744605	Perennial	RPW	6	R3RB2	-	-	05050002	Middle New	Permanent Access Road	-	11	-	66	3	-	10	14
S-HH12	UNT to Clendennin Creek	Giles	37.365134	-80.746301	Ephemeral	NRPW	3	R6	-	-	05050002	Middle New	Permanent Access Road	-	11	-	33	3	-	4	14
S-SS3	UNT to Clendennin Creek	Giles	37.356962	-80.749209	Intermittent	RPW	10	R4SB3	-	-	05050002	Middle New	Permanent Access Road	-	14	-	140	3	-	16	14
S-P9	UNT to Stony Creek	Giles	37.362202	-80.566092	Ephemeral	NRPW	8	R6	-	-	05050002	Middle New	Pipeline ROW	75	-	465	-	10	173	-	20
S-SS-Braid-2	Stony Creek	Giles	37.360329	-80.564214	Ephemeral	NRPW	3	R6	-	Green floater; Candy darter; Fieldcrip	05050002	Middle New	Pipeline ROW	61	-	183	-	10	66	-	21
S-SS-Braid-1	Stony Creek	Giles	37.360275	-80.564193	Ephemeral	NRPW	4	R6	-	Green floater; Candy darter; Fieldcrip	05050002	Middle New	Pipeline ROW	51	-	324	-	10	120	-	21
S-SS	Stony Creek	Giles	37.360071	-80.563960	Perennial	RPW	40	R2UB1	Class V - vi (Stockable)	Green floater; Candy darter; Fieldcrip	05050002	Middle New	Pipeline ROW	79	-	2738	-	10	1014	-	21
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
S-G29	UNT to Dry Branch	Giles	37.350430	-80.559262	Ephemeral	NRPW	4	R6	-	-	05050002	Middle New	Pipeline ROW	30	-	120	-	3	13	-	25
S-G30	UNT to Dry Branch	Giles	37.350373	-80.558230	Ephemeral	NRPW	8	R6	-	-	05050002	Middle New	Pipeline ROW	85	-	680	-	10	252	-	25
S-G32	Dry Branch	Giles	37.349098	-80.552040	Intermittent	RPW	6	R4SB5	-	-	05050002	Middle New	Pipeline ROW	110	-	660	-	10	244	-	27
S-G33	UNT to Dry Branch	Giles	37.346641	-80.547225	Perennial	RPW	8	R3RB2	-	-	05050002	Middle New	Pipeline ROW	99	-	792	-	10	293	-	27
S-G35	UNT to Little Stony Creek	Giles	37.344876	-80.533426	Perennial	RPW	25	R3RB2	Class VI - II (Good)	-	05050002	Middle New	Pipeline ROW	40	-	1000	-	10	370	-	29
S-G38	UNT to Little Stony Creek	Giles	37.344795	-80.533485	Perennial	RPW	26	R3RB2	Class VI - II (Good)	-	05050002	Middle New	Pipeline ROW	62	-	1300	-	10	481	-	29
S-G39	UNT to Little Stony Creek	Giles	37.344779	-80.533379	Perennial	RPW	25	R3RB2	Class VI - II (Good)	-	05050002	Middle New	Pipeline ROW	35	-	950	-	10	352	-	29
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
S-S64	UNT to Little Stony Creek	Giles	37.344859	-80.531296	Ephemeral	NRPW	3	R6	-	-	05050002	Middle New	Pipeline ROW	75	-	234	-	10	87	-	20
S-Z7	UNT to Little Stony Creek	Giles	37.344278	-80.528188	Intermittent	RPW	3	R4SB3	-	-	05050002	Middle New	Pipeline ROW	75	-	228	-	10	84	-	20
S-Z7-Braid-1	UNT to Little Stony Creek	Giles	37.344277	-80.528113	Ephemeral	NRPW	3	R6	-	-	05050002	Middle New	Pipeline ROW	73	-	219	-	10	81	-	20
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
S-Z9	UNT to Little Stony Creek	Giles	37.344163	-80.528400	Perennial	RPW	4	R3UB1	-	-	05050002	Middle New	Pipeline ROW	86	-	344	-	10	127	-	29
S-Z10	UNT to Little Stony Creek	Giles	37.343361	-80.526583	Intermittent	RPW	12	R4SB3	-	-	05050002	Middle New	Pipeline ROW	76	-	912	-	10	336	-	30
S-Z11	UNT to Little Stony Creek	Giles	37.343238	-80.526543	Perennial	RPW	5	R3UB2	-	-	05050002	Middle New	Pipeline ROW	88	-	440	-	10	163	-	30
S-Z12-EPH	UNT to Little Stony Creek	Giles	37.343214	-80.526512	Ephemeral	RPW	6	R6	-	-	05050002	Middle New	Pipeline ROW	80	-	480	-	10	178	-	30
S-Z13	Little Stony Creek	Giles	37.342172	-80.520060	Perennial	RPW	25	R3RB2	Class VI - II (Good); Brook & Rainbow Trout	-	05050002	Middle New	Pipeline ROW	77	-	1383	-	10	512	-	30
S-Z14	UNT to Little Stony Creek	Giles	37.340977	-80.515031	Intermittent	RPW	4	R4SB3	-	-	05050002	Middle New	Pipeline ROW	109	-	436	-	10	161	-	31
S-YZ1	Doe Creek	Giles	37.338903	-80.514616	Intermittent	RPW	10	R3RB2	-	-	05050002	Middle New	Temporary Access Road	102	-	1020	-	3	113	-	31
S-YZ1	Doe Creek	Giles	37.337662	-80.514711	Intermittent	RPW	10	R3RB2	-	-	05050002	Middle New	Temporary Access Road	92	-	920	-	3	102	-	31

Table 2.2 Field Survey Stream Impacts

S-YZ1	Doe Creek	Giles	37.337046	-80.614835	Intermittent	RPW	10	R3RB2	-	-	05050002	Middle New	Temporary Access Road	121	-	1210	-	3	134	-	31
S-Y2	Doe Creek	Giles	37.331331	-80.563047	Perennial	RPW	25	R4UB2	-	-	05050002	Middle New	Pipeline ROW	79	-	1975	-	10	731	-	55
S-A34	UNT to Doe Creek	Giles	37.337763	-80.606005	Ephemeral	NRPW	7	R5	-	-	05050002	Middle New	Pipeline ROW	35	-	602	-	10	223	-	53
S-A33	UNT to Doe Creek	Giles	37.337939	-80.605371	Ephemeral	NRPW	7	R5	-	-	05050002	Middle New	Pipeline ROW	111	-	777	-	10	288	-	33
S-A32	UNT to Doe Creek	Giles	37.335094	-80.596859	Perennial	RPW	16	R3RB1	-	-	05050002	Middle New	Pipeline ROW	75	-	1246	-	10	463	-	34
S-CC3	Sinking Creek	Craig	37.333152	-80.428438	Perennial	RPW	35	R2UB1	Class V - vi (Stockable)	-	05050002	Middle New	Temporary Access Road	40	-	1400	-	3	168	-	67
S-NN17	Sinking Creek	Giles	37.311616	-80.515786	Perennial	RPW	55	R2UB1	Class V - v (Stockable)	-	05050002	Middle New	Pipeline ROW	77	-	3620	-	10	670	-	50
S-MN11-Upstream	UNT to Sinking Creek	Giles	37.332569	-80.569168	Ephemeral	NRPW	4	R5	-	-	05050002	Middle New	Temporary Access Road	15	-	60	-	3	7	-	39
S-MN11-Upstream	UNT to Sinking Creek	Giles	37.332191	-80.569979	Ephemeral	NRPW	4	R5	-	-	05050002	Middle New	Temporary Access Road	30	-	120	-	3	13	-	39
S-MN11-Downstream	UNT to Sinking Creek	Giles	37.332148	-80.580079	Ephemeral	NRPW	5	R5	-	-	05050002	Middle New	Temporary Access Road	37	-	185	-	3	21	-	39
S-Y3	UNT to Doe Creek	Giles	37.331746	-80.583365	Ephemeral	NRPW	10	R5	-	-	05050002	Middle New	Pipeline ROW	77	-	770	-	10	265	-	36
S-PP4	UNT to Sinking Creek	Craig	37.326329	-80.423510	Intermittent	RPW	2	R4SB5	-	-	05050002	Middle New	Pipeline ROW	54	-	108	-	10	63	-	65
S-PP3	UNT to Sinking Creek	Craig	37.325705	-80.435603	Perennial	RPW	3	R3UB1	-	-	05050002	Middle New	Pipeline ROW	62	-	248	-	10	91	-	65
S-RR4	UNT to Sinking Creek	Giles	37.326015	-80.556631	Perennial	RPW	3	R3RB2	-	-	05050002	Middle New	Temporary Access Road	68	-	203	-	3	28	-	42
S-E24	UNT to Sinking Creek	Giles	37.325126	-80.586062	Perennial	RPW	20	R3UB2	-	-	05050002	Middle New	Pipeline ROW	81	-	1620	-	10	590	-	36
S-E25-Downstream	UNT to Sinking Creek	Giles	37.325836	-80.584580	Perennial	RPW	8	R3RB2	-	-	05050002	Middle New	Pipeline ROW	98	-	784	-	10	254	-	35
S-E25-Upstream	UNT to Sinking Creek	Giles	37.325807	-80.584973	Perennial	RPW	10	R3UB1	-	-	05050002	Middle New	Pipeline ROW	16	-	160	-	3	17	-	36
S-E26-Downstream	UNT to Sinking Creek	Giles	37.325805	-80.584465	Perennial	RPW	8	R3RB2	-	-	05050002	Middle New	Pipeline ROW	48	-	384	-	10	143	-	38
S-E25-Downstream	UNT to Sinking Creek	Giles	37.325586	-80.584834	Perennial	RPW	8	R3RB2	-	-	05050002	Middle New	Pipeline ROW	63	-	504	-	10	187	-	58
S-PP1	UNT to Sinking Creek	Craig	37.324781	-80.431446	Intermittent	RPW	3	R4SB3	-	-	05050002	Middle New	Pipeline ROW	55	-	258	-	10	96	-	64
S-RR5	UNT to Sinking Creek	Giles	37.323702	-80.555627	Perennial	RPW	10	R3UB2	-	-	05050002	Middle New	Pipeline ROW	83	-	830	-	10	307	-	41
S-UI8	UNT to Sinking Creek	Giles	37.323104	-80.553058	Ephemeral	NRPW	4	R5	-	-	05050002	Middle New	Temporary Access Road	43	-	172	-	3	19	-	41
S-UI9	UNT to Sinking Creek	Giles	37.321923	-80.55311	Ephemeral	NRPW	4	R5	-	-	05050002	Middle New	Temporary Access Road	9	-	36	-	3	4	-	41
S-UI3	UNT to Sinking Creek	Giles	37.321758	-80.553011	Intermittent	RPW	4	R4SB2	-	-	05050002	Middle New	Temporary Access Road	44	-	176	-	3	20	-	41
S-PP22	UNT to Craig Creek	Montgomery	37.321090	-80.412531	Intermittent	RPW	2.5	R4SB5	-	-	02080201	Upper James	Pipeline ROW	53	-	207.5	-	3	23	-	70
S-CC14	UNT to Sinking Creek	Craig	37.320922	-80.436588	Ephemeral	NRPW	5.5	R5	-	-	05050002	Middle New	Pipeline ROW	6	-	33	-	3	4	-	64
S-OO12	UNT to Sinking Creek	Giles	37.318958	-80.440548	Ephemeral	NRPW	2	R5	-	-	05050002	Middle New	Pipeline ROW	25	-	50	-	3	6	-	63
S-OO13	UNT to Sinking Creek	Giles	37.318930	-80.440930	Perennial	RPW	20	R3RB2	-	-	05050002	Middle New	Pipeline ROW	77	-	1540	-	10	570	-	63
S-OO14	UNT to Sinking Creek	Giles	37.318947	-80.441519	Perennial	RPW	4	R3RB2	-	-	05050002	Middle New	Pipeline ROW	86	-	344	-	10	127	-	63
S-UI7	UNT to Sinking Creek	Giles	37.318324	-80.547730	Ephemeral	NRPW	6	R5	-	-	05050002	Middle New	Pipeline ROW	31	-	248	-	3	35	-	44
S-UI6-b	UNT to Sinking Creek	Giles	37.318246	-80.547711	Ephemeral	NRPW	10	R5	-	-	05050002	Middle New	Pipeline ROW	78	-	780	-	10	289	-	44
S-PP21	UNT to Craig Creek	Montgomery	37.317167	-80.402235	Perennial	RPW	4	R3UB1	-	-	02080201	Upper James	Pipeline ROW	97	-	388	-	10	144	-	70
S-PP20	UNT to Craig Creek	Montgomery	37.316528	-80.405548	Perennial	RPW	6	R3UB1	-	-	02080201	Upper James	Pipeline ROW	89	-	534	-	10	198	-	70
S-RR13	Craig Creek	Montgomery	37.314604	-80.402513	Perennial	RPW	35	R2UB1	Class V - vi (Stockable)	James spinymussel; Atlantic pigtoe	02080201	Upper James	Temporary Access Road	41	-	1435	-	3	169	-	71
S-OO8	Craig Creek	Montgomery	37.313611	-80.404809	Perennial	RPW	35	R2UB1	Class V - vi (Stockable)	James spinymussel; Atlantic pigtoe	02080201	Upper James	Pipeline ROW	76	-	2660	-	10	847	-	71
S-HH16	UNT to Craig Creek	Montgomery	37.313910	-80.398983	Perennial	RPW	6	R3RB1	-	James spinymussel; Atlantic pigtoe	02080201	Upper James	Pipeline ROW	75	-	466	-	10	175	-	72
S-RR14	UNT to Craig Creek	Montgomery	37.313815	-80.402531	Ephemeral	NRPW	7	R5	-	-	02080201	Upper James	Pipeline ROW	75	-	546	-	10	202	-	71

Table 2.2 Field Survey Stream Impacts

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
S-QQ3	UNT to Sinking Creek	Giles	37.311869	-80.532365	Ephemeral	NRPW	2	R5	-	-	05050002	Middle New	Temporary Access Road	106	-	212	-	3	24	-	46
S-QQ3	UNT to Sinking Creek	Giles	37.311306	-80.532112	Ephemeral	NRPW	2	R5	-	-	05050002	Middle New	Temporary Access Road	79	-	158	-	3	15	-	46
S-QQ5-a	UNT to Sinking Creek	Giles	37.310375	-80.532255	Ephemeral	NRPW	4.5	R5	-	-	05050002	Middle New	Temporary Access Road	2	-	9	-	3	1	-	47
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
S-UU8-a	UNT to Sinking Creek	Giles	37.311730	-80.544091	Ephemeral	NRPW	7	R5	-	-	05050002	Middle New	Permanent Access Road	6	45	42	315	3	3	39	46
S-KL43	UNT to Sinking Creek	Giles	37.307824	-80.468568	Perennial	RPW	10	R3UB1	-	-	05050002	Middle New	Pipeline ROW	75	-	750	-	10	278	-	69
S-MN11	UNT to Sinking Creek	Giles	37.305508	-80.467231	Intermittent	RPW	5	R4SB1	-	-	05050002	Middle New	Pipeline ROW	84	-	420	-	10	156	-	69
S-MN12	UNT to Sinking Creek	Giles	37.300454	-80.473911	Ephemeral	NRPW	2	R5	-	-	05050002	Middle New	Pipeline ROW	88	-	176	-	10	65	-	67
S-MN21	UNT to Mill Creek	Montgomery	37.295367	-80.391243	Perennial	RPW	7	R3UB1	-	-	03010101	Upper Roanoke	Pipeline ROW	80	-	560	-	10	207	-	74
S-MM17	UNT to Sinking Creek	Giles	37.298226	-80.480624	Perennial	RPW	2	R5UB1	-	-	05050002	Middle New	Temporary Access Road	49	-	98	-	3	11	-	85
S-MN22	UNT to Mill Creek	Montgomery	37.297168	-80.386612	Ephemeral	NRPW	2	R5	-	-	03010101	Upper Roanoke	Pipeline ROW	96	-	192	-	10	71	-	79
S-RR2	Greenbrier Branch	Giles	37.299866	-80.494174	Perennial	RPW	8	R3RB2	-	-	05050002	Middle New	Pipeline ROW	85	-	680	-	10	252	-	53
S-YZ8	UNT to Greenbrier Branch	Giles	37.298612	-80.494166	Intermittent	RPW	4	R4SB3	-	-	05050002	Middle New	Pipeline ROW	35	-	235	-	3	29	-	63
S-EF62	UNT to Mill Creek	Montgomery	37.296356	-80.379119	Perennial	RPW	11	R3UB1	-	-	03010101	Upper Roanoke	Pipeline ROW	75	-	835	-	10	310	-	79
S-MM18	UNT to Sinking Creek	Giles	37.296226	-80.481465	Ephemeral	NRPW	5	R5	-	-	05050002	Middle New	Pipeline ROW	88	-	440	-	10	163	-	65
S-LM2	UNT to Mill Creek	Montgomery	37.295163	-80.367510	Perennial	RPW	16	R3UB1	-	-	03010101	Upper Roanoke	Pipeline ROW	64	-	1344	-	10	498	-	77
S-EF59	Mill Creek	Montgomery	37.295743	-80.379921	Intermittent	RPW	6	R4SB3	Class VI - II (Good); Brown Trout	Orangefin medium	03010101	Upper Roanoke	Pipeline ROW	162	-	972	-	10	338	-	75
S-LM3	Mill Creek	Roanoke	37.136436	-80.139715	Perennial	RPW	18	R3UB2	Class V - vi (Stockable)	Orangefin medium	03010101	Upper Roanoke	Pipeline ROW	78	-	1182	-	10	439	-	141
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
S-AD1	UNT to Dry Run	Montgomery	37.291414	-80.333537	Intermittent	RPW	3	R4SB5	-	-	03010101	Upper Roanoke	Temporary Access Road	9	-	27	-	3	3	-	81
S-AD1	UNT to Dry Run	Montgomery	37.291127	-80.336528	Intermittent	RPW	3	R4SB5	-	-	03010101	Upper Roanoke	Temporary Access Road	158	-	474	-	3	53	-	81
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
S-OO10	Bradshaw Creek	Montgomery	37.274247	-80.251506	Perennial	RPW	18	R2UB1	-	Roanoke logperch; Orangefin medium	03010101	Upper Roanoke	Temporary Access Road	41	-	618	-	3	68	-	105
S-OO9	UNT to Bradshaw Creek	Montgomery	37.271768	-80.248785	Intermittent	RPW	3	R4SB3	-	-	03010101	Upper Roanoke	Temporary Access Road	41	-	123	-	3	14	-	105
S-O35	North Fork Roanoke River	Montgomery	37.258536	-80.315161	Perennial	RPW	30	R2UB1	-	Roanoke logperch; Orangefin medium	03010101	Upper Roanoke	Permanent Access Road	26	-	520	-	3	85	-	59
S-O36	North Fork Roanoke River	Montgomery	37.256662	-80.314416	Perennial	RPW	20	R2UB1	-	Roanoke logperch; Orangefin medium	03010101	Upper Roanoke	Pipeline ROW	94	-	1657	-	10	625	-	59
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
S-O38	UNT to North Fork Roanoke River	Montgomery	37.257002	-80.312899	Ephemeral	NRPW	3	R5	-	-	03010101	Upper Roanoke	Pipeline ROW	59	-	297	-	10	99	-	99
S-O40	UNT to North Fork Roanoke River	Montgomery	37.254562	-80.307302	Perennial	RPW	3	R3RB2	-	-	03010101	Upper Roanoke	Pipeline ROW	117	-	351	-	10	130	-	90
S-PP23	UNT to North Fork Roanoke River	Montgomery	37.254556	-80.307151	Ephemeral	NRPW	2.5	R5	-	-	03010101	Upper Roanoke	Pipeline ROW	85	-	212.5	-	10	79	-	90
S-O39	UNT to North Fork Roanoke River	Montgomery	37.254617	-80.309486	Intermittent	RPW	6	R4SB1	-	-	03010101	Upper Roanoke	Pipeline ROW	83	-	492	-	10	182	-	90
S-MM14	UNT to Flatwoods Branch	Montgomery	37.258717	-80.293210	Ephemeral	NRPW	7	R5	-	-	03010101	Upper Roanoke	Pipeline ROW	109	-	763	-	10	273	-	94
S-MM16	UNT to Flatwoods Branch	Montgomery	37.258973	-80.296445	Intermittent	RPW	6	R4SB4	-	-	03010101	Upper Roanoke	Pipeline ROW	62	-	492	-	10	182	-	94
S-MM11	UNT to Flatwoods Branch	Montgomery	37.258403	-80.258158	Ephemeral	NRPW	3	R5	-	-	03010101	Upper Roanoke	Pipeline ROW	90	-	840	-	10	237	-	96
S-P15	UNT to Flatwoods Branch	Montgomery	37.258156	-80.258039	Intermittent	RPW	6	R4SB3	-	-	03010101	Upper Roanoke	Pipeline ROW	129	-	774	-	10	287	-	96
S-MM13	UNT to Flatwoods Branch	Montgomery	37.258176	-80.258222	Ephemeral	NRPW	5	R5	-	-	03010101	Upper Roanoke	Pipeline ROW	85	-	425	-	10	157	-	94
S-F16a/F16b	UNT to Flatwoods Branch	Montgomery	37.257986	-80.254735	Ephemeral	NRPW	3	R5	-	-	03010101	Upper Roanoke	Pipeline ROW	51	-	243	-	10	90	-	93
S-O36	UNT to Flatwoods Branch	Montgomery	37.257960	-80.251611	Intermittent	RPW	3	R4SB4	-	-	03010101	Upper Roanoke	Pipeline ROW	99	-	255	-	10	107	-	95
S-O36	UNT to Flatwoods Branch	Montgomery	37.257133	-80.251475	Intermittent	RPW	3	R4SB4	-	-	03010101	Upper Roanoke	Pipeline ROW	38	-	108	-	10	40	-	95
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
S-O33	UNT to Flatwoods Branch	Montgomery	37.257205	-80.251765	Perennial	RPW	6	R3UB3	-	-	03010101	Upper Roanoke	Pipeline ROW	23	-	138	-	3	15	-	95
S-MM31	UNT to Flatwoods Branch	Montgomery	37.255929	-80.280339	Ephemeral	NRPW	4	R5	-	-	03010101	Upper Roanoke	Pipeline ROW	81	-	324	-	10	120	-	95
S-O29	Flatwoods Branch	Montgomery	37.255387	-80.275031	Ephemeral	NRPW	1.2	R5	-	-	03010101	Upper Roanoke	Pipeline ROW	46	-	55.2	-	10	20	-	96

Table 2.2 Field Survey Stream Impacts

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
S-C25	UNT to Bradshaw Creek	Montgomery	37.254342	-80.297595	Intermittent	RPW	3	R4SB3	-	-	03010101	Upper Roanoke	Pipeline ROW	115	-	345	-	10	125	-	97
S-C24	UNT to Bradshaw Creek	Montgomery	37.254135	-80.298743	Intermittent	RPW	3	R4SB1	-	-	03010101	Upper Roanoke	Pipeline ROW	108	-	324	-	10	120	-	97
S-C21	Bradshaw Creek	Montgomery	37.251701	-80.258990	Perennial	RPW	35	R2UB1	-	Roanoke logperch; Orangefin madtom	03010101	Upper Roanoke	Pipeline ROW	89	-	1883	-	10	734	-	99
S-CD11	UNT to Bradshaw Creek	Montgomery	37.251660	-80.257428	Ephemeral	NRPW	2	R6	-	-	03010101	Upper Roanoke	Pipeline ROW	256	-	516	-	10	191	-	99
S-MN34	UNT to Roanoke River	Roanoke	37.250448	-80.204041	Intermittent	RPW	6	R4SB3	-	-	03010101	Upper Roanoke	Permanent Access Road	4	57	30	285	3	2	32	113
S-MN33	UNT to Roanoke River	Roanoke	37.24955	-80.206204	Ephemeral	NRPW	6	R6	-	-	03010101	Upper Roanoke	Permanent Access Road	5	41	25	205	3	3	23	112
S-MN32	UNT to Roanoke River	Montgomery	37.248377	-80.207762	Perennial	RPW	11	R3UB1	-	-	03010101	Upper Roanoke	Permanent Access Road	9	55	99	605	3	11	67	112
S-OO16	UNT to Roanoke River	Montgomery	37.245214	-80.208659	Perennial	RPW	4	R3RB	-	-	03010101	Upper Roanoke	Pipeline ROW	76	-	304	-	10	113	-	114
S-NN19	UNT to Roanoke River	Montgomery	37.244319	-80.208995	Intermittent	RPW	3.5	R4SB3	-	-	03010101	Upper Roanoke	Pipeline ROW	75	-	365	-	10	99	-	114
S-NN18	Roanoke River	Montgomery	37.233402	-80.197943	Perennial	TNW	70	R2UB1	Class V - ***	Roanoke logperch; Orangefin madtom	03010101	Upper Roanoke	Pipeline ROW	88	-	4308	-	10	1696	-	116
S-AE16	UNT to Roanoke River	Montgomery	37.231693	-80.198778	Intermittent	RPW	5	R4SB5	-	-	03010101	Upper Roanoke	Pipeline ROW	76	-	376	-	10	139	-	116
S-I1	UNT to Roanoke River	Montgomery	37.231179	-80.199400	Intermittent	RPW	14	R4SB3	-	-	03010101	Upper Roanoke	Pipeline ROW	76	-	1050	-	10	389	-	116
S-CD12	UNT to South Fork Roanoke River	Montgomery	37.225048	-80.200000	Perennial	RPW	15	R3UB3	-	-	03010101	Upper Roanoke	Pipeline ROW	74	-	1332	-	10	493	-	119
S-EF19	UNT to Indian Run	Montgomery	37.219102	-80.197390	Ephemeral	NRPW	6	R6	-	-	03010101	Upper Roanoke	Pipeline ROW	79	-	395	-	10	146	-	120
S-EF20a	UNT to Roanoke River	Montgomery	37.219922	-80.193318	Perennial	RPW	6	R3UB1	-	-	03010101	Upper Roanoke	Pipeline ROW	109	-	654	-	10	242	-	121
S-MN22	UNT to Roanoke River	Montgomery	37.208354	-80.187282	Perennial	RPW	16	R6	-	-	03010101	Upper Roanoke	Pipeline ROW	176	-	2825	-	10	972	-	123
S-I50	UNT to Roanoke River	Roanoke	37.194064	-80.187533	Perennial	RPW	25	R3RB1	-	-	03010101	Upper Roanoke	Pipeline ROW	77	-	1925	-	10	713	-	127
S-Y13	UNT to Bottom Creek	Roanoke	37.187667	-80.151146	Intermittent	RPW	8	R4SB3	-	-	03010101	Upper Roanoke	Pipeline ROW	65	-	880	-	10	282	-	130
S-Y14	UNT to Bottom Creek	Roanoke	37.187568	-80.151049	Perennial	RPW	14	R3UB1	Class VI - II (Good); Brook Trout	Orangefin madtom	03010101	Upper Roanoke	Pipeline ROW	77	-	1078	-	10	399	-	130
S-EF34	UNT to Bottom Creek	Roanoke	37.180809	-80.144900	Perennial	RPW	10	R2UB1	-	-	03010101	Upper Roanoke	Pipeline ROW	195	-	1380	-	10	511	-	132
S-EF34	UNT to Bottom Creek	Roanoke	37.180332	-80.140475	Perennial	RPW	10	R2UB1	-	-	03010101	Upper Roanoke	ATWS	17	-	170	-	3	19	-	132
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
S-EF35	UNT to Bottom Creek	Roanoke	37.179397	-80.141344	Intermittent	RPW	8	R4SB3	-	-	03010101	Upper Roanoke	Pipeline ROW	111	-	888	-	10	329	-	132
S-EF33	UNT to Bottom Creek	Roanoke	37.179155	-80.141000	Intermittent	RPW	9	R4SB3	-	-	03010101	Upper Roanoke	Pipeline ROW	148	-	1332	-	10	493	-	132
S-U51	UNT to Bottom Creek	Roanoke	37.172484	-80.139972	Intermittent	RPW	3	R4SB4	-	-	03010101	Upper Roanoke	Pipeline ROW	14	-	42	-	3	5	-	133
S-U57	UNT to Bottom Creek	Roanoke	37.17204	-80.129263	Perennial	RPW	5	R3UB2	-	-	03010101	Upper Roanoke	ATWS	19	-	63	-	3	11	-	135
S-U57	UNT to Bottom Creek	Roanoke	37.171968	-80.129051	Perennial	RPW	5	R3UB2	-	-	03010101	Upper Roanoke	ATWS	7	-	35	-	3	4	-	135
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
S-U62	UNT to Bottom Creek	Roanoke	37.170458	-80.138215	Intermittent	RPW	15	R4SB4	-	-	03010101	Upper Roanoke	Pipeline ROW	224	-	3360	-	10	1344	-	134
S-U65	UNT to Bottom Creek	Roanoke	37.169474	-80.130356	Perennial	RPW	8	R3UB2	-	-	03010101	Upper Roanoke	Permanent Access Road	-	50	-	400	3	-	44	135
S-U63	UNT to Bottom Creek	Roanoke	37.169211	-80.138258	Intermittent	RPW	3	R4SB4	-	-	03010101	Upper Roanoke	Pipeline ROW	361	-	1805	-	10	669	-	135
S-U65	Bottom Creek	Roanoke	37.168300	-80.136285	Perennial	RPW	20	R3UB1	Class VI - II (Good); Brook Trout	-	03010101	Upper Roanoke	Pipeline ROW	99	-	1980	-	10	735	-	134
S-U64	UNT to Bottom Creek	Roanoke	37.168361	-80.138381	Perennial	RPW	15	R3UB2	-	-	03010101	Upper Roanoke	Pipeline ROW	35	-	525	-	3	63	-	134
S-U69	UNT to Bottom Creek	Roanoke	37.165662	-80.139317	Perennial	RPW	10	R3UB1	-	-	03010101	Upper Roanoke	Pipeline ROW	152	-	1520	-	10	563	-	134
S-U90	UNT to Bottom Creek	Roanoke	37.165885	-80.139375	Intermittent	RPW	6	R4SB3	-	-	03010101	Upper Roanoke	Pipeline ROW	128	-	640	-	10	237	-	134
S-KL25	UNT to Mill Creek	Roanoke	37.160175	-80.134789	Intermittent	RPW	6	R4SB5	-	-	03010101	Upper Roanoke	Pipeline ROW	82	-	410	-	10	152	-	135
S-ST9b	UNT to Mill Creek	Roanoke	37.154424	-80.129179	Perennial	RPW	15	R3UB2	-	-	03010101	Upper Roanoke	Pipeline ROW	89	-	1335	-	10	494	-	137
S-EF31	UNT to Bottom Creek	Roanoke	37.160901	-80.138742	Intermittent	RPW	3	R4SB3	-	-	03010101	Upper Roanoke	Temporary Access Road	44	-	132	-	3	16	-	136
S-KL36	UNT to Mill Creek	Roanoke	37.160009	-80.13245	Perennial	RPW	15	R3UB2	-	-	03010101	Upper Roanoke	Pipeline ROW	82	-	1230	-	10	456	-	136
S-MN37	UNT to Bottom Creek	Roanoke	37.149763	-80.139125	Ephemeral	NRPW	2	R6	-	-	03010101	Upper Roanoke	Temporary Access Road	11	-	22	-	3	2	-	139
S-EF32	UNT to Bottom Creek	Roanoke	37.149741	-80.139067	Intermittent	RPW	6	R4SB3	-	-	03010101	Upper Roanoke	Temporary Access Road	390	-	2130	-	3	347	-	139
S-U12	UNT to Mill Creek	Roanoke	37.148333	-80.133919	Perennial	RPW	13	R3UB2	-	-	03010101	Upper Roanoke	Pipeline ROW	83	-	1079	-	10	400	-	138
S-EF44	UNT to Bottom Creek	Roanoke	37.143003	-80.138359	Intermittent	RPW	7	R4SB3	-	-	03010101	Upper Roanoke	Pipeline ROW	76	-	532	-	10	197	-	140

Table 2.2 Field Survey Stream Impacts

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
S-Y9	UNT to Mill Creek	Roanoke	37.134579	-80.137649	Intermittent	RPW	4	R4SB6	-	-	03010101	Upper Roanoke	Pipeline ROW	44	-	175	-	3	80	-	142
S-Y7	UNT to Mill Creek	Roanoke	37.134491	-80.137623	Intermittent	RPW	4	R4SB6	-	-	03010101	Upper Roanoke	Pipeline ROW	173	-	692	-	10	255	-	142
S-Y8	UNT to Mill Creek	Roanoke	37.134179	-80.137464	Perennial	RPW	4	R3UB3	-	-	03010101	Upper Roanoke	Pipeline ROW	84	-	336	-	10	124	-	143
S-B22	UNT to Mill Creek	Roanoke	37.128923	-80.133792	Perennial	RPW	4	R3UB3	-	-	03010101	Upper Roanoke	Pipeline ROW	107	-	428	-	10	159	-	145
S-B23	UNT to Mill Creek	Roanoke	37.128853	-80.133910	Intermittent	RPW	2	R4SB4	-	-	03010101	Upper Roanoke	Pipeline ROW	14	-	56	-	3	3	-	146
S-B20	UNT to Mill Creek	Roanoke	37.128490	-80.133601	Ephemeral	NRPW	5	R5	-	-	03010101	Upper Roanoke	Pipeline ROW	147	-	735	-	10	272	-	146
S-B21	UNT to Mill Creek	Roanoke	37.128484	-80.133643	Perennial	RPW	4	R3UB2	-	-	03010101	Upper Roanoke	Pipeline ROW	92	-	368	-	10	136	-	146
S-H1	Green Creek	Franklin	37.127733	-80.116787	Perennial	RPW	10	R2UB2	-	Orangefin madtom	03010101	Upper Roanoke	Pipeline ROW	75	-	750	-	10	282	-	147
S-G26	UNT to Green Creek	Franklin	37.127077	-80.111387	Intermittent	RPW	7	R4RB2	-	-	03010101	Upper Roanoke	Pipeline ROW	79	-	553	-	10	205	-	148
S-G27	UNT to Green Creek	Franklin	37.126952	-80.111062	Perennial	RPW	7	R3RB2	-	-	03010101	Upper Roanoke	Pipeline ROW	79	-	553	-	10	205	-	148
S-G24	UNT to Green Creek	Franklin	37.126412	-80.121398	Intermittent	RPW	8	R4RB3	-	-	03010101	Upper Roanoke	Pipeline ROW	75	-	450	-	10	167	-	147
S-G25	UNT to Green Creek	Franklin	37.126388	-80.121401	Intermittent	RPW	7	R4RB4	-	-	03010101	Upper Roanoke	Pipeline ROW	42	-	294	-	3	33	-	147
S-RR16	UNT to Green Creek	Franklin	37.125988	-80.113578	Intermittent	RPW	2	R3UB3	-	-	03010101	Upper Roanoke	Permanent Access Road	5	-	16	-	3	2	-	148
S-D8	North Fork Blackwater River	Franklin	37.123095	-80.074673	Perennial	RPW	16	R2UB1	-	Roanoke logperch	03010101	Upper Roanoke	Pipeline ROW	78	-	942	-	10	349	-	155 & 154
S-D9	UNT to North Fork Blackwater River	Franklin	37.123074	-80.075898	Intermittent	RPW	7	R4RB4	-	-	03010101	Upper Roanoke	ATWS	25	-	175	-	3	19	-	153
S-D6	UNT to North Fork Blackwater River	Franklin	37.122702	-80.075859	Intermittent	RPW	7	R4RB4	-	-	03010101	Upper Roanoke	ATWS	25	-	175	-	3	19	-	153
S-D5	UNT to North Fork Blackwater River	Franklin	37.122566	-80.075797	Intermittent	RPW	7	R4RB4	-	-	03010101	Upper Roanoke	Pipeline ROW	80	-	560	-	10	267	-	153
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
S-D10	UNT to North Fork Blackwater River	Franklin	37.122301	-80.076907	Intermittent	RPW	8	R4RB3	-	-	03010101	Upper Roanoke	Pipeline ROW	77	-	616	-	10	228	-	153
S-D11	UNT to North Fork Blackwater River	Franklin	37.121897	-80.083065	Perennial	RPW	10	R3UB1	-	-	03010101	Upper Roanoke	Pipeline ROW	81	-	810	-	10	300	-	152
S-D12	UNT to North Fork Blackwater River	Franklin	37.121586	-80.085642	Intermittent	RPW	6	R4RB4	-	-	03010101	Upper Roanoke	Pipeline ROW	64	-	524	-	10	120	-	152
S-MW29	UNT to North Fork Blackwater River	Franklin	37.12155	-80.07619	Perennial	RPW	7	R3UB3	-	-	03010101	Upper Roanoke	Pipeline ROW	78	-	546	-	10	202	-	153
S-MW28	UNT to North Fork Blackwater River	Franklin	37.121211	-80.08163	Perennial	RPW	7	R3UB2	-	-	03010101	Upper Roanoke	Pipeline ROW	92	-	644	-	10	239	-	155
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
S-D13	UNT to North Fork Blackwater River	Franklin	37.121513	-80.085860	Intermittent	RPW	4	R4RB4	-	-	03010101	Upper Roanoke	Pipeline ROW	117	-	456	-	10	175	-	152
S-D17	UNT to North Fork Blackwater River	Franklin	37.121324	-80.087826	Intermittent	RPW	7	R4RB5	-	-	03010101	Upper Roanoke	Pipeline ROW	542	-	3794	-	10	1405	-	152
S-D17	UNT to North Fork Blackwater River	Franklin	37.121108	-80.087060	Intermittent	RPW	7	R4RB3	-	-	03010101	Upper Roanoke	Permanent Access Road	31	24	217	239	3	24	25	152
S-D17	UNT to North Fork Blackwater River	Franklin	37.121103	-80.086852	Intermittent	RPW	7	R4RB3	-	-	03010101	Upper Roanoke	Pipeline ROW	61	-	427	-	10	159	-	152
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
S-I4	UNT to North Fork Blackwater River	Franklin	37.116879	-80.060300	Perennial	RPW	16	R3UB1	-	-	03010101	Upper Roanoke	Pipeline ROW	80	-	1200	-	10	444	-	156
S-EF16	UNT to Green Creek	Franklin	37.114845	-80.097660	Intermittent	RPW	2	R4SB3	-	-	03010101	Upper Roanoke	ATWS	95	-	190	-	3	21	-	151
S-GH7	UNT to North Fork Blackwater River	Franklin	37.106514	-80.054219	Perennial	RPW	9	R3UB1	-	-	03010101	Upper Roanoke	Pipeline ROW	119	-	1071	-	10	397	-	158
S-GH15	UNT to North Fork Blackwater River	Franklin	37.106177	-80.050108	Intermittent	RPW	4	R4SB5	-	-	03010101	Upper Roanoke	Pipeline ROW	75	-	300	-	10	111	-	159
S-GH14	UNT to North Fork Blackwater River	Franklin	37.105893	-80.049861	Perennial	RPW	4	R3UB3	-	-	03010101	Upper Roanoke	Pipeline ROW	76	-	304	-	10	113	-	159
S-GH11	UNT to North Fork Blackwater River	Franklin	37.104707	-80.046230	Intermittent	RPW	3	R4SB4	-	-	03010101	Upper Roanoke	Pipeline ROW	77	-	231	-	10	86	-	159
S-GH9	UNT to North Fork Blackwater River	Franklin	37.104329	-80.045343	Perennial	RPW	4	R3UB1	-	-	03010101	Upper Roanoke	Pipeline ROW	78	-	312	-	10	116	-	159
S-RR08	UNT to North Fork Blackwater River	Franklin	37.103290	-80.041868	Ephemeral	NRPW	7	R5	-	-	03010101	Upper Roanoke	Pipeline ROW	76	-	532	-	10	197	-	159
S-RR09	UNT to North Fork Blackwater River	Franklin	37.102491	-80.041046	Ephemeral	NRPW	9	R5	-	-	03010101	Upper Roanoke	Pipeline ROW	77	-	693	-	10	257	-	160
S-RR11	UNT to North Fork Blackwater River	Franklin	37.101127	-80.039853	Ephemeral	NRPW	7	R5	-	-	03010101	Upper Roanoke	Pipeline ROW	77	-	539	-	10	200	-	160
S-I/1	UNT to North Fork Blackwater River	Franklin	37.093062	-80.027734	Perennial	RPW	12	R3UB1	-	-	03010101	Upper Roanoke	Pipeline ROW	107	-	1284	-	10	476	-	162
S-I/2	UNT to North Fork Blackwater River	Franklin	37.092691	-80.027593	Intermittent	RPW	2.5	R4SB3	-	-	03010101	Upper Roanoke	Pipeline ROW	40	-	100	-	10	37	-	162
S-I8	UNT to Little Creek	Franklin	37.092697	-79.975403	Intermittent	NRPW	3	R4RB5	-	-	03010101	Upper Roanoke	Pipeline ROW	76	-	228	-	10	84	-	170
S-I/3	UNT to North Fork Blackwater River	Franklin	37.092600	-80.027231	Intermittent	RPW	5	R4SB5	-	-	03010101	Upper Roanoke	Pipeline ROW	77	-	585	-	10	143	-	163

Table 2.2 Field Survey Stream Impacts

S-GH5	UNT to Little Creek	Franklin	37.092397	-79.953227	Perennial	RPW	3	R4SB4	-	-	03010101	Upper Roanoke	Pipeline ROW	81	-	243	-	10	90	-	169
S-H12	UNT to Little Creek	Franklin	37.091805	-79.957839	Intermittent	RPW	2	R4RB4	-	-	03010101	Upper Roanoke	Pipeline ROW	85	-	170	-	10	63	-	170
S-H11	UNT to Little Creek	Franklin	37.091964	-79.956051	Perennial	RPW	4	R3UB3	-	-	03010101	Upper Roanoke	Pipeline ROW	95	-	362	-	10	145	-	170
S-I5	UNT to Little Creek	Franklin	37.091415	-79.950944	Intermittent	RPW	2	R4RB4	-	-	03010101	Upper Roanoke	Pipeline ROW	78	-	156	-	10	58	-	166
S-I9	UNT to Little Creek	Franklin	37.091352	-79.950620	Perennial	RPW	20	R3UB1	-	-	03010101	Upper Roanoke	Pipeline ROW	81	-	1620	-	10	600	-	168
S-I7	UNT to Little Creek	Franklin	37.091354	-79.952613	Intermittent	RPW	4	R4RB4	-	-	03010101	Upper Roanoke	Pipeline ROW	76	-	304	-	10	113	-	169
S-L4	UNT to North Fork Blackwater River	Franklin	37.091189	-80.024396	Perennial	RPW	4	R2UB1	-	-	03010101	Upper Roanoke	Pipeline ROW	101	-	404	-	10	150	-	182
S-KL1	UNT to Little Creek	Franklin	37.090405	-79.956415	Perennial	RPW	4.5	R3UB1	-	-	03010101	Upper Roanoke	Pipeline ROW	29	-	130.5	-	3	14	-	167
S-KL6	UNT to Little Creek	Franklin	37.090361	-79.956354	Perennial	RPW	3.7	R3UB2	-	-	03010101	Upper Roanoke	Pipeline ROW	76	-	281.2	-	10	104	-	167
S-GH2	UNT to Tests Creek	Franklin	37.090195	-79.953956	Intermittent	RPW	2	R4SB4	-	-	03010101	Upper Roanoke	Pipeline ROW	85	-	170	-	10	63	-	176
S-GH4	UNT to Tests Creek	Franklin	37.089812	-79.956077	Perennial	RPW	5	R3UB1	-	-	03010101	Upper Roanoke	Pipeline ROW	27	-	135	-	3	16	-	175
S-GH3	UNT to Tests Creek	Franklin	37.089745	-79.956042	Perennial	RPW	6	R4SB3	-	-	03010101	Upper Roanoke	Pipeline ROW	76	-	456	-	10	169	-	175
S-I16	UNT to Little Creek	Franklin	37.089249	-80.018301	Ephemeral	NRPW	1.5	R6	-	-	03010101	Upper Roanoke	Pipeline ROW	29	-	43.5	-	3	5	-	163
S-IJ10	Little Creek	Franklin	37.089179	-80.009026	Perennial	RPW	3	R3RB1	-	-	03010101	Upper Roanoke	Pipeline ROW	77	-	231	-	10	86	-	164
S-CD6	Little Creek	Franklin	37.087564	-79.913921	Perennial	RPW	70	R2UB1	-	Roanoke logperch	03010101	Upper Roanoke	Pipeline ROW	77	-	4424	-	10	1628	-	165
S-I12	Little Creek	Franklin	37.049219	-79.905513	Perennial	RPW	80	R2RB1	-	Roanoke logperch	03010101	Upper Roanoke	Pipeline ROW	76	-	3247	-	10	1203	-	160
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S-E29	UNT to Tests Creek	Franklin	37.069175	-79.950110	Perennial	RPW	8	R3UB1	-	-	03010101	Upper Roanoke	Pipeline ROW	80	-	640	-	10	237	-	176
S-E28	Tests Creek	Franklin	37.069047	-79.9613	Perennial	RPW	12	R2UB2	-	Roanoke logperch	03010101	Upper Roanoke	Pipeline ROW	82	-	984	-	10	364	-	172
S-E26	Tests Creek	Franklin	37.068947	-79.948067	Perennial	RPW	12	R2UB2	-	Roanoke logperch	03010101	Upper Roanoke	Pipeline ROW	76	-	912	-	10	336	-	172
S-E35	Tests Creek	Franklin	37.068879	-79.946566	Perennial	RPW	12	R2UB2	-	Roanoke logperch	03010101	Upper Roanoke	Pipeline ROW	101	-	1212	-	10	449	-	172
S-EF12	Tests Creek	Franklin	37.073367	-79.938665	Perennial	RPW	20	R2UB1	-	Roanoke logperch	03010101	Upper Roanoke	Pipeline ROW	76	-	1520	-	10	565	-	179
S-D33	Tests Creek	Franklin	37.070322	-79.931039	Perennial	RPW	20	R2UB2	-	Roanoke logperch	03010101	Upper Roanoke	Pipeline ROW	82	-	2035	-	10	772	-	181
S-C14	Tests Creek	Franklin	37.065866	-79.921885	Perennial	RPW	50	R3UB1	-	Roanoke logperch	03010101	Upper Roanoke	Pipeline ROW	90	-	3663	-	10	1353	-	183
S-C17	Tests Creek	Franklin	37.066290	-79.918015	Perennial	RPW	30	R3UB1	-	Roanoke logperch	03010101	Upper Roanoke	Pipeline ROW	83	-	1665	-	10	567	-	185
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S-EF4	UNT to Tests Creek	Franklin	37.075955	-79.941911	Perennial	RPW	11	R3UB1	-	-	03010101	Upper Roanoke	Pipeline ROW	80	-	880	-	10	326	-	178
S-EF7	UNT to Tests Creek	Franklin	37.074584	-79.941123	Ephemeral	NRPW	2	R6	-	-	03010101	Upper Roanoke	Pipeline ROW	106	-	212	-	10	78	-	179
S-EF7	UNT to Tests Creek	Franklin	37.074536	-79.941336	Ephemeral	NRPW	2	R6	-	-	03010101	Upper Roanoke	ATWS	22	-	44	-	3	5	-	179
[illegible]																					
S-MM42	UNT to Tests Creek	Franklin	37.070703	-79.937069	Ephemeral	NRPW	2	R6	-	-	03010101	Upper Roanoke	Pipeline ROW	81	-	162	-	10	60	-	180
S-D32	UNT to Tests Creek	Franklin	37.070101	-79.932752	Intermittent	RPW	3	R4RB4	-	-	03010101	Upper Roanoke	Pipeline ROW	83	-	664	-	10	246	-	181
S-D18	UNT to Tests Creek	Franklin	37.069580	-79.926213	Ephemeral	NRPW	2	R6	-	-	03010101	Upper Roanoke	Pipeline ROW	30	-	60	-	3	7	-	181
S-RR16	UNT to Tests Creek	Franklin	37.069542	-79.933582	Perennial	RPW	14	R3UB3	-	-	03010101	Upper Roanoke	Pipeline ROW	97	-	1358	-	10	503	-	181
S-D20	UNT to Tests Creek	Franklin	37.069465	-79.926730	Intermittent	RPW	5	R4RB4	-	-	03010101	Upper Roanoke	Pipeline ROW	76	-	380	-	10	126	-	181
S-KL61	UNT to Blackwater River	Franklin	37.064794	-79.874477	Ephemeral	NRPW	4	R6	-	-	03010101	Upper Roanoke	Pipeline ROW	28	-	112	-	3	12	-	182
S-EF43	UNT to Blackwater River	Franklin	37.064748	-79.874430	Intermittent	RPW	2	R4SB3	-	-	03010101	Upper Roanoke	Pipeline ROW	86	-	172	-	10	64	-	182
S-YZ4	UNT to Blackwater River	Franklin	37.064793	-79.878180	Ephemeral	NRPW	3	R6	-	-	03010101	Upper Roanoke	Pipeline ROW	84	-	252	-	10	93	-	181
S-YZ5	UNT to Blackwater River	Franklin	37.063464	-79.878251	Ephemeral	NRPW	4	R6	-	-	03010101	Upper Roanoke	Pipeline ROW	86	-	344	-	10	127	-	181
S-KL41	UNT to Blackwater River	Franklin	37.062362	-79.862639	Perennial	RPW	12	R3RB1	-	-	03010101	Upper Roanoke	Pipeline ROW	75	-	900	-	10	333	-	199
S-KL39	UNT to Blackwater River	Franklin	37.061193	-79.850018	Perennial	RPW	8.5	R3UB1	-	-	03010101	Upper Roanoke	Pipeline ROW	121	-	1028.5	-	10	391	-	191
S-C18	UNT to Tests Creek	Franklin	37.062810	-79.921179	Perennial	RPW	15	R3UB1	-	-	03010101	Upper Roanoke	Pipeline ROW	79	-	1185	-	10	417	-	183
S-KL64	UNT to Maggodee Creek	Franklin	37.059535	-79.840624	Perennial	RPW	10	R3UB1	-	-	03010101	Upper Roanoke	Pipeline ROW	79	-	750	-	10	251	-	197

Table 2.2 Field Survey Stream Impacts

S-C6	UNT to Blackwater River	Franklin	37.050098	-79.853695	Intermittent	RPW	5	R4RB5	-	-	03010101	Upper Roanoke	Pipeline ROW	86	-	430	-	10	169	-	195
S-F4	UNT to Blackwater River	Franklin	37.050060	-79.853879	Ephemeral	NRPW	10	R6	-	-	03010101	Upper Roanoke	Pipeline ROW	52	-	520	-	3	91	-	196
S-KL32	UNT to Maggodee Creek	Franklin	37.058168	-79.844677	Ephemeral	NRPW	1	R6	-	-	03010101	Upper Roanoke	Pipeline ROW	105	-	105	-	10	39	-	196
S-S10	UNT to Maggodee Creek	Franklin	37.057620	-79.838615	Perennial	RPW	11	R3UB2	-	-	03010101	Upper Roanoke	Temporary Access Road	8	-	88	-	3	10	-	197
S-S11	UNT to Maggodee Creek	Franklin	37.057778	-79.838583	Perennial	RPW	11	R3UB3	-	-	03010101	Upper Roanoke	Temporary Access Road	41	-	451	-	3	50	-	197
S-P5	UNT to Maggodee Creek	Franklin	37.057724	-79.838408	Perennial	RPW	30	R3RB1	-	-	03010101	Upper Roanoke	Pipeline ROW	83	-	2490	-	10	922	-	197
S-HH4	UNT to Maggodee Creek	Franklin	37.056994	-79.835785	Intermittent	RPW	9	R4RB3	-	-	03010101	Upper Roanoke	Pipeline ROW	97	-	873	-	10	323	-	198
S-KL31	UNT to Blackwater River	Franklin	37.059084	-79.850384	Perennial	RPW	5.5	R3UB2	-	-	03010101	Upper Roanoke	Pipeline ROW	67	-	368.5	-	10	136	-	195
S-KL35	UNT to Blackwater River	Franklin	37.055512	-79.863177	Perennial	RPW	7	R3UB1	-	-	03010101	Upper Roanoke	Pipeline ROW	75	-	545	-	10	202	-	190
S-C20	UNT to Maggodee Creek	Franklin	37.055193	-79.833861	Ephemeral	NRPW	4	R6	-	-	03010101	Upper Roanoke	Pipeline ROW	79	-	300	-	10	111	-	195
S-C20	UNT to Maggodee Creek	Franklin	37.054793	-79.833575	Ephemeral	NRPW	4	R6	-	-	03010101	Upper Roanoke	Temporary Access Road	29	-	112	-	3	12	-	196
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S-C19	Maggodee Creek	Franklin	37.055147	-79.830086	Perennial	RPW	40	R3UB1	-	Roanoke logperch	03010101	Upper Roanoke	Pipeline ROW	73	-	3005	-	10	1113	-	196
S-KL36	UNT to Blackwater River	Franklin	37.053335	-79.854604	Perennial	RPW	7.5	R3UB1	-	-	03010101	Upper Roanoke	Pipeline ROW	60	-	600	-	10	222	-	199
S-F11	Blackwater River	Franklin	37.052845	-79.825711	Perennial	THW	90	R2	-	Roanoke logperch	03010101	Upper Roanoke	Pipeline ROW	91	-	6760	-	10	2505	-	199
S-KL38	UNT to Blackwater River	Franklin	37.052125	-79.868182	Perennial	RPW	2.5	R3UB1	-	-	03010101	Upper Roanoke	Pipeline ROW	110	-	290	-	10	107	-	199
S-F5b	UNT to Blackwater River	Franklin	37.049236	-79.817223	Perennial	RPW	15	R3UB1	-	-	03010101	Upper Roanoke	Pipeline ROW	75	-	1140	-	10	423	-	200
S-F10	UNT to Blackwater River	Franklin	37.048037	-79.813934	Ephemeral	NRPW	9	R6	-	-	03010101	Upper Roanoke	Pipeline ROW	86	-	774	-	10	287	-	200
S-CD1	UNT to Blackwater River	Franklin	37.047768	-79.807538	Perennial	RPW	3.5	R3UB2	-	-	03010101	Upper Roanoke	Pipeline ROW	104	-	364	-	10	135	-	188
S-F8a	UNT to Blackwater River	Franklin	37.047172	-79.813000	Intermittent	RPW	15	R4RB3	-	-	03010101	Upper Roanoke	Pipeline ROW	55	-	825	-	10	306	-	200
S-MM28	UNT to Maple Branch	Franklin	37.043871	-79.832898	Perennial	RPW	15	R3RB1	-	-	03010101	Upper Roanoke	Temporary Access Road	43	-	630	-	3	70	-	201
S-MM23	Maple Branch	Franklin	37.043884	-79.832874	Perennial	RPW	20	R2RB1	-	-	03010101	Upper Roanoke	Temporary Access Road	78	-	1560	-	3	173	-	201
S-GG4	UNT to Blackwater River	Franklin	37.042742	-79.809016	Ephemeral	NRPW	5	R6	-	-	03010101	Upper Roanoke	Pipeline ROW	86	-	430	-	10	159	-	203
S-A38	UNT to Foul Ground Creek	Franklin	37.037916	-79.804337	Ephemeral	NRPW	4	R6	-	-	03010101	Upper Roanoke	Pipeline ROW	77	-	308	-	10	114	-	204
S-A39	UNT to Foul Ground Creek	Franklin	37.036271	-79.799443	Intermittent	RPW	8	R4RB4	-	-	03010101	Upper Roanoke	Pipeline ROW	143	-	1278	-	10	473	-	205
S-A40	UNT to Foul Ground Creek	Franklin	37.036173	-79.799240	Intermittent	RPW	5.5	R4RB4	-	-	03010101	Upper Roanoke	Pipeline ROW	13	-	79.4	-	3	5	-	205
S-A41	Foul Ground Creek	Franklin	37.031714	-79.788213	Perennial	RPW	12	R3UB1	-	-	03010101	Upper Roanoke	Pipeline ROW	76	-	912	-	10	336	-	207
S-GH36	UNT to Foul Ground Creek	Franklin	37.031063	-79.778555	Intermittent	RPW	3	R4RB5	-	-	03010101	Upper Roanoke	Pipeline ROW	83	-	249	-	10	92	-	208
S-KL17	UNT to Foul Ground Creek	Franklin	37.031011	-79.776435	Intermittent	RPW	6	R4RB3	-	-	03010101	Upper Roanoke	Pipeline ROW	77	-	385	-	10	143	-	208
S-GH37	UNT to Foul Ground Creek	Franklin	37.030974	-79.776190	Intermittent	RPW	3	R4RB3	-	-	03010101	Upper Roanoke	Pipeline ROW	46	-	138	-	3	15	-	208
S-GH38	UNT to Foul Ground Creek	Franklin	37.030972	-79.776083	Intermittent	RPW	3	R4RB4	-	-	03010101	Upper Roanoke	Pipeline ROW	7	-	21	-	3	2	-	208
S-GH39	UNT to Foul Ground Creek	Franklin	37.030561	-79.776066	Intermittent	RPW	4	R4RB4	-	-	03010101	Upper Roanoke	Pipeline ROW	103	-	412	-	10	153	-	208
S-GH40	UNT to Foul Ground Creek	Franklin	37.028603	-79.774765	Ephemeral	NRPW	3	R6	-	-	03010101	Upper Roanoke	Pipeline ROW	89	-	267	-	10	99	-	208
S-GH44	UNT to Foul Ground Creek	Franklin	37.028362	-79.773859	Perennial	RPW	6	R3UB2	-	-	03010101	Upper Roanoke	Pipeline ROW	175	-	1050	-	10	391	-	209
S-U47	UNT to Foul Ground Creek	Franklin	37.028373	-79.773853	Ephemeral	NRPW	2	R6	-	-	03010101	Upper Roanoke	Pipeline ROW	16	-	32	-	3	4	-	209
S-G22	UNT to Poplar Camp Creek	Franklin	37.019612	-79.761056	Perennial	RPW	12	R3UB1	-	-	03010101	Upper Roanoke	Pipeline ROW	80	-	960	-	10	356	-	210
S-G23	UNT to Poplar Camp Creek	Franklin	37.019625	-79.762002	Intermittent	RPW	3	R4RB2	-	-	03010101	Upper Roanoke	Pipeline ROW	42	-	126	-	3	14	-	210
S-G21	UNT to Poplar Camp Creek	Franklin	37.019359	-79.761643	Intermittent	RPW	3	R4RB4	-	-	03010101	Upper Roanoke	Pipeline ROW	54	-	162	-	3	18	-	210
S-G20	Poplar Camp Creek	Franklin	37.017364	-79.760000	Perennial	RPW	10	R3UB1	-	-	03010101	Upper Roanoke	Pipeline ROW	60	-	600	-	10	266	-	211
S-G18	UNT to Blackwater River	Franklin	37.009236	-79.754233	Intermittent	RPW	2	R4RB4	-	-	03010101	Upper Roanoke	Pipeline ROW	51	-	102	-	10	60	-	212
S-G17	UNT to Blackwater River	Franklin	37.008496	-79.752665	Ephemeral	NRPW	5	R6	-	-	03010101	Upper Roanoke	Pipeline ROW	78	-	390	-	10	144	-	213
S-G17	UNT to Blackwater River	Franklin	37.008446	-79.752154	Ephemeral	NRPW	6	R6	-	-	03010101	Upper Roanoke	Temporary Access Road	13	-	65	-	3	7	-	213

Table 2.2 Field Survey Stream Impacts

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
S-E16	UNT to Blackwater River	Franklin	37.001271	-79.747749	Perennial	RPW	7	R3UB1	-	-	03010101	Upper Roanoke	Pipeline ROW	94	-	658	-	10	244	-	214
S-E17	UNT to Blackwater River	Franklin	37.000529	-79.742760	Perennial	RPW	5	R3RB1	-	-	03010101	Upper Roanoke	Pipeline ROW	98	-	760	-	10	251	-	214
S-E14	UNT to Blackwater River	Franklin	36.995514	-79.736144	Perennial	RPW	20	R2UB2	-	-	03010101	Upper Roanoke	Pipeline ROW	82	-	1640	-	10	507	-	218
S-H38	UNT to Jacks Creek	Franklin	36.969430	-79.732365	Perennial	RPW	12	R3UB2	-	-	03010101	Upper Roanoke	Pipeline ROW	95	-	1140	-	10	423	-	217
S-H32	UNT to Jacks Creek	Franklin	36.968273	-79.726199	Perennial	RPW	10	R3UB2	-	Orangefin medium	03010101	Upper Roanoke	Pipeline ROW	81	-	810	-	10	300	-	219
S-H37	UNT to Jacks Creek	Franklin	36.966931	-79.717450	Ephemeral	NRPW	5	R6	-	-	03010101	Upper Roanoke	Pipeline ROW	52	-	492	-	10	182	-	218
S-H34	UNT to Jacks Creek	Franklin	36.966209	-79.711861	Perennial	RPW	3	R3UB2	-	-	03010101	Upper Roanoke	Pipeline ROW	92	-	276	-	10	102	-	219
S-H36	UNT to Jacks Creek	Franklin	36.965208	-79.714823	Perennial	RPW	3	R3UB1	-	-	03010101	Upper Roanoke	Pipeline ROW	124	-	372	-	10	198	-	218
S-H30	UNT to Jacks Creek	Franklin	36.957961	-79.703711	Intermittent	RPW	1	R4RB5	-	-	03010101	Upper Roanoke	Pipeline ROW	4	-	4	-	3	0	-	221
S-A18	UNT to Jacks Creek	Franklin	36.957815	-79.700634	Intermittent	RPW	2.5	R4RB5	-	-	03010101	Upper Roanoke	Pipeline ROW	67	-	226.2	-	10	84	-	221
S-A19/H29	UNT to Jacks Creek	Franklin	36.957719	-79.699901	Intermittent	RPW	7	R4SB4	-	-	03010101	Upper Roanoke	Pipeline ROW	212	-	1484	-	10	660	-	221
S-A20	UNT to Jacks Creek	Franklin	36.957719	-79.699555	Perennial	RPW	7	R3RB1	-	Orangefin medium	03010101	Upper Roanoke	Pipeline ROW	95	-	665	-	10	254	-	221
S-H28	UNT to Jacks Creek	Franklin	36.965174	-79.692372	Ephemeral	NRPW	5	R6	-	-	03010101	Upper Roanoke	Pipeline ROW	15	-	96	-	3	11	-	222
S-H27	UNT to Jacks Creek	Franklin	36.965124	-79.692373	Ephemeral	NRPW	10	R6	-	-	03010101	Upper Roanoke	Pipeline ROW	36	-	360	-	3	40	-	222
S-A22	UNT to Jacks Creek	Franklin	36.964548	-79.691870	Intermittent	RPW	5	R4RB4	-	-	03010101	Upper Roanoke	Pipeline ROW	98	-	760	-	10	281	-	222
S-MM44	UNT to Little Jacks Creek	Franklin	36.952507	-79.687915	Perennial	RPW	4	R3UB1	-	-	03010101	Upper Roanoke	Pipeline ROW	94	-	376	-	10	139	-	223
S-MM46	UNT to Little Jacks Creek	Franklin	36.952240	-79.687600	Intermittent	RPW	3	R4SB5	-	-	03010101	Upper Roanoke	Pipeline ROW	9	-	27	-	5	3	-	222
S-MM43	UNT to Little Jacks Creek	Franklin	36.951971	-79.686901	Ephemeral	NRPW	4	R6	-	-	03010101	Upper Roanoke	Pipeline ROW	33	-	132	-	3	16	-	223
S-MM45	UNT to Little Jacks Creek	Franklin	36.975323	-79.684183	Perennial	RPW	7	R3UB1	-	-	03010101	Upper Roanoke	Pipeline ROW	133	-	931	-	10	345	-	223
S-H25	Little Jacks Creek	Franklin	36.975529	-79.683166	Perennial	RPW	7	R2UB2	-	-	03010101	Upper Roanoke	Pipeline ROW	60	-	560	-	10	207	-	223
S-H24	UNT to Little Jacks Creek	Franklin	36.975025	-79.680583	Perennial	RPW	10	R3UB2	-	-	03010101	Upper Roanoke	Pipeline ROW	119	-	1190	-	10	441	-	223
S-H23	UNT to Turkey Creek	Franklin	36.974431	-79.677525	Ephemeral	NRPW	5	R6	-	-	03010101	Upper Roanoke	Pipeline ROW	92	-	460	-	10	170	-	225
S-HH1	UNT to Turkey Creek	Franklin	36.974047	-79.674453	Ephemeral	NRPW	6	R6	-	-	03010101	Upper Roanoke	Pipeline ROW	18	-	90	-	3	10	-	225
S-A13	Turkey Creek	Franklin	36.973282	-79.673075	Perennial	RPW	8	R3UB1	-	Orangefin medium	03010101	Upper Roanoke	Pipeline ROW	92	-	736	-	10	273	-	225
S-A11	UNT to Turkey Creek	Franklin	36.973937	-79.669888	Ephemeral	NRPW	3	R6	-	-	03010101	Upper Roanoke	Pipeline ROW	55	-	165	-	3	19	-	227
S-H17	Dinner Creek	Franklin	36.973128	-79.663967	Intermittent	RPW	5	R4RB4	-	-	03010101	Upper Roanoke	Pipeline ROW	101	-	505	-	10	299	-	228
S-A7	UNT to Dinner Creek	Franklin	36.973032	-79.663504	Perennial	RPW	8	R3UB1	-	-	03010101	Upper Roanoke	Pipeline ROW	97	-	582	-	10	216	-	228
S-S55	Polecat Creek	Franklin	36.970904	-79.657970	Perennial	RPW	8	R3UB1	-	-	03010101	Upper Roanoke	Pipeline ROW	94	-	752	-	10	279	-	228
S-CD8	UNT to Owens Creek	Franklin	36.970522	-79.653798	Intermittent	RPW	4.5	R4SB4	-	-	03010101	Upper Roanoke	Pipeline ROW	75	-	551	-	10	130	-	229
S-AB6	UNT to Owens Creek	Franklin	36.970133	-79.651329	Intermittent	RPW	4	R4SB3	-	-	03010101	Upper Roanoke	Pipeline ROW	84	-	336	-	10	124	-	229
S-DD3	Owens Creek	Franklin	36.969119	-79.645042	Intermittent	RPW	16	R4RB3	-	Orangefin medium	03010101	Upper Roanoke	Pipeline ROW	111	-	1888	-	10	617	-	230
S-G10	Strawfield Creek	Franklin	36.968940	-79.642174	Perennial	RPW	30	R3RB1	-	Orangefin medium	03010101	Upper Roanoke	Pipeline ROW	75	-	2250	-	10	833	-	230
S-G15	UNT to Parrot Branch	Franklin	36.967711	-79.638590	Intermittent	RPW	9	R4RB3	-	-	03010101	Upper Roanoke	Pipeline ROW	88	-	792	-	10	293	-	231
S-G13	Parrot Branch	Franklin	36.967025	-79.633747	Perennial	RPW	8	R3UB1	-	Orangefin medium	03010101	Upper Roanoke	Pipeline ROW	79	-	632	-	10	234	-	231
S-D3	UNT to Jennikin Creek	Pittsylvania	36.966831	-79.605642	Perennial	RPW	10	R3UB1	-	Orangefin medium	03010101	Upper Roanoke	Pipeline ROW	77	-	770	-	10	285	-	235
S-D4	UNT to Jennikin Creek	Pittsylvania	36.965800	-79.604694	Intermittent	RPW	6	R4SB5	-	-	03010101	Upper Roanoke	Pipeline ROW	108	-	630	-	10	233	-	235
S-D2	Jennikin Creek	Pittsylvania	36.965405	-79.599130	Perennial	RPW	18	R3UB1	-	Orangefin medium	03010101	Upper Roanoke	Pipeline ROW	78	-	1404	-	10	520	-	236
S-D7	UNT to Jennikin Creek	Franklin	36.964753	-79.617043	Intermittent	RPW	6	R4RB3	-	-	03010101	Upper Roanoke	Pipeline ROW	80	-	640	-	10	237	-	233
S-D1-EPH	UNT to Jennikin Creek	Pittsylvania	36.964430	-79.595891	Ephemeral	NRPW	10	R6	-	-	03010101	Upper Roanoke	Pipeline ROW	61	-	610	-	10	226	-	236
S-D1-INT	UNT to Jennikin Creek	Pittsylvania	36.964407	-79.595841	Intermittent	RPW	10	R4SB5	-	-	03010101	Upper Roanoke	Pipeline ROW	29	-	290	-	3	32	-	236
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
S-G11	UNT to Jennikin Creek	Pittsylvania	36.962420	-79.590500	Intermittent	RPW	6	R4SB3	-	-	03010101	Upper Roanoke	Pipeline ROW	77	-	462	-	10	171	-	237
S-G9	UNT to Jennikin Creek	Pittsylvania	36.963361	-79.586437	Intermittent	RPW	4	R4SB3	-	-	03010101	Upper Roanoke	Pipeline ROW	79	-	316	-	10	117	-	239
S-G8	UNT to Jennikin Creek	Pittsylvania	36.957805	-79.583645	Intermittent	RPW	4	R4SB3	-	-	03010101	Upper Roanoke	Pipeline ROW	90	-	360	-	10	133	-	239

Table 2.2 Field Survey Stream Impacts

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
S-G15	UNT to Jomskin Creek	Pittsylvania	36.957580	-79.583482	Ephemeral	NRPW	5	R6	-	-	03010101	Upper Roanoke	Pipeline ROW	103	-	515	-	10	191	-	239
S-A5	UNT to Rocky Creek	Pittsylvania	36.954126	-79.580570	Ephemeral	NRPW	5	R6	-	-	03010101	Upper Roanoke	Pipeline ROW	13	-	104	-	3	12	-	235
S-A6	UNT to Rocky Creek	Pittsylvania	36.952276	-79.580490	Perennial	RPW	5	R3UB3	-	-	03010101	Upper Roanoke	Pipeline ROW	83	-	415	-	10	154	-	236
S-H11-Braid	UNT to Rocky Creek	Pittsylvania	36.948518	-79.579663	Ephemeral	NRPW	2	R6	-	-	03010101	Upper Roanoke	Pipeline ROW	86	-	170	-	3	19	-	236
S-H11	UNT to Rocky Creek	Pittsylvania	36.948563	-79.579637	Ephemeral	NRPW	3	R6	-	-	03010101	Upper Roanoke	Pipeline ROW	151	-	453	-	3	60	-	236
S-H11	UNT to Rocky Creek	Pittsylvania	36.948715	-79.579666	Ephemeral	NRPW	3	R6	-	-	03010101	Upper Roanoke	Pipeline ROW	36	-	108	-	3	12	-	236
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
S-F2	UNT to Rocky Creek	Pittsylvania	36.944049	-79.571442	Ephemeral	NRPW	7	R6	-	-	03010101	Upper Roanoke	Pipeline ROW	50	-	350	-	10	130	-	241
S-C7	UNT to Rocky Creek	Pittsylvania	36.944016	-79.571517	Perennial	RPW	20	R3UB3	-	Orangefin medium	03010101	Upper Roanoke	Pipeline ROW	99	-	1980	-	10	733	-	241
S-E12	UNT to Pigg River	Pittsylvania	36.933596	-79.540329	Ephemeral	NRPW	3	R6	-	-	03010101	Upper Roanoke	Pipeline ROW	1	-	3	-	3	0	-	245
S-E11[a]	Pigg River	Pittsylvania	36.933353	-79.538393	Perennial	RPW	100	R2UB3	-	Roanoke logperch; Yellow lampmussel; Orangefin bigdam	03010101	Upper Roanoke	Pipeline ROW	100	-	7131	-	10	2541	-	244
S-H9[a]	UNT to Pigg River	Pittsylvania	36.933407	-79.538087	Ephemeral	NRPW	5	R6	-	-	03010101	Upper Roanoke	Pipeline ROW	77	-	462	-	10	171	-	246
S-H4[a]	UNT to Pigg River	Pittsylvania	36.932251	-79.532969	Perennial	RPW	6	R2UB2	-	-	03010101	Upper Roanoke	Pipeline ROW	121	-	978	-	3	109	-	246
S-H7[a]	UNT to Pigg River	Pittsylvania	36.932132	-79.532963	Intermittent	RPW	5	R4SB4	-	-	03010101	Upper Roanoke	Pipeline ROW	69	-	548	-	10	129	-	246
S-C3	Harpen Creek	Pittsylvania	36.928762	-79.526109	Perennial	RPW	16	R3UB2	-	Roanoke logperch; Orangefin medium	03010101	Upper Roanoke	Pipeline ROW	61	-	1064	-	10	594	-	246
S-H13	Harpen Creek	Pittsylvania	36.925108	-79.517350	Perennial	RPW	20	R3UB2	-	Orangefin medium	03010101	Upper Roanoke	Pipeline ROW	77	-	1540	-	10	570	-	247
S-G4	Harpen Creek	Pittsylvania	36.916463	-79.492988	Perennial	RPW	30	R3UB1	-	Orangefin medium	03010101	Upper Roanoke	Pipeline ROW	95	-	2840	-	10	978	-	250
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
S-C4	UNT to Harpen Creek	Pittsylvania	36.926745	-79.528290	Perennial	RPW	4	R3UB1	-	-	03010101	Upper Roanoke	Pipeline ROW	129	-	516	-	10	191	-	245
S-G6	UNT to Harpen Creek	Pittsylvania	36.920737	-79.505898	Intermittent	RPW	6	R4SB4	-	-	03010101	Upper Roanoke	Pipeline ROW	50	-	450	-	10	178	-	249
S-G5	UNT to Harpen Creek	Pittsylvania	36.917694	-79.496504	Ephemeral	NRPW	6	R6	-	-	03010101	Upper Roanoke	Pipeline ROW	77	-	462	-	10	171	-	250
S-G3	UNT to Harpen Creek	Pittsylvania	36.915858	-79.490029	Perennial	RPW	9	R3UB1	-	-	03010101	Upper Roanoke	Pipeline ROW	82	-	738	-	10	273	-	251
S-CC16	UNT to Harpen Creek	Pittsylvania	36.913003	-79.487835	Perennial	RPW	11	R3UB2	-	-	03010101	Upper Roanoke	Pipeline ROW	83	-	913	-	10	336	-	251
S-CC14	UNT to Cherrystone Creek	Pittsylvania	36.906339	-79.471492	Intermittent	RPW	8	R4SB5	-	-	03010105	Banister	Pipeline ROW	77	-	616	-	10	228	-	253
S-CC13	UNT to Cherrystone Creek	Pittsylvania	36.905307	-79.471374	Intermittent	RPW	7	R4SB5	-	-	03010105	Banister	Pipeline ROW	61	-	427	-	10	158	-	253
S-MM9	UNT to Cherrystone Creek	Pittsylvania	36.903591	-79.468320	Perennial	RPW	8	R3UB2	-	-	03010105	Banister	Pipeline ROW	75	-	450	-	10	167	-	254
S-CC15	UNT to Cherrystone Creek	Pittsylvania	36.901941	-79.466535	Perennial	RPW	5	R3UB2	-	-	03010105	Banister	Pipeline ROW	52	-	432	-	10	182	-	254
S-CC9	UNT to Cherrystone Creek	Pittsylvania	36.899437	-79.463685	Intermittent	RPW	6	R4SB4	-	-	03010105	Banister	Pipeline ROW	21	-	189	-	3	19	-	254
S-CC8	UNT to Cherrystone Creek	Pittsylvania	36.899411	-79.463483	Perennial	RPW	12	R3UB1	-	-	03010105	Banister	Pipeline ROW	87	-	1164	-	10	431	-	254
S-CC5	UNT to Cherrystone Creek	Pittsylvania	36.899248	-79.462365	Perennial	RPW	12	R3UB1	-	-	03010105	Banister	Pipeline ROW	54	-	648	-	10	240	-	254
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
S-CC9	UNT to Cherrystone Creek	Pittsylvania	36.897740	-79.456046	Ephemeral	NRPW	5.5	R6	-	-	03010105	Banister	Pipeline ROW	81	-	445.5	-	10	165	-	255
S-CC10	UNT to Cherrystone Creek	Pittsylvania	36.897315	-79.456119	Intermittent	RPW	9	R4SB5	-	-	03010105	Banister	Pipeline ROW	75	-	702	-	10	260	-	255
S-MM10	UNT to Cherrystone Creek	Pittsylvania	36.895315	-79.452960	Intermittent	RPW	7	R4SB3	-	-	03010105	Banister	Pipeline ROW	9	-	63	-	3	7	-	256
S-CC11	UNT to Cherrystone Creek	Pittsylvania	36.895608	-79.452920	Perennial	RPW	5	R3UB2	-	-	03010105	Banister	Pipeline ROW	57	-	596	-	10	236	-	256
S-CC1	Cherrystone Creek	Pittsylvania	36.894043	-79.448744	Perennial	RPW	15	R2UB1	-	-	03010105	Banister	Pipeline ROW	62	-	1230	-	10	456	-	257
S-CC3	UNT to Cherrystone Creek	Pittsylvania	36.893727	-79.444763	Ephemeral	NRPW	8	R6	-	-	03010105	Banister	Pipeline ROW	91	-	728	-	10	270	-	257
S-P5	UNT to Cherrystone Creek	Pittsylvania	36.892751	-79.440083	Ephemeral	NRPW	5	R6	-	-	03010105	Banister	Pipeline ROW	108	-	540	-	10	200	-	257
S-U35-EPH	UNT to Pole Bridge Branch	Pittsylvania	36.891451	-79.433751	Ephemeral	NRPW	4	R6	-	-	03010105	Banister	Pipeline ROW	171	-	684	-	10	253	-	258
S-Q4	UNT to Pole Bridge Branch	Pittsylvania	36.888114	-79.430914	Perennial	RPW	8	R3UB2	-	-	03010105	Banister	Pipeline ROW	91	-	455	-	10	169	-	259
S-Q3	Pole Bridge Branch	Pittsylvania	36.884444	-79.428220	Perennial	RPW	25	R2UB1	-	-	03010105	Banister	Pipeline ROW	75	-	1875	-	10	694	-	259
S-Q2	UNT to Pole Bridge Branch	Pittsylvania	36.884884	-79.427914	Perennial	RPW	7	R3UB3	-	-	03010105	Banister	Pipeline ROW	114	-	798	-	10	296	-	259
S-Q1	UNT to Pole Bridge Branch	Pittsylvania	36.883448	-79.425169	Ephemeral	NRPW	4	R6	-	-	03010105	Banister	Pipeline ROW	13	-	52	-	3	6	-	260

Table 2.2 Field Survey Stream Impacts

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
S-S5	UNT to Pole Bridge Branch	Pittsylvania	36.879003	-79.430189	Ephemeral	NRPW	10	R6	-	-	03010105	Banister	Pipeline ROW	54	-	640	-	10	311	-	260
S-S6	UNT to Pole Bridge Branch	Pittsylvania	36.877837	-79.417933	Intermittent	RPW	4	R4SB3	-	-	03010105	Banister	Pipeline ROW	52	-	325	-	10	121	-	261
S-S9	UNT to Pole Bridge Branch	Pittsylvania	36.877419	-79.415235	Perennial	RPW	7	R3UB1	-	-	03010105	Banister	Pipeline ROW	78	-	645	-	10	202	-	261
S-DD4	UNT to Mill Creek	Pittsylvania	36.871475	-79.403907	Intermittent	RPW	6	R4SB4	-	-	03010105	Banister	Pipeline ROW	41	-	345	-	10	91	-	263
S-DD5	UNT to Mill Creek	Pittsylvania	36.870963	-79.402714	Intermittent	RPW	6	R4SB4	-	-	03010105	Banister	Pipeline ROW	79	-	474	-	10	178	-	263
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
S-KL27	UNT to Mill Creek	Pittsylvania	36.868534	-79.400511	Ephemeral	NRPW	1	R5	-	-	03010105	Banister	Pipeline ROW	84	-	84	-	10	31	-	264
S-C1	Mill Creek	Pittsylvania	36.863513	-79.397914	Intermittent	RPW	6	R4SB4	-	-	03010105	Banister	Pipeline ROW	82	-	552	-	10	204	-	265
S-C2	Little Cherrystone Creek	Pittsylvania	36.861931	-79.388051	Perennial	RPW	7	R3UB2	-	-	03010105	Banister	Pipeline ROW	77	-	539	-	10	200	-	267
S-B2	UNT to Little Cherrystone Creek	Pittsylvania	36.846384	-79.377760	Ephemeral	NRPW	5	R5	-	-	03010105	Banister	Pipeline ROW	76	-	380	-	10	141	-	268
S-H55	UNT to Little Cherrystone Creek	Pittsylvania	36.843486	-79.369222	Ephemeral	NRPW	3	R5	-	-	03010105	Banister	Pipeline ROW	69	-	177	-	10	66	-	269
S-H54	UNT to Little Cherrystone Creek	Pittsylvania	36.841112	-79.368846	Perennial	RPW	12	R3UB1	-	-	03010105	Banister	Pipeline ROW	90	-	1050	-	10	400	-	270
S-GG11	UNT to Little Cherrystone Creek	Pittsylvania	36.841093	-79.368943	Perennial	RPW	5	R3UB1	-	-	03010105	Banister	Pipeline ROW	46	-	368	-	3	41	-	270
S-H3	UNT to Little Cherrystone Creek	Pittsylvania	36.834501	-79.360244	Intermittent	RPW	5	R4SB4	-	-	03010105	Banister	Pipeline ROW	16	-	108	-	3	12	-	271
S-H5	UNT to Little Cherrystone Creek	Pittsylvania	36.833412	-79.359533	Perennial	RPW	5	R3UB2	-	-	03010105	Banister	Pipeline ROW	83	-	664	-	10	249	-	271
S-CC1	UNT to Little Cherrystone Creek	Pittsylvania	36.832285	-79.358615	Intermittent	RPW	6	R4SB3	-	-	03010105	Banister	Pipeline ROW	84	-	420	-	10	168	-	271
S-H44	UNT to Little Cherrystone Creek	Pittsylvania	36.829823	-79.346015	Perennial	RPW	8	R3UB2	-	-	03010105	Banister	Pipeline ROW	120	-	960	-	10	368	-	273
S-H42	UNT to Little Cherrystone Creek	Pittsylvania	36.829993	-79.344442	Perennial	RPW	5	R3UB2	-	-	03010105	Banister	Permanent Access Road	-	39	-	195	5	-	22	273
S-H42	UNT to Little Cherrystone Creek	Pittsylvania	36.829956	-79.344315	Perennial	RPW	5	R3UB2	-	-	03010105	Banister	Pipeline ROW	52	-	260	-	3	29	-	273
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
S-OO3	UNT to Little Cherrystone Creek	Pittsylvania	36.826831	-79.353849	Intermittent	RPW	5	R4SB3	-	-	03010105	Banister	Pipeline ROW	78	-	390	-	10	144	-	272
S-EF38	Little Cherrystone Creek	Pittsylvania	36.826207	-79.349614	Perennial	RPW	20	R2UB1	-	-	03010105	Banister	Pipeline ROW	78	-	1560	-	10	535	-	272
													Total	28826	475	259188	3086	-	89436	341	

Notes:

1 - For identified streams without a NHD (National Hydrography Dataset) name, the identified stream was given the name, "Unidentified Tributary (UNT)", of the first named receiving waterbody

2 - in decimal degrees

3 - RPW = Relatively Permanent Waters
- NRPW = Non-Relatively Permanent Waters
- TNW = Traditional Navigable Waters

4 - See Cowardin et al., 1979

5 - Trout Waters - Virginia Department of Environmental Quality Office of Water Monitoring and Assessment. VEGIS Dataset. http://www.deq.virginia.gov/ConnectWithDEQ/VEGIS/VEGISDatasets.aspx. 2014_Integrated_WQ_Report_Rivers. File Date: 6/2016. File downloaded: 5/2017.
  - Wild Trout - VA DGIF Trout Stream Classification Class I-IV (VA DEQ Natural trout waters Class VI)
  - Stockable Trout - VA DGIF Trout Stream Classification Class V-VI (VA DEQ Stockable trout waters Class V)
- Tier III Exceptional Waterbodies - No Tier III Exceptional Waterbodies crossed by the Project.
  - Tier III data from: http://www.deq.virginia.gov/Programs/Water/WaterQualityInformationTMDLs/WaterQualityStandards/ExceptionalStateWaters(Tier3).aspx
- Anadromous Fish Use Areas - No Anadromous Fish Use Areas crossed by the Project.
  - Anadromous Fish Use Area data from: https://www.dgif.virginia.gov/gis/data/download/

6 - Green floater - *Lasmigona subviridis*; state threatened in Virginia
- James spinymussel - *Pleurobema collina*; federal endangered species
- Orangefin madtom - *Noturus gilberti*; state threatened in Virginia
- Roanoke logperch - *Percina rex*; federal endangered species
- Yellow lampmussel - *Lampsilis cariosa*; state species of concern in Virginia

7 - No in-stream work is anticipated for stream crossings along access roads at existing culverts; therefore, streams crossing access roads in existing culverts will not be impacted and are not included on this table.

8 - Temporary fill discharge into waters of the U.S.

9 - Permanent fill associated with the construction of permanent access road and facilities

A - The Federal Energy Regulatory Commission (FERC) recommended in its Final Environmental Impact Statement (June 2017) that MVP use a horizontal directional drill (HDD) as the preferred method to cross the Pigg River (S-E11), which incidentally also would affect adjacent streams S-H7, S-H8, and S-A4. The proposed impacts to these waters will not occur if the FERC-recommended HDD is completed successfully. If the HDD is unsuccessful for any reason, the dry open cut method will be utilized in accordance with an HDD Contingency Plan. The temporary impacts associated with the dry open cut crossing contingency are included here.

Table 3.1 Wetland Impact Summary

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
USACE Jurisdictional Field Identified	PEM (sq ft)	208,370	0	609	62,294	68
	PSS (sq ft)	0	97,145	0	33,039	0
	PFO (sq ft)	0	90,368	0	31,439	0
	Field Total (sq ft)	208,370	187,513	609	126,771	68
USACE Jurisdictional Desktop Identified	PEM (sq ft)	15	0	84	2	9
	PSS (sq ft)	0	0	0	0	0
	PFO (sq ft)	0	0	0	0	0
	Desktop Total (sq ft)	15	0	84	2	9
All USACE Jurisdictional Features	PEM (sq ft)	208,385	0	693	62,296	77
	PSS (sq ft)	0	97,145	0	33,039	0
	PFO (sq ft)	0	90,368	0	31,439	0
	Grand Total (sq ft)	208,385	187,513	693	126,773	77
All USACE Jurisdictional Features	PEM (acres)	4.78	0.00	0.02	1.43	0.002
	PSS (acres)	0.00	2.23	0.00	0.76	0.00
	PFO (acres)	0.00	2.07	0.00	0.72	0.00
	Grand Total (acres)	4.78	4.30	0.02	2.91	0.002
USACE Non-Jurisdictional Features	PEM (sq ft)	3,508	0	0	1,299	0
	PSS (sq ft)	0	161	0	60	0
	PFO (sq ft)	0	0	0	0	0
	Grand Total (sq ft)	3,508	161	0	1,359	0
USACE Non-Jurisdictional Features	PEM (acres)	0.08	0.00	0.00	0.03	0.00
	PSS (acres)	0.00	0.00	0.00	0.00	0.00
	PFO (acres)	0.00	0.00	0.00	0.00	0.00
	Grand Total (acres)	0.08	0.00	0.00	0.03	0.000

Notes:

1 - PEM = Palustrine Emergent
- PSS = Palustrine Scrub-Shrub
- PFO = Palustrine Forested

2 - Temporary impacts to PEM wetlands in the Temporary limit-of-disturbance

3 - Permanent conversion impacts to PSS and PFO wetlands in the temporary limit-of-disturbance

4 - Permanent fill impacts to PEM, PSS and PFO wetlands within permanent access road limit-of-disturbance

Table 3.2 Field Survey USACE Jurisdictional Wetland Impacts

W-HH16	Giles	37.37103	-80.736207	PEM	DEPRESSIONAL	NRPWW	05050002	Middle New	Permanent Access Road	64	-	-	3	7	-	12
W-Z11	Giles	37.348591	-80.641713	PEM	DEPRESSIONAL	NRPWW	05050002	Middle New	Pipeline ROW	1,141	-	-	10	423	-	29
W-Z3	Giles	37.342244	-80.620612	PSS	RIVERINE	RPWWD	05050002	Middle New	Pipeline ROW	-	1,168	-	10	433	-	30
W-CD12	Giles	37.318844	-80.441717	PEM	RIVERINE	RPWWD	05050002	Middle New	Pipeline ROW	904	-	-	10	338	-	63
W-MM10	Giles	37.298219	-80.480817	PEM	RIVERINE	RPWWD	05050002	Middle New	Temporary Access Road	1,108	-	-	3	123	-	55
W-RR1b	Giles	37.29567	-80.464042	PEM	RIVERINE	RPWWD	05050002	Middle New	Pipeline ROW	768	-	-	10	284	-	53
W-LJ48-PEM	Montgomery	37.288153	-80.367508	PEM	RIVERINE	RPWWD	03010101	Upper Roanoke	Pipeline ROW	1,279	-	-	10	474	-	77
W-AD4	Montgomery	37.288984	-80.330124	PEM	Slope	RPWWD	3010101	Upper Roanoke	Temporary Access Road	301	-	-	3	33	-	82
W-NN6	Montgomery	37.288174	-80.316468	PEM	SLOPE	RPWWN	03010101	Upper Roanoke	Pipeline ROW	361	-	-	3	40	-	88
W-PP9	Montgomery	37.264633	-80.308657	PEM	SLOPE	RPWWD	03010101	Upper Roanoke	Pipeline ROW	437	-	-	3	49	-	90
W-F8-PFO	Montgomery	37.258109	-80.285892	PFO	RIVERINE	RPWWD	03010101	Upper Roanoke	Pipeline ROW	-	735	-	3	82	-	95
W-C12	Montgomery	37.257192	-80.281649	PFO	RIVERINE	RPWWD	03010101	Upper Roanoke	Pipeline ROW	-	2,278	-	3	253	-	95
W-C11	Montgomery	37.257107	-80.281381	PSS	RIVERINE	RPWWD	03010101	Upper Roanoke	Pipeline ROW	-	2,007	-	3	223	-	95
W-C6	Montgomery	37.255806	-80.274237	PEM	SLOPE	NRPWW	03010101	Upper Roanoke	Pipeline ROW	1,977	-	-	10	732	-	96
W-MN11	Montgomery	37.248393	-80.207088	PEM	RIVERINE	RPWWD	03010101	Upper Roanoke	Permanent Access Road	244	-	-	3	27	-	112
W-NN8	Montgomery	37.233819	-80.197841	PFO	RIVERINE	RPWWD	03010101	Upper Roanoke	Pipeline ROW	-	3,307	-	10	1,225	-	116
W-AB7	Montgomery	37.231426	-80.198818	PEM	SLOPE	RPWWD	03010101	Upper Roanoke	Pipeline ROW	655	-	-	10	243	-	116
W-CD11	Montgomery	37.228284	-80.200088	PEM	RIVERINE	RPWWD	03010101	Upper Roanoke	Permanent Access Road	-	-	8	3	-	1	118
W-CD11	Montgomery	37.228042	-80.199968	PEM	RIVERINE	RPWWD	03010101	Upper Roanoke	Pipeline ROW	1,675	-	-	10	620	-	118
[illegible]																
W-EF8-PFO	Montgomery	37.210948	-80.183358	PFO	RIVERINE	RPWWD	03010101	Upper Roanoke	Pipeline ROW	-	4,819	-	10	1,785	-	121
W-EF22	Roanoke	37.180938	-80.143498	PFO	RIVERINE	RPWWD	03010101	Upper Roanoke	Pipeline ROW	-	3,427	-	10	1,269	-	132
W-EF14	Roanoke	37.180832	-80.140139	PEM	RIVERINE	RPWWD	03010101	Upper Roanoke	Temporary Access Road	72	-	-	3	8	-	132
W-EF21	Roanoke	37.180089	-80.14288	PEM	SLOPE	RPWWN	03010101	Upper Roanoke	Pipeline ROW	6,056	-	-	10	2,243	-	132
W-EF18	Roanoke	37.179449	-80.140865	PSS	RIVERINE	RPWWD	03010101	Upper Roanoke	Temporary Access Road	-	465	-	3	51	-	132
W-EF17	Roanoke	37.179402	-80.1406	PFO	RIVERINE	RPWWD	03010101	Upper Roanoke	Temporary Access Road	-	1,725	-	3	192	-	132
W-EF19	Roanoke	37.179388	-80.141463	PSS	SLOPE	RPWWD	03010101	Upper Roanoke	Pipeline ROW	-	1,953	-	10	723	-	132
W-LJ83	Roanoke	37.17248	-80.139916	PEM	RIVERINE	RPWWD	03010101	Upper Roanoke	Pipeline ROW	768	-	-	3	85	-	133
W-LJ99	Roanoke	37.171917	-80.128891	PSS	RIVERINE	RPWWD	03010101	Upper Roanoke	ATWS	-	4,741	-	3	527	-	135
W-LJ94-PEM	Roanoke	37.170092	-80.138294	PEM	SLOPE	RPWWD	03010101	Upper Roanoke	Pipeline ROW	6,038	-	-	3	671	-	134
W-LJ94-PSS	Roanoke	37.169813	-80.138399	PSS	RIVERINE	RPWWD	03010101	Upper Roanoke	Pipeline ROW	-	605	-	3	89	-	134
[illegible]																
W-LJ98-PEM	Roanoke	37.169461	-80.130376	PEM	RIVERINE	RPWWD	03010101	Upper Roanoke	Permanent Access Road	123	-	-	3	14	-	138
W-LJ98-PEM	Roanoke	37.169461	-80.130376	PEM	RIVERINE	RPWWD	03010101	Upper Roanoke	Permanent Access Road	-	-	579	3	-	64	138
[illegible]																
W-LJ97	Roanoke	37.169197	-80.129446	PEM	SLOPE	RPWWD	03010101	Upper Roanoke	Permanent Access Road	-	-	22	3	-	2	138
W-LJ95-PSS	Roanoke	37.169068	-80.138275	PSS	RIVERINE	RPWWD	03010101	Upper Roanoke	Pipeline ROW	-	19,030	-	10	7,048	-	134
W-LJ102	Roanoke	37.168289	-80.138375	PFO	RIVERINE	RPWWD	03010101	Upper Roanoke	Pipeline ROW	-	810	-	3	89	-	134
W-LJ105	Roanoke	37.166929	-80.139093	PEM	RIVERINE	RPWWD	03010101	Upper Roanoke	Pipeline ROW	67	-	-	3	7	-	134
W-LJ100	Roanoke	37.166113	-80.139371	PFO	RIVERINE	RPWWD	03010101	Upper Roanoke	Pipeline ROW	-	321	-	3	38	-	134
W-LJ101	Roanoke	37.16571	-80.13969	PSS	RIVERINE	RPWWD	03010101	Upper Roanoke	Pipeline ROW	-	9	-	3	1	-	134
W-KL17	Roanoke	37.160152	-80.134774	PSS	RIVERINE	RPWWD	03010101	Upper Roanoke	Pipeline ROW	-	1,895	-	10	702	-	136
W-EF42	Roanoke	37.157811	-80.133722	PEM	SLOPE	RPWWD	03010101	Upper Roanoke	Pipeline ROW	213	-	-	3	24	-	137
W-AB6-PEM-2	Roanoke	37.156828	-80.131988	PEM	SLOPE	RPWWD	03010101	Upper Roanoke	Pipeline ROW	14,245	-	-	10	5,277	-	137
W-AB6-PFO-1	Roanoke	37.156713	-80.131681	PFO	SLOPE	RPWWD	03010101	Upper Roanoke	Pipeline ROW	-	2,691	-	10	997	-	137
W-AB6-PEM-1	Roanoke	37.15617	-80.130794	PEM	SLOPE	RPWWD	03010101	Upper Roanoke	Pipeline ROW	2,819	-	-	10	1,044	-	137
W-AB6-PSS	Roanoke	37.156034	-80.130603	PSS	SLOPE	RPWWD	03010101	Upper Roanoke	Pipeline ROW	-	266	-	3	30	-	137
[illegible]																
W-AB5	Roanoke	37.15584	-80.130227	PFO	DEPRESSIONAL	RPWWN	03010101	Upper Roanoke	Pipeline ROW	-	182	-	3	20	-	137
W-AB3-PEM-2	Roanoke	37.155664	-80.129569	PEM	SLOPE	RPWWD	03010101	Upper Roanoke	Pipeline ROW	6,737	-	-	10	2,495	-	137
W-EF46	Roanoke	37.154876	-80.129122	PSS	RIVERINE	RPWWD	03010101	Upper Roanoke	Pipeline ROW	-	11,245	-	10	4,165	-	137
W-KL48-PSS-1	Roanoke	37.152292	-80.130022	PSS	RIVERINE	RPWWD	3010101	Upper Roanoke	Pipeline ROW	-	1,978	-	10	733	-	139
W-KL48-PEM	Roanoke	37.151965	-80.130049	PEM	RIVERINE	RPWWD	3010101	Upper Roanoke	Pipeline ROW	275	-	-	3	31	-	439
W-KL48-PSS-2	Roanoke	37.150926	-80.131271	PSS	RIVERINE	RPWWD	3010101	Upper Roanoke	Pipeline ROW	-	1,152	-	3	128	-	439
[illegible]																
W-KL55	Roanoke	37.150853	-80.138883	PEM	Riverine	RPWWD	3010101	Upper Roanoke	Temporary Access Road	317	-	-	3	35	-	139
W-KL50	Roanoke	37.150726	-80.131537	PEM	Slope	RPWWN	3010101	Upper Roanoke	Pipeline ROW	1,779	-	-	10	658	-	139
W-KL49	Roanoke	37.150297	-80.132193	PEM	Slope	RPWWN	3010101	Upper Roanoke	Pipeline ROW	1,919	-	-	10	711	-	139
W-KL51-PEM	Roanoke	37.150006	-80.132403	PEM	RIVERINE	RPWWD	3010101	Upper Roanoke	Pipeline ROW	1,060	-	-	10	393	-	138
W-KL51-PSS	Roanoke	37.149875	-80.132479	PSS	RIVERINE	RPWWD	3010101	Upper Roanoke	Pipeline ROW	-	1,908	-	10	689	-	138
[illegible]																
W-EF68	Roanoke	37.149837	-80.137749	PEM	SLOPE	RPWWD	03010101	Upper Roanoke	Temporary Access Road	8,612	-	-	3	957	-	139
W-MN9	Roanoke	37.14933	-80.136791	PFO	Slope	RPWWD	3010101	Upper Roanoke	Temporary Access Road	-	1,140	-	3	127	-	139
W-MN8	Roanoke	37.149174	-80.135952	PEM	Slope	RPWWD	3010101	Upper Roanoke	Temporary Access Road	869	-	-	3	97	-	139
W-KL54	Roanoke	37.148781	-80.134382	PEM	Slope	RPWWN	3010101	Upper Roanoke	Temporary Access Road	2,295	-	-	3	255	-	138
W-KL54	Roanoke	37.148761	-80.134382	PEM	Slope	RPWWN	3010101	Upper Roanoke	ATWS	1,649	-	-	3	183	-	138
[illegible]																
W-KL53	Roanoke	37.146727	-80.13469	PEM	Slope	RPWWN	3010101	Upper Roanoke	Temporary Access Road	2,580	-	-	3	284	-	138
W-KL53	Roanoke	37.146727	-80.13469	PEM	Slope	RPWWN	3010101	Upper Roanoke	ATWS	29	-	-	3	3	-	138
[illegible]																
W-MN7-PEM	Roanoke	37.145328	-80.133901	PEM	RIVERINE	RPWWD	3010101	Upper Roanoke	Pipeline ROW	1,350	-	-	10	500	-	139
W-EF44	Roanoke	37.142977	-80.139322	PEM	SLOPE	RPWWD	03010101	Upper Roanoke	Pipeline ROW	663	-	-	10	209	-	140
W-LJ36	Roanoke	37.138922	-80.138845	PSS	RIVERINE	RPWWD	03010101	Upper Roanoke	Pipeline ROW	-	19,044	-	10	7,053	-	141
W-Z7	Roanoke	37.136801	-80.128216	PSS	RIVERINE	RPWWD	03010101	Upper Roanoke	Temporary Access Road	-	12	-	3	1	-	143
W-Z8	Roanoke	37.136468	-80.128238	PFO	RIVERINE	RPWWD	03010101	Upper Roanoke	Temporary Access Road	-	124	-	3	14	-	143
W-LJ62	Roanoke	37.135829	-80.134044	PEM	RIVERINE	RPWWD	03010101	Upper Roanoke	Temporary Access Road	3	-	-	3	0	-	142
W-Y2	Roanoke	37.134284	-80.137448	PEM	RIVERINE	RPWWD	03010101	Upper Roanoke	Pipeline ROW	1,520	-	-	10	563	-	142
W-LJ10	Roanoke	37.132561	-80.131744	PEM	RIVERINE	RPWWD	03010101	Upper Roanoke	Permanent Access Road	88	-	-	3	10	-	142
W-Q11	Roanoke	37.13247	-80.131838	PEM	DEPRESSIONAL	RPWWD	03010101	Upper Roanoke	Permanent Access Road	565	-	-	3	63	-	142
W-KL1	Roanoke	37.132456	-80.131463	PEM	SLOPE	RPWWN	03010101	Upper Roanoke	Permanent Access Road	78	-	-	3	9	-	142
W-KL2	Roanoke	37.128916	-80.134054	PEM	SLOPE	RPWWN	03010101	Upper Roanoke	Pipeline ROW	39	-	-	3	4	-	146
W-B25-PEM-1	Roanoke	37.128646	-80.133283	PEM	SLOPE	RPWWD	03010101	Upper Roanoke	Pipeline ROW	8,227	-	-	10	3,047	-	146
W-B25-PSS-2	Roanoke	37.128527	-80.132335	PSS	SLOPE	RPWWD	03010101	Upper Roanoke	Pipeline ROW	-	16,338	-	10	6,051	-	145
[illegible]																
W-B24-PSS	Roanoke	37.12854	-80.130784	PSS	RIVERINE	RPWWD	03010101	Upper Roanoke	Pipeline ROW	-	7,132	-	10	2,641	-	146
W-B24-PEM	Roanoke	37.12853	-80.13105	PEM	RIVERINE	RPWWD	03010101	Upper Roanoke	Pipeline ROW	4,489	-	-	10	1,663	-	146
[illegible]																
W-S12-PEM	Franklin	37.126329	-80.12145	PEM	RIVERINE	RPWWD	03010101	Upper Roanoke	Pipeline ROW	4,974	-	-	10	1,842	-	147
W-RR4	Franklin	37.125117	-80.11353	PEM	RIVERINE	RPWWD	03010101	Upper Roanoke	Permanent Access Road	943	-	-	3	105	-	146
W-RR3	Franklin	37.124214	-80.114746	PEM	RIVERINE	RPWWD	03010101	Upper Roanoke	Permanent Access Road	82	-	-	3	9	-	146

Table 3.2 Field Survey USACE Jurisdictional Wetland Impacts

W-KL41	Franklin	37.123851	-80.115802	PEM	RIVERINE	RPWWD	03010101	Upper Roanoke	Permanent Access Road	996	-	-	3	111	-	147
W-EF11	Franklin	37.123074	-80.07598	PEM	RIVERINE	RPWWD	03010101	Upper Roanoke	ATWS	302	-	-	3	34	-	163
W-EF11	Franklin	37.122825	-80.075883	PEM	RIVERINE	RPWWD	03010101	Upper Roanoke	Pipeline ROW	1,265	-	-	10	469	-	153
W-EF11	Franklin	37.122702	-80.075859	PEM	RIVERINE	RPWWD	03010101	Upper Roanoke	ATWS	249	-	-	3	28	-	163
[illegible]										[illegible]				[illegible]		
W-D8	Franklin	37.121691	-80.084358	PFO	SLOPE	RPWWN	3010101	Upper Roanoke	Pipeline ROW	-	63	-	3	8	-	152
W-D7-PEM	Franklin	37.121669	-80.08578	PEM	RIVERINE	RPWWD	03010101	Upper Roanoke	Pipeline ROW	693	-	-	3	77	-	152
W-IJ70-PSS	Franklin	37.121351	-80.081659	PSS	SLOPE	RPWWD	3010101	Upper Roanoke	Pipeline ROW	-	1,379	-	3	153	-	153
W-IJ70-PFO-2	Franklin	37.121273	-80.081592	PFO	SLOPE	RPWWD	3010101	Upper Roanoke	Pipeline ROW	-	2,289	-	10	848	-	153
[illegible]											[illegible]			[illegible]		
W-IJ57	Franklin	37.121246	-80.08114	PEM	SLOPE	RPWWD	3010101	Upper Roanoke	Pipeline ROW	72	-	-	3	8	-	153
W-IJ71	Franklin	37.120971	-80.079447	PEM	SLOPE	RPWWN	3010101	Upper Roanoke	Pipeline ROW	793	-	-	3	88	-	163
W-EF3	Franklin	37.117734	-80.065992	PEM	SLOPE	RPWWD	03010101	Upper Roanoke	Permanent Access Road	1,193	-	-	3	128	-	151
W-IJ1	Franklin	37.092827	-80.027568	PEM	SLOPE	RPWWD	03010101	Upper Roanoke	Pipeline ROW	1,812	-	-	10	671	-	162
W-IJ2-PSS	Franklin	37.092845	-80.027178	PSS	SLOPE	RPWWD	03010101	Upper Roanoke	Pipeline ROW	-	347	-	10	129	-	162
W-IJ2-PEM	Franklin	37.092598	-80.027214	PEM	SLOPE	RPWWD	03010101	Upper Roanoke	Pipeline ROW	732	-	-	10	271	-	162
[illegible]										[illegible]	[illegible]			[illegible]		
W-GH2	Franklin	37.092404	-79.985182	PSS	RIVERINE	RPWWD	03010101	Upper Roanoke	Pipeline ROW	-	1,804	-	10	668	-	169
W-II8	Franklin	37.091367	-79.992006	PEM	DEPRESSIONAL	RPWWD	03010101	Upper Roanoke	Pipeline ROW	1,049	-	-	10	368	-	166
W-IJ8	Franklin	37.089166	-80.005036	PEM	RIVERINE	RPWWD	03010101	Upper Roanoke	Pipeline ROW	479	-	-	10	177	-	166
W-EF4	Franklin	37.088328	-79.94802	PEM	RIVERINE	RPWWD	03010101	Upper Roanoke	ATWS	18,236	-	-	3	2,026	-	177
W-E7	Franklin	37.084557	-79.947595	PEM	DEPRESSIONAL	RPWWD	03010101	Upper Roanoke	Pipeline ROW	1,078	-	-	10	399	-	177
W-E8	Franklin	37.082843	-79.9481	PEM	DEPRESSIONAL	RPWWD	03010101	Upper Roanoke	Pipeline ROW	3,004	-	-	10	1,114	-	177
W-EF61	Franklin	37.084781	-79.87448	PEM	RIVERINE	RPWWD	03010101	Upper Roanoke	Pipeline ROW	580	-	-	3	64	-	182
W-KL43b	Franklin	37.069606	-79.840707	PEM	RIVERINE	RPWWD	03010101	Upper Roanoke	Pipeline ROW	17	-	-	3	2	-	187
W-CD6	Franklin	37.057588	-79.916232	PEM	SLOPE	RPWWN	03010101	Upper Roanoke	Pipeline ROW	7,422	-	-	10	2,749	-	185
W-CD5	Franklin	37.056438	-79.910824	PFO	RIVERINE	RPWWN	03010101	Upper Roanoke	Pipeline ROW	-	4,949	-	10	1,833	-	185
W-EF48	Franklin	37.052142	-79.886197	PEM	RIVERINE	RPWWN	03010101	Upper Roanoke	Pipeline ROW	1,045	-	-	10	387	-	189
W-I3	Franklin	37.049378	-79.907892	PEM	DEPRESSIONAL	RPWWD	03010101	Upper Roanoke	ATWS	1,252	-	-	3	139	-	185
W-CD1	Franklin	37.047787	-79.897568	PFO	SLOPE	RPWWD	03010101	Upper Roanoke	Pipeline ROW	-	4,819	-	10	1,785	-	188
W-DD1	Franklin	37.031961	-79.788599	PEM	RIVERINE	RPWWN	03010101	Upper Roanoke	Pipeline ROW	2,179	-	-	10	807	-	207
W-A12-PFO	Franklin	37.031754	-79.788099	PFO	RIVERINE	RPWWD	03010101	Upper Roanoke	Pipeline ROW	-	173	-	3	19	-	207
W-GH16	Franklin	37.028394	-79.773243	PFO	RIVERINE	RPWWD	03010101	Upper Roanoke	Pipeline ROW	-	8,707	-	10	3,225	-	209
W-H17	Franklin	36.99939	-79.72209	PFO	DEPRESSIONAL	RPWWD	03010101	Upper Roanoke	Pipeline ROW	-	6,768	-	10	2,807	-	217
W-H11	Franklin	36.988077	-79.702803	PEM	SLOPE	RPWWD	03010101	Upper Roanoke	Pipeline ROW	2,038	-	-	10	755	-	221
W-H16	Franklin	36.988073	-79.714987	PEM	RIVERINE	RPWWD	03010101	Upper Roanoke	Pipeline ROW	1,326	-	-	3	147	-	218
W-H14	Franklin	36.988069	-79.711841	PEM	RIVERINE	RPWWD	03010101	Upper Roanoke	Pipeline ROW	267	-	-	3	30	-	219
W-A8	Franklin	36.987647	-79.700844	PEM	SLOPE	RPWWD	03010101	Upper Roanoke	Pipeline ROW	673	-	-	3	75	-	221
W-H15	Franklin	36.987838	-79.714829	PSS	RIVERINE	RPWWD	03010101	Upper Roanoke	Pipeline ROW	-	311	-	3	35	-	219
W-H9	Franklin	36.978536	-79.882087	PEM	DEPRESSIONAL	RPWWN	03010101	Upper Roanoke	Pipeline ROW	504	-	-	10	187	-	223
W-H8	Franklin	36.972169	-79.883042	PEM	RIVERINE	RPWWD	03010101	Upper Roanoke	Pipeline ROW	249	-	-	3	28	-	228
W-D3	Pittsylvania	36.968318	-79.59678	PFO	SLOPE	RPWWN	03010101	Upper Roanoke	Pipeline ROW	-	1,785	-	10	661	-	238
W-MM17	Franklin	36.964731	-79.617067	PEM	RIVERINE	RPWWD	03010101	Upper Roanoke	Pipeline ROW	297	-	-	10	110	-	233
W-B5	Pittsylvania	36.959293	-79.596201	PEM	DEPRESSIONAL	RPWWN	03010101	Upper Roanoke	Pipeline ROW	209	-	-	3	23	-	239
W-B4-PSS	Pittsylvania	36.957664	-79.583688	PSS	RIVERINE	RPWWD	03010101	Upper Roanoke	Pipeline ROW	-	205	-	3	23	-	239
W-A4[#]	Pittsylvania	36.933299	-79.537648	PEM	RIVERINE	RPWWN	03010101	Upper Roanoke	Pipeline ROW	334	-	-	-	37	-	244
W-C1	Pittsylvania	36.929854	-79.529631	PEM	DEPRESSIONAL	RPWWN	03010101	Upper Roanoke	Pipeline ROW	793	-	-	3	88	-	246
W-H5	Pittsylvania	36.924983	-79.517169	PEM	DEPRESSIONAL	RPWWD	03010101	Upper Roanoke	Pipeline ROW	9,004	-	-	10	3,335	-	247
W-B3	Pittsylvania	36.916505	-79.49238	PEM	DEPRESSIONAL	RPWWN	03010101	Upper Roanoke	Pipeline ROW	55	-	-	3	6	-	250
W-CC2-PEM	Pittsylvania	36.905418	-79.471688	PEM	RIVERINE	RPWWD	03010105	Banister	Pipeline ROW	466	-	-	3	52	-	253
W-MM8	Pittsylvania	36.903012	-79.489192	PSS	RIVERINE	RPWWD	03010105	Banister	Pipeline ROW	-	879	-	10	326	-	254
W-MM9	Pittsylvania	36.894087	-79.44611	PEM	DEPRESSIONAL	RPWWN	03010105	Banister	Pipeline ROW	664	-	-	10	283	-	257
W-MM8-PEM	Pittsylvania	36.894034	-79.445466	PEM	DEPRESSIONAL	RPWWN	03010105	Banister	Pipeline ROW	2,411	-	-	10	893	-	257
W-MM8-PFO	Pittsylvania	36.89393	-79.445461	PFO	DEPRESSIONAL	RPWWN	03010105	Banister	Pipeline ROW	-	1,833	-	10	679	-	257
[illegible]										[illegible]	[illegible]			[illegible]		
W-Q2	Pittsylvania	36.884874	-79.429607	PFO	RIVERINE	RPWWD	03010105	Banister	Pipeline ROW	-	18,422	-	10	6,082	-	259
W-Q1	Pittsylvania	36.883985	-79.427305	PEM	DEPRESSIONAL	RPWWD	03010105	Banister	Pipeline ROW	638	-	-	10	238	-	259
W-G2	Pittsylvania	36.881818	-79.38593	PEM	RIVERINE	RPWWD	03010105	Banister	Pipeline ROW	5,658	-	-	10	2,096	-	267
W-H1	Pittsylvania	36.836097	-79.360898	PEM	DEPRESSIONAL	RPWWN	03010105	Banister	Pipeline ROW	481	-	-	3	53	-	270
W-EF8	Pittsylvania	36.835004	-79.339128	PFO	RIVERINE	RPWWD	03010105	Banister	Pipeline ROW	-	8,907	-	10	3,299	-	274
W-H2	Pittsylvania	36.834817	-79.360478	PEM	DEPRESSIONAL	RPWWD	03010105	Banister	Pipeline ROW	34,792	-	-	10	12,886	-	271
W-IJ21	Pittsylvania	36.834623	-79.339527	PFO	SLOPE	RPWWN	03010105	Banister	Pipeline ROW	-	463	-	3	51	-	274
W-H3	Pittsylvania	36.833741	-79.360081	PEM	DEPRESSIONAL	RPWWN	03010105	Banister	Pipeline ROW	2,218	-	-	10	821	-	271
W-MM3	Pittsylvania	36.830361	-79.358551	PSS	RIVERINE	RPWWD	03010105	Banister	Pipeline ROW	-	1,480	-	10	548	-	271
W-IJ22-PEM	Pittsylvania	36.82776	-79.350284	PEM	RIVERINE	RPWWD	03010105	Banister	Pipeline ROW	8,527	-	-	10	3,158	-	272
W-IJ22-PFO	Pittsylvania	36.827748	-79.350285	PFO	RIVERINE	RPWWD	03010105	Banister	Pipeline ROW	-	11,817	-	10	4,377	-	272
[illegible]										[illegible]	[illegible]			[illegible]		
									TOTAL	208,370	187,513	899	-	128,771	68	

Notes:
1 - In decimal degrees. Coordinates show wetland test pit locations
2 - PEM = Palustrine Emergent
- PSS = Palustrine Scrub-Shrub
- PFO = Palustrine Forested
3 - HGM = Hydrogeomorphic
4 - RPWWD = Wetlands directly abutting Relatively Permanent Waters (RPWs) that flow directly or indirectly into Traditional Navigable Waterways (TNWs)
- RPWWN = Wetlands adjacent but not directly abutting RPWs that flow directly or indirectly into TNWs
- NRPWW = Wetlands adjacent to non-RPWs that flow directly or indirectly into TNWs
5 - Temporary fill discharge into waters of the U.S.
6 - Permanent fill associated with the construction of permanent access road and facilities
- The Federal Energy Regulatory Commission (FERC) recommended in its Final Environmental Impact Statement (June 2017) that MVP use a horizontal directional drill (HDD) as the preferred method to cross the Pigg River (S-E11), which incidentally also would affect adjacent wetland W-A4. The proposed impacts to these waters will not occur if the FERC-recommended HDD is completed successfully. If the HDD is unsuccessful for any reason, the dry open cut method will be utilized in accordance with an HDD Contingency Plan. The temporary impacts associated with the dry open cut crossing contingency are included here.

Table 3.3 Field Survey Non-Jurisdictional Wetland Impacts

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
W-KL14	Giles	37,396696	-80,580476	PSS	DEPRESSIONAL	ISOLATE	05060002	Middle New	Pipeline ROW	-	161	-	10	50	-	2
W-C8	Montgomery	37,22588	-80,375715	PEM	DEPRESSIONAL	ISOLATE	03010101	Upper Roanoke	Pipeline ROW	1,240	-	-	10	489	-	86
W-KL15	Roanoke	37,159627	-80,134257	PEM	DEPRESSIONAL	ISOLATE	03010101	Upper Roanoke	Pipeline ROW	817	-	-	10	300	-	136
W-KL16	Roanoke	37,158853	-80,133802	PEM	DEPRESSIONAL	ISOLATE	03010101	Upper Roanoke	Pipeline ROW	1,461	-	-	10	537	-	136
									TOTAL	3,518	161	0	-	1,376	0	

Notes:

1 - In decimal degrees. Coordinates show wetland test pit locations

2 - PEM = Palustrine Emergent
- PSS = Palustrine Scrub-Shrub
- PFO = Palustrine Forested

3 - HGM = Hydrogeomorphic

4 - ISOLATE = Isolated (interstate or intrastate) waters, including isolated wetlands
-The USACE has determined that these isolated features are not jurisdictional waters of the United States and therefore not subject to NWP 12. Each feature meets the six criteria necessary to be defined as an isolated wetland of minimal ecological value under the Virginia Water Protection (VWP) Permit Program Regulation. 9 VAC 25-210-10. MVP will request an appropriate VWP permit waiver pursuant to 9 VAC 25-210-230.

5 - Temporary fill discharge into waters of the U.S.

Table 3.4 Desktop Survey Wetland Impacts

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
TTVA-W-301	Roanoke	37.144774	-80.132462	PEM	SLOPE	RPWWD	03010101	Upper Roanoke	Temporary Access Road	15	-	-	3	2	
TTVA-W-CD11	Montgomery	37.228396	-80.200159	PEM	RIVERINE	RPWWD	03010101	Upper Roanoke	Permanent Access Road	-	-	84	3		9
									TOTAL	15	0	84	-	2	9

Notes:

1 - In decimal degrees. Coordinates show wetland test pit locations

2 - PEM = Palustrine Emergent
- PSS = Palustrine Scrub-Shrub
- PFO = Palustrine Forested

3 - HGM = Hydrogeomorphic

4 - RPWWD = Wetlands directly abutting Relatively Permanent Waters (RPWs) that flow directly or indirectly into Traditional Navigable Waterways (TNWs)
- RPWWN = Wetlands adjacent but not directly abutting RPWs that flow directly or indirectly into TNWs
- NRPWW = Wetlands adjacent to non-RPWs that flow directly or indirectly into TNWs
- ISOLATE = Isolated (Interstate or Intrastate) waters, including isolated wetlands

5 - Temporary fill discharge into waters of the U.S.

6 - Permanent fill associated with the construction of permanent access road and facilities

Table 4 Proposed Stream Mitigation

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
S-PP14	Field	Middle New	05050002	Perennial	11	0	16	VARTF
S-PP15	Field	Middle New	05050002	Perennial	11	0	14	VARTF
S-PP17	Field	Middle New	05050002	Intermittent	14	0	19	VARTF
S-MN20	Field	Middle New	05050002	Intermittent	11	0	13	VARTF
S-PP18	Field	Middle New	05050002	Perennial	19	0	23	VARTF
S-PP19	Field	Middle New	05050002	Intermittent	16	0	21	VARTF
S-UU9	Field	Middle New	05050002	Perennial	11	0	15	VARTF
S-HH15	Field	Middle New	05050002	Perennial	14	0	14	VARTF
S-HH14	Field	Middle New	05050002	Intermittent	14	0	15	VARTF
S-HH13	Field	Middle New	05050002	Perennial	11	0	16	VARTF
S-HH12	Field	Middle New	05050002	Ephemeral	11	0	8	VARTF
S-SS2	Field	Middle New	05050002	Intermittent	14	0	20	VARTF
S-IJ16-a	Field	Middle New	05050002	Ephemeral	45	0	23	VARTF
S-MN34	Field	Upper Roanoke	03010101	Intermittent	57	0	74	Graham and David
S-MN33	Field	Upper Roanoke	03010101	Ephemeral	41	0	23	Graham and David
S-MN32	Field	Upper Roanoke	03010101	Perennial	55	0	74	Graham and David
S-IJ85*	Field	Upper Roanoke	03010101	Perennial	50	0	50	Graham and David
S-D17	Field	Upper Roanoke	03010101	Intermittent	34	0	23	Graham and David
S-H42	Field	Banister	03010105	Perennial	39	0	54	Graham and David
				FIELD TOTAL	**478**	**0**	**515**	
				DESKTOP TOTAL	**0**	**0**	**0**	
				GRAND TOTAL	**478**	**0**	**515**	

Notes:

1 - Ratio values for field delineated stream impacts calculated using Unified Stream Methodology. See Table 5 for details.
Ratio values for desktop identified stream impacts are 1:1 because Unified Stream Methodology has not been conducted on these features.

2 - MVP is proposing to mitigate for impacts outside of mitigation bank primary or secondary service areas through the purchase of mitigation credits through the VA Aquatic Resource Trust Fund.

3 - Proposed mitigation type based on the location of the impact and availability of mitigation credits in the impact area.
-Graham and David - Graham and David Mitigation Bank
- VARTF - Virginia Aquatic Resources Trust Fund

* - Unified Stream Methodology field evaluation has not been performed for S-IJ85. Compensatory mitigation requirement ratio of impacts : credits is assumed to be 1:1.

Table 5 Unified Stream Methodology Form 2

Unified Stream Methodology for Use in Virginia

Project	Applicant		Date
	Mountain Valley Pipeline		2017
Evaluators		HUC	Locality
J.Cook, E.Foster		See Table 4	Virginia

Stream Name	Reach ID	Length of Impact (L) (feet)	Reach Condition Index (RCI)	Impact Factor (IF)	Compensation Requirement (CR) (L x RCI x IF)
S-PP14	S-PP14	11	1.42	1.00	16
S-PP15	S-PP15	11	1.28	1.00	14
S-PP17	S-PP17	14	1.39	1.00	19
S-MN20	S-MN20	11	1.15	1.00	13
S-PP18	S-PP18	19	1.23	1.00	23
S-PP19	S-PP19	16	1.34	1.00	21
S-UU9	S-UU9	11	1.33	1.00	15
S-HH15	S-HH15	14	1.01	1.00	14
S-HH14	S-HH14	14	1.06	1.00	15
S-HH13	S-HH13	11	1.45	1.00	16
S-HH12	S-HH12	11	0.73	1.00	8
S-SS2	S-SS2	14	1.46	1.00	20
S-IJ16-a	S-IJ16-a	45	0.52	1.00	23
S-MN34	S-MN34	57	1.29	1.00	74
S-MN33	S-MN33	41	0.55	1.00	23
S-MN32	S-MN32	55	1.35	1.00	74
S-IJ85	S-IJ85	50	1.00	1.00	50
S-D17	S-D17	34	0.69	1.00	23
S-H42	S-H42	39	1.38	1.00	54
	Total L	478		Total CR	515

Note: Round all feet & CR's to the nearest whole number.

Table 6 Proposed Wetland Mitigation

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
W-Z3	Field	05090202	Middle New	PSS	1,168	-	0.027	1 : 1	0	0.027	VARTF	Groundwater Recharge/Discharge; Sediment/Toxicant/Pathogen Retention; Nutrient Removal/Retention/Transformation
W-F9-PFO	Field	03010101	Upper Roanoke	PFO	736	-	0.017	1 : 1	0	0.017	VARTF	Groundwater Recharge/Discharge; Sediment/Toxicant/Pathogen Retention; Nutrient Removal/Retention/Transformation
W-C12	Field	03010101	Upper Roanoke	PFO	2,278	-	0.052	1 : 1	0	0.052	VARTF	Groundwater Recharge/Discharge; Sediment/Toxicant/Pathogen Retention; Nutrient Removal/Retention/Transformation; Floodflow Alteration; Wildlife Habitat; Production Export
W-C11	Field	03010101	Upper Roanoke	PSS	2,007	-	0.046	1 : 1	0	0.046	VARTF	Groundwater Recharge/Discharge; Sediment/Toxicant/Pathogen Retention; Nutrient Removal/Retention/Transformation; Floodflow Alteration
W-NN6	Field	03010101	Upper Roanoke	PFO	3,307	-	0.076	1 : 1	0	0.076	VARTF	Groundwater Recharge/Discharge; Sediment/Toxicant/Pathogen Retention; Nutrient Removal/Retention/Transformation; Floodflow Alteration; Sediment/Shoreline Stabilization
W-CD11	Field	03010101	Upper Roanoke	PEM	-	8	0.0002	1 : 1	0	0.0002	VARTF	Groundwater Recharge/Discharge; Sediment/Toxicant/Pathogen Retention; Nutrient Removal/Retention/Transformation
W-EF5-PFO	Field	03010101	Upper Roanoke	PFO	4,819	-	0.111	1 : 1	0	0.111	VARTF	Groundwater Recharge/Discharge; Sediment/Toxicant/Pathogen Retention; Floodflow Alteration; Wildlife Habitat
W-EF22	Field	03010101	Upper Roanoke	PFO	3,427	-	0.079	1 : 1	0	0.079	VARTF	Groundwater Recharge/Discharge; Sediment/Toxicant/Pathogen Retention; Floodflow Alteration; Wildlife Habitat
W-EF18	Field	03010101	Upper Roanoke	PSS	458	-	0.011	1 : 1	0	0.011	VARTF	Groundwater Recharge/Discharge; Sediment/Toxicant/Pathogen Retention; Nutrient Removal/Retention/Transformation; Floodflow Alteration
W-EF17	Field	03010101	Upper Roanoke	PFO	1,725	-	0.040	1 : 1	0	0.040	VARTF	Groundwater Recharge/Discharge; Sediment/Toxicant/Pathogen Retention
W-EF19	Field	03010101	Upper Roanoke	PSS	1,953	-	0.045	1 : 1	0	0.045	VARTF	Groundwater Recharge/Discharge; Sediment/Toxicant/Pathogen Retention; Nutrient Removal/Retention/Transformation; Floodflow Alteration
W-IJ99	Field	3010101	Upper Roanoke	PSS	4,741	-	0.109	1 : 1	0	0.109	VARTF	Groundwater Recharge/Discharge; Sediment/Toxicant/Pathogen Retention; Nutrient Removal/Retention/Transformation; Floodflow Alteration; Wildlife Habitat
W-IJ94-PSS	Field	3010101	Upper Roanoke	PSS	805	-	0.018	1 : 1	0	0.018	VARTF	Groundwater Recharge/Discharge; Sediment/Toxicant/Pathogen Retention; Nutrient Removal/Retention/Transformation; Floodflow Alteration; Wildlife Habitat
W-IJ96-PEM	Field	3010101	Upper Roanoke	PEM	-	579	0.013	1 : 1	0	0.013	VARTF	Groundwater Recharge/Discharge; Sediment/Toxicant/Pathogen Retention; Nutrient Removal/Retention/Transformation; Floodflow Alteration
W-IJ97	Field	3010101	Upper Roanoke	PEM	-	22	0.001	1 : 1	0	0.001	VARTF	Sediment/Toxicant/Pathogen Retention; Nutrient Removal/Retention/Transformation
W-IJ95-PSS	Field	3010101	Upper Roanoke	PSS	19,030	-	0.437	1 : 1	0	0.437	VARTF	Groundwater Recharge/Discharge; Sediment/Toxicant/Pathogen Retention; Nutrient Removal/Retention/Transformation; Floodflow Alteration; Wildlife Habitat
W-IJ102	Field	03010101	Upper Roanoke	PFO	610	-	0.014	1 : 1	0	0.014	VARTF	Groundwater Recharge/Discharge; Sediment/Toxicant/Pathogen Retention; Nutrient Removal/Retention/Transformation; Floodflow Alteration; Wildlife Habitat
W-IJ100	Field	03010101	Upper Roanoke	PFO	321	-	0.007	1 : 1	0	0.007	VARTF	Sediment/Toxicant/Pathogen Retention; Nutrient Removal/Retention/Transformation; Floodflow Alteration
W-IJ101	Field	03010101	Upper Roanoke	PSS	9	-	0.000	1 : 1	0	0.000	VARTF	Groundwater Recharge/Discharge; Sediment/Toxicant/Pathogen Retention; Nutrient Removal/Retention/Transformation; Floodflow Alteration; Wildlife Habitat
W-KL17	Field	03010101	Upper Roanoke	PSS	1,896	-	0.044	1 : 1	0	0.044	VARTF	Groundwater Recharge/Discharge; Sediment/Toxicant/Pathogen Retention; Nutrient Removal/Retention/Transformation;Wildlife Habitat; Production Export
W-AB6-PFO-1	Field	03010101	Upper Roanoke	PFO	2,691	-	0.062	1 : 1	0	0.062	VARTF	Groundwater Recharge/Discharge; Sediment/Toxicant/Pathogen Retention; Nutrient Removal/Retention/Transformation; Floodflow Alteration; Wildlife Habitat; Production Export
W-AB6-PSS	Field	03010101	Upper Roanoke	PSS	266	-	0.006	1 : 1	0	0.006	VARTF	Groundwater Recharge/Discharge; Sediment/Toxicant/Pathogen Retention; Nutrient Removal/Retention/Transformation; Floodflow Alteration
W-AB5	Field	03010101	Upper Roanoke	PFO	182	-	0.004	1 : 1	0	0.004	VARTF	Sediment/Toxicant/Pathogen Retention; Nutrient Removal/Retention/Transformation;
W-EF46	Field	03010101	Upper Roanoke	PSS	11,245	-	0.258	1 : 1	0	0.258	VARTF	Groundwater Recharge/Discharge; Sediment/Toxicant/Pathogen Retention; Nutrient Removal/Retention/Transformation; Floodflow Alteration; Wildlife Habitat; Production Export,Sediment/Shoreline
W-KL48-PSS-1	Field	3010101	Upper Roanoke	PSS	1,979	-	0.045	1 : 1	0	0.045	VARTF	Groundwater Recharge/Discharge; Sediment/Toxicant/Pathogen Retention; Floodflow Alteration
W-KL48-PSS-2	Field	3010101	Upper Roanoke	PSS	1,152	-	0.026	1 : 1	0	0.026	VARTF	Groundwater Recharge/Discharge; Sediment/Toxicant/Pathogen Retention; Floodflow Alteration; Sediment/Shoreline Stabilization; Wildlife Habitat
W-KL51-PSS	Field	3010101	Upper Roanoke	PSS	1,508	-	0.035	1 : 1	0	0.035	VARTF	Groundwater Recharge/Discharge; Sediment/Toxicant/Pathogen Retention; Floodflow Alteration; Sediment/Shoreline Stabilization
W-MN9	Field	3010101	Upper Roanoke	PFO	1,140	-	0.026	1 : 1	0	0.026	VARTF	Groundwater Recharge/Discharge; Sediment/Toxicant/Pathogen Retention
W-IJ98	Field	03010101	Upper Roanoke	PSS	19,044	-	0.437	1 : 1	0	0.437	VARTF	Groundwater Recharge/Discharge; Sediment/Toxicant/Pathogen Retention; Nutrient Removal/Retention/Transformation; Floodflow Alteration; Wildlife Habitat; Production Export
W-Z7	Field	03010101	Upper Roanoke	PSS	12	-	0.0003	1 : 1	0	0.0003	VARTF	Groundwater Recharge/Discharge; Sediment/Toxicant/Pathogen Retention; Nutrient Removal/Retention/Transformation; Floodflow Alteration
W-Z8	Field	03010101	Upper Roanoke	PFO	124	-	0.003	1 : 1	0	0.003	VARTF	Groundwater Recharge/Discharge; Sediment/Toxicant/Pathogen Retention; Nutrient Removal/Retention/Transformation; Floodflow Alteration
W-B24-PSS	Field	03010101	Upper Roanoke	PSS	7,132	-	0.164	1 : 1	0	0.164	VARTF	Groundwater Recharge/Discharge; Sediment/Toxicant/Pathogen Retention; Nutrient Removal/Retention/Transformation; Floodflow Alteration
W-B25-PSS-2	Field	03010101	Upper Roanoke	PSS	16,336	-	0.375	1 : 1	0	0.375	VARTF	Groundwater Recharge/Discharge; Sediment/Toxicant/Pathogen Retention; Nutrient Removal/Retention/Transformation; Floodflow Alteration
W-D6	Field	3010101	Upper Roanoke	PFO	83	-	0.002	1 : 1	0	0.002	VARTF	Groundwater Recharge/Discharge
W-IJ70-PSS	Field	3010101	Upper Roanoke	PSS	1,379	-	0.032	1 : 1	0	0.032	VARTF	Groundwater Recharge/Discharge; Sediment/Toxicant/Pathogen Retention; Floodflow Alteration; Sediment/Shoreline Stabilization
W-IJ70-PFO-2	Field	3010101	Upper Roanoke	PFO	2,263	-	0.052	1 : 1	0	0.052	VARTF	Groundwater Recharge/Discharge; Sediment/Toxicant/Pathogen Retention; Floodflow Alteration; Sediment/Shoreline Stabilization
W-IJ3-PSS	Field	03010101	Upper Roanoke	PSS	347	-	0.008	1 : 1	0	0.008	Banister Bend	Groundwater Recharge/Discharge; Sediment/Toxicant/Pathogen Retention; Nutrient Removal/Retention/Transformation
W-GH2	Field	03010101	Upper Roanoke	PSS	1,804	-	0.041	1 : 1	0	0.041	Banister Bend	Groundwater Recharge/Discharge; Sediment/Toxicant/Pathogen Retention; Nutrient Removal/Retention/Transformation
W-CD5	Field	03010101	Upper Roanoke	PFO	4,946	-	0.114	1 : 1	0	0.114	Banister Bend	Groundwater Recharge/Discharge; Sediment/Toxicant/Pathogen Retention; Floodflow Alteration
W-CD1	Field	03010101	Upper Roanoke	PFO	4,919	-	0.111	1 : 1	0	0.111	Banister Bend	Groundwater Recharge/Discharge; Sediment/Toxicant/Pathogen Retention; Nutrient Removal/Retention/Transformation;
W-A12-PFO	Field	03010101	Upper Roanoke	PFO	173	-	0.004	1 : 1	0	0.004	Banister Bend	Groundwater Recharge/Discharge; Sediment/Toxicant/Pathogen Retention; Nutrient Removal/Retention/Transformation; Floodflow Alteration

Table 6 Proposed Wetland Mitigation

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
W-GH16	Field	03010101	Upper Roanoke	PFO	8,707	-	0.200	1 : 1	0	0.200	Banister Bend	Groundwater Recharge/Discharge; Sediment/Toxicant/Pathogen Retention; Nutrient Removal/Retention/Transformation; Floodflow Alteration
W-H17	Field	03010101	Upper Roanoke	PFO	6,768	-	0.155	1 : 1	0	0.155	Banister Bend	Groundwater Recharge/Discharge; Sediment/Toxicant/Pathogen Retention; Nutrient Removal/Retention/Transformation, Floodflow Alteration
W-H18	Field	03010101	Upper Roanoke	PSS	311	-	0.007	1 : 1	0	0.007	Banister Bend	Groundwater Recharge/Discharge; Sediment/Toxicant/Pathogen Retention
W-D3	Field	03010101	Upper Roanoke	PFO	1,786	-	0.041	1 : 1	0	0.041	Banister Bend	Sediment/Toxicant/Pathogen Retention
W-B4-PSS	Field	03010101	Upper Roanoke	PSS	205	-	0.005	1 : 1	0	0.005	Banister Bend	Groundwater Recharge/Discharge; Sediment/Toxicant/Pathogen Retention; Nutrient Removal/Retention/Transformation;
W-MM5	Field	03010105	Banister	PSS	879	-	0.020	1 : 1	0	0.020	Banister Bend	Groundwater Recharge/Discharge; Sediment/Toxicant/Pathogen Retention; Nutrient Removal/Retention/Transformation
W-MM8-PFO	Field	03010105	Banister	PFO	1,833	-	0.042	1 : 1	0	0.042	Banister Bend	Groundwater Recharge/Discharge; Sediment/Toxicant/Pathogen Retention; Nutrient Removal/Retention/Transformation; Floodflow Alteration
W-Q2	Field	03010105	Banister	PFO	16,422	-	0.377	1 : 1	0	0.377	Banister Bend	Groundwater Recharge/Discharge; Sediment/Toxicant/Pathogen Retention; Nutrient Removal/Retention/Transformation; Floodflow Alteration; Wildlife Habitat; Production Export;Sediment/Shoreline Stabilization
W-EF6	Field	03010105	Banister	PFO	8,907	-	0.205	1 : 1	0	0.205	Banister Bend	Groundwater Recharge/Discharge; Sediment/Toxicant/Pathogen Retention; Nutrient Removal/Retention/Transformation; Floodflow Alteration
W-LJ21	Field	03010105	Banister	PFO	483	-	0.011	1 : 1	0	0.011	Banister Bend	Groundwater Recharge/Discharge; Sediment/Toxicant/Pathogen Retention; Nutrient Removal/Retention/Transformation; Floodflow Alteration
W-MM3	Field	03010105	Banister	PSS	1,480	-	0.034	1 : 1	0	0.034	Banister Bend	Groundwater Recharge/Discharge; Sediment/Toxicant/Pathogen Retention, Nutrient Removal/Retention/Transformation, Wildlife Habitat, Production Export
W-LJ22-PFO	Field	03010105	Banister	PFO	11,817	-	0.271	1 : 1	0	0.271	Banister Bend	Groundwater Recharge/Discharge; Sediment/Toxicant/Pathogen Retention; Nutrient Removal/Retention/Transformation; Floodflow Alteration; Wildlife Habitat; Production Export
TTVA-W-CD11	Desktop	03010101	Upper Roanoke	PEM	-	84	0.002	1 : 1	0	0.002	VARTF	N/A - Desktop delineated wetland
			FIELD TOTAL		187,513	609	4.32	-	0	4.32		
			DESKTOP TOTAL		0	84	0.002	-	0	0.002		
			GRAND TOTAL		187,513	693	4.32	-	0	4.32		

Notes:

1 - Field classification based on Cowardin et al. 1979. PEM - palustrine emergent wetland, PSS - palustrine scrub-shrub wetland, PFO - palustrine forested wetland

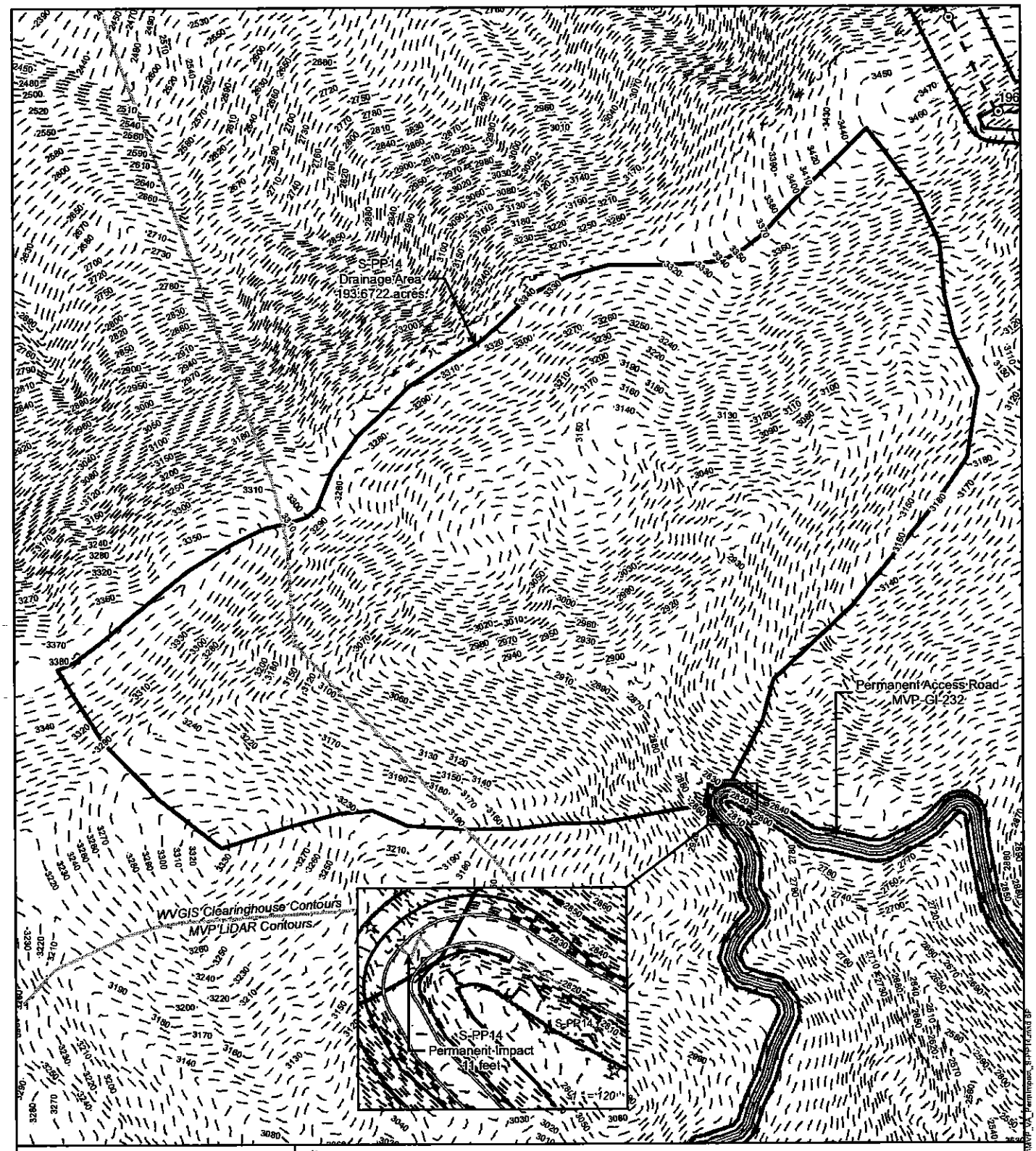
2 - Per VDEQ and USACE guidance, mitigation ratios are 1:1 for PEM fill, PSS conversion, and PFO conversion impacts. Per VDEQ and USACE guidance, mitigation ratios are 1.5:1 for PSS and 2:1 for PFO fill impacts.

3 - Proposed mitigation type based on the location of the impact and availability of mitigation credits in the impact area.
- Banister Bend - Banister Bend Mitigation Bank.
- VARTF - Virginia Aquatic Resources Trust Fund

4 - Wetland Functions and Values assessed according to the USACE Highway Method (See Attachment H2 for details).

USM FORMS AND
PERMANENT IMPACT FIGURES

S-PP14



Mountain Valley Pipeline Project

N

NAD 1983 UTM 17N

1" = 650'

650 325 0 650 Feet

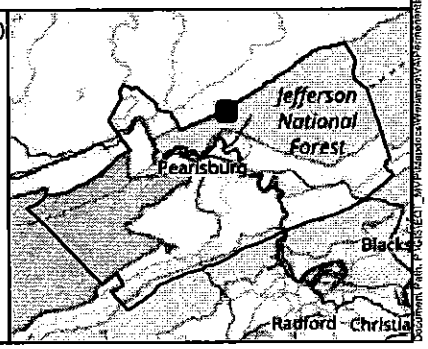
Mountain Valley PIPELINE

Figure 1:
Permanent Impacts for Stream S-PP14
Giles County

SEPTEMBER, 2017

Data Sources: ESRI Streaming Data © 2014
Elevation data derived from LiDAR provided by EQT 2016 and from the West Virginia GIS Clearinghouse.

- Milepost
- Alignment Centerline
- Access Road Permanent LOD
- Limit of Disturbance
- Preliminary Jurisdictional Determination Boundary
- Unified Stream Method (USM) Survey Reach
- Stream Permanent Impact
- Perennial Stream
- Drainage Area



Photograph Number: 1 **Feature Name:** S-PP14 **Flow Regime:** Perennial

Direction: NW **Date:** 10/16/2015

STREAM ID S-PP14	**STREAM NAME** Kimballton Branch
LAT 37.392676 **LONG** -80.693871	**DATE** 10/16/2015
CLIENT MVP	**PROJECT NAME** MVP
INVESTIGATORS D. Hadersbeck, T. Woods, D. McCollough	
FLOW REGIME Perennial ✔ Intermittent___ Ephemeral___	**WATER TYPE** TNW___ RPW ✔ NRPW___

CHANNEL FEATURES

Estimate Measurements
Top of Bank Width: 14 ft
Top of Bank Height:
LB 1.0 ft RB 10.0 in
Water Depth: 8.00 in
Water Width: 5.0 ft
High Water Mark: 8.0 in
Flow Direction: Southeast

Stream Erosion
✔ None ___Moderate ___Heavy

Artificial, Modified or Channelized
✔ Yes ___No

Dam Present ___Yes ✔ No

Sinuosity ___ Low ✔ Medium ✔ High

Gradient
___ Flat (0.5/100 ft) ✔ Moderate (2 ft/100 ft) ___Severe (10 ft/100 ft)

FLOW CHARACTERISTICS

Water Present
___ No water, stream bed dry
___ Stream bed moist
___ Standing water
✔ Flowing water

Velocity
___ Fast ✔ Moderate
___ Slow

Proportion of Reach Represented by Stream Morphology Types
Riffle 30 % Run 50 %
Pool 20 %

Turbidity
✔ Clear ___Slightly turbid ___Turbid
___ Opaque ___Stained
___Other_____

INORGANIC SUBSTRATE COMPONENTS (should add up to 100%)

Substrate Type	Diameter	% Composition in Sampling Reach
Bedrock		
Boulder	> 256 mm (10")	20
Cobble	64-256 mm (2.5"-10")	30
Gravel	2-64 mm (0.1"-2.5")	30
Sand	0.06-2mm (gritty)	20
Silt	0.004-0.06 mm	
Clay	< 0.004 mm (slick)	

ORGANIC SUBSTRATE COMPONENTS (does not necessarily add up to 100%)

Substrate Type	Characteristic	% Composition in Sampling Area
Detritus	sticks, wood, coarse plant materials (CPOM)	55
Muck-Mud	black, very fine organic (FPOM)	
Marl	grey, shell fragments	

WATERSHED FEATURES

Predominant Surrounding Landuse
✔ Forest ___ Commercial
___ Field/Pasture ___ Industrial
___ Agricultural ___ Residential
___ Other:

Canopy Cover
✔ Partly open ___Partly shaded
___ Shaded ___ Open

Indicate the dominant type (Check one)
✔ Trees ___Shrubs
___ Grasses ___Herbaceous

Floodplain Width
___ Wide > 30ft ✔ Moderate 15-30ft
___ Narrow <16ft

Wetland Present ___Yes ✔ No
Wetland ID

AQUATIC VEGETATION

Indicate the dominant type and record the dominant species present
___ Rooted emergent ___Rooted submergent ___Rooted floating ___Free floating
___ Floating algae ✔ Attached algae

MACROINVERTEBRATES OR OTHER WILDLIFE OBSERVED/OTHER OBSERVATIONS AND NOTES

Stream traverses a culvert under the road. Huge culvert observed to have two holes in the top portion allowing sunlight to observed in the culvert under the road

Stream Assessment Form (Form 1)

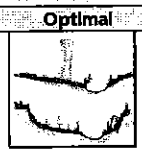
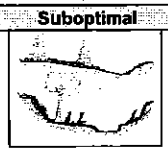
Unified Stream Methodology for use in Virginia

For use in wadeable channels classified as intermittent or perennial

Project	Stream Name	County	Reach ID	HUC	Date	Time	Initial Score
	Mountain Valley Pipeline	Giles	R2RB1	050500020602	10/25/2016		

Evaluators	Stream Classification
J.Cook, E.Foster	S-PP14, Perrenial, MVP-GI-232

Conditional Category

	Optimal	Suboptimal	Marginal	Poor	Severe	
						
Channel Condition	Very little incision or active erosion; 80-100% stable banks. Vegetative surface protection or natural rock, prominent (80-100%). AND/OR Stable point bars/bankfull benches are present. Access to their original floodplain or fully developed wide bankfull benches. Mid-channel bars, and transverse bars few. Transient sediment deposition covers less than 10% of bottom.	Slightly incised, few areas of active erosion or unprotected banks. Majority of banks are stable (60-80%). Vegetative protection or natural rock prominent (60-80%) AND/OR Depositional features contribute to stability. The bankfull and low flow channels are well defined. Stream likely has access to bankfull benches, or newly developed floodplains along portions of the reach. Transient sediment covers 10-40% of the stream bottom.	Often incised, but less than Severe or Poor. Banks more stable than Severe or Poor due to lower bank slopes. Erosion may be present on 40-60% of both banks. Vegetative protection on 40-60% of banks. Streambanks may bevertical or undercut. AND/OR 40-60% of stream is covered by sediment. Sediment may be temporary/transient, contribute instability. Deposition that contribute to stability, may be forming/present. AND/OR V-shaped channels have vegetative protection on > 40% of the banks and depositional features which contribute to stability.	Overwidened/incised. Vertically/laterally unstable. Likely to widen further. Majority of both banks are near vertical. Erosion present on 60-80% of banks. Vegetative protection present on 20-40% of banks, and is insufficient to prevent erosion. AND/OR 60-80% of the stream is covered by sediment. Sediment is temporary/transient in nature, and contributing to instability. AND/OR V-shaped channels have vegetative protection is present on > 40% of the banks and stable sediment deposition is absent.	Deeply incised (or excavated), vertical/lateral instability. Severe incision, flow contained within the banks. Streambed below average rooting depth, majority of banks vertical/undercut. Vegetative protection present on less than 20% of banks, is not preventing erosion. Obvious bank sloughing present. Erosion/raw banks on 80-100%. AND/OR Aggrading channel. Greater than 80% of stream bed is covered by deposition, contributing to instability. Multiple thread channels and/or subterranean flow.	CI
Score	3	2.4	2	1.6	1	3.0

NOTES>> Stable, rocky banks with dense rhododendron on banks

Conditional Category

	Optimal	Suboptimal		Marginal		Poor	
Riparian Buffers	Tree stratum (dbh > 3 inches) present, with > 60% tree canopy cover and a non-maintained understory. Wetlands located within the riparian areas.	High Suboptimal: Riparian areas with tree stratum (dbh > 3 inches) present, with 30% to 60% tree canopy cover and containing both herbaceous and shrub layers or a non-maintained understory.	Low Suboptimal: Riparian areas with tree stratum (dbh > 3 inches) present, with > 60% tree canopy cover and a maintained understory. Recent cutover (dense vegetation).	High Marginal: Non-maintained, dense herbaceous vegetation with either a shrub layer or a tree layer (dbh > 3 inches) present, with <30% tree canopy cover.	Low Marginal: Non-maintained, dense herbaceous vegetation, riparian areas lacking shrub and tree stratum, hay production, ponds, open water. If present, tree stratum (dbh >3 inches) present, with <30% tree canopy cover with maintained understory.	High Poor: Lawns, mowed, and maintained areas, nurseries; no-till cropland; actively grazed pasture, sparsely vegetated non-maintained area, recently seeded and stabilized, or other comparable condition.	Low Poor: Impervious surfaces, mine spoil lands, denuded surfaces, row crops, active feed lots, trails, or other comparable conditions.
		High	Low	High	Low	High	Low
Condition Scores	1.5	1.2	1.1	0.85	0.75	0.6	0.5

NOTES>> Predominately hardwood forest. Some mowed/maintained roadside and gravel. Pocohantas road.`

1. Delineate riparian areas along each stream bank into Condition Categories and Condition Scores using the descriptors.
2. Determine square footage for each by measuring or estimating length and width. Calculators are provided for you below.
3. Enter the % Riparian Area and Score for each riparian category in the blocks below.

Ensure the sums of % Riparian Blocks equal 100

Right Bank	% Riparian Area>	80%	10%	10%				100%
	Score >	1.25						
Left Bank	% Riparian Area>	80%	10%	10%				100%
	Score >	1.25						

CI= (Sum % RA * Scores*0.01)/2

Rt Bank CI >	1.31	CI
Lt Bank CI >	1.31	1.31

Conditional Category

	Optimal	Suboptimal	Marginal	Poor
Instream Habitat/ Available Cover	Habitat elements are typically present in greater than 50% of the reach.	Stable habitat elements are typically present in 30-50% of the reach and are adequate for maintenance of populations.	Stable habitat elements are typically present in 10-30% of the reach and are adequate for maintenance of populations.	Habitat elements listed above are lacking or are unstable. Habitat elements are typically present in less than 10% of the reach.
Score	1.5	1.2	0.9	0.5

NOTES>> Large perennial, varied rock substrate, strong flow as of 10/25/2016

CI
1.50

Stream Impact Assessment Form Page 2

	Mountain Valley Pipeline	Giles		050500020602	10/25/2016	8-PP14	500	1

NOTES>> Culvert. Road is blown out over culvert, forming deep holes in road. Need improvement.

	Conditional Category						
	Negligible	Minor		Moderate		Severe	
Channel Alteration	Channelization, dredging, alteration, or hardening absent. Stream has an unaltered pattern or has naturalized.	Less than 20% of the stream reach is disrupted by any of the channel alterations listed in the parameter guidelines.	20-40% of the stream reach is disrupted by any of the channel alterations listed in the parameter guidelines.	40 - 60% of reach is disrupted by any of the channel alterations listed in the parameter guidelines. If stream has been channelized, normal stable stream meander pattern has not recovered.	60 - 80% of reach is disrupted by any of the channel alterations listed in the parameter guidelines. If stream has been channelized, normal stable stream meander pattern has not recovered.	Greater than 80% of reach is disrupted by any of the channel alterations listed in the parameter guidelines AND/OR 80% of banks shored with gabion, riprap, or cement.	
SCORE	1.5	1.3	1.1	0.9	0.7	0.5	1.30

NOTE: The CIs and RCI should be rounded to 2 decimal places. The CR should be rounded to a whole number.

THE REACH CONDITION INDEX (RCI) >>	1.42

RCI= (Sum of all CI's)/5

COMPENSATION REQUIREMENT (CR) >>	16

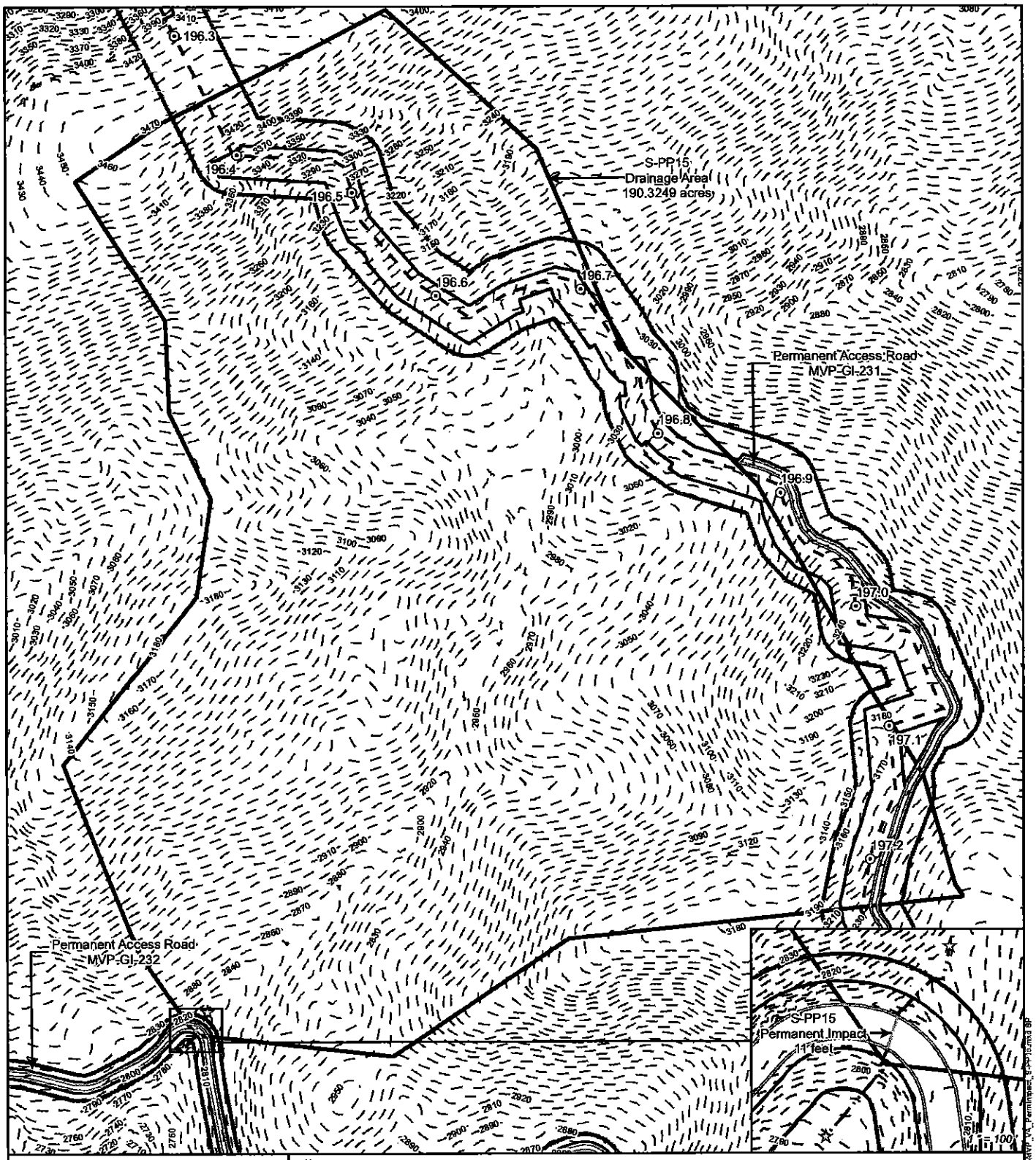
CR = RCI X LF X IF

INSERT PHOTOS:

DESCRIBE PROPOSED IMPACT:

Large perrenial strea. Mostly optimal in all categories.

S-PP15



Mountain Valley Pipeline Project

NAD 1983 UTM 17N

1" = 520'

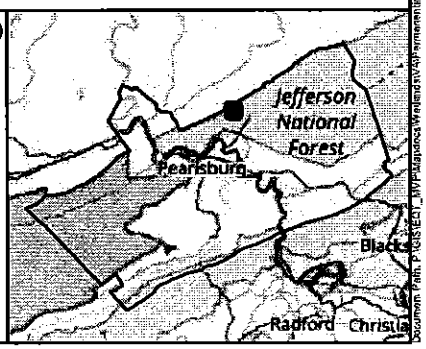
520 260 0 520 Feet

Mountain Valley PIPELINE

Figure 1:
Permanent Impacts for
Stream S-PP15
Giles County

SEPTEMBER, 2017

Milepost
Alignment Centerline
Access Road Permanent LOD
Limit of Disturbance
Preliminary Jurisdictional Determination Boundary
Unified Stream Method (USM) Survey Reach
Stream Permanent Impact
Perennial Stream
Drainage Area



Data Sources: ESRI Streaming Data © 2014
Elevation data derived from LIDAR provided by EQT 2016 and from the West Virginia GIS Clearinghouse.

Photograph Number: 1 **Feature Name:** S-PP15 **Flow Regime:** Perennial

Direction: NNE **Date:** 10/16/2015

STREAM ID S-PP15	**STREAM NAME** UNT to Kimballton Branch
LAT 37.392628 **LONG** -80.690067	**DATE** 10/16/2015
CLIENT MVP	**PROJECT NAME** MVP
INVESTIGATORS D. Hadersbeck, T. Woods, D. McCollough	
FLOW REGIME Perennial ✓ Intermittent __ Ephemeral __	**WATER TYPE** TNW __ RPW ✓ NRPW __

CHANNEL FEATURES

Estimate Measurements
Top of Bank Width: 6 ft
Top of Bank Height:
LB 6.0 in RB 6.0 in
Water Depth: 6.00 in
Water Width: 3.0 ft
High Water Mark: 8.0 in
Flow Direction: Southwest

Stream Erosion
✓ None __ Moderate __ Heavy

Artificial, Modified or Channelized
✓ Yes __ No

Dam Present __ Yes ✓ No

Sinuosity __ Low ✓ Medium ✓ High

Gradient
__ Flat (0.5/100 ft) ✓ Moderate (2 ft/100 ft) __ Severe (10 ft/100 ft)

FLOW CHARACTERISTICS

Water Present
__ No water, stream bed dry
__ Stream bed moist
__ Standing water
✓ Flowing water

Velocity
__ Fast ✓ Moderata
__ Slow

Proportion of Reach Represented by Stream Morphology Types
Riffle 30 % Run 50 %
Pool 20 %

Turbidity
✓ Clear __ Slightly turbid __ Turbid
__ Opaque __ Stained
__ Other__

INORGANIC SUBSTRATE COMPONENTS (should add up to 100%)

Substrate Type	Diameter	% Composition in Sampling Reach
Bedrock		
Boulder	> 256 mm (10")	20
Cobble	64-256 mm (2.5"-10")	30
Gravel	2-64 mm (0.1"-2.5")	30
Sand	0.06-2mm (gritty)	20
Silt	0.004-0.06 mm	
Clay	< 0.004 mm (slick)	

ORGANIC SUBSTRATE COMPONENTS (does not necessarily add up to 100%)

Substrate Type	Characteristic	% Composition in Sampling Area
Detritus	sticks, wood, coarse plant materials (CPOM)	65
Muck-Mud	black, very fine organic (FPOM)	
Marl	grey, shell fragments	

WATERSHED FEATURES

Predominant Surrounding Landuse
✓ Forest __ Commercial
__ Field/Pasture __ Industrial
__ Agricultural __ Residential
__ Other:

Canopy Cover
✓ Partly open __ Partly shaded
__ Shaded __ Open

Indicate the dominant type (Check one)
✓ Trees __ Shrubs
__ Grasses __ Herbaceous

Floodplain Width
__ Wide > 30ft ✓ Moderate 15-30ft
__ Narrow <16ft

Wetland Present __ Yes ✓ No
Wetland ID

AQUATIC VEGETATION

Indicate the dominant type and record the dominant species present
__ Rooted emergent __ Rooted submergent __ Rooted floating __ Free floating
__ Floating algae ✓ Attached algae

MACROINVERTEBRATES OR OTHER WILDLIFE OBSERVED/OTHER OBSERVATIONS AND NOTES

Stream traverses a culvert under the road.

Stream Assessment Form (Form 1)

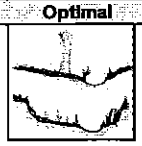
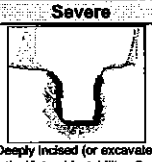
Unified Stream Methodology for use in Virginia

For use in wadeable channels classified as intermittent or perennial

Project/Proposal Name	County	Cowardin Class	USFWS Code	Date	Form Completed by	Final Score
Mountain Valley Pipeline	Giles	R3UB1	050500020602	10/25/2016		

Stream Name(s) Evaluated (Cut/Fill)	Stream Length and Identifier
J.Cook, E.Foster	S-PP15 (NHD), Perrenial, MVP-GI-232

Conditional Category

	Optimal	Suboptimal	Marginal	Poor	Severe
Channel Condition	 Very little incision or active erosion; 80-100% stable banks. Vegetative surface protection or natural rock, prominent (80-100%). AND/OR Stable point bars/bankfull benches are present. Access to their original floodplain or fully developed wide bankfull benches. Mid-channel bars, and transverse bars few. Transient sediment deposition covers less than 10% of bottom.	Slightly incised, few areas of active erosion or unprotected banks. Majority of banks are stable (60-80%). Vegetative protection or natural rock prominent (60-80%) AND/OR Depositional features contribute to stability. The bankfull and low flow channels are well defined. Stream likely has access to bankfull benches, or newly developed floodplains along portions of the reach. Transient sediment covers 10-40% of the stream bottom.	Often incised, but less than Severe or Poor. Banks more stable than Severe or Poor due to lower bank slopes. Erosion may be present on 40-60% of both banks. Vegetative protection on 40-60% of banks. Streambanks may be vertical or undercut. AND/OR 40-60% of stream is covered by sediment. Sediment may be temporary/transient, contribute instability. Deposition that contribute to stability, may be forming/present. AND/OR V-shaped channels have vegetative protection on > 40% of the banks and depositional features which contribute to stability.	Overwidened/incised. Vertically/laterally unstable. Likely to widen further. Majority of both banks are near vertical. Erosion present on 60-80% of banks. Vegetative protection present on 20-40% of banks, and is insufficient to prevent erosion. AND/OR 60-80% of the stream is covered by sediment. Sediment is temporary/transient in nature, and contributing to instability. AND/OR V-shaped channels have vegetative protection is present on > 40% of the banks and stable sediment deposition is absent.	 Deeply incised (or excavated), vertical/lateral instability. Severe incision, flow contained within the banks. Streambed below average rooting depth, majority of banks vertical/undercut. Vegetative protection present on less than 20% of banks, is not preventing erosion. Obvious bank sloughing present. Erosion/raw banks on 80-100%. AND/OR Aggrading channel. Greater than 80% of stream bed is covered by deposition, contributing to instability. Multiple thread channels and/or subterranean flow.
Score	3	2.4	2	1.6	1

		CI
Score	2.4	2.4
NOTES>>	Slight Incision	

Conditional Category

	Optimal	Suboptimal		Marginal		Poor		NOTES>>
Riparian Buffers	Tree stratum (dbh > 3 inches) present, with > 60% tree canopy cover and a non-maintained understory. Wetlands located within the riparian areas.	**High Suboptimal:** Riparian areas with tree stratum (dbh > 3 inches) present, with 30% to 60% tree canopy cover and containing both herbaceous and shrub layers or a non-maintained understory.	**Low Suboptimal:** Riparian areas with tree stratum (dbh > 3 inches) present, with > 30% tree canopy cover and a maintained understory. Recent cutover (dense vegetation).	**High Marginal:** Non-maintained, dense herbaceous vegetation with either a shrub layer or a tree layer (dbh > 3 inches) present, with <30% tree canopy cover.	**Low Marginal:** Non-maintained, dense herbaceous vegetation, riparian areas lacking shrub and tree stratum, hay production, ponds, open water. If present, tree stratum (dbh >3 inches) present, with <30% tree canopy cover with maintained understory.	**High Poor:** Lawns, mowed, and maintained areas, nurseries; no-till cropland; actively grazed pasture, sparsely vegetated non-maintained area, recently seeded and stabilized, or other comparable condition.	**Low Poor:** Impervious surfaces, mine spoil lands, denuded surfaces, row crops, active feed lots, trails, or other comparable conditions.	
		High	Low	High	Low	High	Low	
Condition Scores	1.5	1.2	1.1	0.85	0.75	0.6	0.5	

1. Delineate riparian areas along each stream bank into Condition Categories and Condition Scores using the descriptors.
2. Determine square footage for each by measuring or estimating length and width. Calculators are provided for you below.
3. Enter the % Riparian Area and Score for each riparian category in the blocks below.

Ensure the sums of % Riparian Blocks equal 100

Right Bank	% Riparian Area>							100%
	Score >							
Left Bank	% Riparian Area>							100%
	Score >							

CI= (Sum % RA * Scores*0.01)/2

		CI
Rt Bank CI >	1.50	
Lt Bank CI >	1.50	1.50

NOTES>> Varying substrate, shade and undercut

Conditional Category

	Optimal	Suboptimal	Marginal	Poor
Instream Habitat/ Available Cover	Habitat elements are typically present in greater than 50% of the reach.	Stable habitat elements are typically present in 30-50% of the reach and are adequate for maintenance of populations.	Stable habitat elements are typically present in 10-30% of the reach and are adequate for maintenance of populations.	Habitat elements listed above are lacking or are unstable. Habitat elements are typically present in less than 10% of the reach.
Score	1.5	1.2	0.9	0.5

	CI
Score	1.20

Stream Impact Assessment Form Page 2

	Mountain Valley Pipeline	Giles		0505000020802	10/25/2016	S-:P15	500	1

NOTES>> Extensive culvert

	Conditional Category						
	Negligible	Minor		Moderate		Severe	
Channel Alteration	Channelization, dredging, alteration, or hardening absent. Stream has an unaltered pattern or has naturalized.	Less than 20% of the stream reach is disrupted by any of the channel alterations listed in the parameter guidelines.	20-40% of the stream reach is disrupted by any of the channel alterations listed in the parameter guidelines.	40 - 60% of reach is disrupted by any of the channel alterations listed in the parameter guidelines. If stream has been channelized, normal stable stream meander pattern has not recovered.	60 - 80% of reach is disrupted by any of the channel alterations listed in the parameter guidelines. If stream has been channelized, normal stable stream meander pattern has not recovered.	Greater than 80% of reach is disrupted by any of the channel alterations listed in the parameter guidelines AND/OR 80% of banks shored with gabion, riprap, or cement.	
SCORE	1.5	1.3	1.1	0.9	0.7	0.5	1.30

REACH CONDITION INDEX FOR STREAM CONDITION UNITS FOR THIS REACH

NOTE: The CIs and RCI should be rounded to 2 decimal places. The CR should be rounded to a whole number.

THE REACH CONDITION INDEX (RCI) >>	1.28

RCI= (Sum of all CI's)/5

COMPENSATION REQUIREMENT (CR) >>	14

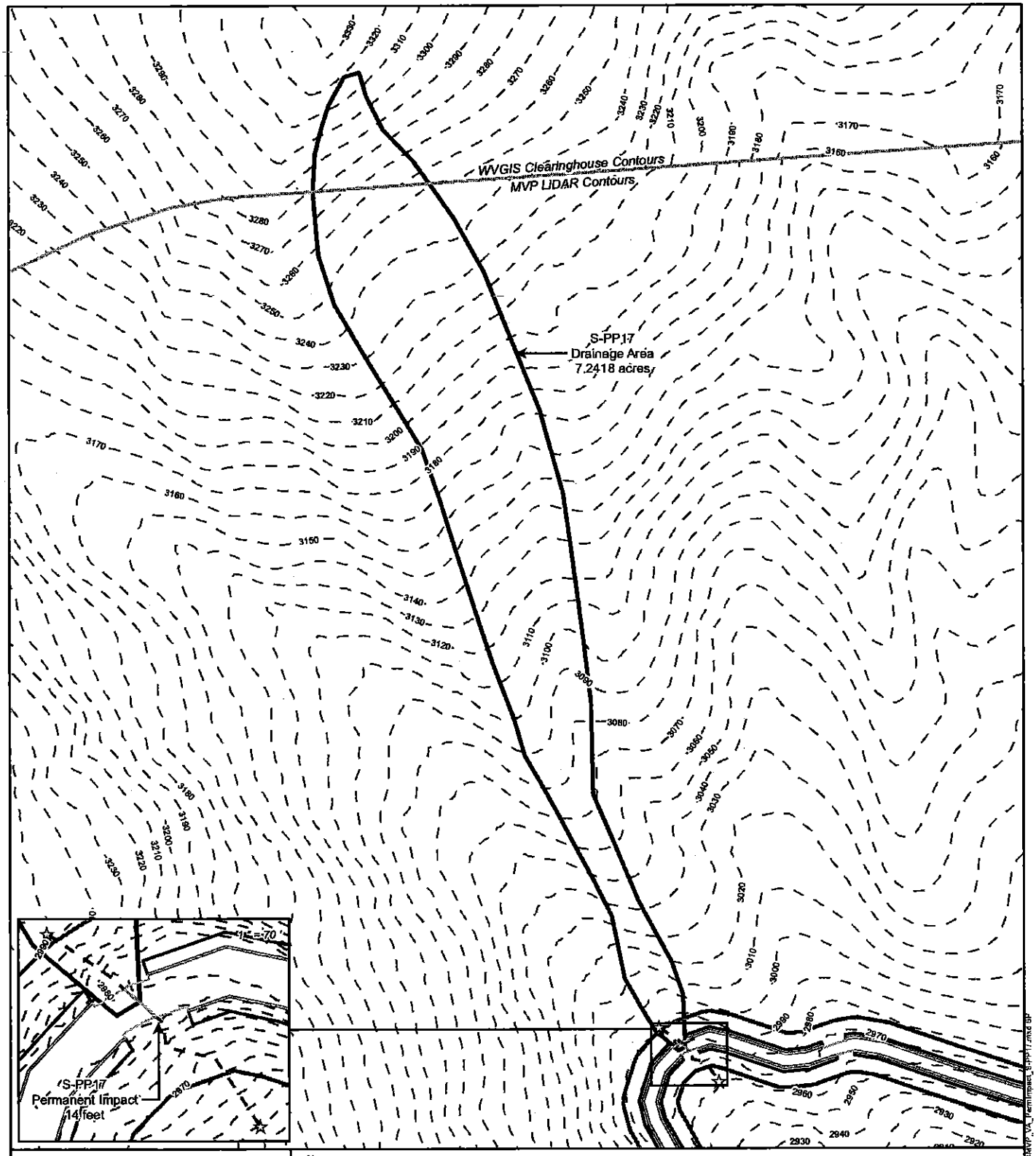
CR = RCI X LF X IF

INSERT PHOTOS:

DESCRIBE PROPOSED IMPACT:

Entire culvert will need to be replaced.

S-PP17



Mountain Valley Pipeline Project

N

NAD 1983 UTM 17N

1 " = 250 '

250 125 0 250 Feet

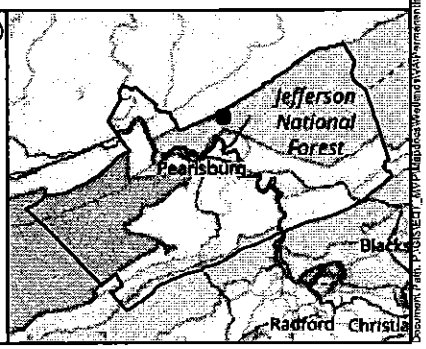
Mountain Valley PIPELINE

Figure 1:
Permanent Impacts for Stream S-PP17
Giles County

SEPTEMBER, 2017

Data Sources: ESRI Streaming Data © 2014
Elevation data derived from LIDAR provided by EQT 2016 and from the West Virginia GIS Clearinghouse.

- Access Road Permanent LOD
- Limit of Disturbance
- Preliminary Jurisdictional Determination Boundary
- Unified Stream Method (USM) Survey Reach
- Stream Permanent Impact
- Intermittent Stream
- Drainage Area



Photograph Number: 1 **Feature Name:** S-PP17 **Flow Regime:** Intermittent

Direction: SE **Date:** 10/16/2015

STREAM ID S-PP17	**STREAM NAME** UNT to New River
LAT 37.386744 **LONG** -80.700408	**DATE** 10/16/2015
CLIENT MVP	**PROJECT NAME** MVP
INVESTIGATORS D. Hadersbeck, T. Woods, D. McCollough	
FLOW REGIME Perennial ___ Intermittent ✓ Ephemeral ___	**WATER TYPE** TNW ___ RPW ✓ NRPW ___

CHANNEL FEATURES

Estimate Measurements
Top of Bank Width: 2 ft
Top of Bank Height:
LB 6.0 in RB 6.0 in
Water Depth: 3.00 in
Water Width: 1.0 ft
High Water Mark: 6.0 in
Flow Direction: South

Stream Erosion
✓ None ___ Moderate ___ Heavy

Artificial, Modified or Channelized
✓ Yes ___ No

Dam Present ___ Yes ✓ No

Sinuosity ___ Low ✓ Medium ✓ High

Gradient
___ Flat (0.5/100 ft) ✓ Moderate (2 ft/100 ft) ___ Severe (10 ft/100 ft)

FLOW CHARACTERISTICS

Water Present
___ No water, stream bed dry
___ Stream bed moist
___ Standing water
✓ Flowing water

Velocity
___ Fast ___ Moderate
✓ Slow

Proportion of Reach Represented by Stream Morphology Types
Riffle 20 % Run 60 %
Pool 20 %

Turbidity
___ Clear ✓ Slightly turbid ___ Turbid
___ Opaque ___ Stained
___ Other ___

INORGANIC SUBSTRATE COMPONENTS (should add up to 100%)

Substrate Type	Diameter	% Composition in Sampling Reach
Bedrock		20
Boulder	> 256 mm (10")	20
Cobble	64-256 mm (2.5"-10")	30
Gravel	2-64 mm (0.1"-2.5")	30
Sand	0.06-2mm (gritty)	
Silt	0.004-0.06 mm	
Clay	< 0.004 mm (slick)	

ORGANIC SUBSTRATE COMPONENTS (does not necessarily add up to 100%)

Substrate Type	Characteristic	% Composition in Sampling Area
Detritus	sticks, wood, coarse plant materials (CPOM)	80
Muck-Mud	black, very fine organic (FPOM)	
Marl	grey, shell fragments	

WATERSHED FEATURES

Predominant Surrounding Landuse
✓ Forest ___ Commercial
___ Field/Pasture ___ Industrial
___ Agricultural ___ Residential
___ Other:

Canopy Cover
✓ Partly open ___ Partly shaded
___ Shaded ___ Open

Indicate the dominant type (Check one)
✓ Trees ___ Shrubs
___ Grasses ___ Herbaceous

Floodplain Width
___ Wide > 30ft ✓ Moderate 15-30ft
___ Narrow <16ft

Wetland Present ___ Yes ✓ No
Wetland ID

AQUATIC VEGETATION

Indicate the dominant type and record the dominant species present
___ Rooted emergent ___ Rooted submergent ___ Rooted floating ___ Free floating
___ Floating algae ___ Attached algae

MACROINVERTEBRATES OR OTHER WILDLIFE OBSERVED/OTHER OBSERVATIONS AND NOTES

Stream emerges from high side of road from black plastic tubing then traverses a culvert under the road.

Stream Assessment Form (Form 1)

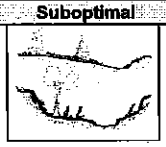
Unified Stream Methodology for use in Virginia

For use in wadeable channels classified as intermittent or perennial

Project/Site	County	Watershed	Date	Stream Name
Mountain Valley Pipeline	Giles	R4SB3	050500020002	10/25/2016

Assessors Name/Affiliation	Assessment Date/Time/Weather
J.Cook, E.Foster	S-PP17, Intermittent, MVP-GI-232

Conditional Category

	Optimal	Suboptimal	Marginal	Poor	Severe	
Channel Condition	Very little incision or active erosion; 80-100% stable banks. Vegetative surface protection or natural rock, prominent (60-100%). AND/OR Stable point bars/bankfull benches are present. Access to their original floodplain or fully developed wide bankfull benches. Mid-channel bars, and transverse bars few. Transient sediment deposition covers less than 10% of bottom.	 Slightly incised, few areas of active erosion or unprotected banks. Majority of banks are stable (60-80%). Vegetative protection or natural rock prominent (60-80%) AND/OR Depositional features contribute to stability. The bankfull and low flow channels are well defined. Stream likely has access to bankfull benches, or newly developed floodplains along portions of the reach. Transient sediment covers 10-40% of the stream bottom.	Often incised, but less than Severe or Poor. Banks more stable than Severe or Poor due to lower bank slopes. Erosion may be present on 40-60% of both banks. Vegetative protection on 40-60% of banks. Streambanks may bevertical or undercut. AND/OR 40-60% of stream is covered by sediment. Sediment may be temporary/transient, contribute instability. Deposition that contribute to stability, may be forming/present. AND/OR V-shaped channels have vegetative protection on > 40% of the banks and depositional features which contribute to stability.	Overwidened/incised. Vertically/laterally unstable. Likely to widen further. Majority of both banks are near vertical. Erosion present on 60-80% of banks. Vegetative protection present on 20-40% of banks, and is insufficient to prevent erosion. AND/OR 60-80% of the stream is covered by sediment. Sediment is temporary/transient in nature, and contributing to instability. AND/OR V-shaped channels have vegetative protection is present on > 40% of the banks and stable sediment deposition is absent.	Deeply incised (or excavated), vertical/lateral instability. Severe incision, flow contained within the banks. Streambed below average rooting depth, majority of banks vertical/undercut. Vegetative protection present on less than 20% of banks, is not preventing erosion. Obvious bank sloughing present. Erosion/raw banks on 80-100%. AND/OR Aggrading channel. Greater than 80% of stream bed is covered by deposition, contributing to instability. Multiple thread channels and/or subterranean flow.	CI
Score	3	2.4	2	1.6	1	3.0

NOTES>> Predominately natural rock -> Bedrock/boulders form majority of channel

Conditional Category

	Optimal	Suboptimal		Marginal		Poor	
Riparian Buffers	Tree stratum (dbh > 3 inches) present, with > 60% tree canopy cover and a non-maintained understory. Wetlands located within the riparian areas.	High Suboptimal: Riparian areas with tree stratum (dbh > 3 inches) present, with 30% to 60% tree canopy cover and containing both herbaceous and shrub layers or a non-maintained understory.	Low Suboptimal: Riparian areas with tree stratum (dbh > 3 inches) present, with > 30% tree canopy cover and a maintained understory. Recent cutover (dense vegetation).	High Marginal: Non-maintained, dense herbaceous vegetation with either a shrub layer or a tree layer (dbh > 3 inches) present, with <30% tree canopy cover.	Low Marginal: Non-maintained, dense herbaceous vegetation, riparian areas lacking shrub and tree stratum, hay production, ponds, open water. If present, tree stratum (dbh >3 inches) present, with <30% tree canopy cover with maintained understory.	High Poor: Lawns, mowed, and maintained areas, nurseries; no-till cropland; actively grazed pasture, sparsely vegetated non-maintained area, recently seeded and stabilized, or other comparable condition.	Low Poor: Impervious surfaces, mine spoil lands, denuded surfaces, row crops, active feed lots, trails, or other comparable conditions.
		High	Low	High	Low	High	Low
Condition Scores	1.5	1.2	1.1	0.85	0.75	0.6	0.5

NOTES>> Hardwood forest predominately

1. Delineate riparian areas along each stream bank into Condition Categories and Condition Scores using the descriptors.
2. Determine square footage for each by measuring or estimating length and width. Calculators are provided for you below.
3. Enter the % Riparian Area and Score for each riparian category in the blocks below.

Ensure the sums of % Riparian Blocks equal 100

Right Bank	% Riparian Area>							100%
	Score >							
Left Bank	% Riparian Area>							100%
	Score >							

CI= (Sum % RA * Scores*0.01)/2

Rt Bank CI >	1.46	CI
Lt Bank CI >	1.46	1.46

Conditional Category

	Optimal	Suboptimal	Marginal	Poor
Instream Habitat/ Available Cover	Habitat elements are typically present in greater than 50% of the reach.	Stable habitat elements are typically present in 30-50% of the reach and are adequate for maintenance of populations.	Stable habitat elements are typically present in 10-30% of the reach and are adequate for maintenance of populations.	Habitat elements listed above are lacking or are unstable. Habitat elements are typically present in less than 10% of the reach.
Score	1.5	1.2	0.9	0.5

NOTES>> No flowing water as of 10/25/2016. Some dripping from seep under boulder.

CI: 1.20

Stream Impact Assessment Form Page 2

	Mountain Valley Pipeline	Giles		050500020802	10/25/2016	–	500	1

NOTES>> Roadside ditch and culvert, slightly alter flow/channel

	Conditional Category						
	Negligible	Minor		Moderate		Severe	
Channel Alteration	Channelization, dredging, alteration, or hardening absent. Stream has an unaltered pattern or has naturalized.	Less than 20% of the stream reach is disrupted by any of the channel alterations listed in the parameter guidelines.	20-40% of the stream reach is disrupted by any of the channel alterations listed in the parameter guidelines.	40 - 60% of reach is disrupted by any of the channel alterations listed in the parameter guidelines. If stream has been channelized, normal stable stream meander pattern has not recovered.	60 - 80% of reach is disrupted by any of the channel alterations listed in the parameter guidelines. If stream has been channelized, normal stable stream meander pattern has not recovered.	Greater than 80% of reach is disrupted by any of the channel alterations listed in the parameter guidelines AND/OR 80% of banks shored with gabion, riprap, or cement.	
SCORE	1.5	1.3	1.1	0.9	0.7	0.5	1.30

NOTE: The CIs and RCI should be rounded to 2 decimal places. The CR should be rounded to a whole number.

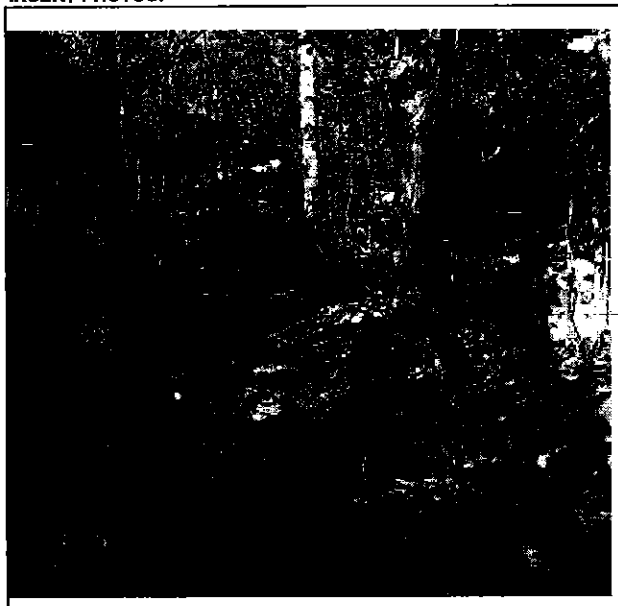
THE REACH CONDITION INDEX (RCI) >>	1.39

RCI= (Sum of all CI's)/5

COMPENSATION REQUIREMENT (CR) >>	19

CR = RCI X LF X IF

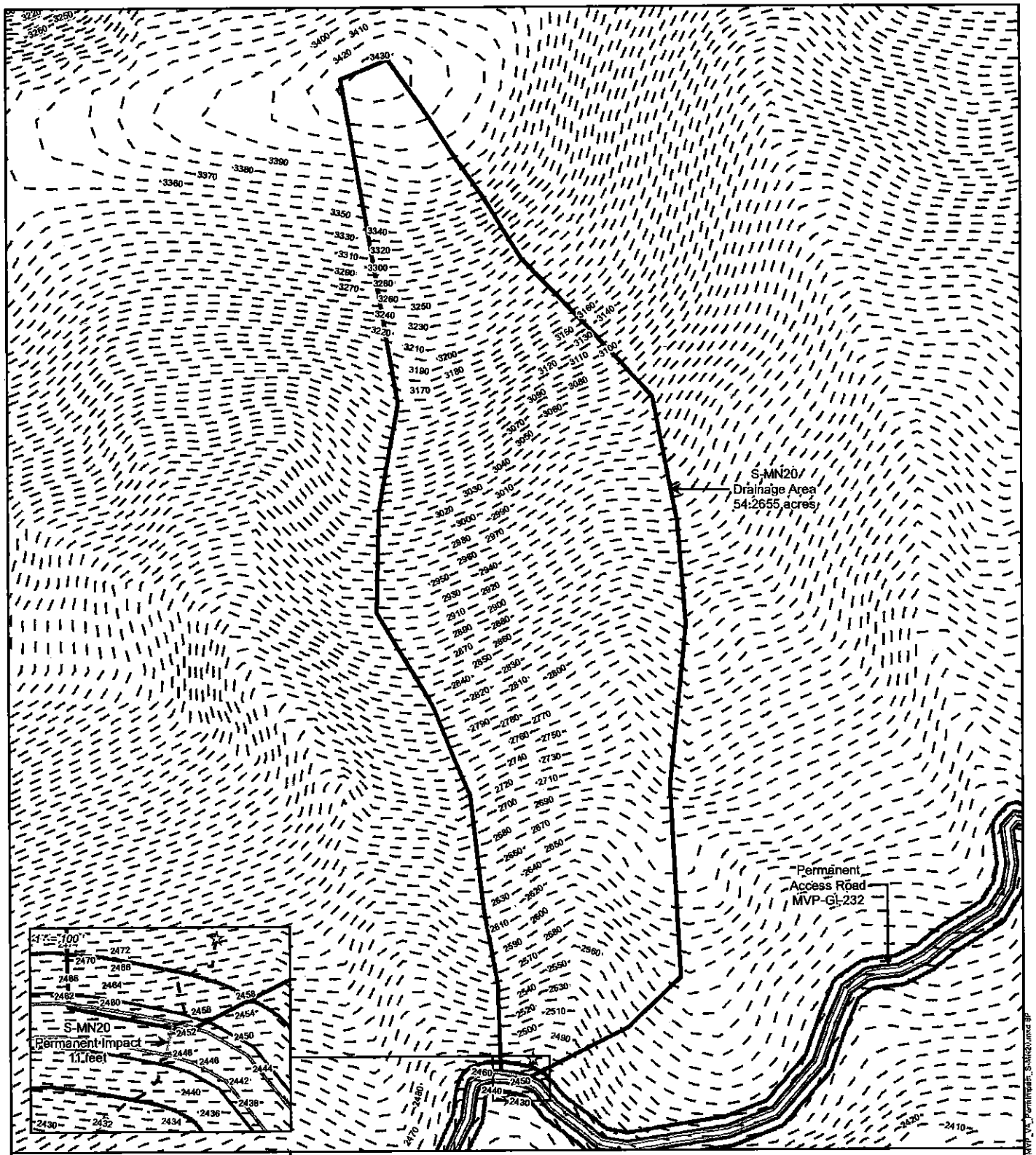
INSERT PHOTOS:



DESCRIBE PROPOSED IMPACT:

S-PP17 appears to be Old streambed with no visible flow. Subterranean water emerges from seeps in one or more locations, notably upstream of culvert from underneath a large boulder. Channel may be historical. NHD mapping present for this stream.

S-MN20



Mountain Valley Pipeline Project

NAD 1983 UTM 17N

1" = 457'

440 220 0 440 Feet

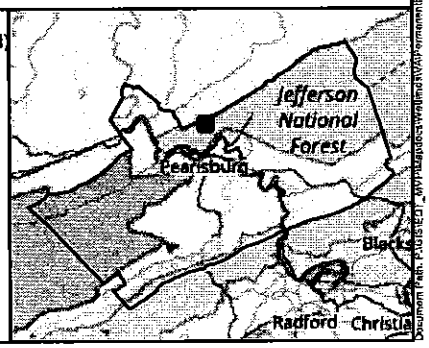
Mountain Valley PIPELINE

Figure 1:
Permanent Impacts for
Stream S-MN20
Giles County

SEPTEMBER, 2017

Data Sources: ESRI Streaming Data © 2014
Elevation data derived from LiDAR provided by EQT 2016
and from the West Virginia GIS Clearinghouse.

- Access Road Permanent LOD
- Limit of Disturbance
- Preliminary Jurisdictional Determination Boundary
- Unified Stream Method (USM) Survey Reach
- Stream Permanent Impact
- Intermittent Stream
- Drainage Area



Photograph Number: 1 **Feature Name:** S-MN20 **Flow Regime:** Intermittent

Direction: NE **Date:** 5/10/2017

STREAM ID S-MN20	**STREAM NAME** UNT to Clendennin Creek
CLIENT MVP	**PROJECT NAME** MVP
LAT 37.373901 **LONG** -80.731631	**DATE** 05/10/2017 **COUNTY** Giles
INVESTIGATORS S Ryan, K Pulver, H Phelan	
WATER TYPE TNW ☐ RPW ☑ NRPW ☐	**FLOW REGIME** Perennial ☐ Intermittent ☑ Ephemeral ☐

CHANNEL FEATURES

Estimate Measurements
Top of Bank Width: 4.0 ft
Top of Bank Height:
LB 1.0 ft RB 1.0 ft
Water Depth: 3.00 in
Water Width: 2.0 ft
Ordinary High Water Mark (Width): 2.0 ft
Ordinary High Water Mark (Height): 3.0 in
Flow Direction: South

Sinuosity __ Low __ Medium ✔ High

Gradient __ Flat (0.5/100 ft) ✔ Moderate (2 ft/100 ft) __ Severe (10 ft/100 ft)

Stream Erosion
✔ None __ Moderate __ Heavy

Artificial, Modified or Channelized
__ Yes ✔ No

Within Roadside Ditch
__ Yes ✔ No

Culvert Present ✔ Yes __ No
Culvert Material: Corrugated Metal
Culvert Size: 16 in

FLOW CHARACTERISTICS

Water Present
__ No water, stream bed dry
__ Stream bed moist
__ Standing water
✔ Flowing water

Velocity
✔ Fast __ Moderate
__ Slow

Proportion of Reach Represented by Stream Morphology Types (Only enter if water present)
Riffle 80 % Run %
Pool 20 %

Turbidity
✔ Clear __ Slightly turbid __ Turbid
__ Other_____

INORGANIC SUBSTRATE COMPONENTS (should add up to 100%) 100

Substrate Type	Diameter	% Composition in Sampling Reach
Bedrock		
Boulder	> 256 mm (10")	25
Cobble	64-256 mm (2.5"-10")	40
Gravel	2-64 mm (0.1"-2.5")	20
Sand	0.06-2mm (gritty)	10
Silt	0.004-0.06 mm	5
Clay	< 0.004 mm (slick)	

ORGANIC SUBSTRATE COMPONENTS (does not necessarily add up to 100%)

Substrate Type	Characteristic	% Composition in Sampling Area
Detritus	sticks, wood, coarse plant materials (CPOM)	15
Muck-Mud	black, very fine organic (FPOM)	0
Marl	grey, shell fragments	0

WATERSHED FEATURES

Predominant Surrounding Landuse
✔ Forest __ Commercial
__ Field/Pasture __ Industrial
__ Agricultural __ Residential
__ ROW __ Other:

Canopy Cover
__ Open __ Partly shaded
✔ Shaded

Floodplain Width
__ Wide > 30ft __ Moderate 15-30ft
✔ Narrow <15ft

MACROINVERTEBRATES/OTHER WILDLIFE OBSERVED OR OTHER NOTES AND OBSERVATIONS

Flows through culvert and joins S-MN17 outside of survey area. Heavy overnight rains.

Stream Assessment Form (Form 1)

Unified Stream Methodology for use in Virginia

For use in wadeable channels classified as intermittent or perennial

Project/Site	County	Stream Name	Date	Assessor(s)
Mountain Valley Pipeline	Giles	R4SB3	050500020602	5/10/17

Assessor Name/Initials	Stream Name and Identifier
S Ryan, K Pulver, H Phelan	S-MN20, Intermittent, MVP-GI-232

Conditional Category

	Optimal	Suboptimal	Marginal	Poor	Severe	
Channel Condition	Very little incision or active erosion; 80-100% stable banks. Vegetative surface protection or natural rock, prominent (80-100%). AND/OR Stable point bars/bankfull benches are present. Access to their original floodplain or fully developed wide bankfull benches. Mid-channel bars, and transverse bars few. Transient sediment deposition covers less than 10% of bottom.	Slightly incised, few areas of active erosion or unprotected banks. Majority of banks are stable (60-80%). Vegetative protection or natural rock prominent (60-80%) AND/OR Depositional features contribute to stability. The bankfull and low flow channels are well defined. Stream likely has access to bankfull benches, or newly developed floodplains along portions of the reach. Transient sediment covers 10-40% of the stream bottom.	Often incised, but less than Severe or Poor. Banks more stable than Severe or Poor due to lower bank slopes. Erosion may be present on 40-60% of both banks. Vegetative protection on 40-60% of banks. Streambanks may bevertical or undercut. AND/OR 40-60% of stream is covered by sediment. Sediment may be temporary/transient, contribute instability. Deposition that contribute to stability, may be forming/present. AND/OR V-shaped channels have vegetative protection on > 40% of the banks and depositional features which contribute to stability.	Overwidened/incised. Vertically/laterally unstable. Likely to widen further. Majority of both banks are near vertical. Erosion present on 60-80% of banks. Vegetative protection present on 20-40% of banks, and is insufficient to prevent erosion. AND/OR 60-80% of the stream is covered by sediment. Sediment is temporary/transient in nature, and contributing to instability. AND/OR V-shaped channels have vegetative protection is present on > 40% of the banks and stable sediment deposition is absent.	Deeply incised (or excavated), vertical/lateral instability. Severe incision, flow contained within the banks. Streambed below average rooting depth, majority of banks vertical/undercut. Vegetative protection present on less than 20% of banks, is not preventing erosion. Obvious bank sloughing present. Erosion/raw banks on 60-100%. AND/OR Aggrading channel. Greater than 80% of stream bed is covered by deposition, contributing to instability. Multiple thread channels and/or subterranean flow.	CI
Score	3	2.4	2	1.6	1	2.4

NOTES>> -Slightly incised, but stable, rocky substrate

Conditional Category

	Optimal	Suboptimal		Marginal		Poor		
Riparian Buffers	Tree stratum (dbh > 3 inches) present, with > 60% tree canopy cover and a non-maintained understory. Wetlands located within the riparian areas.	High Suboptimal: Riparian areas with tree stratum (dbh > 3 inches) present, with 30% to 60% tree canopy cover and containing both herbaceous and shrub layers or a non-maintained understory.	Low Suboptimal: Riparian areas with tree stratum (dbh > 3 inches) present, with > 30% tree canopy cover and a maintained understory. Recent cutover (dense vegetation).	High Marginal: Non-maintained, dense herbaceous vegetation with either a shrub layer or a tree layer (dbh > 3 inches) present, with <30% tree canopy cover.	Low Marginal: Non-maintained, dense herbaceous vegetation, riparian areas lacking shrub and tree stratum, hay production, ponds, open water. If present, tree stratum (dbh >3 inches) present, with <30% tree canopy cover with maintained understory.	High Poor: Lawns, mowed, and maintained areas, nurseries; no-till cropland; actively grazed pasture, sparsely vegetated non-maintained area, recently seeded and stabilized, or other comparable condition.	Low Poor: Impervious surfaces, mine spoil lands, denuded surfaces, row crops, active feed lots, trails, or other comparable conditions.	Hardwood forest bisected by gravel road with small maintained roadside. Canopy composition is L. tulipifera, and Q. montana with average DBH > 8". Understory is rhododendron and H. virginiana. Canopy closure near 100%, excluding road clearing. No wetlands in riparian
Condition Scores	1.5	1.2	1.1	0.85	0.75	0.6	0.5	

1. Delineate riparian areas along each stream bank into Condition Categories and Condition Scores using the descriptors.
2. Determine square footage for each by measuring or estimating length and width. Calculators are provided for you below.
3. Enter the % Riparian Area and Score for each riparian category in the blocks below.

Ensure the sums of % Riparian Blocks equal 100

Right Bank	% Riparian Area>							100%
	Score >							
Left Bank	% Riparian Area>							100%
	Score >							

CI= (Sum % RA * Scores*0.01)/2

Rt Bank CI >	1.04	CI
Lt Bank CI >	1.04	1.04

Conditional Category

	Optimal	Suboptimal	Marginal	Poor	
Instream Habitat/ Available Cover	Habitat elements are typically present in greater than 50% of the reach.	Stable habitat elements are typically present in 30-50% of the reach and are adequate for maintenance of populations.	Stable habitat elements are typically present in 10-30% of the reach and are adequate for maintenance of populations.	Habitat elements listed above are lacking or are unstable. Habitat elements are typically present in less than 10% of the reach.	NOTES>> Stable habitat elements present. High flow during survey as a result of recent rains masks riffle/pool composition.
Score	1.5	1.2	0.9	0.5	CI 1.20

Stream Impact Assessment Form Page 2

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	Mountain Valley Pipeline	Giles	-	050500020602	10/25/2016	S-HH16	500	1

[illegible]

NOTES>> Stream flows under road through culvert.

	Conditional Category						
	Negligible	Minor		Moderate		Severe	
Channel Alteration	Channelization, dredging, alteration, or hardening absent. Stream has an unaltered pattern or has naturalized.	Less than 20% of the stream reach is disrupted by any of the channel alterations listed in the parameter guidelines.	20-40% of the stream reach is disrupted by any of the channel alterations listed in the parameter guidelines.	40 - 60% of reach is disrupted by any of the channel alterations listed in the parameter guidelines. If stream has been channelized, normal stable stream meander pattern has not recovered.	60 - 80% of reach is disrupted by any of the channel alterations listed in the parameter guidelines. If stream has been channelized, normal stable stream meander pattern has not recovered.	Greater than 80% of reach is disrupted by any of the channel alterations listed in the parameter guidelines AND/OR 80% of banks shored with gabion, riprap, or cement.	
SCORE	1.5	1.3	1.1	0.9	0.7	0.5	1.10

[illegible]

NOTE: The CIs and RCI should be rounded to 2 decimal places. The CR should be rounded to a whole number.

THE REACH CONDITION INDEX (RCI) >>	1.15

RCI= (Sum of all CI's)/5

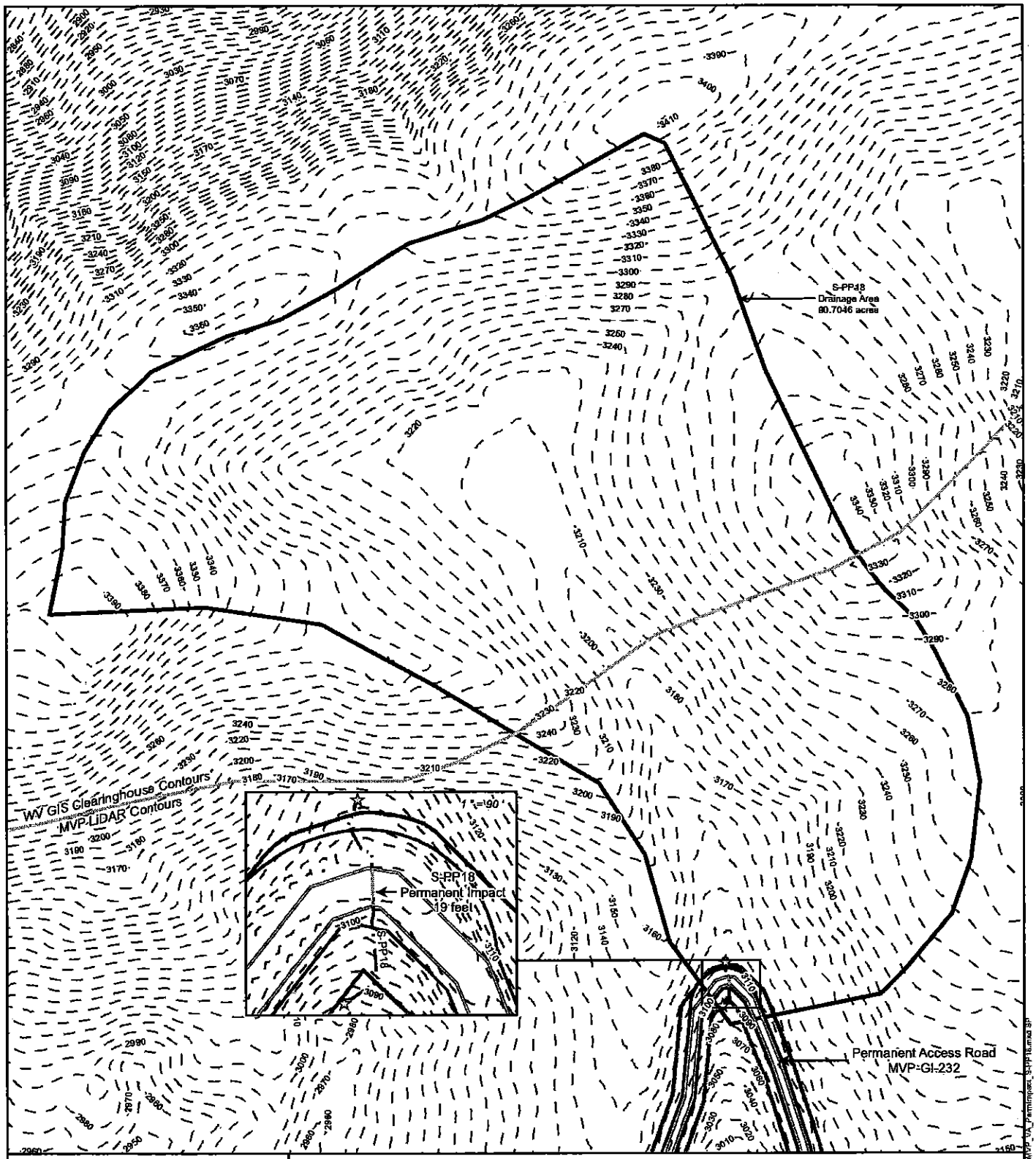
COMPENSATION REQUIREMENT (CR) >>	13

CR = RCI X LF X IF

INSERT PHOTOS:

DESCRIBE PROPOSED IMPACT:

S-PP18



Mountain Valley Pipeline Project

N

NAD 1983 UTM 17N

1 " = 420 '

420 210 0 420 Feet

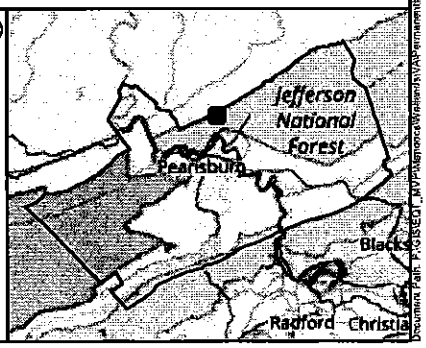
Mountain Valley PIPELINE

Figure 1:
Permanent Impacts for
Stream S-PP18
Giles County

SEPTEMBER, 2017

Data Sources: ESRI Streaming Data © 2014
Elevation data derived from LiDAR provided by EQT 2016 and from the West Virginia GIS Clearinghouse.

- Access Road Permanent LOD
- Limit of Disturbance
- Preliminary Jurisdictional Determination Boundary
- Unified Stream Method (USM) Survey Reach
- Stream Permanent Impact
- Perennial Stream
- Drainage Area



Photograph Number: 1 **Feature Name:** S-PP18 **Flow Regime:** Perennial

Direction: W **Date:** 10/16/2015

STREAM ID S-PP18	**STREAM NAME** Curve Branch
LAT 37.385499 **LONG** -80.708750	**DATE** 10/16/2015
CLIENT MVP	**PROJECT NAME** MVP
INVESTIGATORS D. Hadersbeck, T. Woods, D. McCollough	
FLOW REGIME Perennial ✓ Intermittent___ Ephemeral___	**WATER TYPE** TNW___ RPW ✓ NRPW___

CHANNEL FEATURES

Estimate Measurements
Top of Bank Width: 4 ft
Top of Bank Height:
LB 6.0 in RB 6.0 in
Water Depth: 3.00 in
Water Width: 1.0 ft
High Water Mark: 6.0 in
Flow Direction: Southwest

Stream Erosion
✓ None ___Moderate ___Heavy

Artificial, Modified or Channelized
✓ Yes ___No

Dam Present ___Yes ✓ No

Sinuosity ___ Low ✓ Medium ✓ High

Gradient
___Flat (0.5/100 ft) ✓ Moderate (2 ft/100 ft) ___Severe (10 ft/100 ft)

FLOW CHARACTERISTICS

Water Present
___No water, stream bed dry
___Stream bed moist
___Standing water
✓ Flowing water

Velocity
___Fast ___ Moderate
✓ Slow

Proportion of Reach Represented by Stream Morphology Types
Riffle 20 % Run 60 %
Pool 20 %

Turbidity
___ Clear ✓ Slightly turbid ___Turbid
___ Opaque ___Stained
___Other_____

INORGANIC SUBSTRATE COMPONENTS (should add up to 100%)			ORGANIC SUBSTRATE COMPONENTS (does not necessarily add up to 100%)		
Substrate Type	Diameter	% Composition in Sampling Reach	Substrate Type	Characteristic	% Composition in Sampling Area
Bedrock		20	Detritus	sticks, wood, coarse plant materials (CPOM)	80
Boulder	> 256 mm (10")	20			
Cobble	64-256 mm (2.5"-10")	30	Muck-Mud	black, very fine organic (FPOM)	
Gravel	2-64 mm (0.1"-2.5")	30			
Sand	0.06-2mm (gritty)		Marl	grey, shell fragments	
Silt	0.004-0.06 mm				
Clay	< 0.004 mm (slick)				

WATERSHED FEATURES

Predominant Surrounding Landuse
✓ Forest ___Commercial
___Field/Pasture ___Industrial
___Agricultural ___Residential
___Other:

Canopy Cover
✓ Partly open ___Partly shaded
___Shaded ___Open

Indicate the dominant type (Check one)
✓ Trees ___Shrubs
___Grasses ___Herbaceous

Floodplain Width
___Wide > 30ft ✓ Moderate 15-30ft
___Narrow <16ft

Wetland Present ___Yes ✓ No
Wetland ID

AQUATIC VEGETATION

Indicate the dominant type and record the dominant species present
___Rooted emergent ___Rooted submergent ___Rooted floating ___Free floating
___Floating algae ___Attached algae

MACROINVERTEBRATES OR OTHER WILDLIFE OBSERVED/OTHER OBSERVATIONS AND NOTES

Stream emerges from high side of road from black plastic tubing then traverses a culvert under the road.

Stream Assessment Form (Form 1)

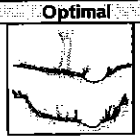
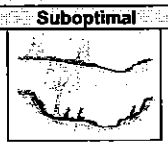
Unified Stream Methodology for use in Virginia

For use in wadeable channels classified as intermittent or perennial

Project/Site	County	City	Stream Name	Date	Form Completed by
Mountain Valley Pipeline	Giles	R4SB3	050500020602	10/25/2016	

Assessment Team	Stream Name and Location
J.Cook, E.Foster	S-PP18, Intermittent, MVP-GI-232

Conditional Category

	Optimal	Suboptimal	Marginal	Poor	Severe	
Channel Condition	 Very little incision or active erosion; 80-100% stable banks. Vegetative surface protection or natural rock, prominent (80-100%). AND/OR Stable point bars/bankfull benches are present. Access to their original floodplain or fully developed wide bankfull benches. Mid-channel bars, and transverse bars few. Transient sediment deposition covers less than 10% of bottom.	 Slightly incised, few areas of active erosion or unprotected banks. Majority of banks are stable (60-80%). Vegetative protection or natural rock prominent (60-80%) AND/OR Depositional features contribute to stability. The bankfull and low flow channels are well defined. Stream likely has access to bankfull benches, or newly developed floodplains along portions of the reach. Transient sediment covers 10-40% of the stream bottom.	Often incised, but less than Severe or Poor. Banks more stable than Severe or Poor due to lower bank slopes. Erosion may be present on 40-60% of both banks. Vegetative protection on 40-60% of banks. Streambanks may bevertical or undercut. AND/OR 40-60% of stream is covered by sediment. Sediment may be temporary/transient, contribute instability. Deposition that contribute to stability, may be forming/present. AND/OR V-shaped channels have vegetative protection on > 40% of the banks and depositional features which contribute to stability.	Overwidened/incised. Vertically/laterally unstable. Likely to widen further. Majority of both banks are near vertical. Erosion present on 60-80% of banks. Vegetative protection present on 20-40% of banks, and is insufficient to prevent erosion. AND/OR 60-80% of the stream is covered by sediment. Sediment is temporary/transient in nature, and contributing to instability. AND/OR V-shaped channels have vegetative protection is present on > 40% of the banks and stable sediment deposition is absent.	Deeply incised (or entrenched), vertical/lateral instability. Severe incision, flow contained within the banks. Streambed below average rooting depth, majority of banks vertical/undercut. Vegetative protection present on less than 20% of banks, is not preventing erosion. Obvious bank sloughing present. Erosion/raw banks on 80-100%. AND/OR Aggrading channel. Greater than 80% of stream bed is covered by deposition, contributing to instability. Multiple thread channels and/or subterranean flow.	CI
Score	3	2.4	2	1.6	1	2.4

NOTES>> Stable banks, boulders, dense shrubs adding stability

Conditional Category

	Optimal	Suboptimal		Marginal		Poor		
Riparian Buffers	Tree stratum (dbh > 3 inches) present, with > 60% tree canopy cover and a non-maintained understory. Wetlands located within the riparian areas.	**High Suboptimal:** Riparian areas with tree stratum (dbh > 3 inches) present, with 30% to 60% tree canopy cover and containing both herbaceous and shrub layers or a non-maintained understory.	**Low Suboptimal:** Riparian areas with tree stratum (dbh > 3 inches) present, with > 30% tree canopy cover and a maintained understory. Recent cutover (dense vegetation).	**High Marginal:** Non-maintained, dense herbaceous vegetation with either a shrub layer or a tree layer (dbh > 3 inches) present, with <30% tree canopy cover.	**Low Marginal:** Non-maintained, dense herbaceous vegetation, riparian areas lacking shrub and tree stratum, hay production, ponds, open water. If present, tree stratum (dbh >3 inches) present, with <30% tree canopy cover with maintained understory.	**High Poor:** Lawns, mowed, and maintained areas, nurseries; no-till cropland; actively grazed pasture, sparsely vegetated non-maintained area, recently seeded and stabilized, or other comparable condition.	**Low Poor:** Impervious surfaces, mine spoil lands, denuded surfaces, row crops, active feed lots, trails, or other comparable conditions.	
		High	Low	High	Low	High	Low	
Condition Scores	1.5	1.2	1.1	0.85	0.75	0.6	0.5	

NOTES>> Predominately hardwood forests and mowed roadside

1. Delineate riparian areas along each stream bank into Condition Categories and Condition Scores using the descriptors.
2. Determine square footage for each by measuring or estimating length and width. Calculators are provided for you below.
3. Enter the % Riparian Area and Score for each riparian category in the blocks below.

Ensure the sums of % Riparian Blocks equal 100

Right Bank	% Riparian Area>							100%	
	Score >								
									CI= (Sum % RA * Scores*0.01)/2
Left Bank	% Riparian Area>							100%	Rt Bank CI > 1.15
	Score >								Lt Bank CI > 1.35

	CI
Rt Bank CI > 1.15	CI
Lt Bank CI > 1.35	1.25

Conditional Category

	Optimal	Suboptimal	Marginal	Poor	
Instream Habitat/ Available Cover	Habitat elements are typically present in greater than 50% of the reach.	Stable habitat elements are typically present in 30-50% of the reach and are adequate for maintenance of populations.	Stable habitat elements are typically present in 10-30% of the reach and are adequate for maintenance of populations.	Habitat elements listed above are lacking or are unstable. Habitat elements are typically present in less than 10% of the reach.	
Score	1.5	1.2	0.9	0.5	CI 1.20

NOTES>> Variable substrate. No flow downstream of culvert as of 10/25/2016. Flow emerges from seep upstream, then becomes subterranean.

Stream Impact Assessment Form Page 2

	Mountain Valley Pipeline	Giles	R4SB3	050500020602	10/25/2016	S-PP18	500	1

NOTES>> Culvert

	Conditional Category						
	Negligible	Minor		Moderate		Severe	
Channel Alteration	Channelization, dredging, alteration, or hardening absent. Stream has an unaltered pattern or has naturalized.	Less than 20% of the stream reach is disrupted by any of the channel alterations listed in the parameter guidelines.	20-40% of the stream reach is disrupted by any of the channel alterations listed in the parameter guidelines.	40 - 60% of reach is disrupted by any of the channel alterations listed in the parameter guidelines. If stream has been channelized, normal stable stream meander pattern has not recovered.	60 - 80% of reach is disrupted by any of the channel alterations listed in the parameter guidelines. If stream has been channelized, normal stable stream meander pattern has not recovered.	Greater than 80% of reach is disrupted by any of the channel alterations listed in the parameter guidelines AND/OR 80% of banks shored with gabion, riprap, or cement.	
SCORE	1.5	1.3	1.1	0.9	0.7	0.5	1.30

NOTE: The CIs and RCI should be rounded to 2 decimal places. The CR should be rounded to a whole number.

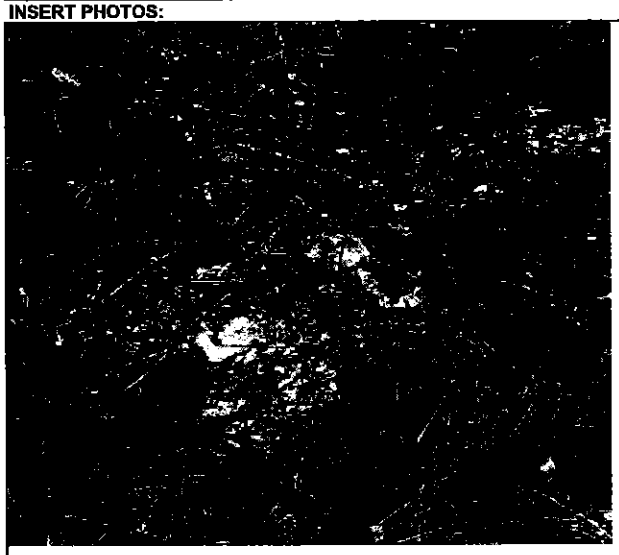
THE REACH CONDITION INDEX (RCI) >>	1.23

RCI= (Sum of all CI's)/5

COMPENSATION REQUIREMENT (CR) >>	23

CR = RCI X LF X IF

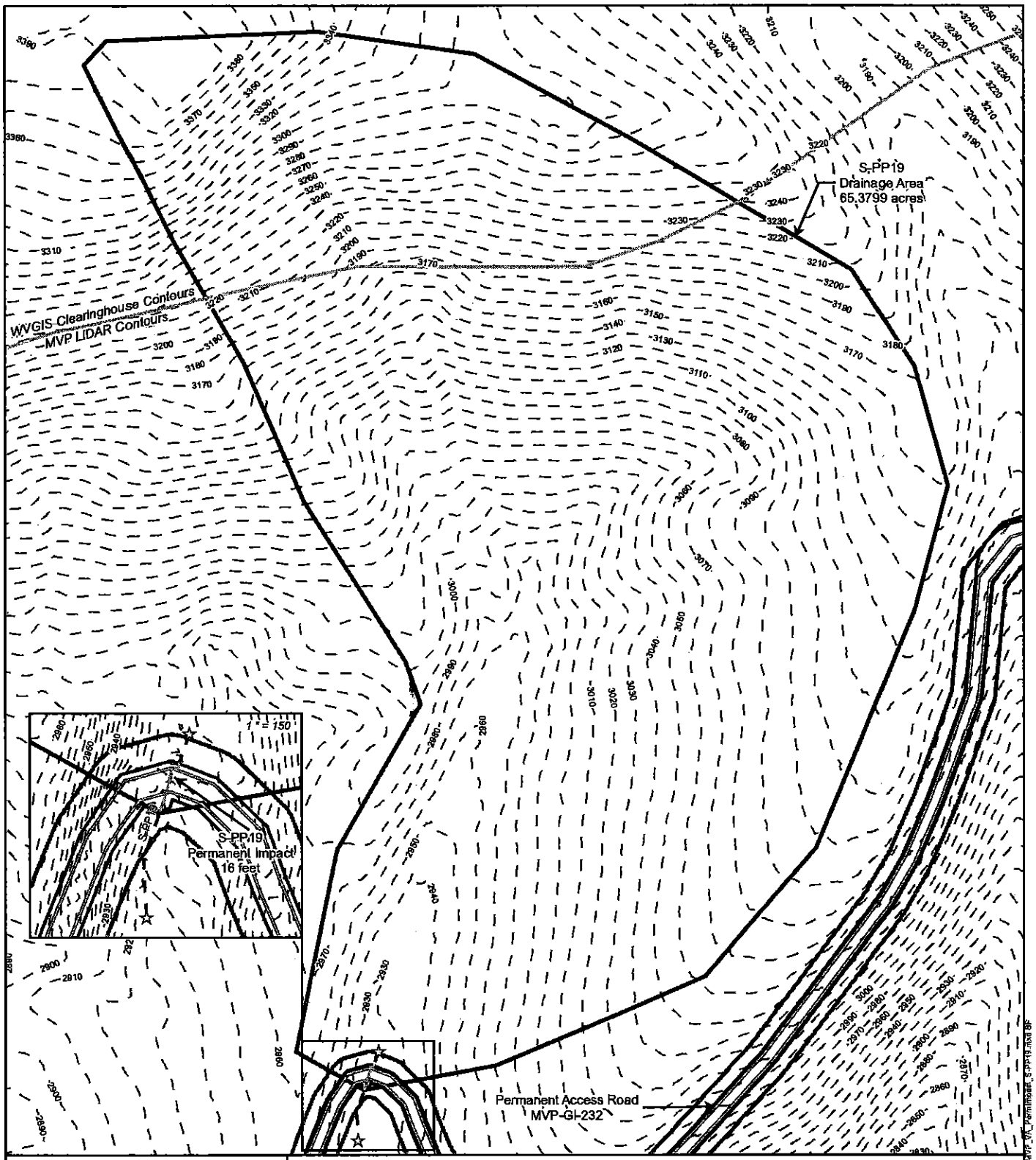
INSERT PHOTOS:



DESCRIBE PROPOSED IMPACT:

Culvert replacement. See attached figure.

S-PP19



Mountain Valley Pipeline Project

N

NAD 1983 UTM 17N

1" = 310'

310 155 0 310 Feet

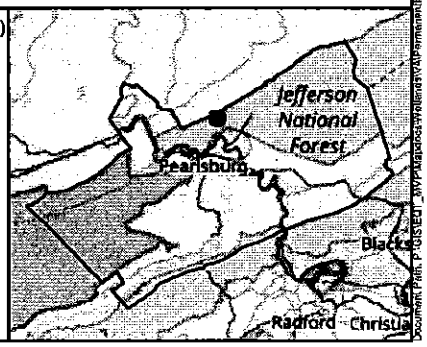
Mountain Valley PIPELINE

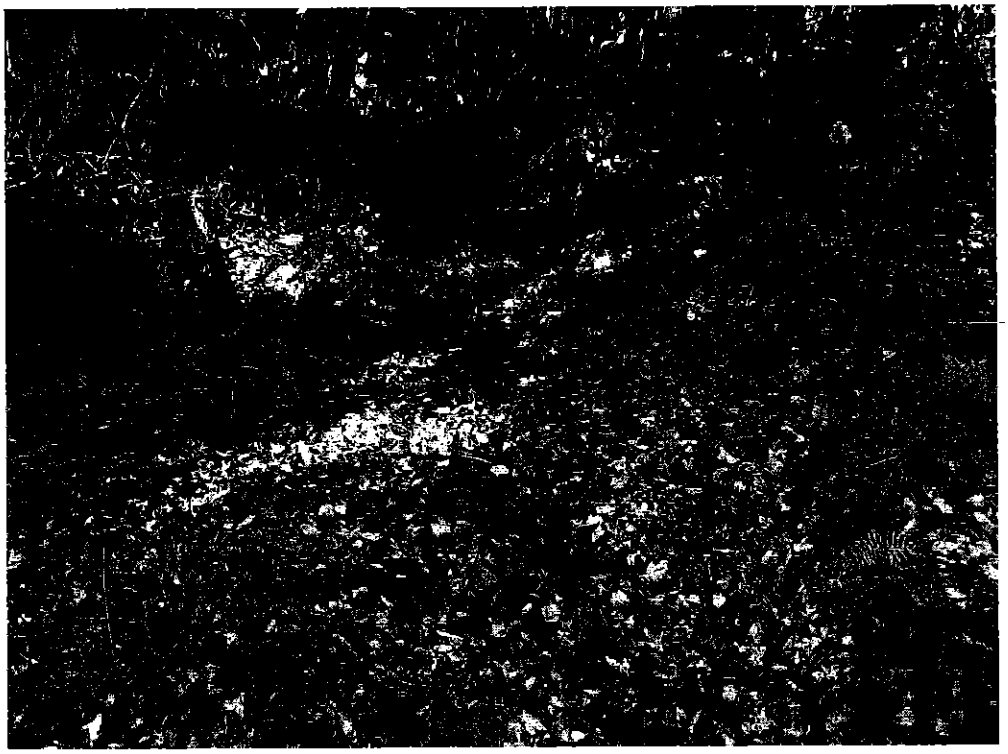
Figure 1:
Permanent Impacts for
Stream S-PP19
Giles County

SEPTEMBER, 2017

Data Sources: ESRI Streaming Data © 2014
Elevation data derived from LIDAR provided by EQT 2016 and from the West Virginia GIS Clearinghouse.

- Access Road Permanent LOD
- Limit of Disturbance
- Preliminary Jurisdictional Determination Boundary
- Unified Stream Method (USM) Survey Reach
- Stream Permanent Impact
- Intermittent Stream
- Drainage Area





Photograph Number: 1 **Feature Name:** S-PP19 **Flow Regime:** Intermittent

Direction: S **Date:** 10/16/2015

STREAM ID S-PP19	**STREAM NAME** UNT to Curve Branch
LAT 37.382048 **LONG** -80.714071	**DATE** 10/16/2015
CLIENT MVP	**PROJECT NAME** MVP
INVESTIGATORS D. Hadersbeck, T. Woods, D. McCollough	
FLOW REGIME Perennial ___ Intermittent ✓ Ephemeral ___	**WATER TYPE** TNW ___ RPW ✓ NRPW ___

CHANNEL FEATURES

Estimate Measurements
Top of Bank Width: 3 ft
Top of Bank Height:
LB 1.0 ft RB 1.0 ft
Water Depth: 3.00 in
Water Width: 2.5 ft
High Water Mark: 1.0 ft
Flow Direction: South

Stream Erosion
✓ None ___ Moderate ___ Heavy

Artificial, Modified or Channelized
✓ Yes ___ No

Dam Present ___ Yes ✓ No

Sinuosity ___ Low ✓ Medium ✓ High

Gradient
___ Flat (0.5/100 ft) ✓ Moderate (2 ft/100 ft) ___ Severe (10 ft/100 ft)

FLOW CHARACTERISTICS

Water Present
___ No water, stream bed dry
___ Stream bed moist
___ Standing water
✓ Flowing water

Velocity
___ Fast ___ Moderate
✓ Slow

Proportion of Reach Represented by Stream Morphology Types
Riffle % Run 80 %
Pool 20 %

Turbidity
✓ Clear ___ Slightly turbid ___ Turbid
___ Opaque ___ Stained
___ Other_____

INORGANIC SUBSTRATE COMPONENTS (should add up to 100%)

Substrate Type	Diameter	% Composition in Sampling Reach
Bedrock		
Boulder	> 256 mm (10")	10
Cobble	64-256 mm (2.5"-10")	20
Gravel	2-64 mm (0.1"-2.5")	20
Sand	0.06-2mm (gritty)	10
Silt	0.004-0.06 mm	40
Clay	< 0.004 mm (slick)	

ORGANIC SUBSTRATE COMPONENTS (does not necessarily add up to 100%)

Substrate Type	Characteristic	% Composition in Sampling Area
Detritus	sticks, wood, coarse plant materials (CPOM)	70
Muck-Mud	black, very fine organic (FPOM)	
Marl	grey, shell fragments	

WATERSHED FEATURES

Predominant Surrounding Landuse
✓ Forest ___ Commercial
___ Field/Pasture ___ Industrial
___ Agricultural ___ Residential
___ Other:

Canopy Cover
✓ Partly open ___ Partly shaded
___ Shaded ___ Open

Indicate the dominant type (Check one)
✓ Trees ___ Shrubs
___ Grasses ___ Herbaceous

Floodplain Width
___ Wide > 30ft ✓ Moderate 15-30ft
___ Narrow <16ft

Wetland Present ___ Yes ✓ No
Wetland ID

AQUATIC VEGETATION

Indicate the dominant type and record the dominant species present
___ Rooted emergent ___ Rooted submergent ___ Rooted floating ___ Free floating
___ Floating algae ___ Attached algae

MACROINVERTEBRATES OR OTHER WILDLIFE OBSERVED/OTHER OBSERVATIONS AND NOTES

Stream traverses a culvert under the road.

Stream Assessment Form (Form 1)

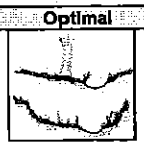
Unified Stream Methodology for use in Virginia

For use in wadeable channels classified as Intermittent or perennial

Project	Stream Name	Location	Stream ID	Date	Time	Impact/Mitigation	Impact Factor
	Mountain Valley Pipeline	Giles	R4SB5	050500020602	10/25/2016		

Evaluator(s)	Stream Identification
J.Cook, E.Foster	S-PP19, Intermittent, MVP-GI-232

Conditional Category

	Optimal	Suboptimal	Marginal	Poor	Severe	
Channel Condition	 Very little incision or active erosion; 80-100% stable banks. Vegetative surface protection or natural rock, prominent (80-100%). AND/OR Stable point bars/bankfull benches are present. Access to their original floodplain or fully developed wide bankfull benches. Mid-channel bars, and transverse bars few. Transient sediment deposition covers less than 10% of bottom.	Slightly incised, few areas of active erosion or unprotected banks. Majority of banks are stable (60-80%). Vegetative protection or natural rock prominent (60-80%) AND/OR Depositional features contribute to stability. The bankfull and low flow channels are well defined. Stream likely has access to bankfull benches, or newly developed floodplains along portions of the reach. Transient sediment covers 10-40% of the stream bottom.	Often incised, but less than Severe or Poor. Banks more stable than Severe or Poor due to lower bank slopes. Erosion may be present on 40-60% of both banks. Vegetative protection on 40-60% of banks. Streambanks may bevertical or undercut. AND/OR 40-60% of stream is covered by sediment. Sediment may be temporary/transient, contribute instability. Deposition that contribute to stability, may be forming/present. AND/OR V-shaped channels have vegetative protection on > 40% of the banks and depositional features which contribute to stability.	Overwidened/incised. Vertically/laterally unstable. Likely to widen further. Majority of both banks are near vertical. Erosion present on 60-80% of banks. Vegetative protection present on 20-40% of banks, and is insufficient to prevent erosion. AND/OR 60-80% of the stream is covered by sediment. Sediment is temporary/transient in nature, and contributing to instability. AND/OR V-shaped channels have vegetative protection is present on > 40% of the banks and stable sediment deposition is absent.	Deeply incised (or overwidened), vertical/lateral instability. Severe incision, flow contained within the banks. Streambed below average rooting depth, majority of banks vertical/undercut. Vegetative protection present on less than 20% of banks, is not preventing erosion. Obvious bank sloughing present. Erosion/raw banks on 80-100%. AND/OR Aggrading channel. Greater than 80% of stream bed is covered by deposition, contributing to instability. Multiple thread channels and/or subterranean flow.	CI
Score	3	2.4	2	1.6	1	3.0
NOTES>>	Stable channel and banks					

2. RIPARIAN BUFFERS

Conditional Category

	Optimal	Suboptimal		Marginal		Poor		NOTES>>
Riparian Buffers	Tree stratum (dbh > 3 inches) present, with > 60% tree canopy cover and a non-maintained understory. Wetlands located within the riparian areas.	**High Suboptimal:** Riparian areas with tree stratum (dbh > 3 inches) present, with 30% to 60% tree canopy cover and containing both herbaceous and shrub layers or a non-maintained understory.	**Low Suboptimal:** Riparian areas with tree stratum (dbh > 3 inches) present, with > 30% tree canopy cover and a maintained understory. Recent cutover (dense vegetation).	**High Marginal:** Non-maintained, dense herbaceous vegetation with either a shrub layer or a tree layer (dbh > 3 inches) present, with <30% tree canopy cover.	**Low Marginal:** Non-maintained, dense herbaceous vegetation, riparian areas lacking shrub and tree stratum, hay production, ponds, open water. If present, tree stratum (dbh >3 inches) present, with <30% tree canopy cover with maintained understory.	**High Poor:** Lawns, mowed, and maintained areas, nurseries; no-till cropland; actively grazed pasture, sparsely vegetated non-maintained area, recently seeded and stabilized, or other comparable condition.	**Low Poor:** Impervious surfaces, mine spoil lands, denuded surfaces, row crops, active feed lots, trails, or other comparable conditions.	
		High	Low	High	Low	High	Low	
Condition Scores	1.5	1.2	1.1	0.85	0.75	0.6	0.5	

1. Delineate riparian areas along each stream bank into Condition Categories and Condition Scores using the descriptors.
2. Determine square footage for each by measuring or estimating length and width. Calculators are provided for you below.
3. Enter the % Riparian Area and Score for each riparian category in the blocks below.

Ensure the sums of % Riparian Blocks equal 100

Right Bank	% Riparian Area>	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	100%	
	Score >	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		
Left Bank	% Riparian Area>	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	100%	
	Score >	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		

CI= (Sum % RA * Scores*0.01)/2

Rt Bank CI >	1.41	CI
Lt Bank CI >	1.41	1.41

3. INSTREAM HABITAT/AVAILABLE COVER

Conditional Category

	Optimal	Suboptimal	Marginal	Poor	NOTES>> No flowing water as of 10/25/2016	
Instream Habitat/ Available Cover	Habitat elements are typically present in greater than 50% of the reach.	Stable habitat elements are typically present in 30-50% of the reach and are adequate for maintenance of populations.	Stable habitat elements are typically present in 10-30% of the reach and are adequate for maintenance of populations.	Habitat elements listed above are lacking or are unstable. Habitat elements are typically present in less than 10% of the reach.		CI
Score	1.5	1.2	0.9	0.5		1.20

Stream Impact Assessment Form Page 2

	Mountain Valley Pipeline	Giles		050500020602	10/25/2016	S-PP19	500	1

NOTES>>

	Conditional Category						
	Negligible	Minor		Moderate		Severe	
Channel Alteration	Channelization, dredging, alteration, or hardening absent. Stream has an unaltered pattern or has naturalized.	Less than 20% of the stream reach is disrupted by any of the channel alterations listed in the parameter guidelines.	20-40% of the stream reach is disrupted by any of the channel alterations listed in the parameter guidelines.	40 - 60% of reach is disrupted by any of the channel alterations listed in the parameter guidelines. If stream has been channelized, normal stable stream meander pattern has not recovered.	60 - 80% of reach is disrupted by any of the channel alterations listed in the parameter guidelines. If stream has been channelized, normal stable stream meander pattern has not recovered.	Greater than 80% of reach is disrupted by any of the channel alterations listed in the parameter guidelines AND/OR 80% of banks shored with gabion, riprap, or cement.	
SCORE	1.5	1.3	1.1	0.9	0.7	0.5	1.10

NOTE: The CIs and RCI should be rounded to 2 decimal places. The CR should be rounded to a whole number.

THE REACH CONDITION INDEX (RCI) >> 1.34

RCI= (Sum of all CI's)/5

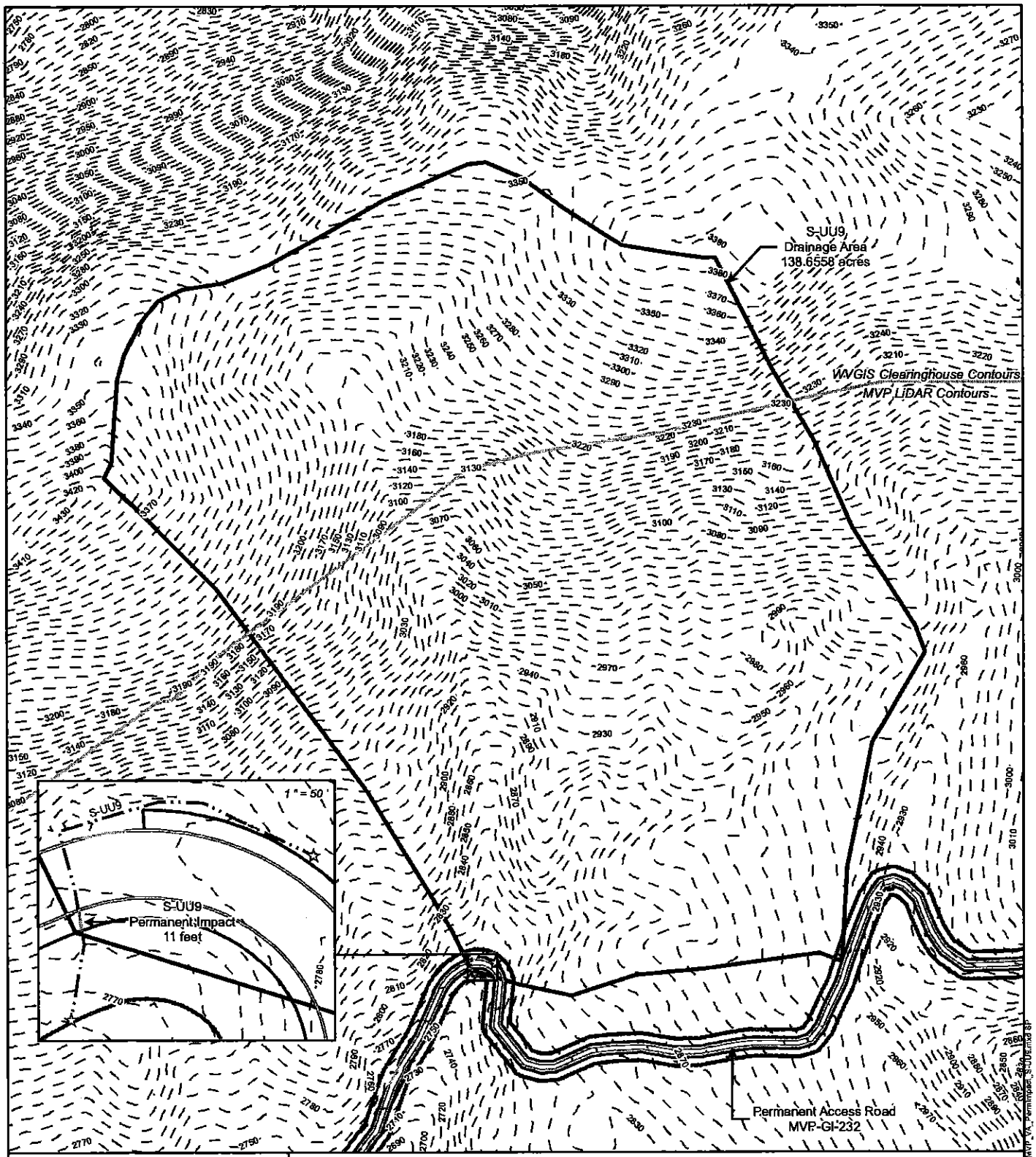
COMPENSATION REQUIREMENT (CR) >> 21

CR = RCI X LF X IF

INSERT PHOTOS:

DESCRIBE PROPOSED IMPACT:

S-UU9



Mountain Valley Pipeline Project

N

NAD 1983 UTM 17N

1" = 500'

500 250 0 500 Feet

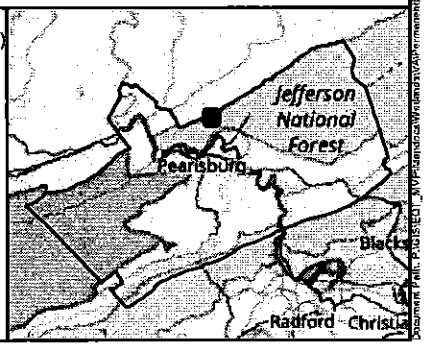
Mountain Valley PIPELINE

Figure 1:
Permanent Impacts for
Stream S-UU9
Giles County

SEPTEMBER, 2017

Data Sources: ESRI Streaming Data © 2014
Elevation data derived from LiDAR provided by EQT 2016 and from the West Virginia GIS Clearinghouse.

- Access Road Permanent LOD
- Limit of Disturbance
- Preliminary Jurisdictional Determination Boundary
- Unified Stream Method (USM) Survey Reach
- Stream Permanent Impact
- Perennial Stream
- Drainage Area



Photograph Number: 1 **Feature Name:** S-UU9 **Flow Regime:** Perennial

Direction: SSW **Date:** 10/16/2015

STREAM ID S-UU9	**STREAM NAME** Clendennin Creek
LAT 37.381405 **LONG** -80.719414	**DATE** 10/16/2015
CLIENT MVP	**PROJECT NAME** MVP
INVESTIGATORS S. Townsend, A. Hatfield	
FLOW REGIME Perennial ✓ Intermittent ___ Ephemeral ___	**WATER TYPE** TNW ___ RPW ✓ NRPW ___

CHANNEL FEATURES	**Estimate Measurements** Top of Bank Width: 5 ft Top of Bank Height: LB 1.5 ft RB 3.0 ft Water Depth: 2.00 in Water Width: 3.5 ft High Water Mark: 1.5 ft Flow Direction: West	**Stream Erosion** ✓ None ___ Moderate ___ Heavy **Artificial, Modified or Channelized** ✓ Yes ___ No **Dam Present** ___ Yes ✓ No **Sinuosity** ___ Low ✓ Medium ✓ High **Gradient** ✓ Flat (0.5/100 ft) ✓ Moderate (2 ft/100 ft) ___ Severe (10 ft/100 ft)
FLOW CHARACTERISTICS	**Water Present** ___ No water, stream bed dry ___ Stream bed moist ___ Standing water ✓ Flowing water **Velocity** ___ Fast ___ Moderate ✓ Slow	**Proportion of Reach Represented by Stream Morphology Types** Riffle 100 % Run % Pool % **Turbidity** ✓ Clear ___ Slightly turbid ___ Turbid ___ Opaque ___ Stained ___ Other_____

INORGANIC SUBSTRATE COMPONENTS (should add up to 100%)			**ORGANIC SUBSTRATE COMPONENTS (does not necessarily add up to 100%)**		
Substrate Type	Diameter	% Composition in Sampling Reach	Substrate Type	Characteristic	% Composition in Sampling Area
Bedrock		15	Detritus	sticks, wood, coarse plant materials (CPOM)	5
Boulder	> 256 mm (10")	5			
Cobble	64-256 mm (2.5"-10")	45	Muck-Mud	black, very fine organic (FPOM)	
Gravel	2-64 mm (0.1"-2.5")	15			
Sand	0.06-2mm (gritty)	15	Marl	grey, shell fragments	
Silt	0.004-0.06 mm	5			
Clay	< 0.004 mm (slick)				

WATERSHED FEATURES	**Predominant Surrounding Landuse** ✓ Forest ___ Commercial ___ Field/Pasture ___ Industrial ___ Agricultural ___ Residential ___ Other: **Canopy Cover** ___ Partly open ✓ Partly shaded ___ Shaded ___ Open	**Indicate the dominant type (Check one)** ✓ Trees ___ Shrubs ___ Grasses ___ Herbaceous **Floodplain Width** ___ Wide > 30ft ___ Moderate 15-30ft ✓ Narrow <16ft **Wetland Present** ___ Yes ✓ No **Wetland ID**
AQUATIC VEGETATION	**Indicate the dominant type and record the dominant species present** ___ Rooted emergent ___ Rooted submergent ___ Rooted floating ___ Free floating ___ Floating algae ___ Attached algae	

MACROINVERTEBRATES OR OTHER WILDLIFE OBSERVED/OTHER OBSERVATIONS AND NOTES	

Stream Assessment Form (Form 1)

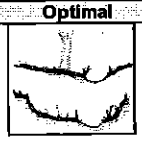
Unified Stream Methodology for use in Virginia

For use in wadeable channels classified as intermittent or perennial

Project/Site	County	Stream Name	Cowardin Class	Date		HUC12	Stream Factor
Mountain Valley Pipeline	Giles	R2UB1	050500020602	10/25/2016			

Evaluators Name(s)	Site Identification/Description
J.Cook, E.Foster	S-UU9, Perennial, MVP-GI-232

1. Channel Condition — Conditional Category

	Optimal	Suboptimal	Marginal	Poor	Severe	
Channel Condition	 Very little incision or active erosion; 80-100% stable banks. Vegetative surface protection or natural rock, prominent (80-100%). AND/OR Stable point bars/bankfull benches are present. Access to their original floodplain or fully developed wide bankfull benches. Mid-channel bars, and transverse bars few. Transient sediment deposition covers less than 10% of bottom.	Slightly incised, few areas of active erosion or unprotected banks. Majority of banks are stable (60-80%). Vegetative protection or natural rock prominent (60-80%) AND/OR Depositional features contribute to stability. The bankfull and low flow channels are well defined. Stream likely has access to bankfull benches, or newly developed floodplains along portions of the reach. Transient sediment covers 10-40% of the stream bottom.	Often incised, but less than Severe or Poor. Banks more stable than Severe or Poor due to lower bank slopes. Erosion may be present on 40-60% of both banks. Vegetative protection on 40-60% of banks. Streambanks may bevertical or undercut. AND/OR 40-60% of stream is covered by sediment. Sediment may be temporary/transient, contribute instability. Deposition that contribute to stability, may be forming/present. AND/OR V-shaped channels have vegetative protection on > 40% of the banks and depositional features which contribute to stability.	Overwidened/incised. Vertically/laterally unstable. Likely to widen further. Majority of both banks are near vertical. Erosion present on 60-80% of banks. Vegetative protection present on 20-40% of banks, and is insufficient to prevent erosion. AND/OR 60-80% of the stream is covered by sediment. Sediment is temporary/transient in nature, and contributing to instability. AND/OR V-shaped channels have vegetative protection is present on > 40% of the banks and stable sediment deposition is absent.	Deeply incised (or entrenched), vertical/lateral instability. Severe incision, flow contained within the banks. Streambed below average rooting depth, majority of banks vertical/undercut. Vegetative protection present on less than 20% of banks, is not preventing erosion. Obvious bank sloughing present. Erosion/raw banks on 80-100%. AND/OR Aggrading channel. Greater than 80% of stream bed is covered by deposition, contributing to instability. Multiple thread channels and/or subterranean flow.	CI
Score	3	2.4	2	1.6	1	3.0

NOTES>> -Stable channel condition

2. RIPARIAN BUFFERS — Conditional Category

	Optimal	Suboptimal		Marginal		Poor	
Riparian Buffers	Tree stratum (dbh > 3 inches) present, with > 60% tree canopy cover and a non-maintained understory. Wetlands located within the riparian areas.	High Suboptimal: Riparian areas with tree stratum (dbh > 3 inches) present, with 30% to 60% tree canopy cover and containing both herbaceous and shrub layers or a non-maintained understory.	Low Suboptimal: Riparian areas with tree stratum (dbh > 3 inches) present, with > 30% tree canopy cover and a maintained understory. Recent cutover (dense vegetation).	High Marginal: Non-maintained, dense herbaceous vegetation with either a shrub layer or a tree layer (dbh > 3 inches) present, with <30% tree canopy cover.	Low Marginal: Non-maintained, dense herbaceous vegetation, riparian areas lacking shrub and tree stratum, hay production, ponds, open water. If present, tree stratum (dbh >3 inches) present, with <30% tree canopy cover with maintained understory.	High Poor: Lawns, mowed, and maintained areas, nurseries; no-till cropland; actively grazed pasture, sparsely vegetated non-maintained area, recently seeded and stabilized, or other comparable condition.	Low Poor: Impervious surfaces, mine spoil lands, denuded surfaces, row crops, active feed lots, trails, or other comparable conditions.
		High	Low	High	Low	High	Low
Condition Scores	1.5	1.2	1.1	0.85	0.75	0.6	0.5

NOTES>> Mostly woods with mowed area and road mixed in

1. Delineate riparian areas along each stream bank into Condition Categories and Condition Scores using the descriptors.
2. Determine square footage for each by measuring or estimating length and width. Calculators are provided for you below.
3. Enter the % Riparian Area and Score for each riparian category in the blocks below.

Ensure the sums of % Riparian Blocks equal 100

Right Bank	% Riparian Area>							100%
	Score >							
Left Bank	% Riparian Area>							100%
	Score >							

CI= (Sum % RA * Scores*0.01)/2

Rt Bank CI >	1.40	CI
Lt Bank CI >	1.31	1.36

3. INSTREAM HABITAT/AVAILABLE COVER — Conditional Category

	Optimal	Suboptimal	Marginal	Poor
Instream Habitat/ Available Cover	Habitat elements are typically present in greater than 50% of the reach.	Stable habitat elements are typically present in 30-50% of the reach and are adequate for maintenance of populations.	Stable habitat elements are typically present in 10-30% of the reach and are adequate for maintenance of populations.	Habitat elements listed above are lacking or are unstable. Habitat elements are typically present in less than 10% of the reach.
Score	1.5	1.2	0.9	0.5

NOTES>> Plenty of stream variability

CI
1.20

Stream Impact Assessment Form Page 2

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	Mountain Valley Pipeline	Giles		050500020602	10/25/2016	S-JU9	500	1

[illegible]

NOTES>> Culvert, Impacted road

	Conditional Category						
	Negligible	Minor		Moderate		Severe	
Channel Alteration	Channelization, dredging, alteration, or hardening absent. Stream has an unaltered pattern or has naturalized.	Less than 20% of the stream reach is disrupted by any of the channel alterations listed in the parameter guidelines.	20-40% of the stream reach is disrupted by any of the channel alterations listed in the parameter guidelines.	40 - 60% of reach is disrupted by any of the channel alterations listed in the parameter guidelines. If stream has been channelized, normal stable stream meander pattern has not recovered.	60 - 80% of reach is disrupted by any of the channel alterations listed in the parameter guidelines. If stream has been channelized, normal stable stream meander pattern has not recovered.	Greater than 80% of reach is disrupted by any of the channel alterations listed in the parameter guidelines AND/OR 80% of banks shored with gabion, riprap, or cement.	
SCORE	1.5	1.3	1.1	0.9	0.7	0.5	1.10

[illegible]

NOTE: The CIs and RCI should be rounded to 2 decimal places. The CR should be rounded to a whole number.

THE REACH CONDITION INDEX (RCI) >>	1.33

RCI= (Sum of all CI's)/5

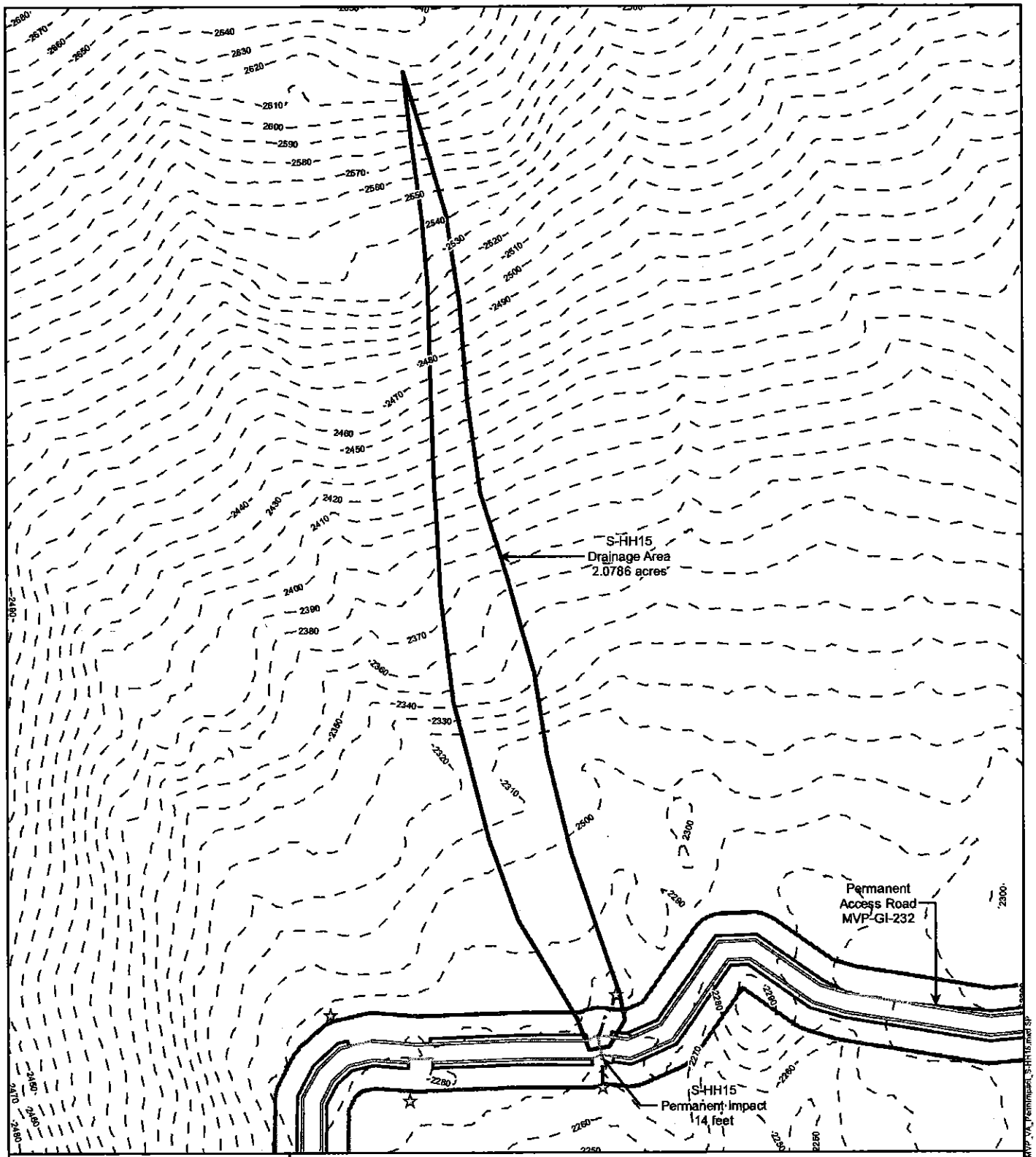
COMPENSATION REQUIREMENT (CR) >>	15

CR = RCI X LF X IF

INSERT PHOTOS:

DESCRIBE PROPOSED IMPACT:

S-HH15



Mountain Valley Pipeline Project

N

NAD 1983 UTM 17N

1 " = 180 '

180 90 0 180 Feet

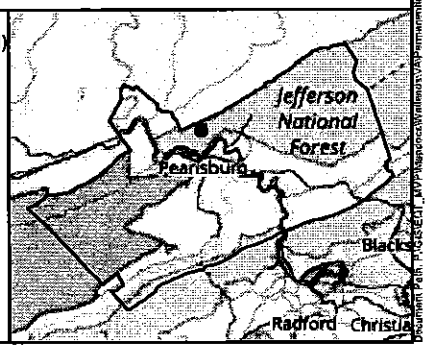
Mountain Valley PIPELINE

Figure 1:
Permanent Impacts for
Stream S-HH15
Giles County

SEPTEMBER, 2017

Data Sources: ESRI Streaming Data © 2014
Elevation data derived from LiDAR provided by EQT 2016
and from the West Virginia GIS Clearinghouse.

Access Road Permanent LOD
Limit of Disturbance
Preliminary Jurisdictional Determination Boundary
Unified Stream Method (USM) Survey Reach
Stream Permanent Impact
Perennial Stream
Drainage Area



Photograph Number: 1 **Feature Name:** S-HH15 **Flow Regime:** Perennial

Direction: S **Date:** 10/16/2015

STREAM ID S-HH15	**STREAM NAME** UNT to Clendennin Creek
LAT 37.370798 **LONG** -80.737186	**DATE** 10/16/2015
CLIENT MVP	**PROJECT NAME** MVP
INVESTIGATORS S Ryan, A Larson, M Whitten	
FLOW REGIME Perennial ✔ Intermittent___ Ephemeral___	**WATER TYPE** TNW ___ RPW ✔ NRPW___

CHANNEL FEATURES

Estimate Measurements
Top of Bank Width: 5 ft
Top of Bank Height:
LB 1.5 ft RB 1.5 ft
Water Depth: 1.00 in
Water Width: 2.0 ft
High Water Mark: 4.0 in
Flow Direction: South

Stream Erosion
✔ None ___Moderate ___Heavy

Artificial, Modified or Channelized
___ Yes ✔ No

Dam Present ___Yes ✔ No

Sinuosity ___ Low ✔ Medium ✔ High

Gradient
___ Flat (0.5/100 ft) ✔ Moderate (2 ft/100 ft) ___Severe (10 ft/100 ft)

FLOW CHARACTERISTICS

Water Present
___ No water, stream bed dry
___ Stream bed moist
___ Standing water
✔ Flowing water

Velocity
___ Fast ✔ Moderate
___ Slow

Proportion of Reach Represented by Stream Morphology Types
Riffle 70 % Run %
Pool 30 %

Turbidity
✔ Clear ___Slightly turbid ___Turbid
___ Opaque ___Stained
___Other_____

INORGANIC SUBSTRATE COMPONENTS (should add up to 100%)

Substrate Type	Diameter	% Composition in Sampling Reach
Bedrock		
Boulder	> 256 mm (10")	
Cobble	64-256 mm (2.5"-10")	30
Gravel	2-64 mm (0.1"-2.5")	10
Sand	0.06-2mm (gritty)	40
Silt	0.004-0.06 mm	20
Clay	< 0.004 mm (slick)	

ORGANIC SUBSTRATE COMPONENTS (does not necessarily add up to 100%)

Substrate Type	Characteristic	% Composition in Sampling Area
Detritus	sticks, wood, coarse plant materials (CPOM)	75
Muck-Mud	black, very fine organic (FPOM)	
Marl	grey, shell fragments	

WATERSHED FEATURES

Predominant Surrounding Landuse
✔ Forest ___ Commercial
___ Field/Pasture ___ Industrial
___ Agricultural ___ Residential
___ Other:

Canopy Cover
___Partly open ___Partly shaded
✔ Shaded ___ Open

Indicate the dominant type (Check one)
✔ Trees ___ Shrubs
___ Grasses ___ Herbaceous

Floodplain Width
___ Wide > 30ft ___ Moderate 15-30ft
✔ Narrow <16ft

Wetland Present ✔ Yes ___No
Wetland ID W-HH14

AQUATIC VEGETATION

Indicate the dominant type and record the dominant species present
___ Rooted emergent ___Rooted submergent ___Rooted floating ___Free floating
___ Floating algae ___Attached algae

MACROINVERTEBRATES OR OTHER WILDLIFE OBSERVED/OTHER OBSERVATIONS AND NOTES

Stream enters survey area and crosses AR via culvert and flows south out of survey area. W-HH14 drains into stream north of AR.

Stream Assessment Form (Form 1)

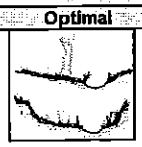
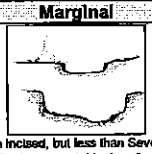
Unified Stream Methodology for use in Virginia

For use in wadeable channels classified as intermittent or perennial

Project/Site	County	Stream Name	Stream Code	Date	Impact/Stream Impact Length
Mountain Valley Pipeline	Giles	R3UB1	050500020602	10/25/2016	

Assessment Author(s)	Stream Name and Information
J.Cook, E.Foster	S-HH15, Perennial, MVP-GI-232

1. Channel Condition — Conditional Category

	Optimal	Suboptimal	Marginal	Poor	Severe
Channel Condition	 Very little incision or active erosion; 80-100% stable banks. Vegetative surface protection or natural rock, prominent (80-100%). AND/OR Stable point bars/bankfull benches are present. Access to their original floodplain or fully developed wide bankfull benches. Mid-channel bars, and transverse bars few. Transient sediment deposition covers less than 10% of bottom.	Slightly incised, few areas of active erosion or unprotected banks. Majority of banks are stable (60-80%). Vegetative protection or natural rock prominant (60-80%) AND/OR Depositional features contribute to stability. The bankfull and low flow channels are well defined. Stream likely has access to bankfull benches, or newly developed floodplains along portions of the reach. Transient sediment covers 10-40% of the stream bottom.	 Often incised, but less than Severe or Poor. Banks more stable than Severe or Poor due to lower bank slopes. Erosion may be present on 40-60% of both banks. Vegetative protection on 40-60% of banks. Streambanks may bevertical or undercut. AND/OR 40-60% of stream is covered by sediment. Sediment may be temporary/transient. contribute instability. Deposition that contribute to stability, may be forming/present. AND/OR V-shaped channels have vegetative protection on > 40% of the banks and depositional features which contribute to stability.	Overwidened/incised. Vertically/laterally unstable. Likely to widen further. Majority of both banks are near vertical. Erosion present on 60-80% of banks. Vegetative protection present on 20-40% of banks, and is insufficient to prevent erosion. AND/OR 60-80% of the stream is covered by sediment. Sediment is temporary/transient in nature, and contributing to instability. AND/OR V-shaped channels have vegetative protection is present on > 40% of the banks and stable sediment deposition is absent.	Canopy altered (or absent), vertical/lateral instability. Severe incision, flow contained within the banks. Streambed below average rooting depth, majority of banks vertical/undercut. Vegetative protection present on less than 20% of banks, is not preventing erosion. Obvious bank sloughing present. Erosion/raw banks on 80-100%. AND/OR Aggrading channel. Greater than 80% of stream bed is covered by deposition, contributing to instability. Multiple thread channels and/or subterranean flow.
Score	3	2.4	2	1.6	1

CI: 2.4

NOTES>>

2. RIPARIAN BUFFERS — Conditional Category

	Optimal	Suboptimal		Marginal		Poor	
Riparian Buffers	Tree stratum (dbh > 3 inches) present, with > 60% tree canopy cover and a non-maintained understory. Wetlands located within the riparian areas.	**High Suboptimal:** Riparian areas with tree stratum (dbh > 3 inches) present, with 30% to 60% tree canopy cover and containing both herbaceous and shrub layers or a non-maintained understory.	**Low Suboptimal:** Riparian areas with tree stratum (dbh > 3 inches) present, with > 30% tree canopy cover and a maintained understory. Recent cutover (dense vegetation).	**High Marginal:** Non-maintained, dense herbaceous vegetation with either a shrub layer or a tree layer (dbh > 3 inches) present, with <30% tree canopy cover.	**Low Marginal:** Non-maintained, dense herbaceous vegetation, riparian areas lacking shrub and tree stratum, hay production, ponds, open water. If present, tree stratum (dbh >3 inches) present, with <30% tree canopy cover with maintained understory.	**High Poor:** Lawns, mowed, and maintained areas, nurseries; no-till cropland; actively grazed pasture, sparsely vegetated non-maintained area, recently seeded and stabilized, or other comparable condition.	**Low Poor:** Impervious surfaces, mine spoil lands, denuded surfaces, row crops, active feed lots, trails, or other comparable conditions.
		High	Low	High	Low	High	Low
Condition Scores	1.5	1.2	1.1	0.85	0.75	0.6	0.5

NOTES>>

1. Delineate riparian areas along each stream bank into Condition Categories and Condition Scores using the descriptors.
2. Determine square footage for each by measuring or estimating length and width. Calculators are provided for you below.
3. Enter the % Riparian Area and Score for each riparian category in the blocks below.

Ensure the sums of % Riparian Blocks equal 100

Right Bank	% Riparian Area>							100%
	Score >							
Left Bank	% Riparian Area>							100%
	Score >							

CI= (Sum % RA * Scores*0.01)/2

Rt Bank CI >	1.04	CI
Lt Bank CI >	1.08	1.06

3. INSTREAM HABITAT/AVAILABLE COVER — Conditional Category

	Optimal	Suboptimal	Marginal	Poor
Instream Habitat/ Available Cover	Habitat elements are typically present in greater than 50% of the reach.	Stable habitat elements are typically present in 30-50% of the reach and are adequate for maintenance of populations.	Stable habitat elements are typically present in 10-30% of the reach and are adequate for maintenance of populations.	Habitat elements listed above are lacking or are unstable. Habitat elements are typically present in less than 10% of the reach.
Score	1.5	1.2	0.9	0.5

NOTES>> Most of stream runs through easement

CI: 0.90

Stream Impact Assessment Form Page 2

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	-Mountain Valley Pipeline	Giles	-	050500020602	10/25/2016	S-HH15	500	1

[illegible]

NOTES>> Culvert and active easement

	Conditional Category						
	Negligible	Minor		Moderate		Severe	
Channel Alteration	Channelization, dredging, alteration, or hardening absent. Stream has an unaltered pattern or has naturalized.	Less than 20% of the stream reach is disrupted by any of the channel alterations listed in the parameter guidelines.	20-40% of the stream reach is disrupted by any of the channel alterations listed in the parameter guidelines.	40 - 60% of reach is disrupted by any of the channel alterations listed in the parameter guidelines. If stream has been channelized, normal stable stream meander pattern has not recovered.	60 - 80% of reach is disrupted by any of the channel alterations listed in the parameter guidelines. If stream has been channelized, normal stable stream meander pattern has not recovered.	Greater than 80% of reach is disrupted by any of the channel alterations listed in the parameter guidelines AND/OR 80% of banks shored with gabion, riprap, or cement.	
SCORE	1.5	1.3	1.1	0.9	0.7	0.5	0.70

[illegible]

NOTE: The CIs and RCI should be rounded to 2 decimal places. The CR should be rounded to a whole number.

THE REACH CONDITION INDEX (RCI) >>	1.01

RCI= (Sum of all CI's)/5

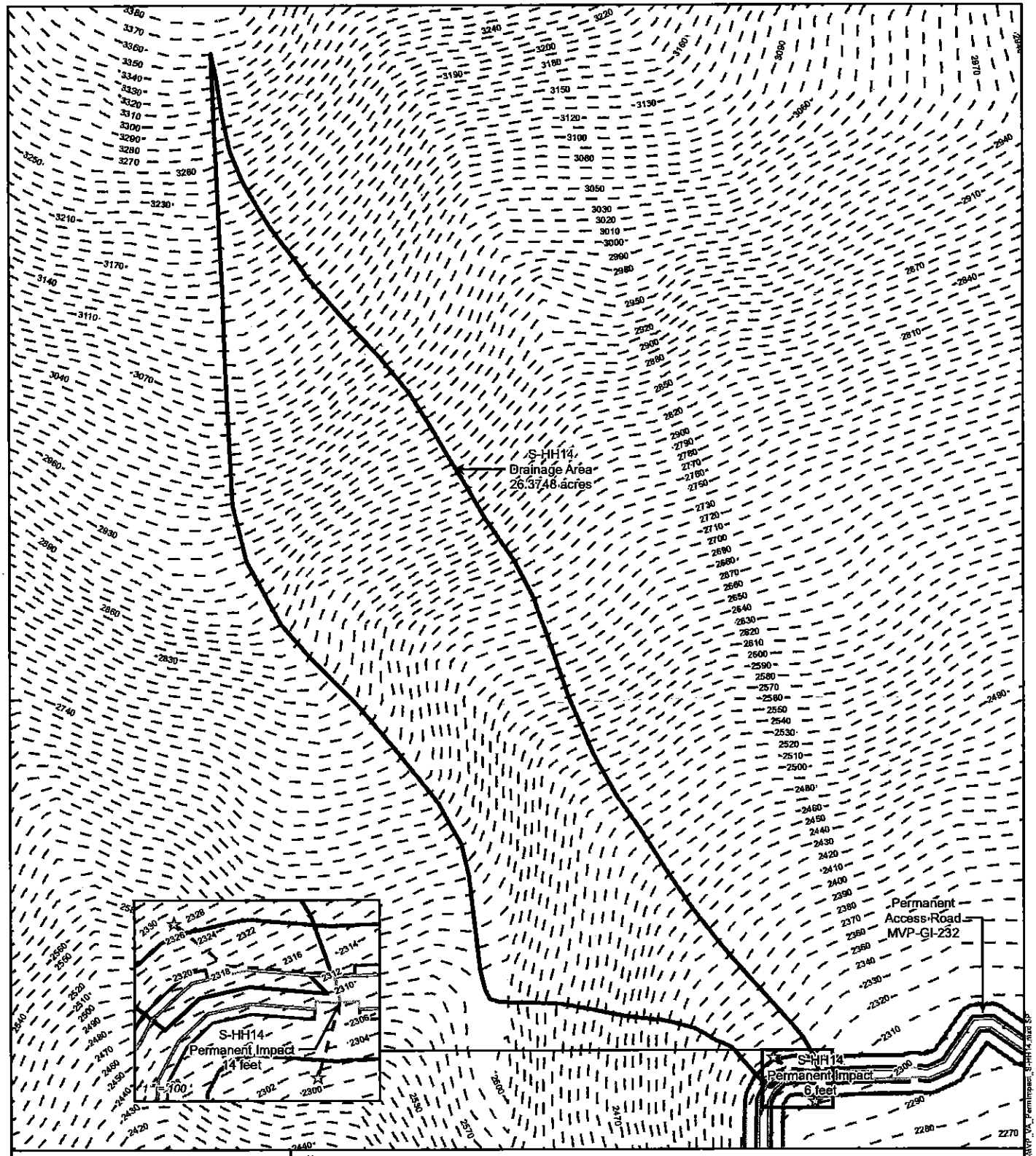
COMPENSATION REQUIREMENT (CR) >>	14

CR = RCI X LF X IF

INSERT PHOTOS:

DESCRIBE PROPOSED IMPACT:

S-HH14



Mountain Valley Pipeline Project

N

NAD 1983 UTM 17N

1 " = 350 '

350 175 0 350 Feet

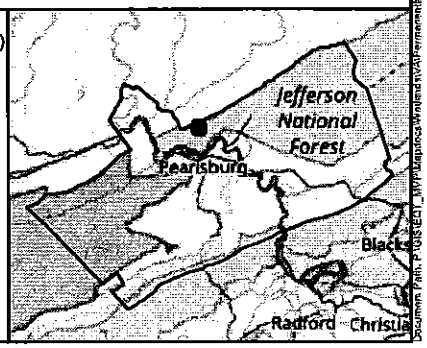
Mountain Valley PIPELINE

Figure 1:
Permanent Impacts for Stream S-HH14
Giles County

SEPTEMBER, 2017

Data Sources: ESRI Streaming Data © 2014
Elevation data derived from LiDAR provided by EQT 2016 and from the West Virginia GIS Clearinghouse.

Access Road Permanent LOD
Limit of Disturbance
Preliminary Jurisdictional Determination Boundary
Unified Stream Method (USM) Survey Reach
Stream Permanent Impact
Intermittent Stream
Drainage Area



Photograph Number: 1 **Feature Name:** S-HH14 **Flow Regime:** Intermittent

Direction: S **Date:** 10/16/2015

STREAM ID S-HH14	**STREAM NAME** UNT to Clendennin Creek
LAT 37.370790 **LONG** -80.738127	**DATE** 10/16/2015
CLIENT MVP	**PROJECT NAME** MVP
INVESTIGATORS S Ryan, A Larson, M Whitten	
FLOW REGIME Perennial ___ Intermittent ✓ Ephemeral ___	**WATER TYPE** TNW ___ RPW ✓ NRPW ___

CHANNEL FEATURES

Estimate Measurements
Top of Bank Width: 3 ft
Top of Bank Height:
LB 1.5 ft RB 1.5 ft
Water Depth: 0.00 ft
Water Width: 0.0 ft
High Water Mark: 3.0 in
Flow Direction: Southwest

Stream Erosion
✓ None ___ Moderate ___ Heavy

Artificial, Modified or Channelized
___ Yes ✓ No

Dam Present ___ Yes ✓ No

Sinuosity ___ Low ✓ Medium ✓ High

Gradient
___ Flat (0.5/100 ft) ✓ Moderate (2 ft/100 ft) ___ Severe (10 ft/100 ft)

FLOW CHARACTERISTICS

Water Present
___ No water, stream bed dry
✓ Stream bed moist
___ Standing water
___ Flowing water

Velocity
___ Fast ___ Moderate
___ Slow

Proportion of Reach Represented by Stream Morphology Types
Riffle % Run %
Pool %

Turbidity
___ Clear ___ Slightly turbid ___ Turbid
___ Opaque ___ Stained
___ Other ___

INORGANIC SUBSTRATE COMPONENTS (should add up to 100%)

Substrate Type	Diameter	% Composition in Sampling Reach
Bedrock		
Boulder	> 256 mm (10")	
Cobble	64-256 mm (2.5"-10")	
Gravel	2-64 mm (0.1"-2.5")	10
Sand	0.06-2mm (gritty)	10
Silt	0.004-0.06 mm	80
Clay	< 0.004 mm (slick)	

ORGANIC SUBSTRATE COMPONENTS (does not necessarily add up to 100%)

Substrate Type	Characteristic	% Composition in Sampling Area
Detritus	sticks, wood, coarse plant materials (CPOM)	90
Muck-Mud	black, very fine organic (FPOM)	
Marl	grey, shell fragments	

WATERSHED FEATURES

Predominant Surrounding Landuse
✓ Forest ___ Commercial
___ Field/Pasture ___ Industrial
___ Agricultural ___ Residential
___ Other:

Canopy Cover
___ Partly open ___ Partly shaded
✓ Shaded ___ Open

Indicate the dominant type (Check one)
✓ Trees ___ Shrubs
___ Grasses ___ Herbaceous

Floodplain Width
___ Wide > 30ft ___ Moderate 15-30ft
✓ Narrow <16ft

Wetland Present ___ Yes ✓ No
Wetland ID

AQUATIC VEGETATION

Indicate the dominant type and record the dominant species present
___ Rooted emergent ___ Rooted submergent ___ Rooted floating ___ Free floating
___ Floating algae ___ Attached algae

MACROINVERTEBRATES OR OTHER WILDLIFE OBSERVED/OTHER OBSERVATIONS AND NOTES

Stream begins in survey area then parallels AR before crossing AR via culvert then exits survey area flowing SW.

Stream Assessment Form (Form 1)

Unified Stream Methodology for use in Virginia

For use in wadeable channels classified as intermittent or perennial

Project/Site	County	Stream ID	Assessment Reach ID	Date	Form Completed by (Initials)
Mountain Valley Pipeline	Giles	R4SB5	050500020602	10/25/2017	

Form Completed by (Evaluators Initials)	Stream Name and Identifying Information
J.Cook, E.Foster	S-HH14, Intermittent, MVP-GI-232

1. Channel Condition — Conditional Category

	Optimal	Suboptimal	Marginal	Poor	Severe
Channel Condition	Very little incision or active erosion; 80-100% stable banks. Vegetative surface protection or natural rock, prominent (80-100%). AND/OR Stable point bars/bankfull benches are present. Access to their original floodplain or fully developed wide bankfull benches. Mid-channel bars, and transverse bars few. Transient sediment deposition covers less than 10% of bottom.	Slightly incised, few areas of active erosion or unprotected banks. Majority of banks are stable (60-80%). Vegetative protection or natural rock prominent (60-80%) AND/OR Depositional features contribute to stability. The bankfull and low flow channels are well defined. Stream likely has access to bankfull benches, or newly developed floodplains along portions of the reach. Transient sediment covers 10-40% of the stream bottom.	Often incised, but less than Severe or Poor. Banks more stable than Severe or Poor due to lower bank slopes. Erosion may be present on 40-60% of both banks. Vegetative protection on 40-60% of banks. Streambanks may bevertical or undercut. AND/OR 40-60% of stream is covered by sediment. Sediment may be temporary/transient, contribute instability. Deposition that contribute to stability, may be forming/present. AND/OR V-shaped channels have vegetative protection on > 40% of the banks and depositional features which contribute to stability.	Overwidened/incised. Vertically/laterally unstable. Likely to widen further. Majority of both banks are near vertical. Erosion present on 60-80% of banks. Vegetative protection present on 20-40% of banks, and is insufficient to prevent erosion. AND/OR 60-80% of the stream is covered by sediment. Sediment is temporary/transient in nature, and contributing to instability. AND/OR V-shaped channels have vegetative protection is present on > 40% of the banks and stable sediment deposition is absent.	Deeply incised (or entrenched), vertical/lateral instability. Severe incision, flow contained within the banks. Streambed below average rooting depth, majority of banks vertical/undercut. Vegetative protection present on less than 20% of banks, is not preventing erosion. Obvious bank sloughing present. Erosion/raw banks on 80-100%. AND/OR Aggrading channel. Greater than 80% of stream bed is covered by deposition, contributing to instability. Multiple thread channels and/or subterranean flow.
Score	3	2.4	2	1.6	1

CI: 2.4

NOTES>> Some incision though minimal erosion with clear bank stability

2. RIPARIAN BUFFERS — Conditional Category

	Optimal	Suboptimal		Marginal		Poor	
Riparian Buffers	Tree stratum (dbh > 3 inches) present, with > 60% tree canopy cover and a non-maintained understory. Wetlands located within the riparian areas.	**High Suboptimal:** Riparian areas with tree stratum (dbh > 3 inches) present, with 30% to 80% tree canopy cover and containing both herbaceous and shrub layers or a non-maintained understory.	**Low Suboptimal:** Riparian areas with tree stratum (dbh > 3 inches) present, with > 30% tree canopy cover and a maintained understory. Recent cutover (dense vegetation).	**High Marginal:** Non-maintained, dense herbaceous vegetation with either a shrub layer or a tree layer (dbh > 3 inches) present, with <30% tree canopy cover.	**Low Marginal:** Non-maintained, dense herbaceous vegetation, riparian areas lacking shrub and tree stratum, hay production, ponds, open water. If present, tree stratum (dbh >3 inches) present, with <30% tree canopy cover with maintained understory.	**High Poor:** Lawns, mowed, and maintained areas, nurseries; no-till cropland; actively grazed pasture, sparsely vegetated non-maintained area, recently seeded and stabilized, or other comparable condition.	**Low Poor:** Impervious surfaces, mine spoil lands, denuded surfaces, row crops, active feed lots, trails, or other comparable conditions.
		High	Low	High	Low	High	Low
Condition Scores	1.5	1.2	1.1	0.85	0.75	0.6	0.5

1. Delineate riparian areas along each stream bank into Condition Categories and Condition Scores using the descriptors.
2. Determine square footage for each by measuring or estimating length and width. Calculators are provided for you below.
3. Enter the % Riparian Area and Score for each riparian category in the blocks below.

Ensure the sums of % Riparian Blocks equal 100

Right Bank	% Riparian Area>	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	100%
	Score >	[illegible]	[illegible]	0.85	[illegible]	[illegible]	[illegible]	
Left Bank	% Riparian Area>	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	100%
	Score >	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	

NOTES>>

CI= (Sum % RA * Scores*0.01)/2

		CI
Rt Bank CI >	1.12	
Lt Bank CI >	1.12	1.12

3. INSTREAM HABITAT/AVAILABLE COVER — Conditional Category

	Optimal	Suboptimal	Marginal	Poor
Instream Habitat/ Available Cover	Habitat elements are typically present in greater than 50% of the reach.	Stable habitat elements are typically present in 30-50% of the reach and are adequate for maintenance of populations.	Stable habitat elements are typically present in 10-30% of the reach and are adequate for maintenance of populations.	Habitat elements listed above are lacking or are unstable. Habitat elements are typically present in less than 10% of the reach.
Score	1.5	1.2	0.9	0.5

NOTES>> Stream has minimal habitat with low shelf development

CI: 0.90

Stream Impact Assessment Form Page 2

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	Mountain Valley Pipeline			050500020602	10/25/2017		500	1

[illegible] NOTES>> Stream is impac

	Conditional Category						
	Negligible	Minor		Moderate		Severe	
Channel Alteration	Channelization, dredging, alteration, or hardening absent. Stream has an unaltered pattern or has naturalized.	Less than 20% of the stream reach is disrupted by any of the channel alterations listed in the parameter guidelines.	20-40% of the stream reach is disrupted by any of the channel alterations listed in the parameter guidelines.	40 - 60% of reach is disrupted by any of the channel alterations listed in the parameter guidelines. If stream has been channelized, normal stable stream meander pattern has not recovered.	60 - 80% of reach is disrupted by any of the channel alterations listed in the parameter guidelines. If stream has been channelized, normal stable stream meander pattern has not recovered.	Greater than 80% of reach is disrupted by any of the channel alterations listed in the parameter guidelines AND/OR 80% of banks shored with gabion, riprap, or cement.	
SCORE	1.5	1.3	1.1	0.9	0.7	0.5	0.90

[illegible]

NOTE: The CIs and RCI should be rounded to 2 decimal places. The CR should be rounded to a whole number.

THE REACH CONDITION INDEX (RCI) >>	1.06

RCI= (Sum of all CI's)/5

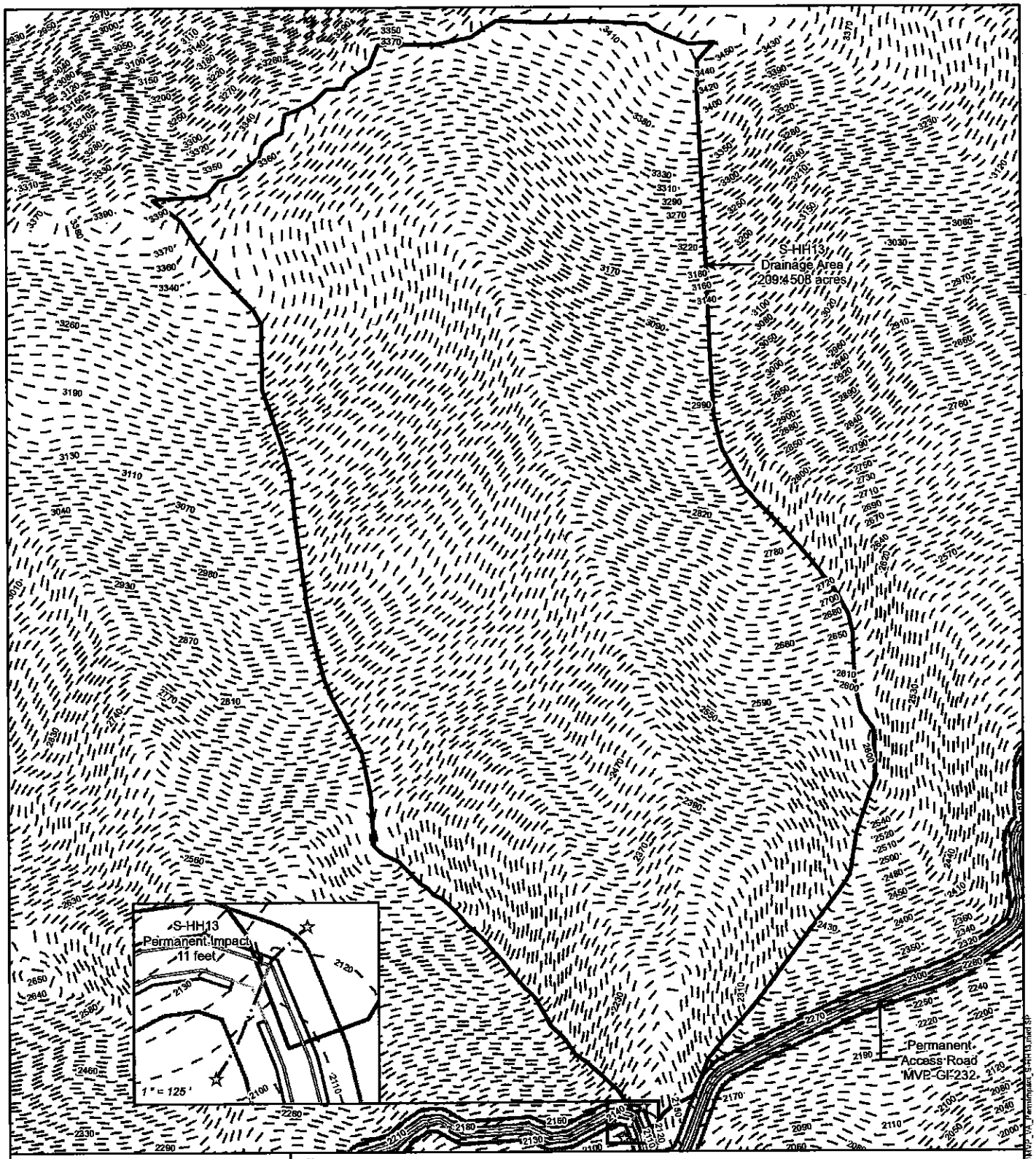
COMPENSATION REQUIREMENT (CR) >>	15

CR = RCI X LF X IF

INSERT PHOTOS:

DESCRIBE PROPOSED IMPACT:

S-HH13



Mountain Valley Pipeline Project

N

NAD 1983 UTM 17N

1 " = 600 '

600 300 0 600 Feet

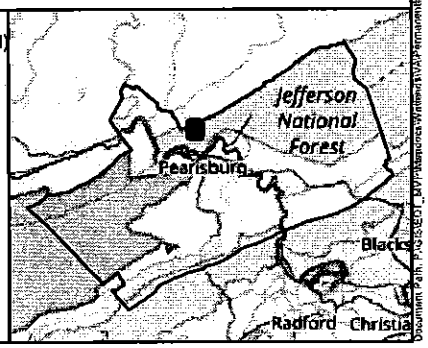
Mountain Valley PIPELINE

Figure 1:
Permanent Impacts for
Stream S-HH13
Giles County

SEPTEMBER, 2017

Data Sources: ESRI Streaming Data © 2014
Elevation data derived from LiDAR provided by EQT 2016
and from the West Virginia GIS Clearinghouse.

Access Road Permanent LOD
Limit of Disturbance
Preliminary Jurisdictional Determination Boundary
Unified Stream Method (USM) Survey Reach
Stream Permanent Impact
Perennial Stream
Drainage Area



Photograph Number: 1 **Feature Name:** S-HH13 **Flow Regime:** Perennial

Direction: SSW **Date:** 10/16/2015

STREAM ID S-HH13	**STREAM NAME** UNT to Clendennin Creek
LAT 37.366221 **LONG** -80.744635	**DATE** 10/16/2015
CLIENT MVP	**PROJECT NAME** MVP
INVESTIGATORS S Ryan, A Larson, M Whitten	
FLOW REGIME Perennial ✔ Intermittent ___ Ephemeral ___	**WATER TYPE** TNW ___ RPW ✔ NRPW ___

CHANNEL FEATURES

Estimate Measurements
Top of Bank Width: 8 ft
Top of Bank Height:
LB 2.0 ft RB 2.0 ft
Water Depth: 2.00 in
Water Width: 8.0 ft
High Water Mark: 7.0 in
Flow Direction: Southwest

Stream Erosion
✔ None ___ Moderate ___ Heavy

Artificial, Modified or Channelized
___ Yes ✔ No

Dam Present ___ Yes ✔ No

Sinuosity ___ Low ✔ Medium ✔ High

Gradient
___ Flat (0.5/100 ft) ✔ Moderate (2 ft/100 ft) ___ Severe (10 ft/100 ft)

FLOW CHARACTERISTICS

Water Present
___ No water, stream bed dry
___ Stream bed moist
___ Standing water
✔ Flowing water

Velocity
___ Fast ✔ Moderate
___ Slow

Proportion of Reach Represented by Stream Morphology Types
Riffle 75 % Run 15 %
Pool 10 %

Turbidity
✔ Clear ___ Slightly turbid ___ Turbid
___ Opaque ___ Stained
___ Other_____

INORGANIC SUBSTRATE COMPONENTS (should add up to 100%)			ORGANIC SUBSTRATE COMPONENTS (does not necessarily add up to 100%)		
Substrate Type	Diameter	% Composition in Sampling Reach	Substrate Type	Characteristic	% Composition in Sampling Area
Bedrock			Detritus	sticks, wood, coarse plant materials (CPOM)	25
Boulder	> 256 mm (10")	10			
Cobble	64-256 mm (2.5"-10")	50	Muck-Mud	black, very fine organic (FPOM)	
Gravel	2-64 mm (0.1"-2.5")	25			
Sand	0.06-2mm (gritty)	15	Marl	grey, shell fragments	
Silt	0.004-0.06 mm				
Clay	< 0.004 mm (slick)				

WATERSHED FEATURES

Predominant Surrounding Landuse
✔ Forest ___ Commercial
___ Field/Pasture ___ Industrial
___ Agricultural ___ Residential
___ Other:

Canopy Cover
___ Partly open ___ Partly shaded
✔ Shaded ___ Open

Indicate the dominant type (Check one)
✔ Trees ___ Shrubs
___ Grasses ___ Herbaceous

Floodplain Width
___ Wide > 30ft ___ Moderate 15-30ft
✔ Narrow <16ft

Wetland Present ___ Yes ✔ No
Wetland ID

AQUATIC VEGETATION

Indicate the dominant type and record the dominant species present
___ Rooted emergent ___ Rooted submergent ___ Rooted floating ___ Free floating
___ Floating algae ___ Attached algae

MACROINVERTEBRATES OR OTHER WILDLIFE OBSERVED/OTHER OBSERVATIONS AND NOTES

Crosses AR via culvert then exits survey area flowing SW. Pools listed above are mainly the result of minor flow interruption related to the culvert.

Stream Assessment Form (Form 1)

Unified Stream Methodology for use in Virginia

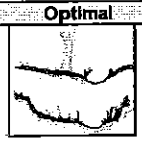
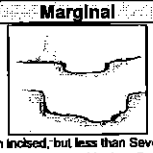
For use in wadeable channels classified as Intermittent or perennial

Project/Site	County	Stream Name	HUC	Date	[illegible]	[illegible]
Mountain Valley Pipeline	Giles	R3RB2	050500020602	10/25/2016		

Assessors Name/Affiliation	Stream Station Identification
J.Cook, E.Foster	S-HH13, Perennial, MVP-GI-232

1. CHANNEL CONDITION [illegible]

Conditional Category

	Optimal	Suboptimal	Marginal	Poor	Severe	
Channel Condition	 Very little incision or active erosion; 80-100% stable banks. Vegetative surface protection or natural rock, prominent (80-100%). AND/OR Stable point bars/bankfull benches are present. Access to their original floodplain or fully developed wide bankfull benches. Mid-channel bars, and transverse bars few. Transient sediment deposition covers less than 10% of bottom.	Slightly incised, few areas of active erosion or unprotected banks. Majority of banks are stable (60-80%). Vegetative protection or natural rock prominent (60-80%) AND/OR Depositional features contribute to stability. The bankfull and low flow channels are well defined. Stream likely has access to bankfull benches, or newly developed floodplains along portions of the reach. Transient sediment covers 10-40% of the stream bottom.	 Often incised, but less than Severe or Poor. Banks more stable than Severe or Poor due to lower bank slopes. Erosion may be present on 40-60% of both banks. Vegetative protection on 40-60% of banks. Streambanks may bevertical or undercut. AND/OR 40-60% of stream is covered by sediment. Sediment may be temporary/transient, contribute instability. Deposition that contribute to stability, may be forming/present. AND/OR V-shaped channels have vegetative protection on > 40% of the banks and depositional features which contribute to stability.	Overwidened/Incised. Vertically/laterally unstable. Likely to widen further. Majority of both banks are near vertical. Erosion present on 60-80% of banks. Vegetative protection present on 20-40% of banks, and is insufficient to prevent erosion. AND/OR 60-80% of the stream is covered by sediment. Sediment is temporary/transient in nature, and contributing to instability. AND/OR V-shaped channels have vegetative protection is present on > 40% of the banks and stable sediment deposition is absent.	[illegible], vertical/lateral instability. Severe incision, flow contained within the banks. Streambed below average rooting depth, majority of banks vertical/undercut. Vegetative protection present on less than 20% of banks, is not preventing erosion. Obvious bank sloughing present. Erosion/raw banks on 80-100%. AND/OR Aggrading channel. Greater than 80% of stream bed is covered by deposition, contributing to instability. Multiple thread channels and/or subterranean flow.	CI
Score	3	2.4	2	1.6	1	3.0

NOTES>>

2. RIPARIAN BUFFERS [illegible]

Conditional Category

	Optimal	Suboptimal		Marginal		Poor	
Riparian Buffers	Tree stratum (dbh > 3 inches) present, with > 60% tree canopy cover and a non-maintained understory. Wetlands located within the riparian areas.	High Suboptimal: Riparian areas with tree stratum (dbh > 3 inches) present, with 30% to 60% tree canopy cover and containing both herbaceous and shrub layers or a non-maintained understory.	Low Suboptimal: Riparian areas with tree stratum (dbh > 3 inches) present, with > 30% tree canopy cover and a maintained understory. Recent cutover (dense vegetation).	High Marginal: Non-maintained, dense herbaceous vegetation with either a shrub layer or a tree layer (dbh > 3 inches) present, with <30% tree canopy cover.	Low Marginal: Non-maintained, dense herbaceous vegetation, riparian areas lacking shrub and tree stratum, hay production, ponds, open water. If present, tree stratum (dbh >3 inches) present, with <30% tree canopy cover with maintained understory.	High Poor: Lawns, mowed, and maintained areas, nurseries; no-till cropland; actively grazed pasture, sparsely vegetated non-maintained area, recently seeded and stabilized, or other comparable condition.	Low Poor: Impervious surfaces, mine spoil lands, denuded surfaces, row crops, active feed lots, trails, or other comparable conditions.
	[illegible]	High	Low	High	Low	High	Low
Condition Scores	1.5	1.2	1.1	0.85	0.75	0.6	0.5

NOTES>> Mostly optimal woods

1. Delineate riparian areas along each stream bank into Condition Categories and Condition Scores using the descriptors.
2. Determine square footage for each by measuring or estimating length and width. Calculators are provided for you below.
3. Enter the % Riparian Area and Score for each riparian category in the blocks below.

Ensure the sums of % Riparian Blocks equal 100

Right Bank	% Riparian Area>	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	100%
	Score >	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
Left Bank	% Riparian Area>	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	100%
	Score >	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	

CI= (Sum % RA * Scores*0.01)/2

Rt Bank CI >	1.46	CI
Lt Bank CI >	1.41	1.43

3. INSTREAM HABITAT [illegible]

NOTES>> Varying substrate and functional shade for habitat

Conditional Category

	Optimal	Suboptimal	Marginal	Poor	
Instream Habitat/ Available Cover	Habitat elements are typically present in greater than 50% of the reach.	Stable habitat elements are typically present in 30-50% of the reach and are adequate for maintenance of populations.	Stable habitat elements are typically present in 10-30% of the reach and are adequate for maintenance of populations.	Habitat elements listed above are lacking or are unstable. Habitat elements are typically present in less than 10% of the reach.	CI
Score	1.5	1.2	0.9	0.5	1.50

Stream Impact Assessment Form Page 2

	Mountain Valley Pipeline	Giles		050500020602	10/25/2016	S-HH13	500	1

NOTES>> Culvert

	Conditional Category					
	Negligible	Minor		Moderate		Severe
Channel Alteration	Channelization, dredging, alteration, or hardening absent. Stream has an unaltered pattern or has naturalized.	Less than 20% of the stream reach is disrupted by any of the channel alterations listed in the parameter guidelines.	20-40% of the stream reach is disrupted by any of the channel alterations listed in the parameter guidelines.	40 - 60% of reach is disrupted by any of the channel alterations listed in the parameter guidelines. If stream has been channelized, normal stable stream meander pattern has not recovered.	60 - 80% of reach is disrupted by any of the channel alterations listed in the parameter guidelines. If stream has been channelized, normal stable stream meander pattern has not recovered.	Greater than 80% of reach is disrupted by any of the channel alterations listed in the parameter guidelines AND/OR 80% of banks shored with gabion, riprap, or cement.
SCORE	1.5	1.3	1.1	0.9	0.7	0.5

1.30

NOTE: The CIs and RCI should be rounded to 2 decimal places. The CR should be rounded to a whole number.

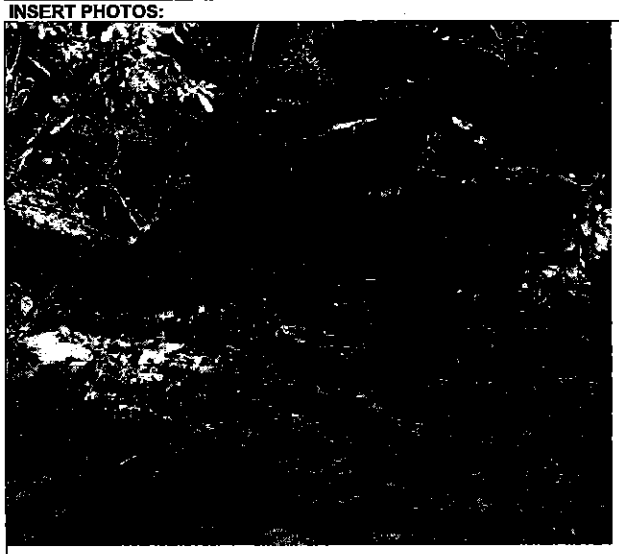
THE REACH CONDITION INDEX (RCI) >>	1.45

RCI= (Sum of all CI's)/5

COMPENSATION REQUIREMENT (CR) >>	16

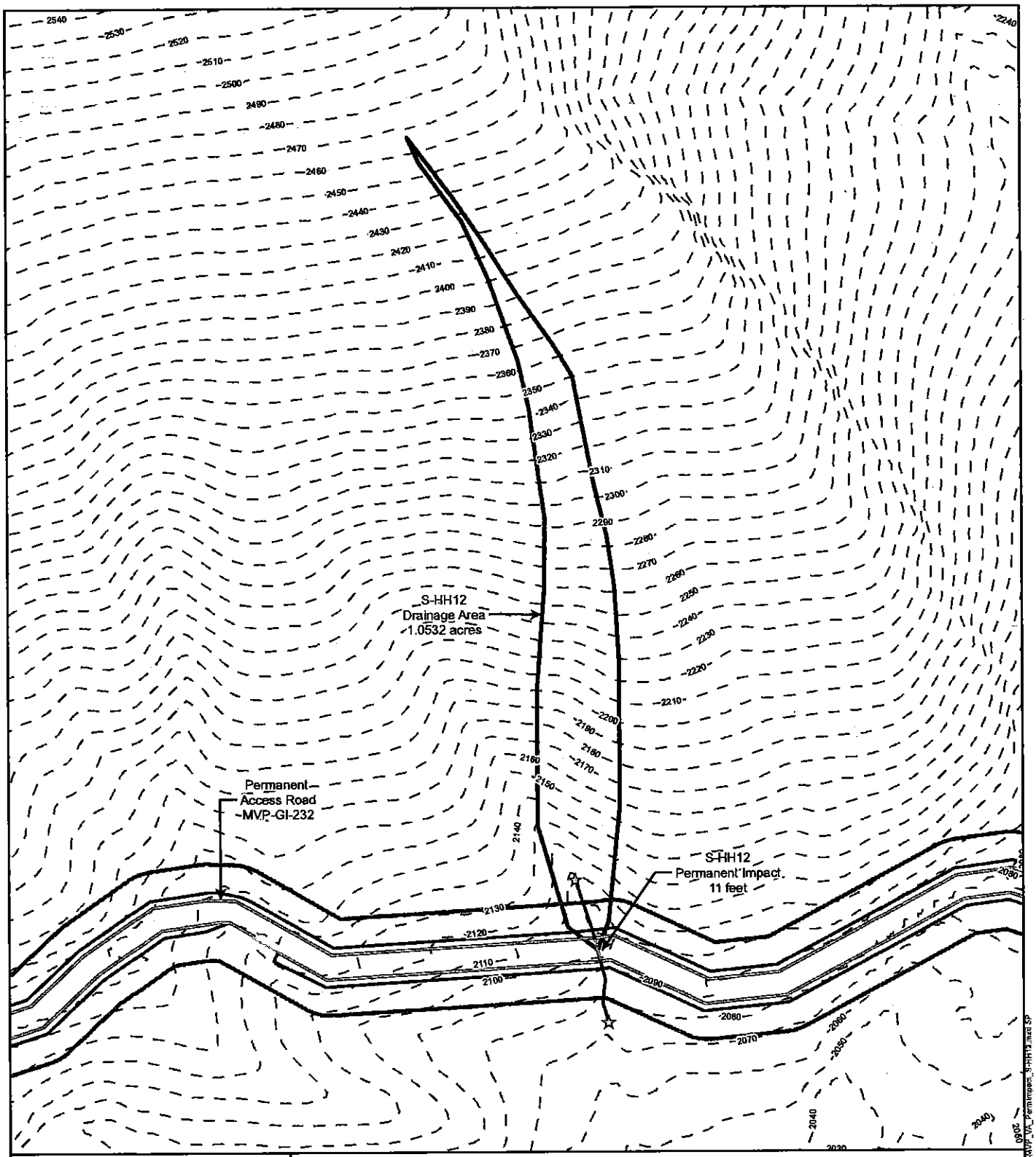
CR = RCI X LF X IF

INSERT PHOTOS:



DESCRIBE PROPOSED IMPACT:

S-HH12



Mountain Valley Pipeline Project

N

NAD 1983 UTM 17N

1 " = 140 '

140 70 0 140 Feet

Mountain Valley PIPELINE

Figure 1:
Permanent Impacts for
Stream S-HH12
Giles County

SEPTEMBER, 2017

Data Sources: ESRI Streaming Data © 2014
Elevation data derived from LiDAR provided by EQT 2016
and from the West Virginia GIS Clearinghouse.

Access Road Permanent LOD

Limit of Disturbance

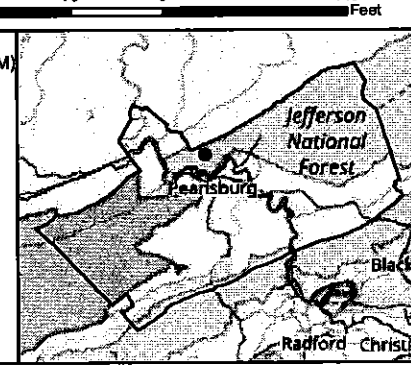
Preliminary Jurisdictional Determination Boundary

Unified Stream Method (USM) Survey Reach

Stream Permanent Impact

Ephemeral Stream

Drainage Area



Photograph Number: 1 **Feature Name:** S-HH12 **Flow Regime:** Ephemeral

Direction: N **Date:** 10/16/2015

STREAM ID S-HH12	**STREAM NAME** UNT to Clendennin Creek
LAT 37.366134 **LONG** -80.746301	**DATE** 10/16/2015
CLIENT MVP	**PROJECT NAME** MVP
INVESTIGATORS S Ryan, A Larson, M Whitten	
FLOW REGIME Perennial ___ Intermittent ___ Ephemeral ✓	**WATER TYPE** TNW ___ RPW ___ NRPW ✓

CHANNEL FEATURES

Estimate Measurements
Top of Bank Width: 3 ft
Top of Bank Height:
LB 1.0 ft RB 1.0 ft
Water Depth: 0.00 ft
Water Width: 0.0 ft
High Water Mark: 3.0 in
Flow Direction: South

Stream Erosion
✓ None ___ Moderate ___ Heavy

Artificial, Modified or Channelized
___ Yes ✓ No

Dam Present ___ Yes ✓ No

Sinuosity ___ Low ✓ Medium ✓ High

Gradient
___ Flat (0.5/100 ft) ✓ Moderate (2 ft/100 ft) ___ Severe (10 ft/100 ft)

FLOW CHARACTERISTICS

Water Present
___ No water, stream bed dry
✓ Stream bed moist
___ Standing water
___ Flowing water

Velocity
___ Fast ___ Moderate
___ Slow

Proportion of Reach Represented by Stream Morphology Types
Riffle % Run %
Pool %

Turbidity
___ Clear ___ Slightly turbid ___ Turbid
___ Opaque ___ Stained
___ Other_____

INORGANIC SUBSTRATE COMPONENTS (should add up to 100%)

Substrate Type	Diameter	% Composition in Sampling Reach
Bedrock		
Boulder	> 256 mm (10")	
Cobble	64-256 mm (2.5"-10")	10
Gravel	2-64 mm (0.1"-2.5")	20
Sand	0.06-2mm (gritty)	35
Silt	0.004-0.06 mm	35
Clay	< 0.004 mm (slick)	

ORGANIC SUBSTRATE COMPONENTS (does not necessarily add up to 100%)

Substrate Type	Characteristic	% Composition in Sampling Area
Detritus	sticks, wood, coarse plant materials (CPOM)	100
Muck-Mud	black, very fine organic (FPOM)	
Marl	grey, shell fragments	

WATERSHED FEATURES

Predominant Surrounding Landuse
✓ Forest ___ Commercial
___ Field/Pasture ___ Industrial
___ Agricultural ___ Residential
___ Other:

Canopy Cover
___ Partly open ✓ Partly shaded
___ Shaded ___ Open

Indicate the dominant type (Check one)
✓ Trees ___ Shrubs
___ Grasses ___ Herbaceous

Floodplain Width
___ Wide > 30ft ___ Moderate 15-30ft
✓ Narrow <16ft

Wetland Present ___ Yes ✓ No
Wetland ID

AQUATIC VEGETATION

Indicate the dominant type and record the dominant species present
___ Rooted emergent ___ Rooted submergent ___ Rooted floating ___ Free floating
___ Floating algae ___ Attached algae

MACROINVERTEBRATES OR OTHER WILDLIFE OBSERVED/OTHER OBSERVATIONS AND NOTES

Crosses AR via culvert then exits survey area to the S. Marginal bed/bank charecteristics within majority of survey area, with better defined bed/bank near southern survey boundary and outside survey area to south.

Ephemeral Stream Assessment Form (Form 1a)

Unified Stream Methodology for use in Virginia

For use in ephemeral streams

Project	Applicant	County	Watershed	Date	Assessment Time
Mountain Valley Pipeline	Giles	R6	050500020602	10/25/2016	

Assessors Name/Affiliation	Stream Name and Information
J.Cook, E.Foster	S-HH12, Ephemeral, MVP-GI-232

RIPARIAN BUFFERS (Condition Index and Condition Scores)

	Conditional Category							NOTES>>
	Optimal	Suboptimal		Marginal		Poor		
Riparian Buffers	Tree stratum (dbh > 3 inches) present, with > 60% tree canopy cover and an non-maintained understory. Wetlands areas.	High Suboptimal: Riparian areas with tree stratum (dbh > 3 inches) present, with 30% to 60% tree canopy cover and containing both herbaceous and shrub layers or a non-maintained understory.	Low Suboptimal: Riparian areas with tree stratum (dbh > 3 inches) present, with >30% tree canopy cover and a maintained understory. Recent cutover (dense vegetation).	High Marginal: Non-maintained, dense herbaceous vegetation with either a shrub layer or a tree layer (dbh > 3 inches) present, with <30% tree canopy cover.	Low Marginal: Non-maintained, dense herbaceous vegetation, riparian areas lacking shrub and tree stratum, hay production, ponds, open water. If present, tree stratum (dbh >3 inches) present, with <30% tree canopy cover with maintained understory.	High Poor: Lawns, mowed, and maintained areas, nurseries; no-till cropland; actively grazed pasture, sparsely vegetated non-maintained area, recently seeded and stabilized, or other comparable condition.	Low Poor: Impervious surfaces, mine spoil lands, denuded surfaces, row crops, active feed lots, trails, or other comparable conditions.	
		High	Low	High	Low	High	Low	
Condition Scores	1.5	1.2	1.1	0.85	0.75	0.6	0.5	

1. Delineate riparian areas along each stream bank into Condition Categories and Condition Scores using the descriptors.
2. Determine square footage for each by measuring or estimating length and width. Calculators are provided for you below.
3. Enter the % Riparian Area and Score for each riparian category in the blocks below.

Ensure the sums of % Riparian Blocks equal 100

Right Bank	% Riparian Area>							100%			
	Score >										
									CI= (Sum % RA * Scores*0.01)/2		
Left Bank	% Riparian Area>							100%	Rt Bank CI >	1.46	CI
	Score >								Lt Bank CI >	1.46	1.46

REACH CONDITION INDEX (RCI) STREAM CONDITION UNIT SCORE (USCU)

NOTE: The CIs and RCI should be rounded to 2 decimal places. The CR should be rounded to a whole number.

THE REACH CONDITION INDEX (RCI) >>	0.73

RCI= (Riparian CI)/2

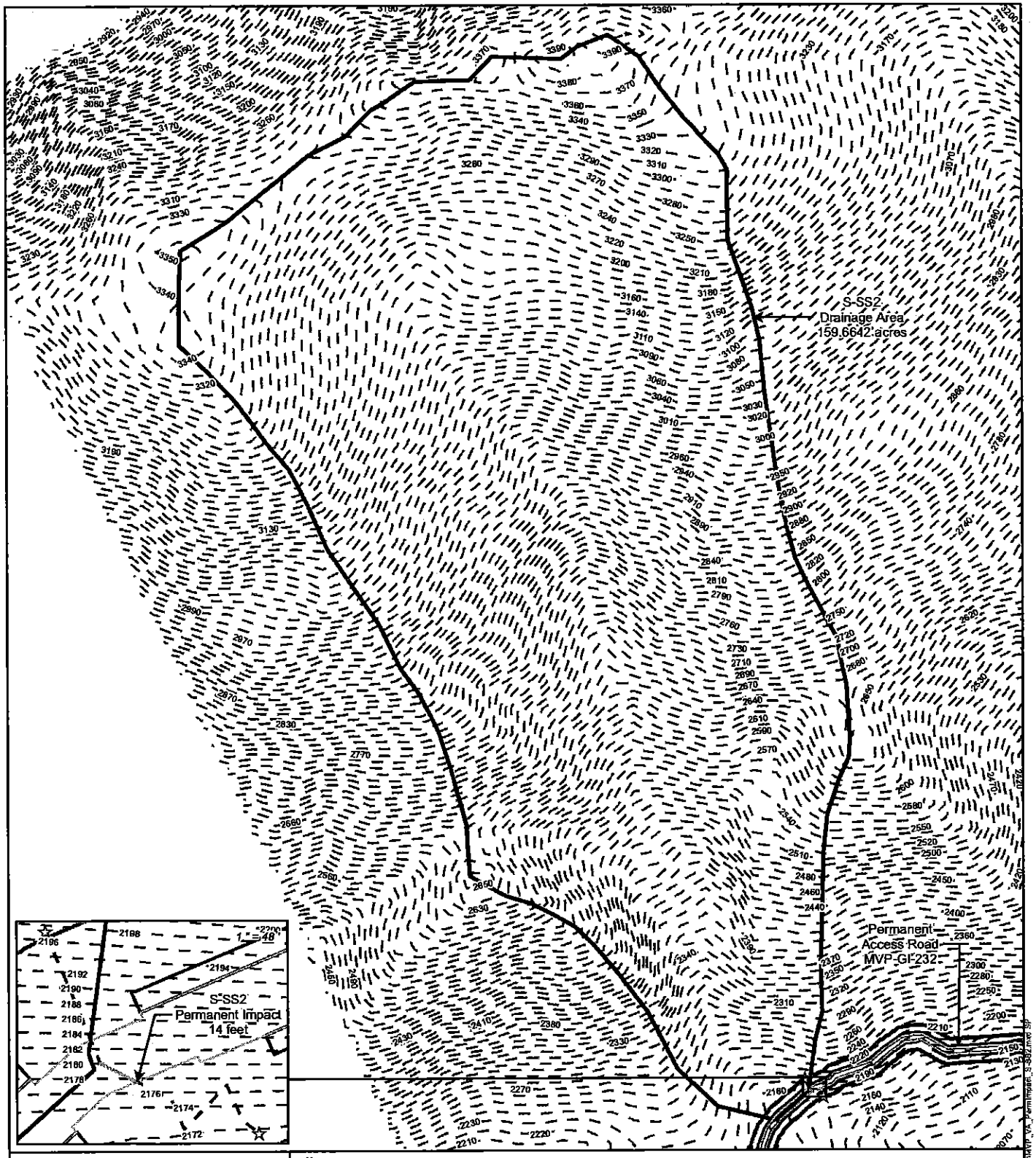
COMPENSATION REQUIREMENT (CR) >>	8

CR = RCI X LF X IF

INSERT PHOTOS:

DESCRIBE PROPOSED IMPACT:

S-SS2



Mountain Valley Pipeline Project

N

NAD 1983 UTM 17N

1" = 550'

550 275 0 550 Feet

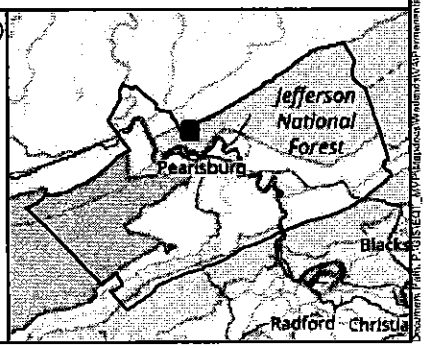
Mountain Valley PIPELINE

Figure 1:
Permanent Impacts for
Stream S-SS2
Giles County

SEPTEMBER, 2017

Data Sources: ESRI Streaming Data © 2014
Elevation data derived from LIDAR provided by EQT 2016
and from the West Virginia GIS Clearinghouse.

- Access Road Permanent LOD
- Limit of Disturbance
- Preliminary Jurisdictional Determination Boundary
- Unified Stream Method (USM) Survey Reach
- Stream Permanent Impact
- Intermittent Stream
- Drainage Area



Photograph Number: 23 **Feature Name:** S-SS2 **Flow Regime:** Intermittent

Direction: SSE **Date:** 9/11/2015

STREAM ID S-SS2	**STREAM NAME** UNT to Clendennin Creek
LAT 37.365645 **LONG** -80.749167	**DATE** 09/11/2015
CLIENT MVP	**PROJECT NAME** MVP
INVESTIGATORS L. Canty, E. Foster, A. Carrano	
FLOW REGIME Perennial ___ Intermittent ✔ Ephemeral ___	**WATER TYPE** TNW ___ RPW ✔ NRPW ___

CHANNEL FEATURES	**Estimate Measurements** Top of Bank Width: 10 ft Top of Bank Height: LB 20.0 in RB 10.0 in Water Depth: 0.00 in Water Width: 0.0 ft High Water Mark: 4.0 in Flow Direction: South	**Stream Erosion** ___ None ✔ Moderate ___ Heavy **Artificial, Modified or Channelized** ___ Yes ✔ No **Dam Present** ___ Yes ✔ No **Sinuosity** ✔ Low ___ Medium ✔ High **Gradient** ___ Flat (0.5/100 ft ✔ Moderate (2 ft/100 ft) ___ Severe (10 ft/100 ft)
FLOW CHARACTERISTICS	**Water Present** ✔ No water, stream bed dry ___ Stream bed moist ___ Standing water ___ Flowing water **Velocity** ___ Fast ___ Moderate ___ Slow	**Proportion of Reach Represented by Stream Morphology Types** Riffle % Run % Pool % **Turbidity** ___ Clear ___ Slightly turbid ___ Turbid ___ Opaque ___ Stained ___ Other_____

INORGANIC SUBSTRATE COMPONENTS (should add up to 100%)			**ORGANIC SUBSTRATE COMPONENTS (does not necessarily add up to 100%)**		
Substrate Type	Diameter	% Composition in Sampling Reach	Substrate Type	Characteristic	% Composition in Sampling Area
Bedrock			Detritus	sticks, wood, coarse plant materials (CPOM)	15
Boulder	> 256 mm (10")	25			
Cobble	64-256 mm (2.5"-10")	25	Muck-Mud	black, very fine organic (FPOM)	
Gravel	2-64 mm (0.1"-2.5")	30			
Sand	0.06-2mm (gritty)		Marl	grey, shell fragments	
Silt	0.004-0.06 mm	10			
Clay	< 0.004 mm (slick)	10			

WATERSHED FEATURES	**Predominant Surrounding Landuse** ✔ Forest ___ Commercial ___ Field/Pasture ___ Industrial ___ Agricultural ___ Residential ___ Other: **Canopy Cover** ✔ Partly open ___ Partly shaded ___ Shaded ___ Open	**Indicate the dominant type (Check one)** ✔ Trees ___ Shrubs ___ Grasses ___ Herbaceous **Floodplain Width** ___ Wide > 30ft ___ Moderate 15-30ft ✔ Narrow <16ft **Wetland Present** ___ Yes ✔ No **Wetland ID**
AQUATIC VEGETATION	**Indicate the dominant type and record the dominant species present** ___ Rooted emergent ___ Rooted submergent ___ Rooted floating ___ Free floating ___ Floating algae ___ Attached algae	

MACROINVERTEBRATES OR OTHER WILDLIFE OBSERVED/OTHER OBSERVATIONS AND NOTES	

Stream Assessment Form (Form 1)

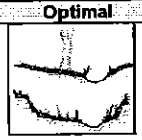
Unified Stream Methodology for use in Virginia

For use in wadeable channels classified as intermittent or perennial

Project/Site	County	Stream Name	Perennial, Intermittent, Tidal	Date	Investigators	Assessment Unit ID
Mountain Valley Pipeline	Giles	R4SB3	050500020602	10/25/2016		

Assessment Team Members	Site Name and Information
J.Cook, E.Foster	S-SS2, Intermittent, MVP-GI-232

Conditional Category

	Optimal	Suboptimal	Marginal	Poor	Severe	
Channel Condition	 Very little incision or active erosion; 80-100% stable banks. Vegetative surface protection or natural rock, prominent (80-100%). AND/OR Stable point bars/bankfull benches are present. Access to their original floodplain or fully developed wide bankfull benches. Mid-channel bars, and transverse bars few. Transient sediment deposition covers less than 10% of bottom.	Slightly incised, few areas of active erosion or unprotected banks. Majority of banks are stable (60-80%). Vegetative protection or natural rock prominent (60-80%) AND/OR Depositional features contribute to stability. The bankfull and low flow channels are well defined. Stream likely has access to bankfull benches, or newly developed floodplains along portions of the reach. Transient sediment covers 10-40% of the stream bottom.	Often incised, but less than Severe or Poor. Banks more stable than Severe or Poor due to lower bank slopes. Erosion may be present on 40-60% of both banks. Vegetative protection on 40-60% of banks. Streambanks may bevertical or undercut. AND/OR 40-60% of stream is covered by sediment. Sediment may be temporary/transient, contribute instability. Deposition that contribute to stability, may be forming/present. AND/OR V-shaped channels have vegetative protection on > 40% of the banks and depositional features which contribute to stability.	Overwidened/incised. Vertically/laterally unstable. Likely to widen further. Majority of both banks are near vertical. Erosion present on 60-80% of banks. Vegetative protection present on 20-40% of banks, and is insufficient to prevent erosion. AND/OR 60-80% of the stream is covered by sediment. Sediment is temporary/transient in nature, and contributing to instability. AND/OR V-shaped channels have vegetative protection is present on > 40% of the banks and stable sediment deposition is absent.	Deeply incised (or overwidened), vertical/lateral instability. Severe incision, flow contained within the banks. Streambed below average rooting depth, majority of banks vertical/undercut. Vegetative protection present on less than 20% of banks, is not preventing erosion. Obvious bank sloughing present. Erosion/raw banks on 80-100%. AND/OR Aggrading channel. Greater than 80% of stream bed is covered by deposition, contributing to instability. Multiple thread channels and/or subterranean flow.	CI
Score	3	2.4	2	1.6	1	3.0
NOTES>>	Stable channel condition					

Conditional Category

	Optimal	Suboptimal		Marginal		Poor		NOTES>>
Riparian Buffers	Tree stratum (dbh > 3 inches) present, with > 60% tree canopy cover and a non-maintained understory. Wetlands located within the riparian areas.	**High Suboptimal:** Riparian areas with tree stratum (dbh > 3 inches) present, with 30% to 60% tree canopy cover and containing both herbaceous and shrub layers or a non-maintained understory.	**Low Suboptimal:** Riparian areas with tree stratum (dbh > 3 inches) present, with > 30% tree canopy cover and a maintained understory. Recent cutover (dense vegetation).	**High Marginal:** Non-maintained, dense herbaceous vegetation with either a shrub layer or a tree layer (dbh > 3 inches) present, with <30% tree canopy cover.	**Low Marginal:** Non-maintained, dense herbaceous vegetation, riparian areas lacking shrub and tree stratum, hay production, ponds, open water. If present, tree stratum (dbh >3 inches) present, with <30% tree canopy cover with maintained understory.	**High Poor:** Lawns, mowed, and maintained areas, nurseries; no-till cropland; actively grazed pasture, sparsely vegetated non-maintained area, recently seeded and stabilized, or other comparable condition.	**Low Poor:** Impervious surfaces, mine spoil lands, denuded surfaces, row crops, active feed lots, trails, or other comparable conditions.	
		High	Low	High	Low	High	Low	
Condition Scores	1.5	1.2	1.1	0.85	0.75	0.6	0.5	

1. Delineate riparian areas along each stream bank into Condition Categories and Condition Scores using the descriptors.
2. Determine square footage for each by measuring or estimating length and width. Calculators are provided for you below.
3. Enter the % Riparian Area and Score for each riparian category in the blocks below.

Ensure the sums of % Riparian Blocks equal 100

Right Bank	% Riparian Area>							100%	
	Score >								
Left Bank	% Riparian Area>							100%	
	Score >								

CI= (Sum % RA * Scores*0.01)/2

Rt Bank CI >	1.50	CI
Lt Bank CI >	1.50	1.50

Conditional Category

	Optimal	Suboptimal	Marginal	Poor	NOTES>>	
Instream Habitat/ Available Cover	Habitat elements are typically present in greater than 50% of the reach.	Stable habitat elements are typically present in 30-50% of the reach and are adequate for maintenance of populations.	Stable habitat elements are typically present in 10-30% of the reach and are adequate for maintenance of populations.	Habitat elements listed above are lacking or are unstable. Habitat elements are typically present in less than 10% of the reach.		CI
Score	1.5	1.2	0.9	0.5		1.50

Stream Impact Assessment Form Page 2

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
---	Mountain Valley Pipeline	Giles		050500020602	10/25/2016		500	1

[illegible]

NOTES>> Culverted

	Conditional Category							
	Negligible	Minor		Moderate		Severe		
Channel Alteration	Channelization, dredging, alteration, or hardening absent. Stream has an unaltered pattern or has naturalized.	Less than 20% of the stream reach is disrupted by any of the channel alterations listed in the parameter guidelines.	20-40% of the stream reach is disrupted by any of the channel alterations listed in the parameter guidelines.	40 - 60% of reach is disrupted by any of the channel alterations listed in the parameter guidelines. If stream has been channelized, normal stable stream meander pattern has not recovered.	60 - 80% of reach is disrupted by any of the channel alterations listed in the parameter guidelines. If stream has been channelized, normal stable stream meander pattern has not recovered.	Greater than 80% of reach is disrupted by any of the channel alterations listed in the parameter guidelines AND/OR 80% of banks shored with gabion, riprap, or cement.		
SCORE	1.5	1.3	1.1	0.9	0.7	0.5		1.30

[illegible]

NOTE: The CIs and RCI should be rounded to 2 decimal places. The CR should be rounded to a whole number.

THE REACH CONDITION INDEX (RCI) >>	1.46

RCI= (Sum of all CI's)/5

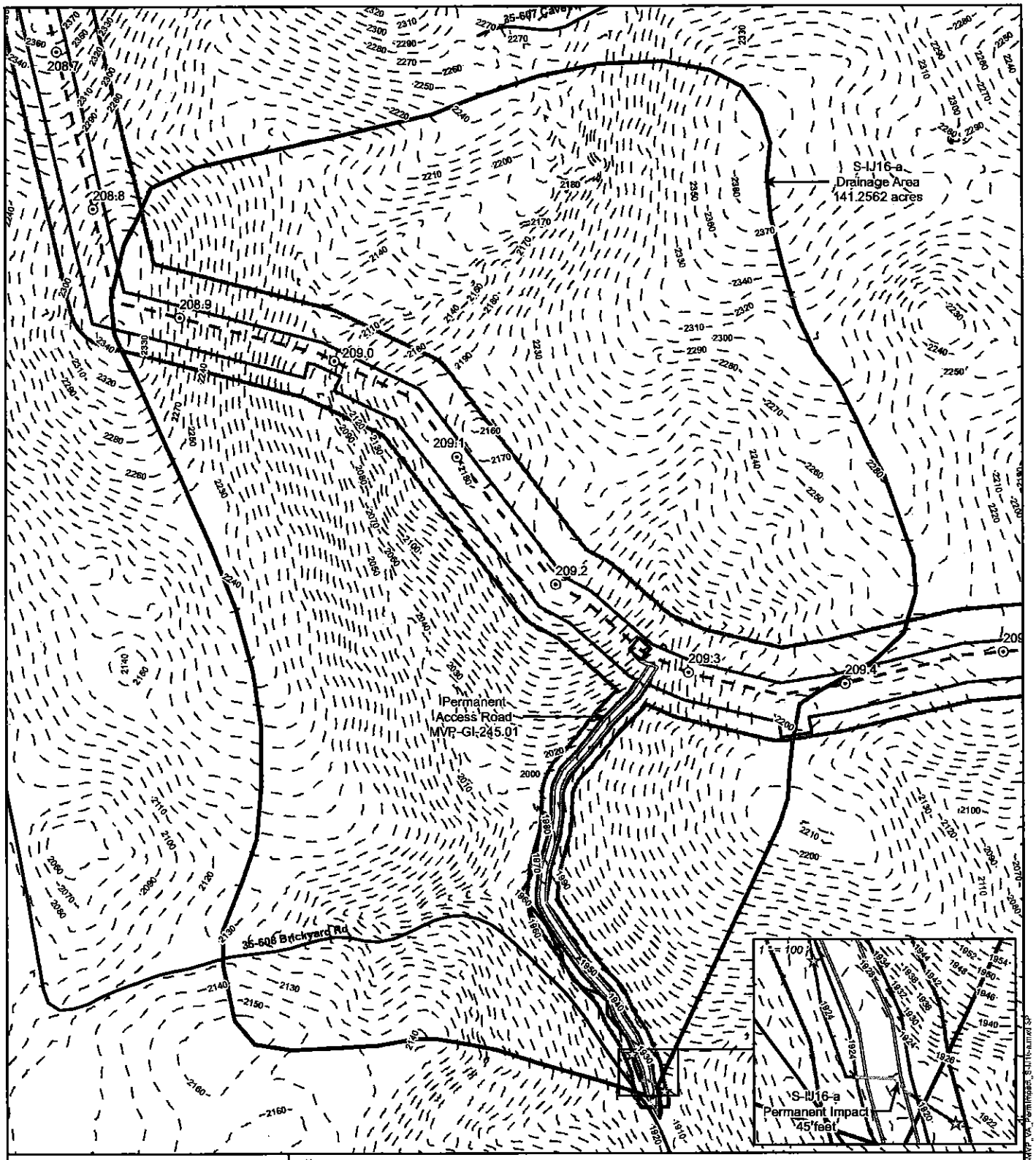
COMPENSATION REQUIREMENT (CR) >>	20

CR = RCI X LF X IF

INSERT PHOTOS:

DESCRIBE PROPOSED IMPACT:

S-IJ16a



Mountain Valley Pipeline Project

N

NAD 1983 UTM 17N

1" = 440'

440 220 0 440 Feet

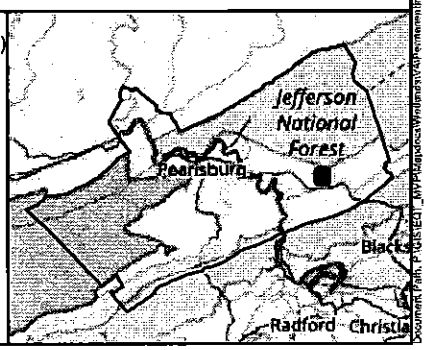
Mountain Valley PIPELINE

Figure 1:
Permanent Impacts for
Stream S-IJ16-a
Giles County

SEPTEMBER, 2017

Data Sources: ESRI Streaming Data © 2014
Elevation data derived from LiDAR provided by EQT 2016
and from the West Virginia GIS Clearinghouse.

- Milepost
- Alignment Centerline
- Permanent Facility
- Access Road Permanent LOD
- Limit of Disturbance
- Preliminary Jurisdictional Determination Boundary
- Unified Stream Method (USM) Survey Reach
- Stream Permanent Impact
- Ephemeral Stream
- Drainage Area



Photograph Number: 1 **Feature Name:** S-IJ16-a **Flow Regime:** Ephemeral

Direction: SE **Date:** 4/14/2016

STREAM ID S-IJ16-a	**STREAM NAME** UNT to Sinking Creek
CLIENT MVP	**PROJECT NAME** MVP
LAT 37.312740 **LONG** -80.545017	**DATE** 04/14/2016 **COUNTY** Giles
INVESTIGATORS E. Foster, S. Lieb, J. Niergarth	
WATER TYPE TNW ☐ RPW ☐ NRPW ☑	**FLOW REGIME** Perennial ☐ Intermittent ☐ Ephemeral ☑

CHANNEL FEATURES

Estimate Measurements
Top of Bank Width: 7.0 ft
Top of Bank Height:
LB 2.0 ft RB 2.0 ft
Water Depth: 0.00 in
Water Width: 0.0 ft
Ordinary High Water Mark (Width): 4.0 ft
Ordinary High Water Mark (Height): 6.0 in
Flow Direction: South

Sinuosity __ Low ✓ Medium __ High

Gradient ✓ Flat (0.5/100 ft) __ Moderate (2 ft/100 ft) __ Severe (10 ft/100 ft)

Stream Erosion
__ None ✓ Moderate __ Heavy

Artificial, Modified or Channelized
✓ Yes __ No

Within Roadside Ditch
__ Yes ✓ No

Culvert Present ✓ Yes __ No
Culvert Material: Corrugated Metal
Culvert Size: 24 in

FLOW CHARACTERISTICS

Water Present
✓ No water, stream bed dry
__ Stream bed moist
__ Standing water
__ Flowing water

Velocity
__ Fast __ Moderate
__ Slow

Proportion of Reach Represented by Stream Morphology Types (Only enter if water present)
Riffle % Run %
Pool %

Turbidity
__ Clear __ Slightly turbid __ Turbid
__ Other_____

INORGANIC SUBSTRATE COMPONENTS (should add up to 100%) 100

Substrate Type	Diameter	% Composition in Sampling Reach
Bedrock		
Boulder	> 256 mm (10")	40
Cobble	64-256 mm (2.5"-10")	20
Gravel	2-64 mm (0.1"-2.5")	20
Sand	0.06-2mm (gritty)	10
Silt	0.004-0.06 mm	10
Clay	< 0.004 mm (slick)	

ORGANIC SUBSTRATE COMPONENTS (does not necessarily add up to 100%)

Substrate Type	Characteristic	% Composition in Sampling Area
Detritus	sticks, wood, coarse plant materials (CPOM)	15
Muck-Mud	black, very fine organic (FPOM)	
Marl	grey, shell fragments	

WATERSHED FEATURES

Predominant Surrounding Landuse
✓ Forest __ Commercial
__ Field/Pasture __ Industrial
__ Agricultural __ Residential
__ ROW __ Other:

Canopy Cover
__ Open ✓ Partly shaded
__ Shaded

Floodplain Width
__ Wide > 30ft __ Moderate 15-30ft
✓ Narrow <15ft

MACROINVERTEBRATES/OTHER WILDLIFE OBSERVED OR OTHER NOTES AND OBSERVATIONS

Ephemeral Stream Assessment Form (Form 1a)

Unified Stream Methodology for use in Virginia

For use in ephemeral streams

Project/Site	County	Basin	Subbasin	Date	Stream	Impact/Stat Number
Mountain Valley Pipeline	Giles	R6	05050002	8/23/2017		

Name of Evaluator(s)	Stream Name and Location
James Cook, Emily Foster	S-IJ16-a

Conditional Category

	Optimal	Suboptimal		Marginal		Poor	
Riparian Buffers	Tree stratum (dbh > 3 inches) present, with > 60% tree canopy cover and an non-maintained understory. Wetlands areas.	High Suboptimal: Riparian areas with tree stratum (dbh > 3 inches) present, with 30% to 60% tree canopy cover and containing both herbaceous and shrub layers or a non-maintained understory.	Low Suboptimal: Riparian areas with tree stratum (dbh > 3 inches) present, with >30% tree canopy cover and a maintained understory. Recent cutover (dense vegetation).	High Marginal: Non-maintained, dense herbaceous vegetation with either a shrub layer or a tree layer (dbh > 3 inches) present, with <30% tree canopy cover.	Low Marginal: Non-maintained, dense herbaceous vegetation, riparian areas lacking shrub and tree stratum, hay production, ponds, open-water. If present, tree stratum (dbh >3 inches) present, with <30% tree canopy cover with maintained understory.	High Poor: Lawns, mowed, and maintained areas, nurseries; no-till cropland, actively grazed pasture, sparsely vegetated non-maintained area, recently seeded and stabilized, or other comparable condition.	Low Poor: Impervious surfaces, mine spoil lands, denuded surfaces, row crops, active feed lots, trails, or other comparable conditions.
		High	Low	High	Low	High	Low
Condition Scores	1.5	1.2	1.1	0.85	0.75	0.6	0.5

NOTES>> Majority of the impact area is outside of the permanent road, though it does cross perpandicular to the asset. Bed was dry during the early spring. At area of impact, the majority of the canopy is low suboptimal to high marginal, with the right ripairan buffer extends into an impermeable road surface.

1. Delineate riparian areas along each stream bank into Condition Categories and Condition Scores using the descriptors.
2. Determine square footage for each by measuring or estimating length and width. Calculators are provided for you below.
3. Enter the % Riparian Area and Score for each riparian category in the blocks below.

Ensure the sums of % Riparian Blocks equal 100

Right Bank	% Riparian Area>	80%	20%					100%	
	Score >	1.5	1.1						
Left Bank	% Riparian Area>	70%	30%					100%	
	Score >	1.5	1.1						

CI= (Sum % RA * Scores*0.01)/2

Rt Bank CI >	1.06	CI
Lt Bank CI >	1.03	1.04

THE REACH CONDITION INDEX (RCI) >> 0.52

RCI= (Riparian CI)/2

COMPENSATION REQUIREMENT (CR) >> 23

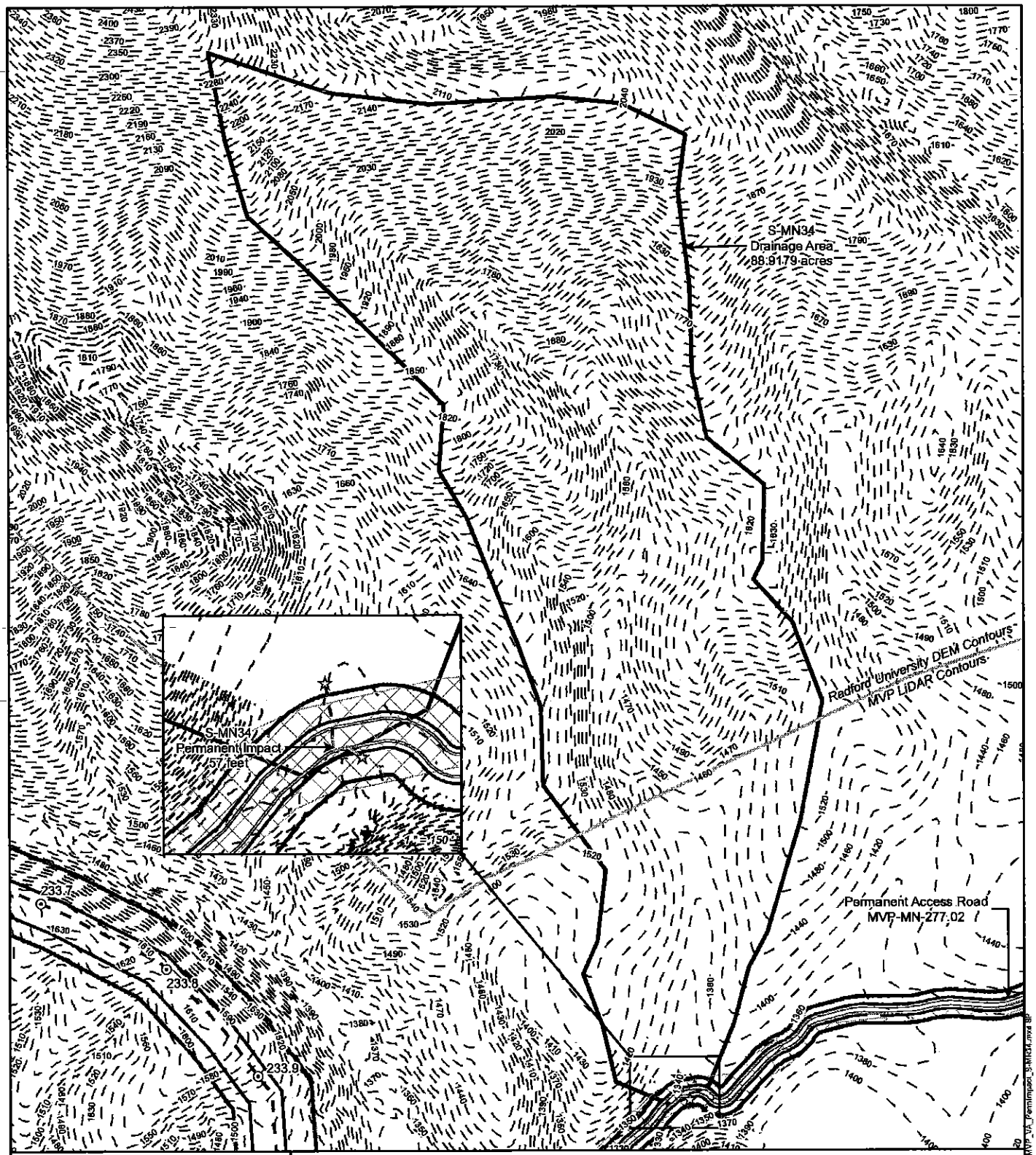
CR = RCI X LF X IF

NOTE: The CIs and RCI should be rounded to 2 decimal places. The CR should be rounded to a whole number.

INSERT PHOTOS:

DESCRIBE PROPOSED IMPACT:

S-MN34



Mountain Valley Pipeline Project

N

NAD 1983 UTM 17N

1 " = 150 '

500 250 0 500 Feet

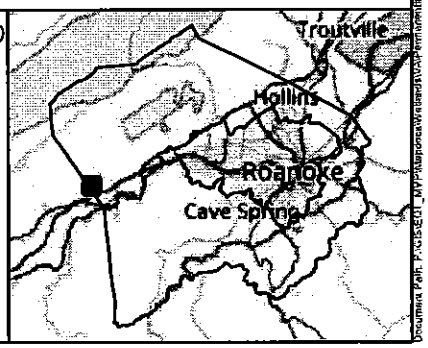
Mountain Valley PIPELINE

Figure 1:
Permanent Impacts for
Stream S-MN34
Roanoke County

SEPTEMBER, 2017

Data Sources: ESRI Streaming Data © 2014
Elevation data derived from LiDAR provided by EQT 2016 and from Radford University DEM files.

- Milepost
- Alignment Centerline
- Access Road Permanent LOD
- Limit of Disturbance
- Preliminary Jurisdictional Determination Boundary
- Unsurveyed Areas
- Unified Stream Method (USM) Survey Reach
- Stream Permanent Impact
- Intermittent Stream
- Drainage Area



Photograph Number: 1 **Feature Name:** S-MN34 **Flow Regime:** Intermittent

Direction: NW **Date:** 6/5/2017

STREAM ID S-MN34	**STREAM NAME** UNT to Roanoke River
CLIENT MVP	**PROJECT NAME** MVP
LAT 37.250481 **LONG** -80.204971	**DATE** 06/05/2017 **COUNTY** Montgomery
INVESTIGATORS S Ryan, S Pilcher	
WATER TYPE TNW ☐ RPW ☑ NRPW ☐	**FLOW REGIME** Perennial ☐ Intermittent ☑ Ephemeral ☐

CHANNEL FEATURES

Estimate Measurements
Top of Bank Width: 5.0 ft
Top of Bank Height:
LB 1.0 ft RB 1.0 ft
Water Depth: 3.00 in
Water Width: 5.0 ft
Ordinary High Water Mark (Width): 4.5 ft
Ordinary High Water Mark (Height): 6.0 in
Flow Direction: Southeast

Sinuosity ✓ Low __ Medium __ High

Gradient __ Flat (0.5/100 ft) ✓ Moderate (2 ft/100 ft) __ Severe (10 ft/100 ft)

Stream Erosion
✓ None __ Moderate __ Heavy

Artificial, Modified or Channelized
__ Yes ✓ No

Within Roadside Ditch
__ Yes ✓ No

Culvert Present __ Yes ✓ No
Culvert Material: _____
Culvert Size: _____ in

FLOW CHARACTERISTICS

Water Present
__ No water, stream bed dry
__ Stream bed moist
__ Standing water
✓ Flowing water

Velocity
__ Fast ✓ Moderate
__ Slow

Proportion of Reach Represented by Stream Morphology Types (Only enter if water present)
Riffle 60 % Run 20 %
Pool 20 %

Turbidity
✓ Clear __ Slightly turbid __ Turbid
__ Other _____

INORGANIC SUBSTRATE COMPONENTS (should add up to 100%) 100			ORGANIC SUBSTRATE COMPONENTS (does not necessarily add up to 100%)		
Substrate Type	Diameter	% Composition in Sampling Reach	Substrate Type	Characteristic	% Composition in Sampling Area
Bedrock			Detritus	sticks, wood, coarse plant materials (CPOM)	10
Boulder	> 256 mm (10")	20			
Cobble	64-256 mm (2.5"-10")	20	Muck-Mud	black, very fine organic (FPOM)	0
Gravel	2-64 mm (0.1"-2.5")	40			
Sand	0.06-2mm (gritty)	20	Marl	grey, shell fragments	0
Silt	0.004-0.06 mm				
Clay	< 0.004 mm (slick)				

WATERSHED FEATURES

Predominant Surrounding Landuse
✓ Forest __ Commercial
__ Field/Pasture __ Industrial
__ Agricultural __ Residential
__ ROW __ Other:

Canopy Cover
__ Open __ Partly shaded
✓ Shaded

Floodplain Width
__ Wide > 30ft __ Moderate 15-30ft
✓ Narrow <15ft

MACROINVERTEBRATES/OTHER WILDLIFE OBSERVED OR OTHER NOTES AND OBSERVATIONS

Stream crosses existing road through eroded depression to join S-MN12.

Stream Assessment Form (Form 1)

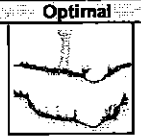
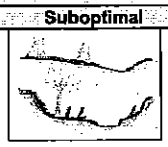
Unified Stream Methodology for use in Virginia

For use in wadeable channels classified as intermittent or perennial

Project/Site	County	City	Date		
Mountain Valley Pipeline	Montgomery	R4SB3	030101010301	06/05/2017	

Assessor Name/Organization	Stream Name and Identification No.
Stephen Ryan, Stephen Pilcher	S-MN34 Intermittent

1. CHANNEL CONDITION – Select the one category that most closely matches the channel condition. Assign a score within the range for that category.

	Optimal	Suboptimal	Marginal	Poor	Severe	
Channel Condition	 Very little incision or active erosion; 80-100% stable banks. Vegetative surface protection or natural rock, prominent (80-100%). AND/OR Stable point bars/bankfull benches are present. Access to their original floodplain or fully developed wide bankfull benches. Mid-channel bars, and transverse bars few. Transient sediment deposition covers less than 10% of bottom.	 Slightly incised, few areas of active erosion or unprotected banks. Majority of banks are stable (60-80%). Vegetative protection or natural rock prominent (60-80%) AND/OR Depositional features contribute to stability. The bankfull and low flow channels are well defined. Stream likely has access to bankfull benches, or newly developed floodplains along portions of the reach. Transient sediment covers 10-40% of the stream bottom.	Often incised, but less than Severe or Poor. Banks more stable than Severe or Poor due to lower bank slopes. Erosion may be present on 40-60% of both banks. Vegetative protection on 40-60% of banks. Streambanks may bevertical or undercut. AND/OR 40-60% of stream is covered by sediment. Sediment may be temporary/transient, contribute instability. Deposition that contribute to stability, may be forming/present. AND/OR V-shaped channels have vegetative protection on > 40% of the banks and depositional features which contribute to stability.	Overwidened/incised. Vertically/laterally unstable. Likely to widen further. Majority of both banks are near vertical. Erosion present on 60-80% of banks. Vegetative protection present on 20-40% of banks, and is insufficient to prevent erosion. AND/OR 60-80% of the stream is covered by sediment. Sediment is temporary/transient in nature, and contributing to instability. AND/OR V-shaped channels have vegetative protection is present on > 40% of the banks and stable sediment deposition is absent.	Deeply incised (or entrenched), vertical/lateral instability. Severe incision, flow contained within the banks. Streambed below average rooting depth, majority of banks vertical/undercut. Vegetative protection present on less than 20% of banks, is not preventing erosion. Obvious bank sloughing present. Erosion/raw banks on 80-100%. AND/OR Aggrading channel. Greater than 80% of stream bed is covered by deposition, contributing to instability. Multiple thread channels and/or subterranean flow.	CI
Score	3	2.4	2	1.6	1	3.0

NOTES>> Little to no incision with apparently stable channel and natural rock stability along majority of banks.

2. RIPARIAN BUFFERS – Select the one category that most closely matches the riparian buffers. Assign a score within the range for that category.

	Optimal	Suboptimal		Marginal		Poor	
Riparian Buffers	Tree stratum (dbh > 3 inches) present, with > 60% tree canopy cover and a non-maintained understory. Wetlands located within the riparian areas.	**High Suboptimal:** Riparian areas with tree stratum (dbh > 3 inches) present, with 30% to 60% tree canopy cover and containing both herbaceous and shrub layers or a non-maintained understory.	**Low Suboptimal:** Riparian areas with tree stratum (dbh > 3 inches) present, with > 30% tree canopy cover and a maintained understory. Recent cutover (dense vegetation).	**High Marginal:** Non-maintained, dense herbaceous vegetation with either a shrub layer or a tree layer (dbh > 3 inches) present, with <30% tree canopy cover.	**Low Marginal:** Non-maintained, dense herbaceous vegetation, riparian areas lacking shrub and tree stratum, hay production, ponds, open water. If present, tree stratum (dbh >3 inches) present, with <30% tree canopy cover with maintained understory.	**High Poor:** Lawns, mowed, and maintained areas, nurseries; no-till cropland; actively grazed pasture, sparsely vegetated non-maintained area, recently seeded and stabilized, or other comparable condition.	**Low Poor:** Impervious surfaces, mine spoil lands, denuded surfaces, row crops, active feed lots, trails, or other comparable conditions.
		High	Low	High	Low	High	Low
Condition Scores	1.5	1.2	1.1	0.85	0.75	0.6	0.5

NOTES>> Riparian area consists primarily of a hardwood canopy with a moderate mid-story and understory. Existing access road crossas stream channel. No culvert present (over-road flow). The percentages described represent the riparian area along the approximately 100ft delineated reach only (90% forest, 10% road)

1. Delineate riparian areas along each stream bank into Condition Categories and Condition Scores using the descriptors.
2. Determine square footage for each by measuring or estimating length and width. Calculators are provided for you below.
3. Enter the % Riparian Area and Score for each riparian category in the blocks below.

Ensure the sums of % Riparian Blocks equal 100

Right Bank	% Riparian Area>	90%	10%					100%
	Score >	1.5	1.1					
Left Bank	% Riparian Area>	90%	10%					100%
	Score >	1.5	1.1					

CI= (Sum % RA * Scores*0.01)/2

Rt Bank CI >	1.13	CI
Lt Bank CI >	1.13	1.13

3. INSTREAM HABITAT/AVAILABLE COVER – Select the one category that most closely matches the instream habitat/available cover. Assign a score within the range for that category.

	Optimal	Suboptimal	Marginal	Poor	
Instream Habitat/ Available Cover	Habitat elements are typically present in greater than 50% of the reach.	Stable habitat elements are typically present in 30-50% of the reach and are adequate for maintenance of populations.	Stable habitat elements are typically present in 10-30% of the reach and are adequate for maintenance of populations.	Habitat elements listed above are lacking or are unstable. Habitat elements are typically present in less than 10% of the reach.	CI
Score	1.5	1.2	0.9	0.5	1.20

NOTES>> Low to moderate riffle/pool complexity. Substrate realtively high in sand but also contains a cobble/gravel/boulder component.

Stream Impact Assessment Form Page 2

	Mountain Valley Pipeline	Montgomery		030101010301	06/05/2017		500	1

NOTES>>
Road crosses unculverted stream channel.

	Conditional Category						
	Negligible	Minor		Moderate		Severe	
Channel Alteration	Channelization, dredging, alteration, or hardening absent. Stream has an unaltered pattern or has naturalized.	Less than 20% of the stream reach is disrupted by any of the channel alterations listed in the parameter guidelines.	20-40% of the stream reach is disrupted by any of the channel alterations listed in the parameter guidelines.	40 - 60% of reach is disrupted by any of the channel alterations listed in the parameter guidelines. If stream has been channelized, normal stable stream meander pattern has not recovered.	60 - 80% of reach is disrupted by any of the channel alterations listed in the parameter guidelines. If stream has been channelized, normal stable stream meander pattern has not recovered.	Greater than 80% of reach is disrupted by any of the channel alterations listed in the parameter guidelines AND/OR 80% of banks shored with gabion, riprap, or cement.	
SCORE	1.5	1.3	1.1	0.9	0.7	0.5	1.10

NOTE: The CIs and RCI should be rounded to 2 decimal places. The CR should be rounded to a whole number.

THE REACH CONDITION INDEX (RCI) >>	1.29

RCI= (Sum of all CI's)/5

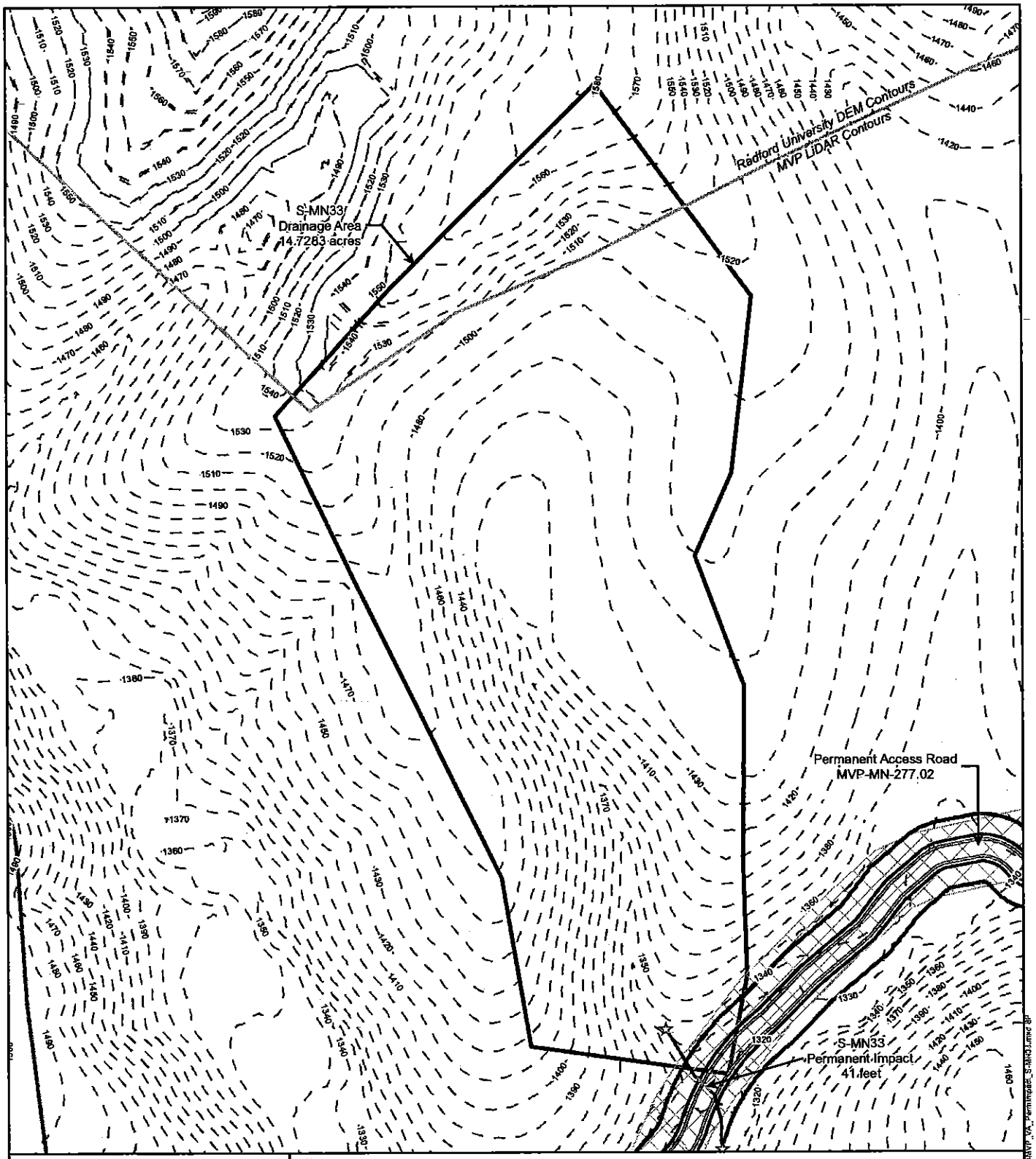
COMPENSATION REQUIREMENT (CR) >>	74

CR = RCI X LF X IF

INSERT PHOTOS:

DESCRIBE PROPOSED IMPACT:

S-MN33



Mountain Valley Pipeline Project

N

NAD 1983 UTM 17N

1 " = 200 '

200 100 0 200 Feet

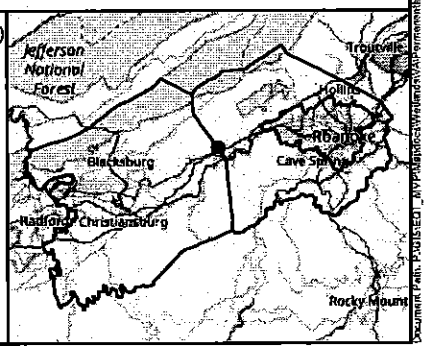
Mountain Valley PIPELINE

Figure 1:
Permanent Impacts for
Stream S-MN32
Roanoke County

SEPTEMBER, 2017

Data Sources: ESRI Streaming Data © 2014
Elevation data derived from LIDAR provided by EQT 2016 and from Radford University DEM files.

- Access Road Permanent LOD
- Limit of Disturbance
- Preliminary Jurisdictional Determination Boundary
- Unsurveyed Areas
- Unified Stream Method (USM) Survey Reach
- Stream Permanent Impact
- Ephemeral Stream
- Drainage Area



Photograph Number: 69 **Feature Name:** S-MN33 **Flow Regime:** Ephemeral

Direction: S **Date:** 6/5/2017

STREAM ID S-MN33	**STREAM NAME** UNT to Roanoke River
CLIENT MVP	**PROJECT NAME** MVP
LAT 37.249537 **LONG** -80.206186	**DATE** 06/05/2017 **COUNTY** Montgomery
INVESTIGATORS S Ryan, S Pilcher	
WATER TYPE TNW ☐ RPW ☐ NRPW ☑	**FLOW REGIME** Perennial ☐ Intermittent ☐ Ephemeral ☑

CHANNEL FEATURES	**Estimate Measurements** Top of Bank Width: 5.0 ft Top of Bank Height: LB 2.0 ft RB 2.0 ft Water Depth: 2.00 in Water Width: 1.0 ft Ordinary High Water Mark (Width): 4.0 ft Ordinary High Water Mark (Height): 6.0 in Flow Direction: Southeast	**Sinuosity** ✓ Low ___ Medium ___ High **Gradient** ___ Flat (0.5/100 ft) ___ Moderate (2 ft/100 ft) ✓ Severe (10 ft/100 ft) **Stream Erosion** ✓ None ___ Moderate ___ Heavy **Artificial, Modified or Channelized** ___ Yes ✓ No **Within Roadside Ditch** ___ Yes ✓ No **Culvert Present** ___ Yes ✓ No Culvert Material: ___ Culvert Size: ___ in
FLOW CHARACTERISTICS	**Water Present** ___ No water, stream bed dry ___ Stream bed moist ___ Standing water ✓ Flowing water **Velocity** ___ Fast ✓ Moderate ___ Slow	**Proportion of Reach Represented by Stream Morphology Types** (Only enter if water present) Riffle 60 % Run 20 % Pool 20 % **Turbidity** ✓ Clear ___ Slightly turbid ___ Turbid ___ Other ___

INORGANIC SUBSTRATE COMPONENTS (should add up to 100%) 100			**ORGANIC SUBSTRATE COMPONENTS (does not necessarily add up to 100%)**		
Substrate Type	Diameter	% Composition in Sampling Reach	Substrate Type	Characteristic	% Composition in Sampling Area
Bedrock		20	Detritus	sticks, wood, coarse plant materials (CPOM)	20
Boulder	> 256 mm (10")	10			
Cobble	64-256 mm (2.5"-10")	10	Muck-Mud	black, very fine organic (FPOM)	0
Gravel	2-64 mm (0.1"-2.5")	40			
Sand	0.06-2mm (gritty)	20	Marl	grey, shell fragments	0
Silt	0.004-0.06 mm				
Clay	< 0.004 mm (slick)				

WATERSHED FEATURES	**Predominant Surrounding Landuse** ✓ Forest ___ Commercial ___ Field/Pasture ___ Industrial ___ Agricultural ___ Residential ___ ROW ___ Other: **Canopy Cover** ___ Open ___ Partly shaded ✓ Shaded	**Floodplain Width** ___ Wide > 30ft ___ Moderate 15-30ft ✓ Narrow <15ft

MACROINVERTEBRATES/OTHER WILDLIFE OBSERVED OR OTHER NOTES AND OBSERVATIONS

Leaf debris suggests recent heavy flow. Stream crosses existing road through eroded depression.

Ephemeral Stream Assessment Form (Form 1a)

Unified Stream Methodology for use in Virginia

For use in ephemeral streams

Project	Project Name	Locality	Watershed	Date	SAR	Impact/SAR Initials	Date
	Mountain Valley Pipeline	Montgomery	R6	030101010301	6/5/17		

Name(s) of Evaluator(s)	Stream Name and Information
Stephen Ryan, Stephen Pilcher	S-MN33 Ephemeral

RIPARIAN BUFFERS

	Conditional Category						
	Optimal	Suboptimal		Marginal		Poor	
Riparian Buffers	Tree stratum (dbh > 3 inches) present, with > 60% tree canopy cover and an non-maintained understory. Wetlands areas.	High Suboptimal: Riparian areas with tree stratum (dbh > 3 inches) present, with 30% to 60% tree canopy cover and containing both herbaceous and shrub layers or a non-maintained understory.	Low Suboptimal: Riparian areas with tree stratum (dbh > 3 inches) present, with >30% tree canopy cover and a maintained understory. Recent cutover (dense vegetation).	High Marginal: Non-maintained, dense herbaceous vegetation with either a shrub layer or a tree layer (dbh > 3 inches) present, with <30% tree canopy cover.	Low Marginal: Non-maintained, dense herbaceous vegetation, riparian areas lacking shrub and tree stratum, hay production, ponds, open water. If present, tree stratum (dbh >3 inches) present, with <30% tree canopy cover with maintained understory.	High Poor: Lawns, mowed, and maintained areas, nurseries; no-till cropland; actively grazed pasture, sparsely vegetated non-maintained area, recently seeded and stabilized, or other comparable condition.	Low Poor: Impervious surfaces, mine spoil lands, denuded surfaces, row crops, active feed lots, trails, or other comparable conditions.
		High	Low	High	Low	High	Low
Condition Scores	1.5	1.2	1.1	0.85	0.75	0.6	0.5

NOTES>>
Riparian area consists primarily of a hardwood canopy with little understory north of access road (score of 1.2). Canopy similar on south side of access road but understory increases (score of 1.1). Existing access road crosses stream channel (score of 0.5). No culvert present (over-road flow).

1. Delineate riparian areas along each stream bank into Condition Categories and Condition Scores using the descriptors.
2. Determine square footage for each by measuring or estimating length and width. Calculators are provided for you below.
3. Enter the % Riparian Area and Score for each riparian category in the blocks below.

Ensure the sums of % Riparian Blocks equal 100

Right Bank	% Riparian Area>	45%	45%	10%				100%
	Score >	1.2	1.1	0.5				
Left Bank	% Riparian Area>	45%	45%	10%				100%
	Score >	1.2	1.1	0.6				

CI= (Sum % RA * Scores*0.01)/2

Rt Bank CI >	1.09	CI
Lt Bank CI >	1.09	1.09

REACH CONDITION INDEX THIS STREAM CONDITION UNITS FOR THIS REACH

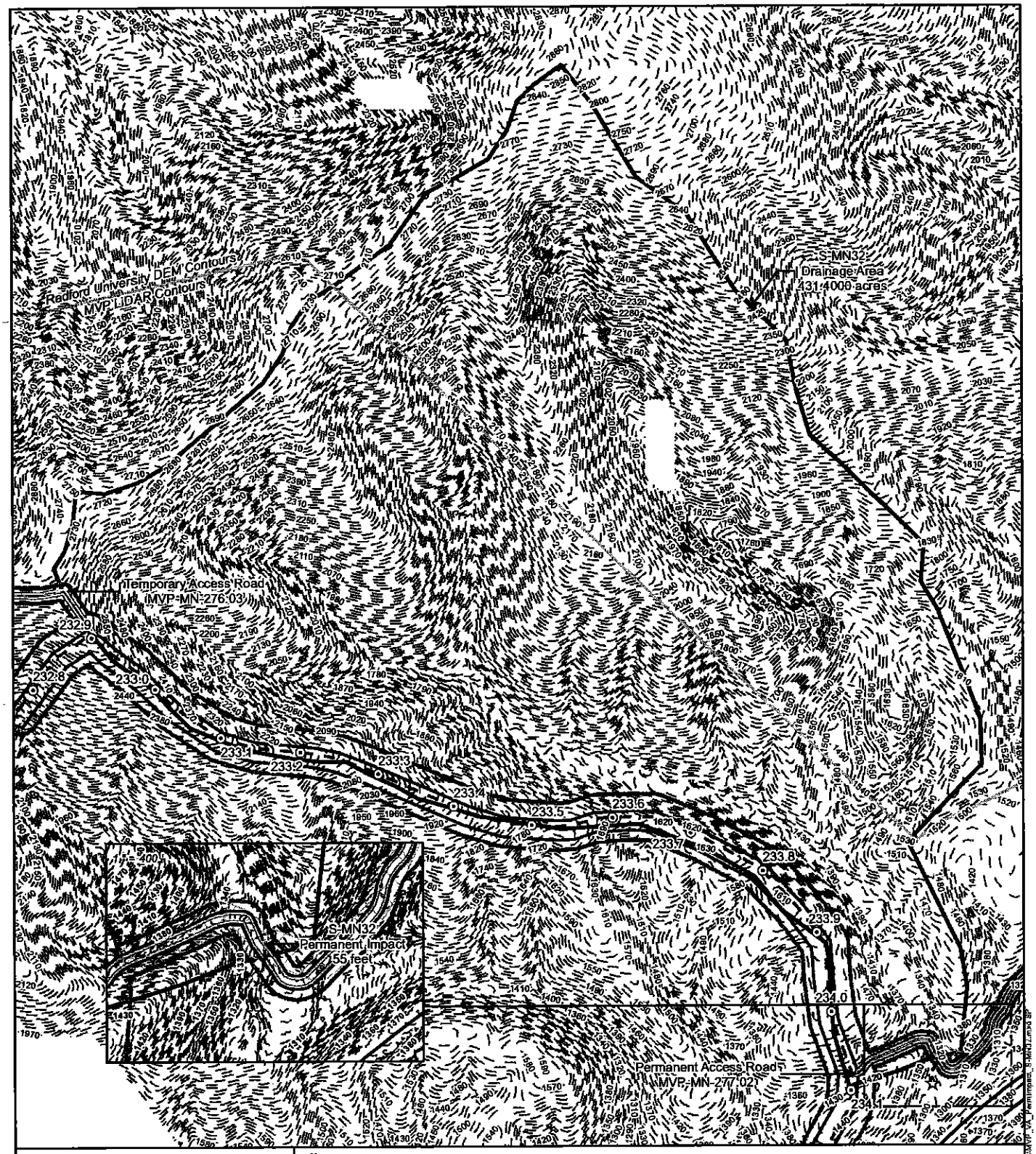
NOTE: The CIs and RCI should be rounded to 2 decimal places. The CR should be rounded to a whole number.

THE REACH CONDITION INDEX (RCI) >>	0.55
RCI= (Riparian CI)/2	
COMPENSATION REQUIREMENT (CR) >>	23
CR = RCI X LF X IF	

INSERT PHOTOS:

DESCRIBE PROPOSED IMPACT:

S-MN32



Mountain Valley Pipeline Project

N

NAD 1983 UTM 17N

1" = 860'

860 430 0 860 Feet

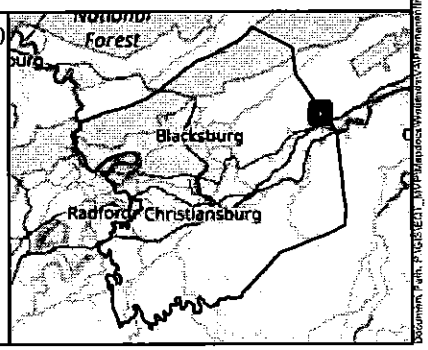
Mountain Valley PIPELINE

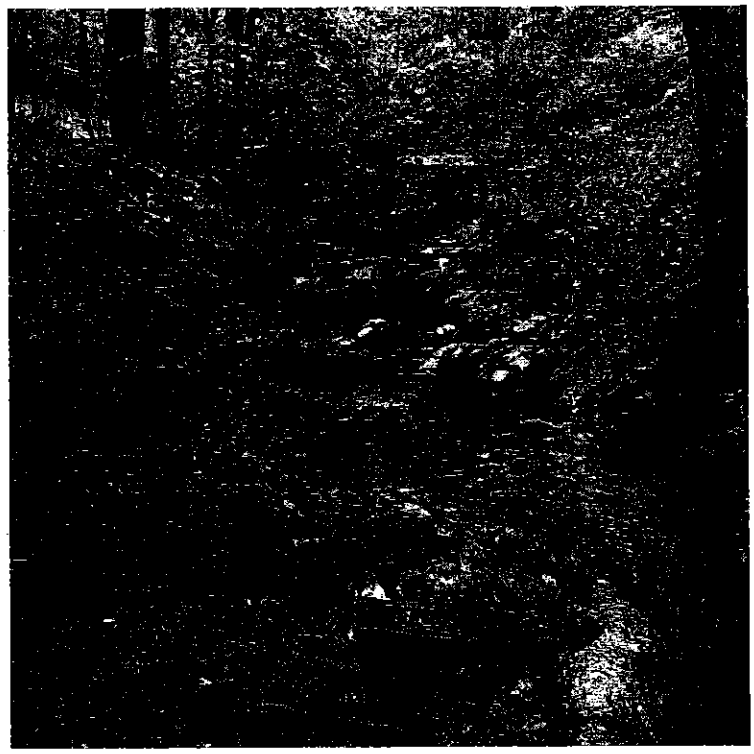
Figure 1:
Permanent Impacts for Stream S-MN32
Montgomery County

SEPTEMBER, 2017

Data Sources: ESRI Streaming Data © 2014
Elevation data derived from LIDAR provided by EQT 2016 and from Radford University DEM files.

- Milepost
- Alignment Centerline
- Access Road Temporary LOD
- Access Road Permanent LOD
- Limit of Disturbance
- Preliminary Jurisdictional Determination Boundary
- Unsurveyed Areas
- Unified Stream Method (USM) Survey Reach
- Stream Permanent Impact
- Perennial Stream
- Drainage Area





Photograph Number: 1 **Feature Name:** S-MN32 **Flow Regime:** Perennial

Direction: N **Date:** 6/5/2017

STREAM ID S-MN32	**STREAM NAME** UNT to Roanoke River
CLIENT MVP	**PROJECT NAME** MVP
LAT 37.248563 **LONG** -80.207761	**DATE** 06/05/2017 **COUNTY** Montgomery
INVESTIGATORS S Ryan, S Pilcher	
WATER TYPE TNW ☐ RPW ☑ NRPW ☐	**FLOW REGIME** Perennial ☑ Intermittent ☐ Ephemeral ☐

CHANNEL FEATURES

Estimate Measurements
Top of Bank Width: 11.0 ft
Top of Bank Height:
LB 3.0 ft RB 3.0 ft
Water Depth: 5.00 in
Water Width: 5.0 ft
Ordinary High Water Mark (Width): 8.0 ft
Ordinary High Water Mark (Height): 8.0 in
Flow Direction: South

Sinuosity ___ Low ✓ Medium ___ High

Gradient ___ Flat (0.5/100 ft) ✓ Moderate (2 ft/100 ft) ___ Severe (10 ft/100 ft)

Stream Erosion
✓ None ___ Moderate ___ Heavy

Artificial, Modified or Channelized
___ Yes ✓ No

Within Roadside Ditch
___ Yes ✓ No

Culvert Present ___ Yes ✓ No
Culvert Material: _____
Culvert Size: _____ in

FLOW CHARACTERISTICS

Water Present
___ No water, stream bed dry
___ Stream bed moist
___ Standing water
✓ Flowing water

Velocity
___ Fast ✓ Moderate
___ Slow

Proportion of Reach Represented by Stream Morphology Types (Only enter if water present)
Riffle 35 % Run 35 %
Pool 30 %

Turbidity
✓ Clear ___ Slightly turbid ___ Turbid
___ Other _____

INORGANIC SUBSTRATE COMPONENTS (should add up to 100%) 100

Substrate Type	Diameter	% Composition in Sampling Reach
Bedrock		25
Boulder	> 256 mm (10")	10
Cobble	64-256 mm (2.5"-10")	25
Gravel	2-64 mm (0.1"-2.5")	25
Sand	0.06-2mm (gritty)	15
Silt	0.004-0.06 mm	
Clay	< 0.004 mm (slick)	

ORGANIC SUBSTRATE COMPONENTS (does not necessarily add up to 100%)

Substrate Type	Characteristic	% Composition in Sampling Area
Detritus	sticks, wood, coarse plant materials (CPOM)	15
Muck-Mud	black, very fine organic (FPOM)	0
Marl	grey, shell fragments	0

WATERSHED FEATURES

Predominant Surrounding Landuse
✓ Forest ___ Commercial
___ Field/Pasture ___ Industrial
___ Agricultural ___ Residential
___ ROW ___ Other:

Canopy Cover
___ Open ___ Partly shaded
✓ Shaded

Floodplain Width
___ Wide > 30ft ___ Moderate 15-30ft
✓ Narrow <15ft

MACROINVERTEBRATES/OTHER WILDLIFE OBSERVED OR OTHER NOTES AND OBSERVATIONS

Stream flows over existing road, which was built up causing a 5' waterfall. Minnows present in stream.

Stream Assessment Form (Form 1)

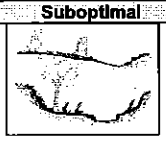
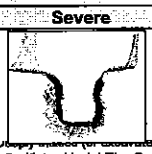
Unified Stream Methodology for use in Virginia

For use in wadeable channels classified as intermittent or perennial

Project/Site	County	Date	Stream Name	Assessment Unit ID	Stream Class	Investigator(s)	Location and Description
Mountain Valley Pipeline	Montgomery	R3UB1	030101010301	-06/05/2017			

Evaluator's Name	Stream Name/Identification
Stephen Ryan, Stephen Pilcher	S-MN32 perennial

Channel Condition — Conditional Category

	Optimal	Suboptimal	Marginal	Poor	Severe	
Channel Condition	Very little incision or active erosion; 80-100% stable banks. Vegetative surface protection or natural rock, prominent (80-100%). AND/OR Stable point bars/bankfull benches are present. Access to their original floodplain or fully developed wide bankfull benches. Mid-channel bars, and transverse bars few. Transient sediment deposition covers less than 10% of bottom.	 Slightly incised, few areas of active erosion or unprotected banks. Majority of banks are stable (60-80%). Vegetative protection or natural rock prominent (60-80%) AND/OR Depositional features contribute to stability. The bankfull and low flow channels are well defined. Stream likely has access to bankfull benches, or newly developed floodplains along portions of the reach. Transient sediment covers 10-40% of the stream bottom.	Often incised, but less than Severe or Poor. Banks more stable than Severe or Poor due to lower bank slopes. Erosion may be present on 40-60% of both banks. Vegetative protection on 40-60% of banks. Streambanks may bevertical or undercut. AND/OR 40-60% of stream is covered by sediment. Sediment may be temporary/transient, contribute instability. Deposition that contribute to stability, may be forming/present. AND/OR V-shaped channels have vegetative protection on > 40% of the banks and depositional features which contribute to stability.	Overwidened/incised. Vertically/laterally unstable. Likely to widen further. Majority of both banks are near vertical. Erosion present on 60-80% of banks. Vegetative protection present on 20-40% of banks, and is insufficient to prevent erosion. AND/OR 60-80% of the stream is covered by sediment. Sediment is temporary/transient in nature, and contributing to instability. AND/OR V-shaped channels have vegetative protection is present on > 40% of the banks and stable sediment deposition is absent.	 Disappeared (or obscured), vertical/lateral instability. Severe incision, flow contained within the banks. Streambed below average rooting depth, majority of banks vertical/undercut. Vegetative protection present on less than 20% of banks, is not preventing erosion. Obvious bank sloughing present. Erosion/raw banks on 80-100%. AND/OR Aggrading channel. Greater than 80% of stream bed is covered by deposition, contributing to instability. Multiple thread channels and/or subterranean flow.	CI
Score	3	2.4	2	1.6	1	3.0

NOTES>> Little to no incision with apparently stable channel and natural rock stability along majority of banks.

Riparian Buffers — Conditional Category

	Optimal	Suboptimal		Marginal		Poor	
Riparian Buffers	Tree stratum (dbh > 3 inches) present, with > 60% tree canopy cover and a non-maintained understory. Wetlands located within the riparian areas.	High Suboptimal: Riparian areas with tree stratum (dbh > 3 inches) present, with 30% to 60% tree canopy cover and containing both herbaceous and shrub layers or a non-maintained understory.	Low Suboptimal: Riparian areas with tree stratum (dbh > 3 inches) present, with > 30% tree canopy cover and a maintained understory. Recent cutover (dense vegetation).	High Marginal: Non-maintained, dense herbaceous vegetation with either a shrub layer or a tree layer (dbh > 3 inches) present, with <30% tree canopy cover.	Low Marginal: Non-maintained, dense herbaceous vegetation, riparian areas lacking shrub and tree stratum, hay production, ponds, open water. If present, tree stratum (dbh >3 inches) present, with <30% tree canopy cover with maintained understory.	High Poor: Lawns, mowed, and maintained areas, nurseries; no-till cropland; actively grazed pasture, sparsely vegetated non-maintained area, recently seeded and stabilized, or other comparable condition.	Low Poor: Impervious surfaces, mine spoil lands, denuded surfaces, row crops, active feed lots, trails, or other comparable conditions.
		High	Low	High	Low	High	Low
Condition Scores	1.5	1.2	1.1	0.85	0.75	0.6	0.5

1. Delineate riparian areas along each stream bank into Condition Categories and Condition Scores using the descriptors.
2. Determine square footage for each by measuring or estimating length and width. Calculators are provided for you below.
3. Enter the % Riparian Area and Score for each riparian category in the blocks below.

Ensure the sums of % Riparian Blocks equal 100

Right Bank	% Riparian Area>	90%	10%						100%
	Score >								
Left Bank	% Riparian Area>	100%							100%
	Score >								

NOTES>> Riparian area consists primarily of a hardwood canopy with a moderate mid-story and understory. Existing access road crosses stream channel. No culvert present (over-road flow). The percentages described represent the riparian area along the approximately 100ft delineated reach only (90% forest, 10% road)

CI= (Sum % RA * Scores*0.01)/2

Rt Bank CI >	1.13	CI
Lt Bank CI >	1.13	1.13

Instream Habitat/ Available Cover — Conditional Category

	Optimal	Suboptimal	Marginal	Poor	
Instream Habitat/ Available Cover	Habitat elements are typically present in greater than 50% of the reach.	Stable habitat elements are typically present in 30-50% of the reach and are adequate for maintenance of populations.	Stable habitat elements are typically present in 10-30% of the reach and are adequate for maintenance of populations.	Habitat elements listed above are lacking or are unstable. Habitat elements are typically present in less than 10% of the reach.	CI
Score	1.5	1.2	0.9	0.5	1.50

NOTES>> Riffle/pool mosaic through most of delineated reach.Habitat elements appear stable and present in greater than 50% of reach.

Stream Impact Assessment Form Page 2

	Mountain Valley Pipeline	Montgomery		030101010301	06/05/2017		500	1

NOTES>>
Road crosses unculverted channel and man-made timber dam present just south of road crossing. Remainder of reach is unaltered.

	Conditional Category						
	Negligible	Minor		Moderate		Severe	
Channel Alteration	Channelization, dredging, alteration, or hardening absent. Stream has an unaltered pattern or has naturalized.	Less than 20% of the stream reach is disrupted by any of the channel alterations listed in the parameter guidelines.	20-40% of the stream reach is disrupted by any of the channel alterations listed in the parameter guidelines.	40 - 60% of reach is disrupted by any of the channel alterations listed in the parameter guidelines. If stream has been channelized, normal stable stream meander pattern has not recovered.	60 - 80% of reach is disrupted by any of the channel alterations listed in the parameter guidelines. If stream has been channelized, normal stable stream meander pattern has not recovered.	Greater than 80% of reach is disrupted by any of the channel alterations listed in the parameter guidelines AND/OR 80% of banks shored with gabion, riprap, or cement.	
SCORE	1.5	1.3	1.1	0.9	0.7	0.5	1.10

NOTE: The CIs and RCI should be rounded to 2 decimal places. The CR should be rounded to a whole number.

THE REACH CONDITION INDEX (RCI) >>	1.35

RCI= (Sum of all CI's)/5

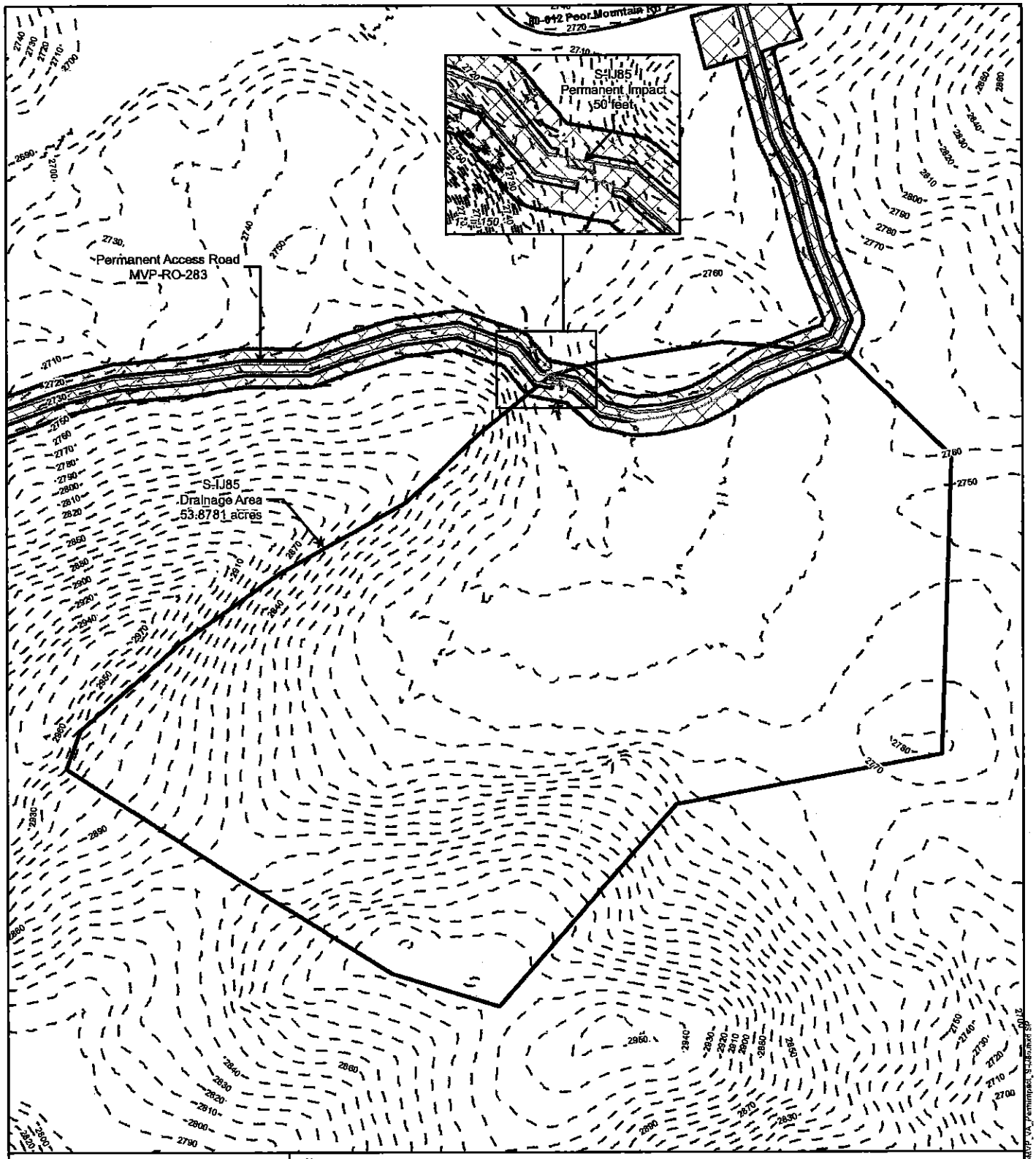
COMPENSATION REQUIREMENT (CR) >>	74

CR = RCI X LF X IF

INSERT PHOTOS:

DESCRIBE PROPOSED IMPACT:

S-IJ85



Mountain Valley Pipeline Project

N

NAD 1983 UTM 17N

1 " = 350 '

350 175 0 350 Feet

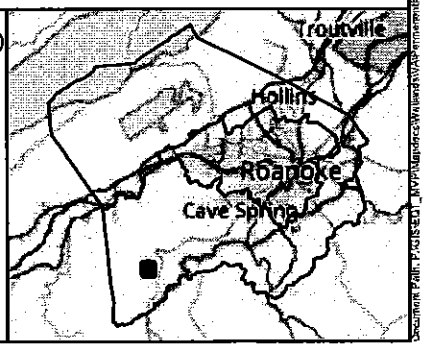
Mountain Valley PIPELINE

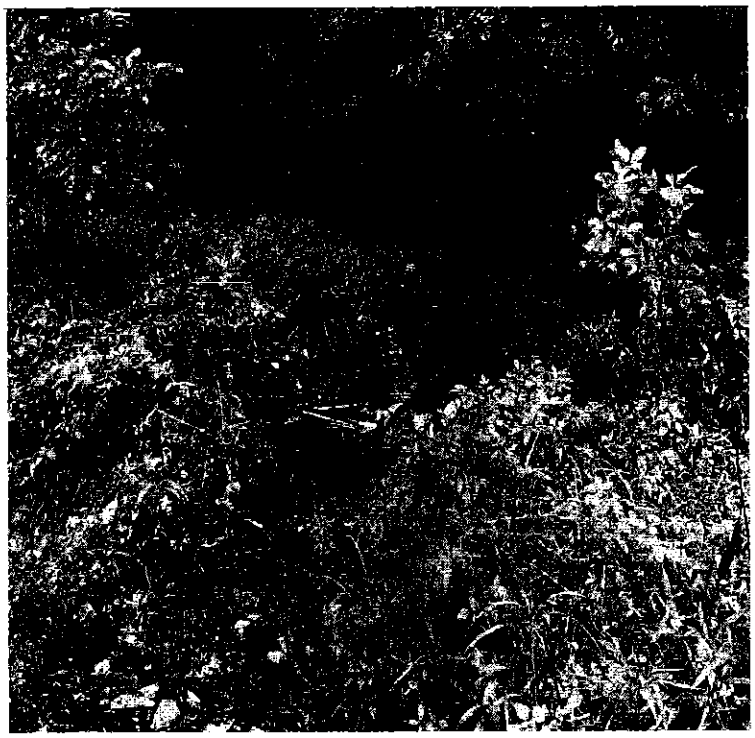
Figure 1:
Permanent Impacts for
Stream S-IJ85
Roanoke County

SEPTEMBER, 2017

Data Sources: ESRI Streaming Data © 2014
Elevation data derived from LIDAR provided by EQT 2016

- Access Road Permanent LOD
- Limit of Disturbance
- Preliminary Jurisdictional Determination Boundary
- Unsurveyed Areas
- Unified Stream Method (USM) Survey Reach
- Stream Permanent Impact
- Perennial Stream
- Drainage Area





Photograph Number: 1 **Feature Name:** S-IJ85 **Flow Regime:** Perennial

Direction: NNW **Date:** 8/29/2017

STREAM ID S-IJ85	**STREAM NAME** UNT to Bottom Creek
CLIENT MVP	**PROJECT NAME** MVP
LAT 37.169583 **LONG** -80.130428	**DATE** 08/29/2017 **COUNTY** Roanoke
INVESTIGATORS E. Foster, K. Pulver, S. Pilcher	
WATER TYPE TNW ☐ RPW ☑ NRPW ☐	**FLOW REGIME** Perennial ☑ Intermittent ☐ Ephemeral ☐

CHANNEL FEATURES	**Estimate Measurements** Top of Bank Width: 8.0 ft Top of Bank Height: LB 1.5 ft RB 1.5 ft Water Depth: 2.00 in Water Width: 4.0 ft Ordinary High Water Mark (Width): 5.0 ft Ordinary High Water Mark (Height): 4.0 in Flow Direction: South	**Sinuosity** __ Low ✓ Medium __ High **Gradient** __ Flat (0.5/100 ft) ✓ Moderate (2 ft/100 ft) __ Severe (10 ft/100 ft) **Stream Erosion** __ None __ Moderate __ Heavy **Artificial, Modified or Channelized** __ Yes ✓ No **Within Roadside Ditch** __ Yes ✓ No **Culvert Present** __ Yes ✓ No Culvert Material: ____ Culvert Size: ____ in
FLOW CHARACTERISTICS	**Water Present** __ No water, stream bed dry __ Stream bed moist __ Standing water ✓ Flowing water **Velocity** __ Fast ✓ Moderate __ Slow	**Proportion of Reach Represented by Stream Morphology Types** (Only enter if water present) Riffle 25 % Run 60 % Pool 15 % **Turbidity** __ Clear ✓ Slightly turbid __ Turbid __ Other ____

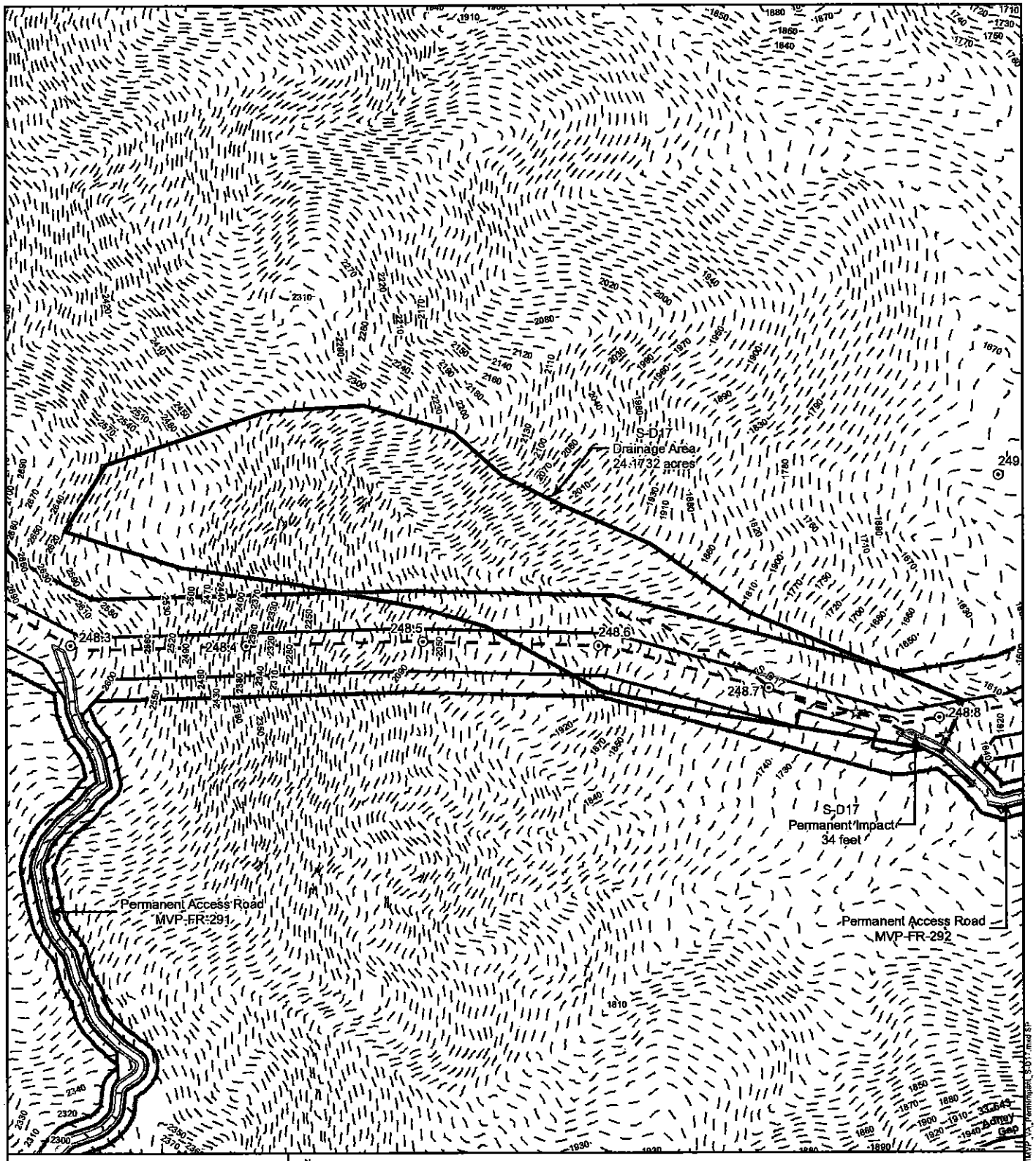
INORGANIC SUBSTRATE COMPONENTS (should add up to 100%) 100			**ORGANIC SUBSTRATE COMPONENTS (does not necessarily add up to 100%)**		
Substrate Type	Diameter	% Composition in Sampling Reach	Substrate Type	Characteristic	% Composition in Sampling Area
Bedrock			Detritus	sticks, wood, coarse plant materials (CPOM)	
Boulder	> 256 mm (10")				
Cobble	64-256 mm (2.5"-10")		Muck-Mud	black, very fine organic (FPOM)	
Grevel	2-64 mm (0.1"-2.5")	20			
Sand	0.06-2mm (gritty)	70	Marl	grey, shell fragments	
Silt	0.004-0.06 mm	10			
Clay	< 0.004 mm (slick)				

WATERSHED FEATURES	**Predominant Surrounding Landuse** ✓ Forest __ Commercial __ Field/Pasture __ Industrial __ Agricultural __ Residential __ ROW ✓ Other: Unimproved road **Canopy Cover** __ Open __ Partly shaded __ Shaded	**Floodplain Width** ✓ Wide > 30ft __ Moderate 15-30ft __ Narrow <15ft

MACROINVERTEBRATES/OTHER WILDLIFE OBSERVED OR OTHER NOTES AND OBSERVATIONS

No macros. Small fish in pools

S-D17



Mountain Valley Pipeline Project

N

NAD 1983 UTM 17N

1 " = 400 '

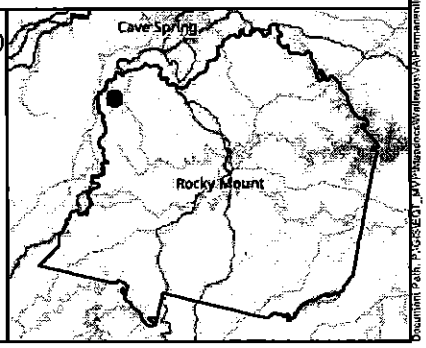
400 200 0 400 Feet

Mountain Valley PIPELINE

Figure 1:
Permanent Impacts for Stream S-D17
Franklin County

SEPTEMBER, 2017

Milepost
Alignment Centerline
Access Road Permanent LOD
Limit of Disturbance
Preliminary Jurisdictional Determination Boundary
Unified Stream Method (USM) Survey Reach
Stream Permanent Impact
Intermittent Stream
Drainage Area



Data Sources: ESRI Streaming Data © 2014
Elevation data derived from LiDAR provided by EQT 2016

Photograph Number: 1 **Feature Name:** S-D17 **Flow Regime:** Intermittent

Direction: SSE **Date:** 4/7/2015

STREAM ID S-D17	**STREAM NAME** UNT to North Fork Blackwater River
LAT 37.121529 **LONG** -80.088575	**DATE** 04/07/2015
CLIENT MVP	**PROJECT NAME** MVP
INVESTIGATORS A. Bensted, J. Kraus, A. Larson	
FLOW REGIME Perennial ___ Intermittent ✓ Ephemeral ___	**WATER TYPE** TNW ___ RPW ✓ NRPW ___

CHANNEL FEATURES

Estimate Measurements
Top of Bank Width: 7 ft
Top of Bank Height:
LB 6.0 in RB 6.0 in
Water Depth: 1.00 in
Water Width: 4.0 ft
High Water Mark: 2.0 in
Flow Direction: Southeast

Stream Erosion
✓ None ___ Moderate ___ Heavy

Artificial, Modified or Channelized
___ Yes ✓ No

Dam Present ___ Yes ✓ No

Sinuosity ___ Low ✓ Medium ___ High

Gradient
___ Flat (0.5/100 ft) ___ Moderate (2 ft/100 ft) ✓ Severe (10 ft/100 ft)

FLOW CHARACTERISTICS

Water Present
___ No water, stream bed dry
___ Stream bed moist
___ Standing water
✓ Flowing water

Velocity
___ Fast ___ Moderate
✓ Slow

Proportion of Reach Represented by Stream Morphology Types
Riffle 100 % Run %
Pool %

Turbidity
✓ Clear ___ Slightly turbid ___ Turbid
___ Opaque ___ Stained
___ Other_____

INORGANIC SUBSTRATE COMPONENTS (should add up to 100%)			ORGANIC SUBSTRATE COMPONENTS (does not necessarily add up to 100%)		
Substrate Type	Diameter	% Composition in Sampling Reach	Substrate Type	Characteristic	% Composition in Sampling Area
Bedrock			Detritus	sticks, wood, coarse plant materials (CPOM)	25
Boulder	> 256 mm (10")	20			
Cobble	64-256 mm (2.5"-10")	20	Muck-Mud	black, very fine organic (FPOM)	
Gravel	2-64 mm (0.1"-2.5")	20			
Sand	0.06-2mm (gritty)	20	Marl	grey, shell fragments	
Silt	0.004-0.06 mm	15			
Clay	< 0.004 mm (slick)	5			

WATERSHED FEATURES

Predominant Surrounding Landuse
✓ Forest ___ Commercial
___ Field/Pasture ___ Industrial
___ Agricultural ___ Residential
___ Other:

Canopy Cover
___ Partly open ✓ Partly shaded
___ Shaded ___ Open

Indicate the dominant type (Check one)
✓ Trees ___ Shrubs
___ Grasses ___ Herbaceous

Floodplain Width
✓ Wide > 30ft ___ Moderate 15-30ft
___ Narrow <16ft

Wetland Present ___ Yes ✓ No
Wetland ID

AQUATIC VEGETATION

Indicate the dominant type and record the dominant species present
___ Rooted emergent ___ Rooted submergent ___ Rooted floating ___ Free floating
___ Floating algae ___ Attached algae

MACROINVERTEBRATES OR OTHER WILDLIFE OBSERVED/OTHER OBSERVATIONS AND NOTES

Stream begins just upslope of project boundary, at a small seep. Water level likely high due to rain the day of the survey. Flow goes subsurface before leaving the project corridor.

Stream Assessment Form (Form 1)

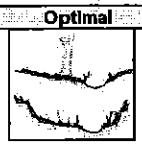
Unified Stream Methodology for use in Virginia

For use in wadeable channels classified as intermittent or perennial

Project	Project Name	County	Watershed Name	Watershed Code	Date	Stream Name	Impact Length
	Mountain Valley Pipeline	Franklin	R4RB3	03010101050 1	11/15/2016		

Assessment Evaluators	Stream Name and Information
J.Cook, E.Foster	S-D17, Franklin County, FR-292

1. Channel Condition — Conditional Category

	Optimal	Suboptimal	Marginal	Poor	Severe	
Channel Condition	 Very little incision or active erosion; 80-100% stable banks. Vegetative surface protection or natural rock, prominent (80-100%). AND/OR Stable point bars/bankfull benches are present. Access to their original floodplain or fully developed wide bankfull benches. Mid-channel bars, and transverse bars few. Transient sediment deposition covers less than 10% of bottom.	Slightly incised, few areas of active erosion or unprotected banks. Majority of banks are stable (60-80%). Vegetative protection or natural rock prominent (60-80%) AND/OR Depositional features contribute to stability. The bankfull and low flow channels are well defined. Stream likely has access to bankfull benches, or newly developed floodplains along portions of the reach. Transient sediment covers 10-40% of the stream bottom.	Often incised, but less than Severe or Poor. Banks more stable than Severe or Poor due to lower bank slopes. Erosion may be present on 40-60% of both banks. Vegetative protection on 40-60% of banks. Streambanks may bevertical or undercut. AND/OR 40-60% of stream is covered by sediment. Sediment may be temporary/transient, contribute instability. Deposition that contribute to stability, may be forming/present. AND/OR V-shaped channels have vegetative protection on > 40% of the banks and depositional features which contribute to stability.	Overwidened/incised. Vertically/laterally unstable. Likely to widen further. Majority of both banks are near vertical. Erosion present on 60-80% of banks. Vegetative protection present on 20-40% of banks, and is insufficient to prevent erosion. AND/OR 60-80% of the stream is covered by sediment. Sediment is temporary/transient in nature, and contributing to instability. AND/OR V-shaped channels have vegetative protection is present on > 40% of the banks and stable sediment deposition is absent.	vertical/lateral instability. Severe incision, flow contained within the banks. Streambed below average rooting depth, majority of banks vertical/undercut. Vegetative protection present on less than 20% of banks, is not preventing erosion. Obvious bank sloughing present. Erosion/raw banks on 80-100%. AND/OR Aggrading channel. Greater than 80% of stream bed is covered by deposition, contributing to instability. Multiple thread channels and/or subterranean flow.	CI
Score	3	2.4	2	1.6	1	1.6

NOTES>> Crossing is eroded portion of the road, water upstream may have gone subsurface.

2. RIPARIAN BUFFERS — Conditional Category

	Optimal	Suboptimal		Marginal		Poor		NOTES>>
Riparian Buffers	Tree stratum (dbh > 3 inches) present, with > 60% tree canopy cover and a non-maintained understory. Wetlands located within the riparian areas.	High Suboptimal: Riparian areas with tree stratum (dbh > 3 inches) present, with 30% to 60% tree canopy cover and containing both herbaceous and shrub layers or a non-maintained understory.	Low Suboptimal: Riparian areas with tree stratum (dbh > 3 inches) present, with > 30% tree canopy cover and a maintained understory. Recent cutover (dense vegetation).	High Marginal: Non-maintained, dense herbaceous vegetation with either a shrub layer or a tree layer (dbh > 3 inches) present, with <30% tree canopy cover.	Low Marginal: Non-maintained, dense herbaceous vegetation, riparian areas lacking shrub and tree stratum, hay production, ponds, open water. If present, tree stratum (dbh >3 inches) present, with <30% tree canopy cover with maintained understory.	High Poor: Lawns, mowed, and maintained areas, nurseries; no-till cropland; actively grazed pasture, sparsely vegetated non-maintained area, recently seeded and stabilized, or other comparable condition.	Low Poor: Impervious surfaces, mine spoil lands, denuded surfaces, row crops, active feed lots, trails, or other comparable conditions.	
		High	Low	High	Low	High	Low	
Condition Scores	1.5	1.2	1.1	0.85	0.75	0.6	0.5	

1. Delineate riparian areas along each stream bank into Condition Categories and Condition Scores using the descriptors.
2. Determine square footage for each by measuring or estimating length and width. Calculators are provided for you below.
3. Enter the % Riparian Area and Score for each riparian category in the blocks below.

Ensure the sums of % Riparian Blocks equal 100

Right Bank	% Riparian Area>	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	100%		
	Score >	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]			
									CI= (Sum % RA * Scores*0.01)/2	
Left Bank	% Riparian Area>	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	100%	Rt Bank CI > 0.83	CI
	Score >	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		Lt Bank CI > 0.83	0.83

3. INSTREAM HABITAT — Conditional Category

	Optimal	Suboptimal	Marginal	Poor	NOTES>>
Instream Habitat/ Available Cover	Habitat elements are typically present in greater than 50% of the reach.	Stable habitat elements are typically present in 30-50% of the reach and are adequate for maintenance of populations.	Stable habitat elements are typically present in 10-30% of the reach and are adequate for maintenance of populations.	Habitat elements listed above are lacking or are unstable. Habitat elements are typically present in less than 10% of the reach.	CI
Score	1.5	1.2	0.9	0.5	0.50

Stream Impact Assessment Form Page 2

[illegible]								
							500	1

CHANNEL ALTERATION [illegible]							NOTES>>	
	Conditional Category							
	Negligible	Minor		Moderate		Severe		
Channel Alteration	Channelization, dredging, alteration, or hardening absent. Stream has an unaltered pattern or has naturalized.	Less than 20% of the stream reach is disrupted by any of the channel alterations listed in the parameter guidelines.	20-40% of the stream reach is disrupted by any of the channel alterations listed in the parameter guidelines.	40 - 60% of reach is disrupted by any of the channel alterations listed in the parameter guidelines. If stream has been channelized, normal stable stream meander pattern has not recovered.	60 - 80% of reach is disrupted by any of the channel alterations listed in the parameter guidelines. If stream has been channelized, normal stable stream meander pattern has not recovered.	Greater than 80% of reach is disrupted by any of the channel alterations listed in the parameter guidelines AND/OR 80% of banks shored with gabion, riprap, or cement.		
SCORE	1.5	1.3	1.1	0.9	0.7	0.5		0.50

[illegible] REACH CONDITION INDEX [illegible] STREAM CONDITION UNITS FOR THIS REACH

NOTE: The CIs and RCI should be rounded to 2 decimal places. The CR should be rounded to a whole number.

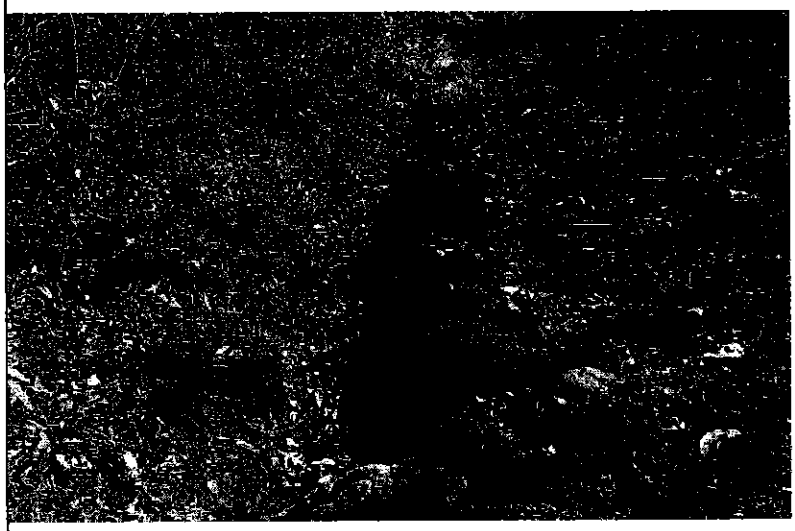
THE REACH CONDITION INDEX (RCI) >>	0.69

RCI= (Sum of all CI's)/5

COMPENSATION REQUIREMENT (CR) >>	23

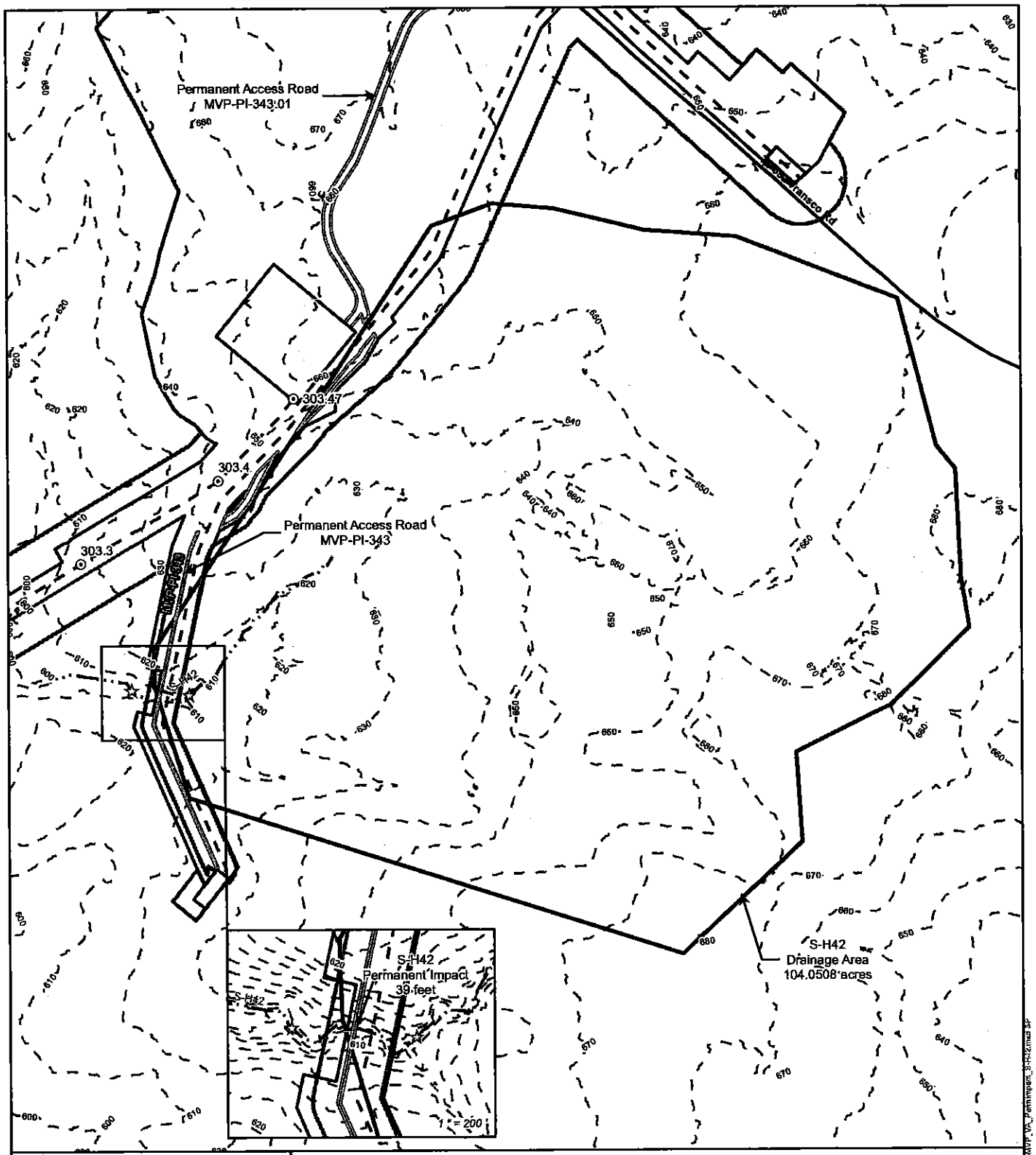
CR = RCI X LF X IF

INSERT PHOTOS:



DESCRIBE PROPOSED IMPACT:

S-H42



Mountain Valley Pipeline Project

N

NAD 1983 UTM 17N

1" = 440'

440 220 0 440 Feet

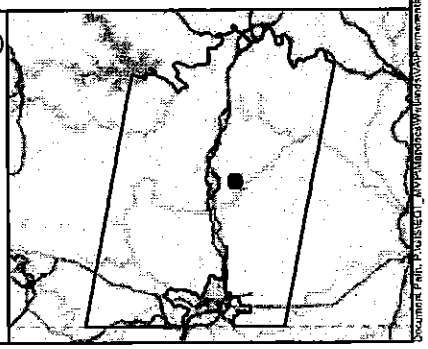
Mountain Valley PIPELINE

Figure 1:
Permanent Impacts for Stream S-H42
Pittsylvania County

SEPTEMBER, 2017

Data Sources: ESRI Streaming Data © 2014
Elevation data derived from LIDAR provided by EQT 2016

- Milepost
- Alignment Centerline
- Permanent Facility
- Access Road Permanent LOD
- Limit of Disturbance
- Preliminary Jurisdictional Determination Boundary
- Unified Stream Method (USM) Survey Reach
- Stream Permanent Impact
- Perennial Stream
- Drainage Area



Photograph Number: 1 **Feature Name:** S-H42 **Flow Regime:** Perennial

Direction: NE **Date:** 4/6/2015

STREAM ID S-H42	**STREAM NAME** UNT to Little Cherrystone Creek
LAT 36.829057 **LONG** -79.343877	**DATE** 04/06/2015
CLIENT MVP	**PROJECT NAME** MVP
INVESTIGATORS A.Stott, A.Grech, H.Heist	
FLOW REGIME Perennial ✔ Intermittent ___ Ephemeral ___	**WATER TYPE** TNW ___ RPW ✔ NRPW ___

CHANNEL FEATURES	**Estimate Measurements** Top of Bank Width: 7.0 ft Top of Bank Height: LB 3.0 ft RB 4.0 ft Water Depth: 4.00 in Water Width: 5.0 ft High Water Mark: 2.0 ft Flow Direction: South	**Stream Erosion** ___ None ✔ Moderate ___ Heavy **Artificial, Modified or Channelized** ___ Yes ✔ No **Dam Present** ___ Yes ✔ No **Sinuosity** ✔ Low ___ Medium ___ High **Gradient** ___ Flat (0.5/100 ft) ✔ Moderate (2 ft/100 ft) ___ Severe (10 ft/100 ft)
FLOW CHARACTERISTICS	**Water Present** ___ No water, stream bed dry ___ Stream bed moist ___ Standing water ✔ Flowing water **Velocity** ___ Fast ✔ Moderate ___ Slow	**Proportion of Reach Represented by Stream Morphology Types** Riffle 25 % Run 25 % Pool 50 % **Turbidity** ___ Clear ✔ Slightly turbid ___ Turbid ___ Opaque ___ Stained ___ Other_____

INORGANIC SUBSTRATE COMPONENTS (should add up to 100%)			ORGANIC SUBSTRATE COMPONENTS (does not necessarily add up to 100%)		
Substrate Type	Diameter	% Composition in Sampling Reach	Substrate Type	Characteristic	% Composition in Sampling Area
Bedrock			Detritus	sticks, wood, coarse plant materials (CPOM)	15
Boulder	> 256 mm (10")	5			
Cobble	64-256 mm (2.5"-10")	5	Muck-Mud	black, very fine organic (FPOM)	0
Gravel	2-64 mm (0.1"-2.5")	10			
Sand	0.06-2mm (gritty)	50	Marl	grey, shell fragments	
Silt	0.004-0.06 mm	15			
Clay	< 0.004 mm (slick)	15			

WATERSHED FEATURES	**Predominant Surrounding Landuse** ✔ Forest ___ Commercial ___ Field/Pasture ___ Industrial ___ Agricultural ___ Residential ✔ Other: **Canopy Cover** ___ Partly open ✔ Partly shaded ___ Shaded ___ Open	**Indicate the dominant type (Check one)** ✔ Trees ___ Shrubs ___ Grasses ___ Herbaceous **Floodplain Width** ___ Wide > 30ft ___ Moderate 15-30ft ✔ Narrow <16ft **Wetland Present** ___ Yes ✔ No **Wetland ID**
AQUATIC VEGETATION	**Indicate the dominant type and record the dominant species present** ___ Rooted emergent ___ Rooted submergent ___ Rooted floating ___ Free floating ___ Floating algae ___ Attached algae	

MACROINVERTEBRATES OR OTHER WILDLIFE OBSERVED/OTHER OBSERVATIONS AND NOTES	

Stream Assessment Form (Form 1)

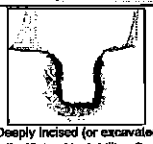
Unified Stream Methodology for use in Virginia

For use in wadeable channels classified as intermittent or perennial

Project/Proposal Name	County	Watershed Name	Watershed Code	Date	Assessment Length	Assessment Reach ID
Mountain Valley Pipeline	Pittsylvania		030101050104	11/16/2016		

Assessors Name/Affiliation	Stream Name/Identifier
J.Cook, E.Foster	S-H42, Permanent Easement (Transco), Perennial

Conditional Category

	Optimal	Suboptimal	Marginal	Poor	Severe	
Channel Condition	Very little incision or active erosion; 80-100% stable banks. Vegetative surface protection or natural rock, prominent (80-100%). AND/OR Stable point bars/bankfull benches are present. Access to their original floodplain or fully developed wide bankfull benches. Mid-channel bars, and transverse bars few. Transient sediment deposition covers less than 10% of bottom.	Slightly incised, few areas of active erosion or unprotected banks. Majority of banks are stable (60-80%). Vegetative protection or natural rock prominent (60-80%) AND/OR Depositional features contribute to stability. The bankfull and low flow channels are well defined. Stream likely has access to bankfull benches, or newly developed floodplains along portions of the reach. Transient sediment covers 10-40% of the stream bottom.	Often incised, but less than Severe or Poor. Banks more stable than Severe or Poor due to lower bank slopes. Erosion may be present on 40-60% of both banks. Vegetative protection on 40-60% of banks. Streambanks may bevertical or undercut. AND/OR 40-60% of stream is covered by sediment. Sediment may be temporary/transient, contribute instability. Deposition that contribute to stability, may be forming/present. AND/OR V-shaped channels have vegetative protection on > 40% of the banks and depositional features which contribute to stability.	Overwidened/incised. Vertically/laterally unstable. Likely to widen further. Majority of both banks are near vertical. Erosion present on 60-80% of banks. Vegetative protection present on 20-40% of banks, and is insufficient to prevent erosion. AND/OR 60-80% of the stream is covered by sediment. Sediment is temporary/transient in nature, and contributing to instability. AND/OR V-shaped channels have vegetative protection is present on > 40% of the banks and stable sediment deposition is absent.	 Deeply incised (or excavated), vertical/lateral instability. Severe incision, flow contained within the banks. Streambed below average rooting depth, majority of banks vertical/undercut. Vegetative protection present on less than 20% of banks, is not preventing erosion. Obvious bank sloughing present. Erosion/raw banks on 80-100%. AND/OR Aggrading channel. Greater than 80% of stream bed is covered by deposition, contributing to instability. Multiple thread channels and/or subterranean flow.	CI
Score	3	2.4	2	1.6	1	2.4

NOTES>> Immature forest, some pine saplings, Dense invasive vegetation, tree of heaven and microstegium vimineum

Conditional Category

	Optimal	Suboptimal		Marginal		Poor		NOTES>>
Riparian Buffers	Tree stratum (dbh > 3 inches) present, with > 60% tree canopy cover and a non-maintained understory. Wetlands located within the riparian areas.	**High Suboptimal:** Riparian areas with tree stratum (dbh > 3 inches) present, with 30% to 60% tree canopy cover and containing both herbaceous and shrub layers or a non-maintained understory.	**Low Suboptimal:** Riparian areas with tree stratum (dbh > 3 inches) present, with > 30% tree canopy cover and a maintained understory. Recent cutover (dense vegetation).	**High Marginal:** Non-maintained, dense herbaceous vegetation with either a shrub layer or a tree layer (dbh > 3 inches) present, with <30% tree canopy cover.	**Low Marginal:** Non-maintained, dense herbaceous vegetation, riparian areas lacking shrub and tree stratum, hay production, ponds, open water. If present, tree stratum (dbh >3 inches) present, with <30% tree canopy cover with maintained understory.	**High Poor:** Lawns, mowed, and maintained areas, nurseries; no-till cropland; actively grazed pasture, sparsely vegetated non-maintained area, recently seeded and stabilized, or other comparable condition.	**Low Poor:** Impervious surfaces, mine spoil lands, denuded surfaces, row crops, active feed lots, trails, or other comparable conditions.	
		High	Low	High	Low	High	Low	
Condition Scores	1.5	1.2	1.1	0.85	0.75	0.6	0.5	

1. Delineate riparian areas along each stream bank into Condition Categories and Condition Scores using the descriptors.
2. Determine square footage for each by measuring or estimating length and width. Calculators are provided for you below.
3. Enter the % Riparian Area and Score for each riparian category in the blocks below.

Ensure the sums of % Riparian Blocks equal 100

Right Bank	% Riparian Area>								100%
	Score >								
Left Bank	% Riparian Area>								100%
	Score >								

CI= (Sum % RA * Scores*0.01)/2

Rt Bank CI >	1.50	CI
Lt Bank CI >	1.50	1.50

Conditional Category

	Optimal	Suboptimal	Marginal	Poor	NOTES>>	
Instream Habitat/ Available Cover	Habitat elements are typically present in greater than 50% of the reach.	Stable habitat elements are typically present in 30-50% of the reach and are adequate for maintenance of populations.	Stable habitat elements are typically present in 10-30% of the reach and are adequate for maintenance of populations.	Habitat elements listed above are lacking or are unstable. Habitat elements are typically present in less than 10% of the reach.	Undercut banks and roots, stable. Varied water velocity and depths. Riffle-pool complexes.	CI
Score	1.5	1.2	0.9	0.5		1.50

Stream Impact Assessment Form Page 2

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
							500	1

[illegible]

No current channel alterations.

	Conditional Category						
	Negligible	Minor		Moderate		Severe	
Channel Alteration	Channelization, dredging, alteration, or hardening absent. Stream has an unaltered pattern or has naturalized.	Less than 20% of the stream reach is disrupted by any of the channel alterations listed in the parameter guidelines.	20-40% of the stream reach is disrupted by any of the channel alterations listed in the parameter guidelines.	40 - 60% of reach is disrupted by any of the channel alterations listed in the parameter guidelines. If stream has been channelized, normal stable stream meander pattern has not recovered.	60 - 80% of reach is disrupted by any of the channel alterations listed in the parameter guidelines. If stream has been channelized, normal stable stream meander pattern has not recovered.	Greater than 80% of reach is disrupted by any of the channel alterations listed in the parameter guidelines AND/OR 80% of banks shored with gabion, riprap, or cement.	
SCORE	1.5	1.3	1.1	0.9	0.7	0.5	1.50

[illegible]

NOTE: The CIs and RCI should be rounded to 2 decimal places. The CR should be rounded to a whole number.

THE REACH CONDITION INDEX (RCI) >>	1.38

RCI= (Sum of all CI's)/5

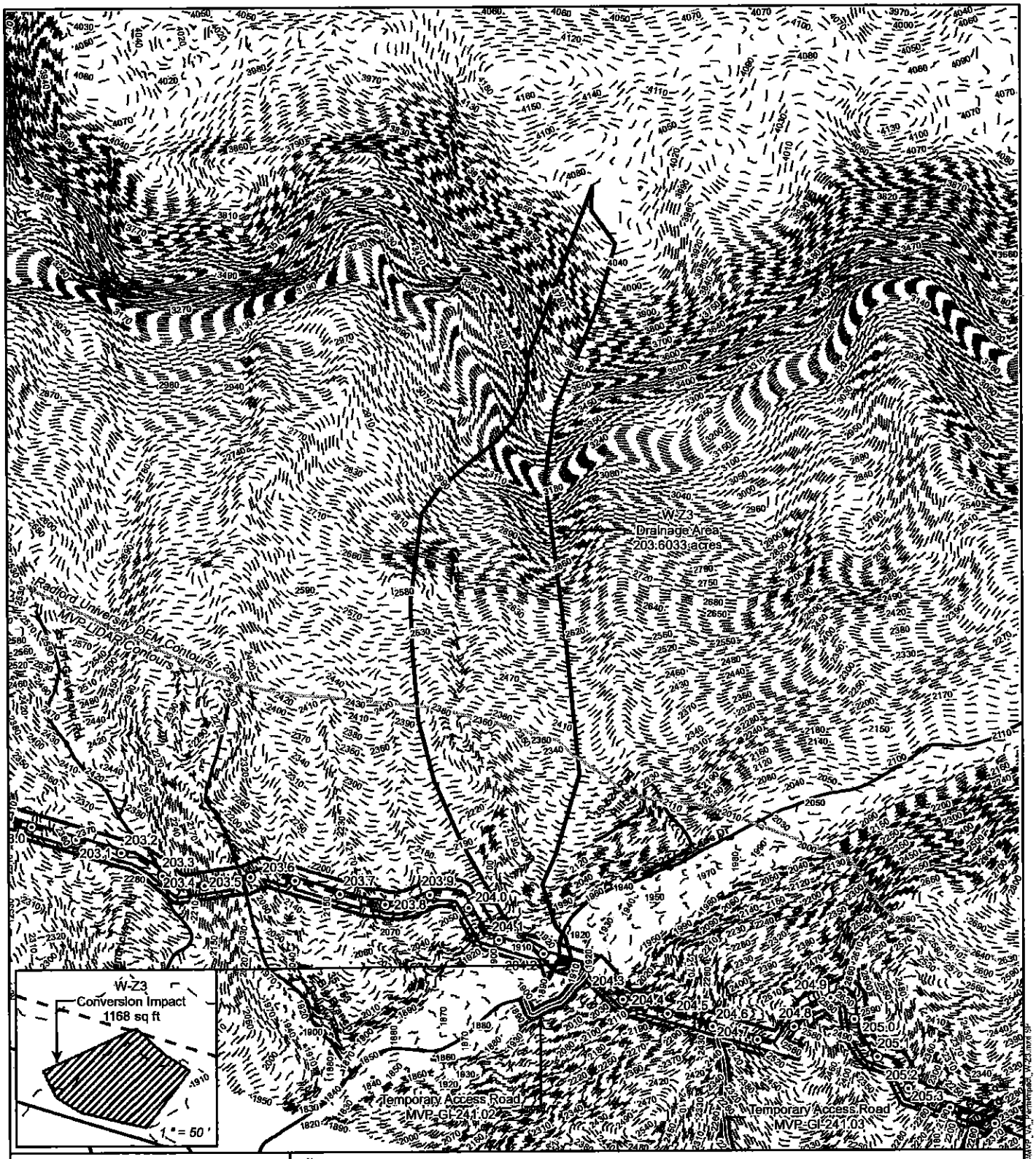
COMPENSATION REQUIREMENT (CR) >>	54

CR = RCI X LF X IF

INSERT PHOTOS:

DESCRIBE PROPOSED IMPACT:

W-Z3



Mountain Valley Pipeline Project

N

NAD 1983 UTM 17N

1 " = 1,500 '

1,500 750 0 1,500 Feet

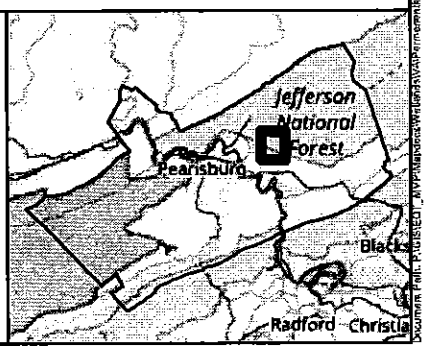
Mountain Valley PIPELINE

Figure 1:
Permanent Impacts for Wetland W-Z3
Giles County

SEPTEMBER, 2017

Milepost
Alignment Centerline
Access Road Temporary LOD
Limit of Disturbance
Preliminary Jurisdictional Determination Boundary

Drainage Area
PSS Wetland
Wetland Impact
Conversion



Data Sources: ESRI Streaming Data © 2014
Elevation data derived from LiDAR provided by EQT 2016 and from Radford University DEM files.

Photograph Number: 10 **Feature Name:** W-Z3 **Cowardin Class:** PSS

Direction: NNE **Date:** 7/12/2015

WETLAND DETERMINATION DATA FORM – Eastern Mountains and Piedmont Region

Project/Site: MVP City/County: Giles Sampling Date: 07/12/2015

Applicant/Owner: MVP State: VA Sampling Point: W-Z3

Investigator(s): SET, SJT, DM Section, Township, Range: N/A

Landform (hillslope, terrace, etc.): hill-slope Local relief (concave, convex, none): Concave Slope (%): 3-5%

Subregion (LRR or MLRA): LRRN Lat: 37.342235 Long: -80.620665 Datum: NAD 83

Soil Map Unit Name: 30C - Nolichucky very stony sandy loam, 7 to 15 percent slopes NWI classification: None

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✔ No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes ✔ No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ✔	No ____
Hydric Soil Present?	Yes ✔	No ____
Wetland Hydrology Present?	Yes ✔	No ____

Is the Sampled Area within a Wetland? Yes ✔ No ____

Remarks:
Cowardin Code:PSS
HGM: Riverine
WT: RPWWD

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ✔ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ True Aquatic Plants (B14)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Sparsely Vegetated Concave Surface (B8)
- ✔ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ✔ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ____	No ✔	Depth (inches): ____
Water Table Present?	Yes ✔	No ____	Depth (inches): 16"
Saturation Present? (includes capillary fringe)	Yes ✔	No ____	Depth (inches): 6"

Wetland Hydrology Present? Yes ✔ No ____

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Four Strata) – Use scientific names of plants. Sampling Point: W-Z3

Tree Stratum (Plot size: 30')	Absolute % Cover	Dominant Species?	Indicator Status
1. Acer saccharum	10	✔	FACU
2.			
3.			
4.			
5.			
6.			
7.			
	10 = Total Cover		
50% of total cover: 5	20% of total cover: 2		

Sapling/Shrub Stratum (Plot size: 15')			
1. Lindera benzoin	40	✔	FAC
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
	40 = Total Cover		
50% of total cover: 20	20% of total cover: 8		

Herb Stratum (Plot size: 5')			
1. Carex vulpinoidea	20	✔	OBL
2. Impatiens capensis	5		FACW
3. Leersia oryzoides	5		OBL
4. Athyrium filix-femina	5		UPL
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	35 = Total Cover		
50% of total cover: 17.5	20% of total cover: 7		

Woody Vine Stratum (Plot size: 15')			
1.			
2.			
3.			
4.			
5.			
	0 = Total Cover		
50% of total cover: 0	20% of total cover: 0		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 3 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 75 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species		x 1 =
FACW species		x 2 =
FAC species		x 3 =
FACU species		x 4 =
UPL species		x 5 =
Column Totals:	(A)	(B)

Prevalence Index = B/A =

Hydrophytic Vegetation Indicators:

- ___ 1 - Rapid Test for Hydrophytic Vegetation
- ✔ 2 - Dominance Test is >50%
- ___ 3 - Prevalence Index is ≤3.0[1]
- ___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Four Vegetation Strata:

Tree – Woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/Shrub – Woody plants, excluding vines, less than 3 in. DBH and greater than or equal to 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vine – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? Yes ✔ No ___

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point: W-Z3

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-3	7.5YR 3/2	90	7.5YR 4/6	10	C	M	SL	
4-16	10YR 3/2	95	5YR 4/4	5	C	M	SL	Gravelly

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ 2 cm Muck (A10) **(LRR N)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1) **(LRR N, MLRA 147, 148)**
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7)
- ___ Polyvalue Below Surface (S8) **(MLRA 147, 148)**
- ___ Thin Dark Surface (S9) **(MLRA 147, 148)**
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ✔ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Iron-Manganese Masses (F12) **(LRR N, MLRA 136)**
- ___ Umbric Surface (F13) **(MLRA 136, 122)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 148)**
- ___ Red Parent Material (F21) **(MLRA 127, 147)**

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) **(MLRA 147)**
- ___ Coast Prairie Redox (A16) **(MLRA 147, 148)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 136, 147)**
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

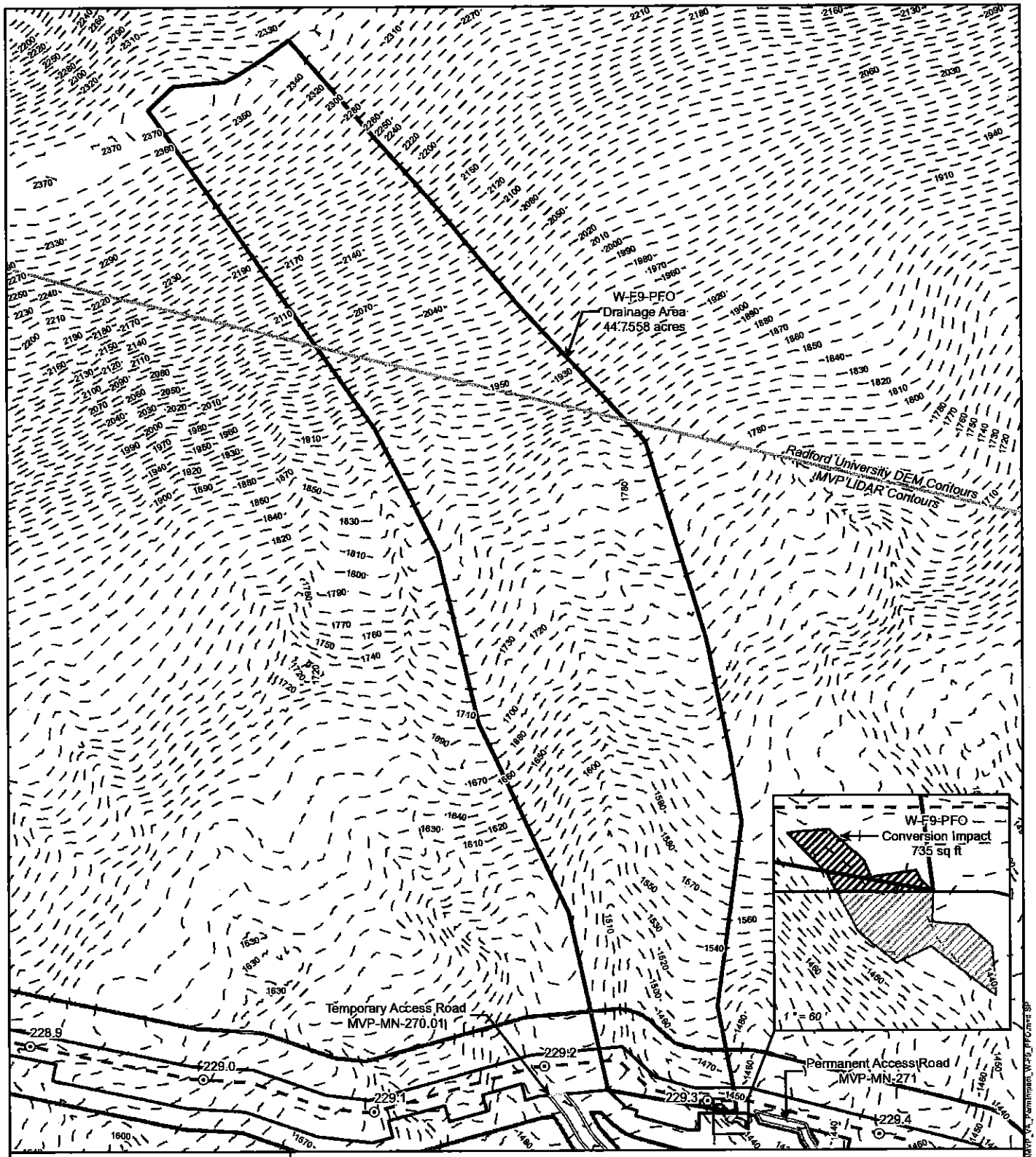
Type: Cobbles

Depth (inches): 16"

Hydric Soil Present? Yes ✔ No ___

Remarks:

W-F9-PFO



Mountain Valley Pipeline Project

N

NAD 1983 UTM 17N

1" = 400'

400 200 0 400 Feet

Mountain Valley PIPELINE

Figure 1:
Permanent Impacts for Wetland W-F9-PFO
Montgmery County

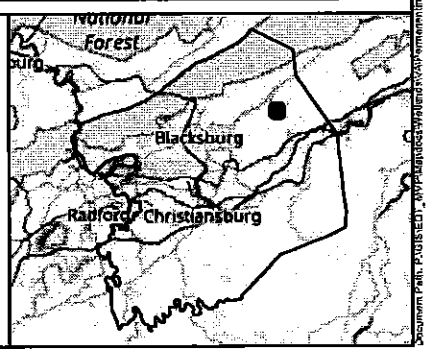
SEPTEMBER, 2017

Data Sources: ESRI Streaming Data © 2014
Elevation data derived from LIDAR provided by EQT 2016 and from Radford University DEM files.

- Milepost
- Alignment Centerline
- Access Road Temporary LOD
- Access Road Permanent LOD
- Limit of Disturbance
- Preliminary Jurisdictional Determination Boundary
- Drainage Area
- PFO Wetland

Wetland Impact

- Conversion



Photograph Number: 9 **Feature Name:** W-F9 **Cowardin Class:** PFO

Direction: WNW **Date:** 4/8/2015

WETLAND DETERMINATION DATA FORM – Eastern Mountains and Piedmont Region

Project/Site: MVP City/County: Montgomery Sampling Date: 04/08/2015

Applicant/Owner: MVP State: VA Sampling Point: W-F9-PFO

Investigator(s): E. Stromhaier, D. McCullough, A. Flake Section, Township, Range: N/A

Landform (hillslope, terrace, etc.): Terrace Local relief (concave, convex, none): none Slope (%): 0

Subregion (LRR or MLRA): LRRN Lat: 37.258049 Long: -80.285880 Datum: NAD 83

Soil Map Unit Name: Berks and Weikert soils, 25 to 65 percent slopes NWI classification: None

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✔ No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes ✔ No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ✔	No ____
Hydric Soil Present?	Yes ✔	No ____
Wetland Hydrology Present?	Yes ✔	No ____

Is the Sampled Area within a Wetland? Yes ✔ No ____

Remarks:
Cowardin Code: PFO
HGM: riverine flow-through
WT: RPWWD

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ✔ High Water Table (A2)
- ✔ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ True Aquatic Plants (B14)
- ___ Hydrogen Sulfide Odor (C1)
- ✔ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ✔ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ✔ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ____	No ✔	Depth (inches): ____
Water Table Present?	Yes ✔	No ____	Depth (inches): 0
Saturation Present? (includes capillary fringe)	Yes ✔	No ____	Depth (inches): 0

Wetland Hydrology Present? Yes ✔ No ____

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:
Wetland plot on vegetated ground in an area of braided small stream channels. Plot area includes braided channels with shallow flowing about 25% of area of the plot.

VEGETATION (Four Strata) – Use scientific names of plants. Sampling Point: W-F9-PFO

Tree Stratum (Plot size: 30')	Absolute % Cover	Dominant Species?	Indicator Status
1. Quercus bicolor	50	✔	FACW
2.			
3.			
4.			
5.			
6.			
7.			
	50 = Total Cover		
50% of total cover: 25	20% of total cover: 10		

Sapling/Shrub Stratum (Plot size: 15')			
1. Lindera benzoin	30	✔	FAC
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
	30 = Total Cover		
50% of total cover: 15	20% of total cover: 6		

Herb Stratum (Plot size: 5')			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	0 = Total Cover		
50% of total cover: 0	20% of total cover: 0		

Woody Vine Stratum (Plot size: 15')			
1.			
2.			
3.			
4.			
5.			
	0 = Total Cover		
50% of total cover: 0	20% of total cover: 0		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index worksheet:

Total % Cover of:	Multiply by:
OBL species	x 1 =
FACW species	x 2 =
FAC species	x 3 =
FACU species	x 4 =
UPL species	x 5 =
Column Totals: (A)	(B)

Prevalence Index = B/A =

Hydrophytic Vegetation Indicators:

- ___ 1 - Rapid Test for Hydrophytic Vegetation
- ✔ 2 - Dominance Test is >50%
- ___ 3 - Prevalence Index is ≤3.0[1]
- ___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Four Vegetation Strata:

Tree – Woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/Shrub – Woody plants, excluding vines, less than 3 in. DBH and greater than or equal to 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vine – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? Yes ✔ No ___

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL Sampling Point: W-F9-PFO

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-15"	10YR 3/2	80	5YR 4/6	20	C	M/PL	SiLo	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ 2 cm Muck (A10) **(LRR N)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1) **(LRR N, MLRA 147, 148)**
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7)
- ___ Polyvalue Below Surface (S8) **(MLRA 147, 148)**
- ___ Thin Dark Surface (S9) **(MLRA 147, 148)**
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ✔ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Iron-Manganese Masses (F12) **(LRR N, MLRA 136)**
- ___ Umbric Surface (F13) **(MLRA 136, 122)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 148)**
- ___ Red Parent Material (F21) **(MLRA 127, 147)**

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) **(MLRA 147)**
- ___ Coast Prairie Redox (A16) **(MLRA 147, 148)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 136, 147)**
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

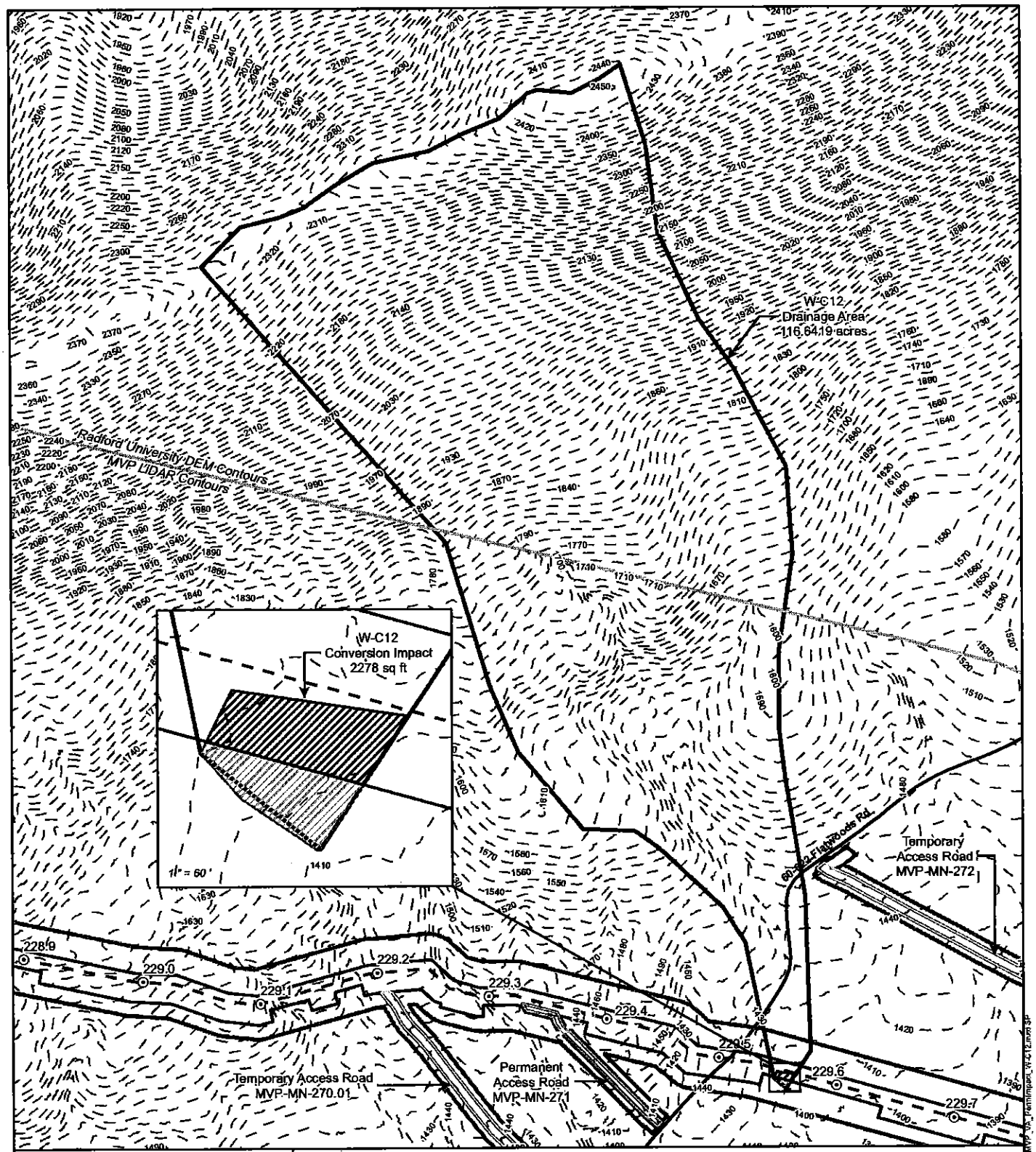
Type: 15

Depth (inches): Rocks

Hydric Soil Present? Yes ✔ No ___

Remarks:

W-C12



Mountain Valley Pipeline Project

N

NAD 1983 UTM 17N

1" = 580'

580 290 0 580 Feet

Mountain Valley PIPELINE

Figure 1:
Permanent Impacts for Wetland W-C12
Montgomery County

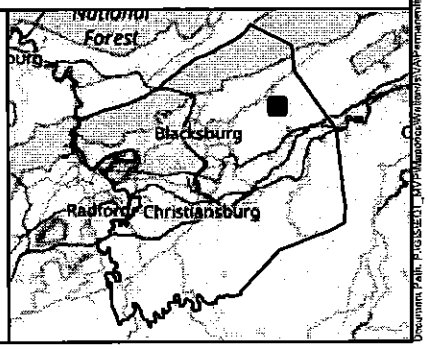
SEPTEMBER, 2017

Data Sources: ESRI Streaming Data © 2014
Elevation data derived from LIDAR provided by EQT 2016 and from Radford University DEM files.

- Milepost
- Alignment Centerline
- Access Road Temporary LOD
- Access Road Permanent LOD
- Limit of Disturbance
- Preliminary Jurisdictional Determination Boundary
- Drainage Area
- PFO Wetland

Wetland Impact

- Conversion



Photograph Number: 14 **Feature Name:** W-C12 **Cowardin Class:** PFO

Direction: ESE **Date:** 4/8/2015

WETLAND DETERMINATION DATA FORM – Eastern Mountains and Piedmont Region

Project/Site: MVP City/County: Montgomery Sampling Date: 04/09/2015

Applicant/Owner: MVP State: VA Sampling Point: W-C12

Investigator(s): L.Harloe, K.Lamontagne, L. Summers Section, Township, Range: N/A

Landform (hillslope, terrace, etc.): Floodplain Local relief (concave, convex, none): Concave Slope (%): 2

Subregion (LRR or MLRA): LRRN Lat: 37.257125 Long: -80.281757 Datum: NAD 83

Soil Map Unit Name: McGary and Purdy soils NWI classification: None

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✔ No ____ (If no, explain in Remarks.)

Are Vegetation ✔, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes ✔ No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any-answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ✔	No ____	**Is the Sampled Area within a Wetland?** Yes ✔ No ____
Hydric Soil Present?	Yes ✔	No ____	
Wetland Hydrology Present?	Yes ✔	No ____	

Remarks:
Cowardin Code:PFO
HGM:Riverine flow through
WT:RPWWD
Part of wetland complex including W-C10, W-C11, and W-C12

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ✔ High Water Table (A2)
- ✔ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ True Aquatic Plants (B14)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ✔ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ✔ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ____	No ✔	Depth (inches): ____
Water Table Present?	Yes ✔	No ____	Depth (inches): 2
Saturation Present? (includes capillary fringe)	Yes ✔	No ____	Depth (inches): 2

Wetland Hydrology Present? Yes ✔ No ____

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:
Adjacent to PEM. Adjacent to powerline ROW, abundant down trees. Heavy rain overnight could contribute to hydrology. Spring peepers heard.

VEGETATION (Four Strata) – Use scientific names of plants. Sampling Point: W-C12

Tree Stratum (Plot size: 30')	Absolute % Cover	Dominant Species?	Indicator Status
1. Quercus bicolor	40	✔	FACW
2.			
3.			
4.			
5.			
6.			
7.			
	40 = Total Cover		
50% of total cover: 20	20% of total cover: 8		

Sapling/Shrub Stratum (Plot size: 15')			
1. Acer rubrum	30	✔	FAC
2. Lindera benzoin	10	✔	FAC
3.			
4.			
5.			
6.			
7.			
8.			
9.			
	40 = Total Cover		
50% of total cover: 20	20% of total cover: 8		

Herb Stratum (Plot size: 5')			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	0 = Total Cover		
50% of total cover: 0	20% of total cover: 0		

Woody Vine Stratum (Plot size: 15')			
1. Lonicera japonica	15	✔	FAC
2. Smilix rotundifolia	5	✔	FAC
3.			
4.			
5.			
	20 = Total Cover		
50% of total cover: 10	20% of total cover: 4		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 5 (A)

Total Number of Dominant Species Across All Strata: 5 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species		x 1 =
FACW species		x 2 =
FAC species		x 3 =
FACU species		x 4 =
UPL species		x 5 =
Column Totals:	(A)	(B)

Prevalence Index = B/A =

Hydrophytic Vegetation Indicators:

- ___ 1 - Rapid Test for Hydrophytic Vegetation
- ✔ 2 - Dominance Test is >50%
- ___ 3 - Prevalence Index is ≤3.0[1]
- ___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Four Vegetation Strata:

Tree – Woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/Shrub – Woody plants, excluding vines, less than 3 in. DBH and greater than or equal to 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vine – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? Yes ✔ No ___

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point: W-C12

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-6"	10YR5/2	90	10YR6/8	10	C	M	SiL	
6-20"	7.5YR7/2	90	7.5YR6/8	10	C	M	SiL	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ✔ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ 2 cm Muck (A10) **(LRR N)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1) **(LRR N, MLRA 147, 148)**
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7)
- ___ Polyvalue Below Surface (S8) **(MLRA 147, 148)**
- ___ Thin Dark Surface (S9) **(MLRA 147, 148)**
- ___ Loamy Gleyed Matrix (F2)
- ✔ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Iron-Manganese Masses (F12) **(LRR N, MLRA 136)**
- ___ Umbric Surface (F13) **(MLRA 136, 122)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 148)**
- ___ Red Parent Material (F21) **(MLRA 127, 147)**

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) **(MLRA 147)**
- ___ Coast Prairie Redox (A16) **(MLRA 147, 148)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 136, 147)**
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

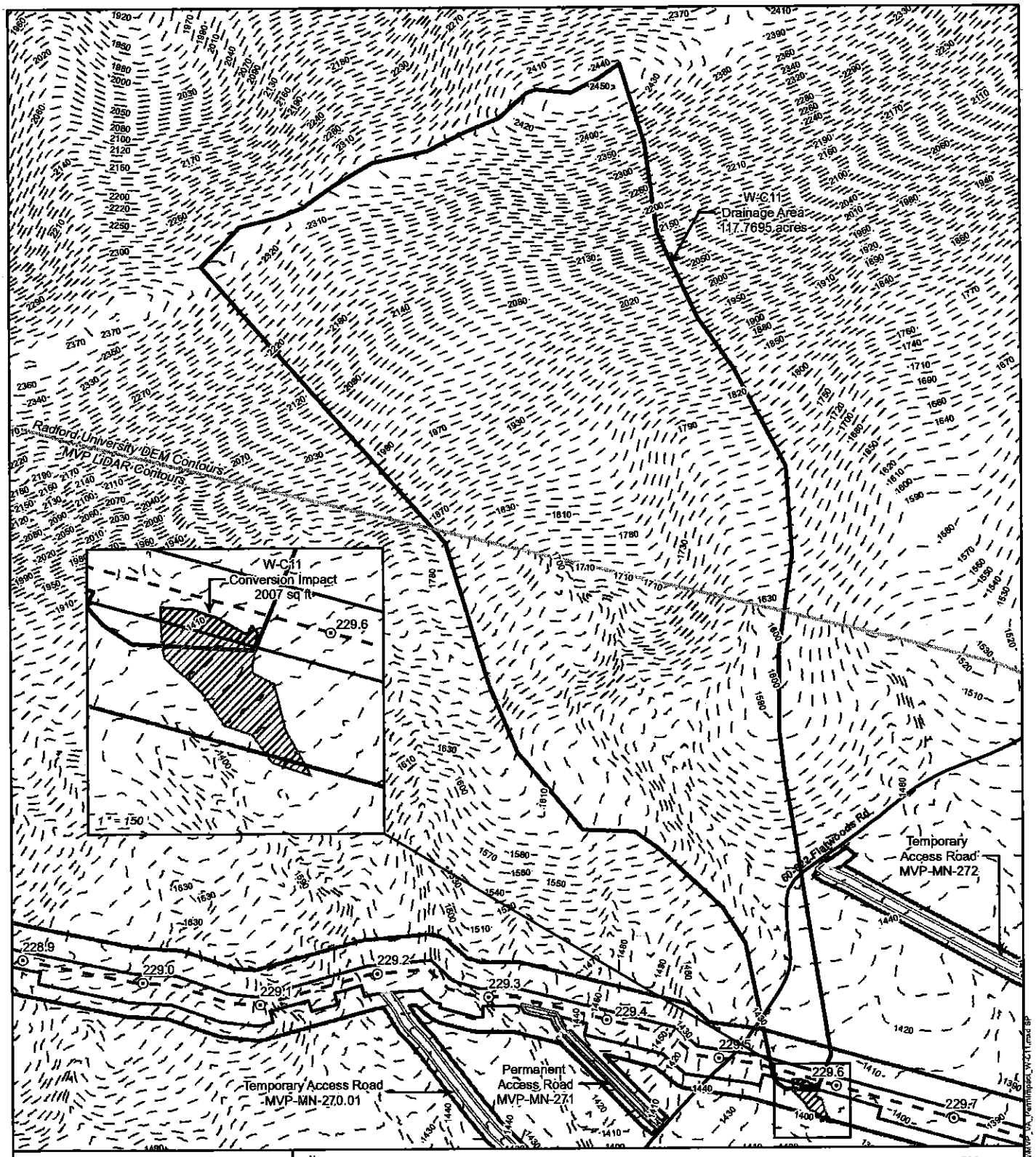
Type: NA

Depth (inches): ___

Hydric Soil Present? Yes ✔ No ___

Remarks:

W-C11



Mountain Valley Pipeline Project

N

NAD 1983 UTM 17N

1" = 580'

580 290 0 580 Feet

Mountain Valley PIPELINE

Figure 1:
Permanent Impacts for
Wetland W-C11
Montgomery County

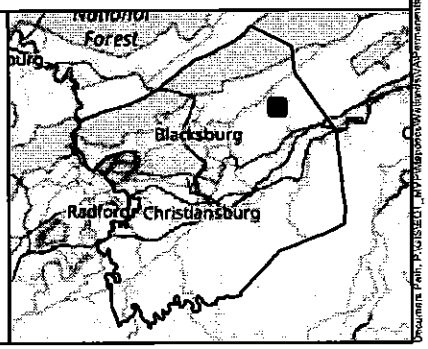
SEPTEMBER, 2017

Data Sources: ESRI Streaming Data © 2014
Elevation data derived from LIDAR provided by EQT 2016
and from Radford University DEM files.

- Milepost
- Alignment Centerline
- Access Road Temporary LOD
- Access Road Permanent LOD
- Limit of Disturbance
- Preliminary Jurisdictional Determination Boundary
- Drainage Area
- PSS Wetland

Wetland Impact

- Conversion



Photograph Number: 1 **Feature Name:** W-C11 **Cowardin Class:** PSS

Direction: SW **Date:** 4/9/2015

WETLAND DETERMINATION DATA FORM – Eastern Mountains and Piedmont Region

Project/Site: MVP City/County: Montgomery Sampling Date: 04/09/2015

Applicant/Owner: MVP State: VA Sampling Point: W-C11

Investigator(s): L.Harloe, K.Lamontagne, L. Summers Section, Township, Range: N/A

Landform (hillslope, terrace, etc.): Valley bottom Local relief (concave, convex, none): Concave Slope (%): 2

Subregion (LRR or MLRA): LRRN Lat: 37.257071 Long: -80.281424 Datum: NAD 83

Soil Map Unit Name: McGary and Purdy soils NWI classification: None

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✔ No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes ✔ No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ✔	No ____
Hydric Soil Present?	Yes ✔	No ____
Wetland Hydrology Present?	Yes ✔	No ____

Is the Sampled Area within a Wetland? Yes ✔ No ____

Remarks:
Cowardin Code:PSS
HGM: Riverine flow through
WT:RPWWD

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ✔ High Water Table (A2)
- ✔ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ✔ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ True Aquatic Plants (B14)
- ✔ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ____	No ✔	Depth (inches): ____
Water Table Present?	Yes ✔	No ____	Depth (inches): 2
Saturation Present? (includes capillary fringe)	Yes ✔	No ____	Depth (inches): 2

Wetland Hydrology Present? Yes ✔ No ____

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Four Strata) – Use scientific names of plants. Sampling Point: W-C11

Tree Stratum (Plot size: 30')	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
7.			
	0 = Total Cover		
50% of total cover: 0	20% of total cover: 0		
Sapling/Shrub Stratum (Plot size: 15')			
1. Rosa multiflora	15	✔	FACU
2. Lindera benzoin	30	✔	FAC
3.			
4.			
5.			
6.			
7.			
8.			
9.			
	45 = Total Cover		
50% of total cover: 22.5	20% of total cover: 9		
Herb Stratum (Plot size: 5')			
1. Cyperus strigosus	5		FACW
2. Arthraxon hispidus	15	✔	FAC
3. Juncus effusus	10	✔	FACW
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	30 = Total Cover		
50% of total cover: 15	20% of total cover: 6		
Woody Vine Stratum (Plot size: 15')			
1. Lonicera japonica	20	✔	FAC
2.			
3.			
4.			
5.			
	20 = Total Cover		
50% of total cover: 10	20% of total cover: 4		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 4 (A)

Total Number of Dominant Species Across All Strata: 5 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 80% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species		x 1 =
FACW species		x 2 =
FAC species		x 3 =
FACU species		x 4 =
UPL species		x 5 =
Column Totals:	(A)	(B)

Prevalence Index = B/A =

Hydrophytic Vegetation Indicators:

- ___ 1 - Rapid Test for Hydrophytic Vegetation
- ✔ 2 - Dominance Test is >50%
- ___ 3 - Pravalence Index is ≤3.0[1]
- ___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Four Vegetation Strata:

Tree – Woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/Shrub – Woody plants, excluding vines, less than 3 in. DBH and greater than or equal to 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vine – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? Yes ✔ No ___

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point: W-C11

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-20"	10YR4/1	90	10YR6/8	10	C	M	SSi	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ✔ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ 2 cm Muck (A10) **(LRR N)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1) **(LRR N, MLRA 147, 148)**
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7)
- ___ Polyvalue Below Surface (S8) **(MLRA 147, 148)**
- ___ Thin Dark Surface (S9) **(MLRA 147, 148)**
- ___ Loamy Gleyed Matrix (F2)
- ✔ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Iron-Manganese Masses (F12) **(LRR N, MLRA 136)**
- ___ Umbric Surface (F13) **(MLRA 136, 122)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 148)**
- ___ Red Parent Material (F21) **(MLRA 127, 147)**

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) **(MLRA 147)**
- ___ Coast Prairie Redox (A16) **(MLRA 147, 148)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 136, 147)**
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

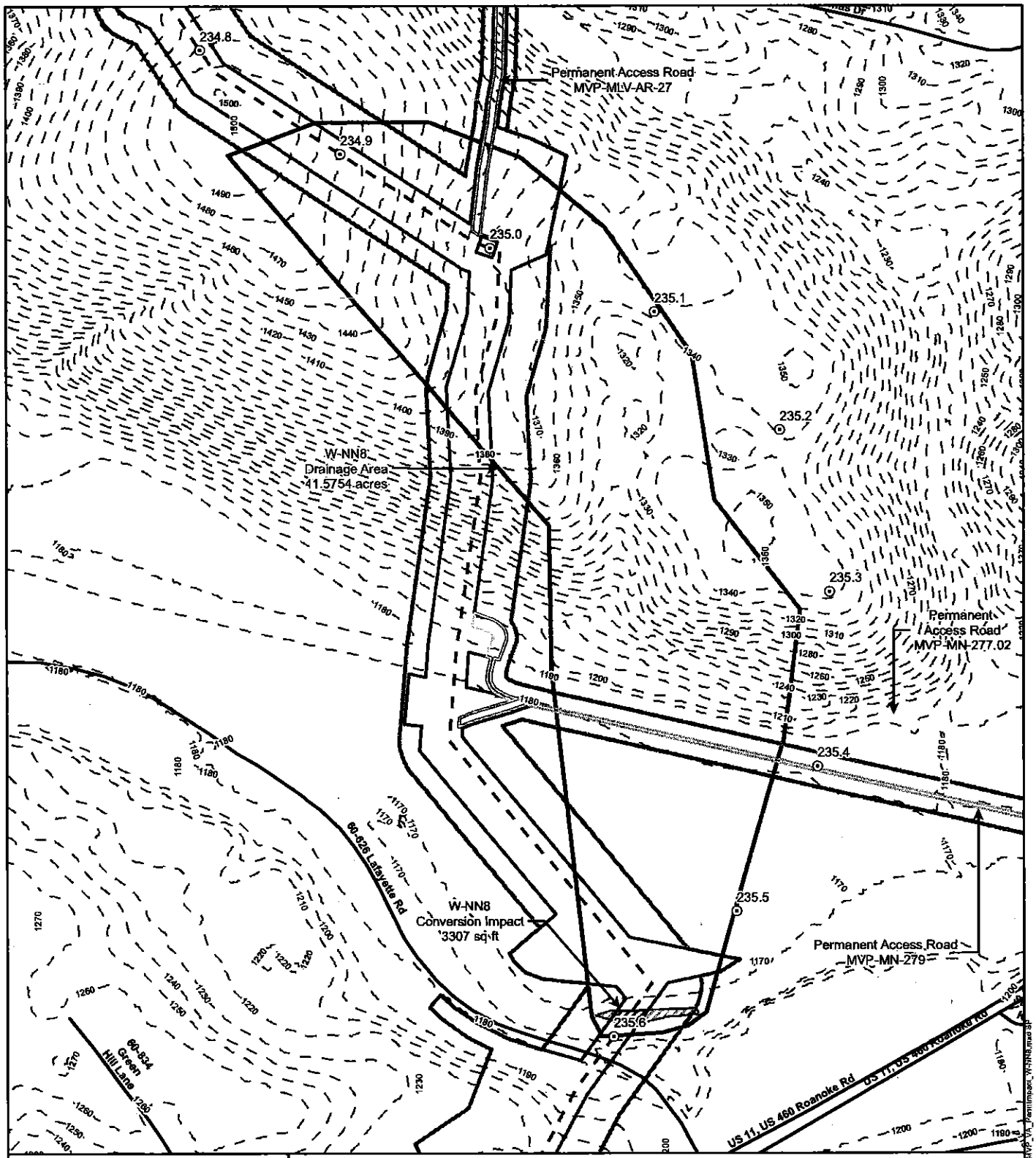
Type: NA

Depth (inches): ___

Hydric Soil Present? Yes ✔ No ___

Remarks:

W-NN8



Mountain Valley Pipeline Project

NAD 1983 UTM 17N

1 " = 400 '

400 200 0 400 Feet

Mountain Valley PIPELINE

Figure 1:
Permanent Impacts for Wetland W-NN8
Montgomery County

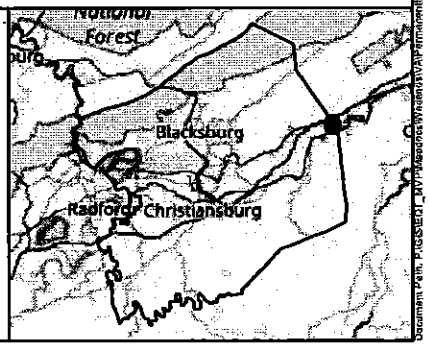
SEPTEMBER, 2017

Data Sources: ESRI Streaming Data © 2014
Elevation data derived from LiDAR provided by EQT 2016

- Milepost
- Alignment Centerline
- Permanent Facility
- Access Road Temporary LOD
- Access Road Permanent LOD
- Limit of Disturbance
- Preliminary Jurisdictional Determination Boundary
- Drainage Area
- PFO Wetland

Wetland Impact

- Conversion



Photograph Number: 22 **Feature Name:** W-NN8 **Cowardin Class:** PFO

Direction: E **Date:** 8/28/2015

WETLAND DETERMINATION DATA FORM – Eastern Mountains and Piedmont Region

Project/Site: MVP City/County: Montgomery Sampling Date: 08/28/2015

Applicant/Owner: MVP State: VA Sampling Point: W-NN8

Investigator(s): D. Mccullough, K. Larsen, R. Turner Section, Township, Range: N/A

Landform (hillslope, terrace, etc.): Floodplain Local relief (concave, convex, none): Convex Slope (%): 10

Subregion (LRR or MLRA): LRRN Lat: 37.233558 Long: -80.197654 Datum: NAD83

Soil Map Unit Name: Weaver soils NWI classification: R3USA

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✔ No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes ✔ No ____

Are Vegetation ____, Soil ✔, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ✔	No ____
Hydric Soil Present?	Yes ✔	No ____
Wetland Hydrology Present?	Yes ✔	No ____

Is the Sampled Area within a Wetland? Yes ✔ No ____

Remarks:
Cowardin Code:PFO
HGM: Riverine
WT:RPWWD

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ✔ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ True Aquatic Plants (B14)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Sparsely Vegetated Concave Surface (B8)
- ✔ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ✔ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ✔ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ____	No ✔	Depth (inches): ____
Water Table Present?	Yes ____	No ✔	Depth (inches): ____
Saturation Present? (includes capillary fringe)	Yes ____	No ✔	Depth (inches): ____

Wetland Hydrology Present? Yes ✔ No ____

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Four Strata) – Use scientific names of plants. Sampling Point: W-NN8

Tree Stratum (Plot size: 30')	Absolute % Cover	Dominant Species?	Indicator Status
1. Platanus occidentalis	75	✔	FACW
2. Robinia psudoacacea	10		FACU
3. Betula nigra	10		FACW
4. Juglans nigra	5		FACU
5.			
6.			
7.			
	100 = Total Cover		
50% of total cover: 50	20% of total cover: 20		

Sapling/Shrub Stratum (Plot size: 15')			
1. Asimina triloba	7		FACU
2. Lindera benzoin	35	✔	FAC
3. Salix nigra	10		OBL
4. Betula nigra	15	✔	FACW
5.			
6.			
7.			
8.			
9.			
	67 = Total Cover		
50% of total cover: 33.5	20% of total cover: 13.4		

Herb Stratum (Plot size: 5')			
1. Micristegium viminium	40	✔	FAC
2. Dichanthelium clandestinum	15	✔	FAC
3. Verbesina alterniflora	10		FAC
4. Leersia oryzoides	5		OBL
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	70 = Total Cover		
50% of total cover: 35	20% of total cover: 14		

Woody Vine Stratum (Plot size: 15')			
1. Vitis aestivalis	15	✔	FACU
2. Toxicodendron radicans	25	✔	FAC
3.			
4.			
5.			
	40 = Total Cover		
50% of total cover: 20	20% of total cover: 8		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 6 (A)

Total Number of Dominant Species Across All Strata: 7 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 86 (A/B)

Prevalence Index worksheet:

Total % Cover of:	Multiply by:
OBL species	x 1 =
FACW species	x 2 =
FAC species	x 3 =
FACU species	x 4 =
UPL species	x 5 =
Column Totals: (A)	(B)

Prevalence Index = B/A =

Hydrophytic Vegetation Indicators:

- ___ 1 - Rapid Test for Hydrophytic Vegetation
- ✔ 2 - Dominance Test is >50%
- ___ 3 - Prevalence Index is ≤3.0[1]
- ___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Four Vegetation Strata:

Tree – Woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/Shrub – Woody plants, excluding vines, less than 3 in. DBH and greater than or equal to 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vine – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? Yes ✔ No ___

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL Sampling Point: W-NN8

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-2	10 YR 4/3	100					S	Sandy/gravel

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ 2 cm Muck (A10) **(LRR N)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1) **(LRR N, MLRA 147, 148)**
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7)
- ___ Polyvalue Below Surface (S8) **(MLRA 147, 148)**
- ___ Thin Dark Surface (S9) **(MLRA 147, 148)**
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Iron-Manganese Masses (F12) **(LRR N, MLRA 136)**
- ___ Umbric Surface (F13) **(MLRA 136, 122)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 148)**
- ___ Red Parent Material (F21) **(MLRA 127, 147)**

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) **(MLRA 147)**
- ___ Coast Prairie Redox (A16) **(MLRA 147, 148)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 136, 147)**
- ___ Very Shallow Dark Surface (TF12)
- ✔ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: Cobble/gravel

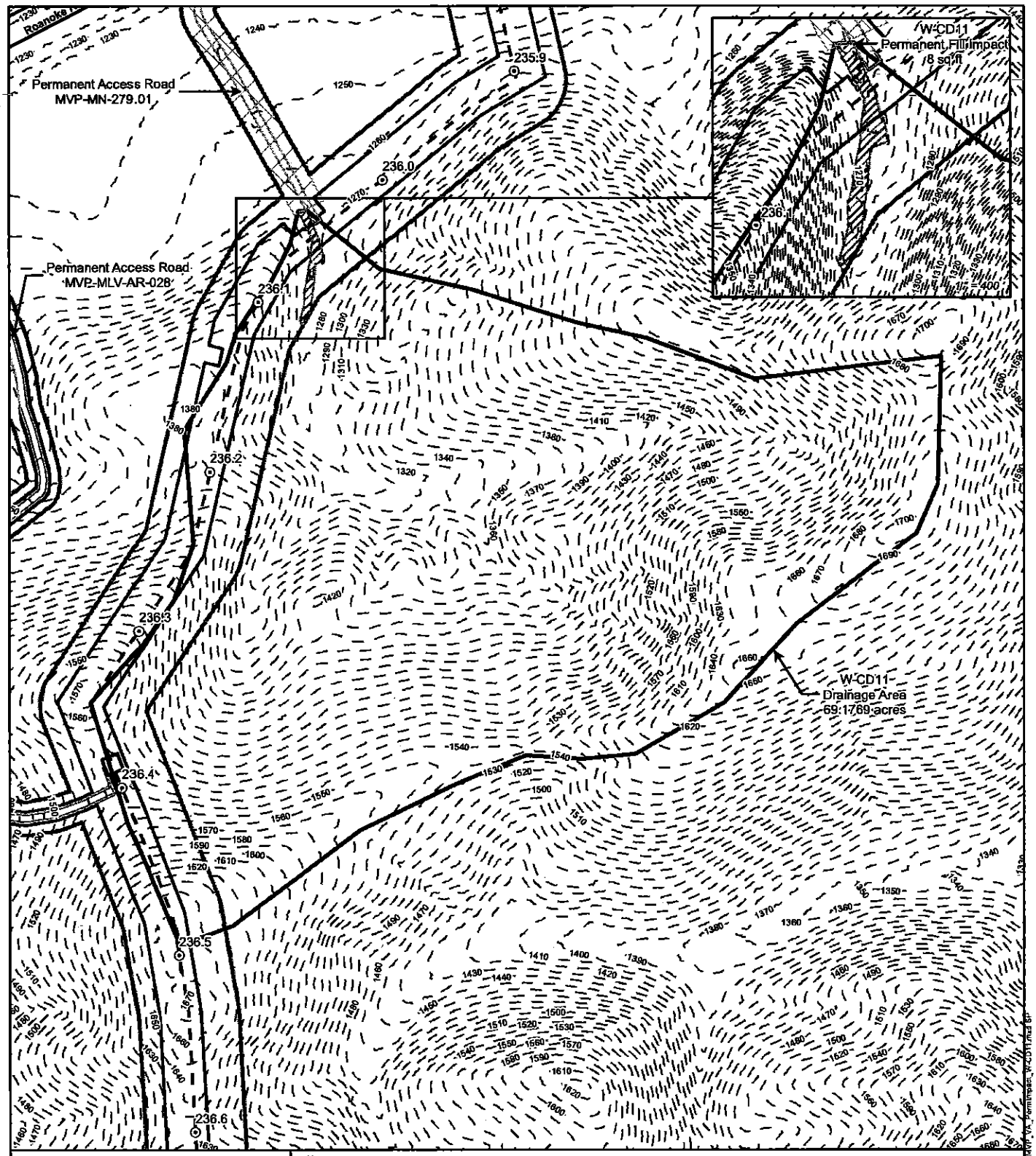
Depth (inches): 2

Hydric Soil Present? Yes ✔ No ___

Remarks:

Fluvial Deposits within a Floodplain: The soils are naturally problematic.

W-CD11



Mountain Valley Pipeline Project

NAD 1983 UTM 17N

1 " = 400 '

400 200 0 400 Feet

Mountain Valley PIPELINE

Figure 1:
Permanent Impacts for Wetland W-CD11
Montgomery County

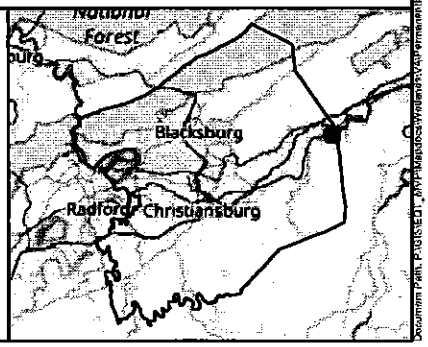
SEPTEMBER, 2017

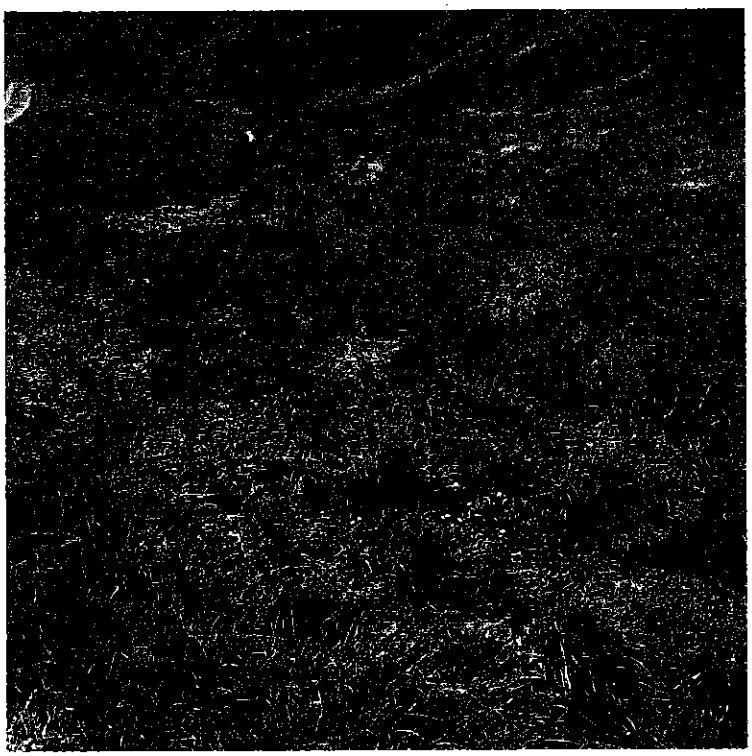
Data Sources: ESRI Streaming Data © 2014
Elevation data derived from LiDAR provided by EQT 2016

- Milepost
- Alignment Centerline
- Permanent Facility
- Access Road Permanent LOD
- Limit of Disturbance
- Preliminary Jurisdictional Determination Boundary
- Unsurveyed Areas
- Drainage Area
- PEM Wetland

Wetland Impact

- Permanent Fill





Photograph Number: 24 **Feature Name:** W-CD11 **Cowardin Class:** PEM

Direction: SW **Date:** 4/11/2016

WETLAND DETERMINATION DATA FORM – Eastern Mountains and Piedmont Region

Project/Site: MVP City/County: Montgomery Sampling Date: 04/11/2016

Applicant/Owner: MVP State: VA Sampling Point: W-CD11

Investigator(s): HS,CW,AC Section, Township, Range: N/A

Landform (hillslope, terrace, etc.): Slope Local relief (concave, convex, none): Concave Slope (%): 3-5

Subregion (LRR or MLRA): LRR N Lat: 37.228102 Long: -80.200038 Datum: NAD 83

Soil Map Unit Name: 11C - Duffield-Ernest complex, 7 to 15 percent slopes, continued below NWI classification: None

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✔ No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes ✔ No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ✔	No ____
Hydric Soil Present?	Yes ✔	No ____
Wetland Hydrology Present?	Yes ✔	No ____

Is the Sampled Area within a Wetland? Yes ✔ No ____

Remarks: Cowardin Code: PEM HGM: Riverine Water Type: RPWWD

Soil Map Unit Name (cont): 3E - Berks-Lowell-Rayne complex, 25 to 65 percent slopes

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ✔ High Water Table (A2)
- ✔ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ✔ Aquatic Fauna (B13)
- ___ True Aquatic Plants (B14)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheras on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ✔ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ✔ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ____	No ✔	Depth (inches): ____
Water Table Present?	Yes ✔	No ____	Depth (inches): 1
Saturation Present? (includes capillary fringe)	Yes ✔	No ____	Depth (inches): 0

Wetland Hydrology Present? Yes ✔ No ____

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:
Dusky salamanders, green frogs

VEGETATION (Four Strata) – Use scientific names of plants. Sampling Point: W-CD11

Tree Stratum (Plot size: 30')	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
7.			
	0 = Total Cover		
50% of total cover: 0	20% of total cover: 0		

Sapling/Shrub Stratum (Plot size: 15')			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
	0 = Total Cover		
50% of total cover: 0	20% of total cover: 0		

Herb Stratum (Plot size: 5')			
1. Poa trivialis	80	✔	FACW
2. Ranunculus repens	5		FAC
3. Juncus effusus	5		FACW
4. Nasturtium officionale	10		OBL
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	100 = Total Cover		
50% of total cover: 50	20% of total cover: 20		

Woody Vine Stratum (Plot size: 15')			
1.			
2.			
3.			
4.			
5.			
	0 = Total Cover		
50% of total cover: 0	20% of total cover: 0		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species		x 1 =
FACW species		x 2 =
FAC species		x 3 =
FACU species		x 4 =
UPL species		x 5 =
Column Totals:	(A)	(B)

Prevalence Index = B/A =

Hydrophytic Vegetation Indicators:

✔ 1 - Rapid Test for Hydrophytic Vegetation

✔ 2 - Dominance Test is >50%

___ 3 - Prevalence Index is ≤3.0[1]

___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Four Vegetation Strata:

Tree – Woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/Shrub – Woody plants, excluding vines, less than 3 in. DBH and greater than or equal to 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vine – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? Yes ✔ No ___

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL Sampling Point: W-CD11

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-6	10YR 3/2	90	7.5YR 5/6	10	C	M	CSiL	
6-16	2.5Y 3/2	100					CL	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ 2 cm Muck (A10) **(LRR N)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1) **(LRR N, MLRA 147, 148)**
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7)
- ___ Polyvalue Below Surface (S8) **(MLRA 147, 148)**
- ___ Thin Dark Surface (S9) **(MLRA 147, 148)**
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ✔ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Iron-Manganese Masses (F12) **(LRR N, MLRA 136)**
- ___ Umbric Surface (F13) **(MLRA 136, 122)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 148)**
- ___ Red Parent Material (F21) **(MLRA 127, 147)**

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) **(MLRA 147)**
- ___ Coast Prairie Redox (A16) **(MLRA 147, 148)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 136, 147)**
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? **Yes** ✔ **No** ___

Remarks:

W-EF5-PFO

Mountain Valley Pipeline Project

Standard JPA-NWP12 Pre-Construction Notification, Virginia

Attachment H-4: Non-Virginia Marine Resource Commission (VMRC) Stream Plans and Cross Sections

September 2017

ATTACHMENT H-4: NON-VIRGINIA MARINE RESOURCE COMMISSION (VMRC) STREAM IMPACT PLANS AND CROSS SECTIONS

Attached are environmental details and typical construction details for anticipated Project wetland and streams crossings. Specific crossing plans and cross sections are provided in Attachment H-5 for each Virginia Marine Resource Commission (VMRC) jurisdictional stream crossed by the Project.

DRAWINGS

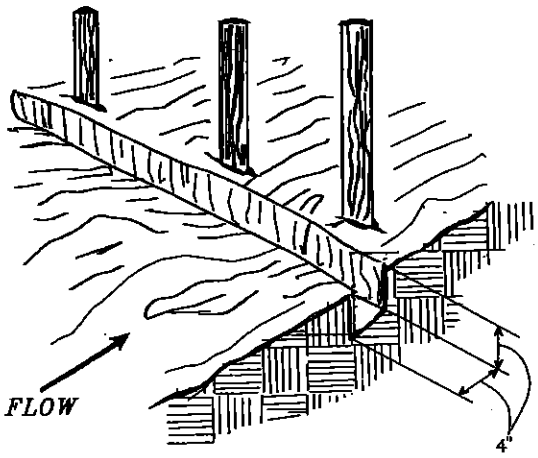
STD & SPEC 3.05	Silt Fence
STD & SPEC 3.26	Dewatering Structure
MVP-ES2:	Pumped Water Filter Bag
MVP-ES3:	Compost Filter Sock
MVP-ES3.1:	Compost Filter Sock Tables
MVP-ES3.2:	Compost Filter Sock Tables
MVP-ES6:	Access Roads
MVP-ES8:	Stream Crossing Pump Station
MVP-ES9:	Belted Silt Retention Fence (BSRF)
MVP-ES9.1:	Belted Silt Retention Fence (BSRF)
MVP-ES9.2:	Super Silt Fence
MVP-ES9.2A:	Super Silt Fence
MVP-ES9.3:	Stacked Compost Filter Sock
MVP-ES13.1:	Cofferdam Stream Crossing Method
MVP-ES13.2:	Cofferdam Stream Crossing Method
MVP-ES37:	Timber Mat/Wetland Crossing
MVP-ES41:	Modular Temporary Bailey Bridge
MVP-ES44:	Post Construction Stream Crossing Stabilization
MVP-ES44.1:	Post Construction Stream Crossing Stabilization
MVP-ES44.2:	Post Construction Stream Crossing Stabilization
MVP-ES44.3:	Post Construction Stream Crossing Stabilization
MVP-ES44.4:	Post Construction Stream Crossing Stabilization
MVP-ES44.5:	Post Construction Stream Crossing Stabilization
MVP-ES44.6:	Post Construction Stream Crossing Stabilization

DRAWINGS (CONTINUED)

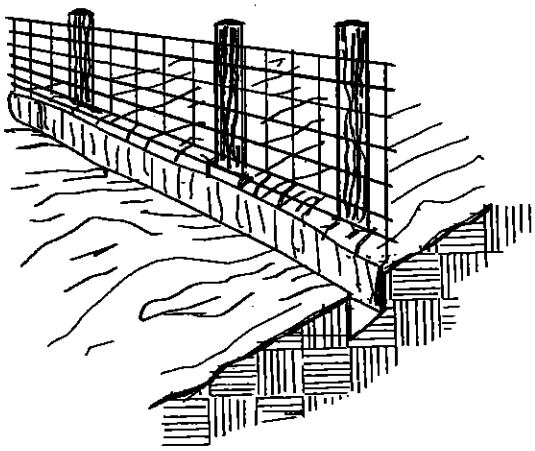
MVP-ES44.7:	Post Construction Stream Crossing Stabilization
MVP-ES44.8:	Post Construction Stream Crossing Stabilization
MVP-ES44.9:	Post Construction Stream Crossing Stabilization
MVP-6:	Mainline Construction Waterbody Crossing, Open Cut - Flume
MVP-6.1:	Mainline Construction Waterbody Crossing, Open Cut - Flume
MVP-15:	Mainline Construction Waterbody Crossing, Open Cut – Dry/Dam and Pump, Right-of-Way
MVP-15.1:	Mainline Construction Waterbody Crossing, Open Cut – Dry/Dam and Pump, Right-of-Way
MVP 20:	Typical Trench Breaker Requirements
MVP-47:	Timber Mat and Pipe Bundle Temporary Stream Crossing
MVP-48:	Timber Mat and Jersey Barrier Temporary Stream Crossing
MVP-53:	Wetland Crossing Typical For USACE Norfolk (VA) District
MVP-JPA-1	Typical Access Road Culvert Crossing

CONSTRUCTION OF A SILT FENCE (WITH WIRE SUPPORT)

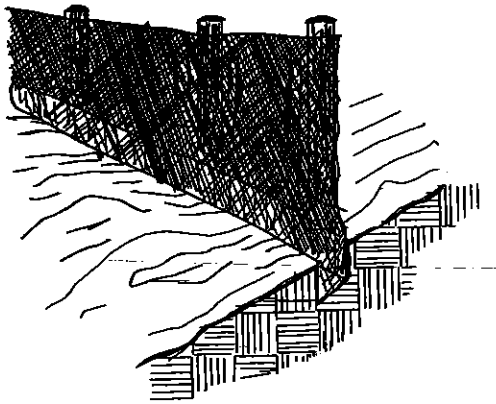
1. SET POSTS AND EXCAVATE A 4"X4" TRENCH UPSLOPE ALONG THE LINE OF POSTS.



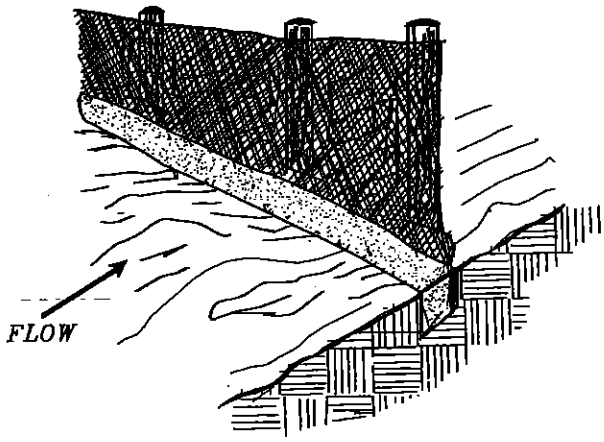
2. STAPLE WIRE FENCING TO THE POSTS.



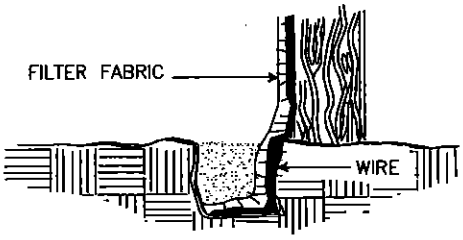
3. ATTACH THE FILTER FABRIC TO THE WIRE FENCE AND EXTEND IT INTO THE TRENCH.



4. BACKFILL AND COMPACT THE EXCAVATED SOIL.



EXTENSION OF FABRIC AND WIRE INTO THE TRENCH.

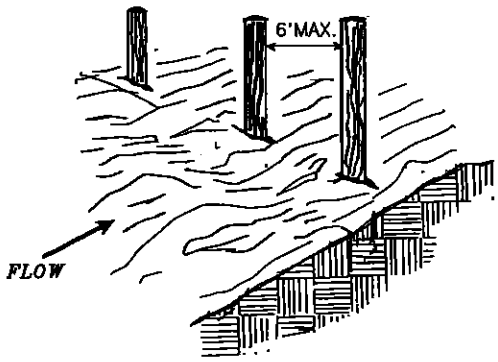


Source: Adapted from Installation of Straw and Fabric Filter Barriers for Sediment Control, Sherwood and Wyant

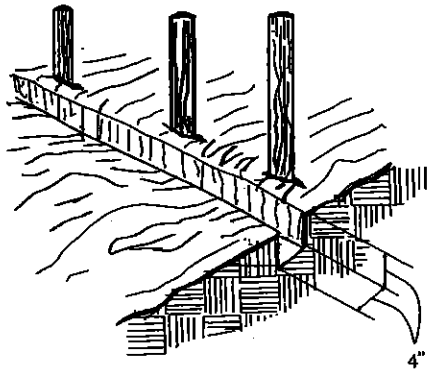
Plate 3.05-1

CONSTRUCTION OF A SILT FENCE (WITHOUT WIRE SUPPORT)

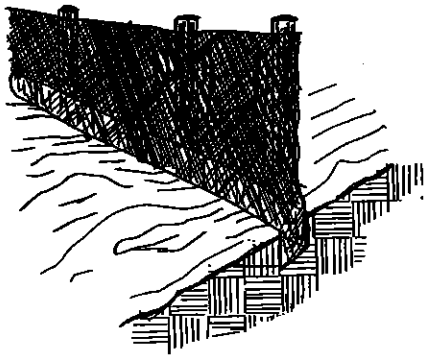
1. SET THE STAKES.



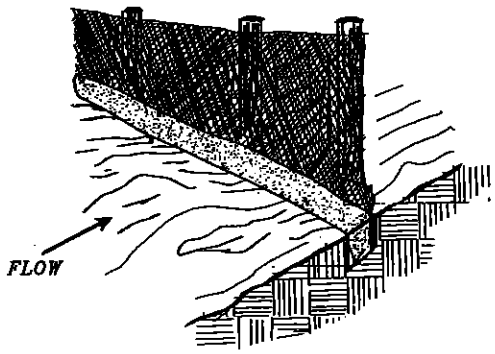
2. EXCAVATE A 4"X 4" TRENCH UPSLOPE ALONG THE LINE OF STAKES.



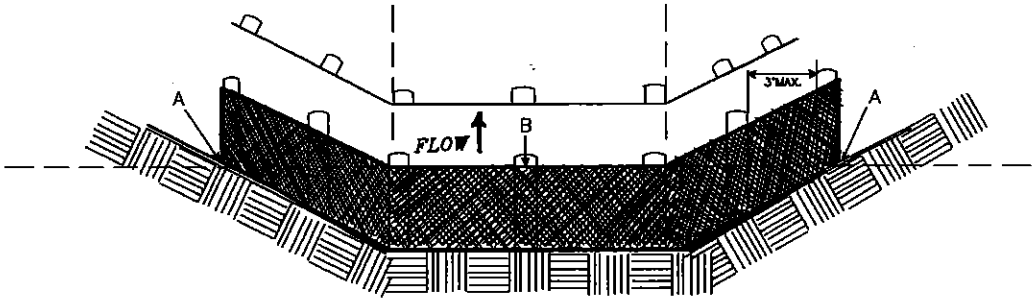
3. STAPLE FILTER MATERIAL TO STAKES AND EXTEND IT INTO THE TRENCH.



4. BACKFILL AND COMPACT THE EXCAVATED SOIL.



SHEET FLOW INSTALLATION
(PERSPECTIVE VIEW)



POINTS A SHOULD BE HIGHER THAN POINT B.

DRAINAGEWAY INSTALLATION
(FRONT ELEVATION)

Source: Adapted from Installation of Straw and Fabric Filter Barriers for Sediment Control, Sherwood and Wyant

Plate 3.05-2

STD & SPEC 3.26

DEWATERING STRUCTURE

DS

Definition

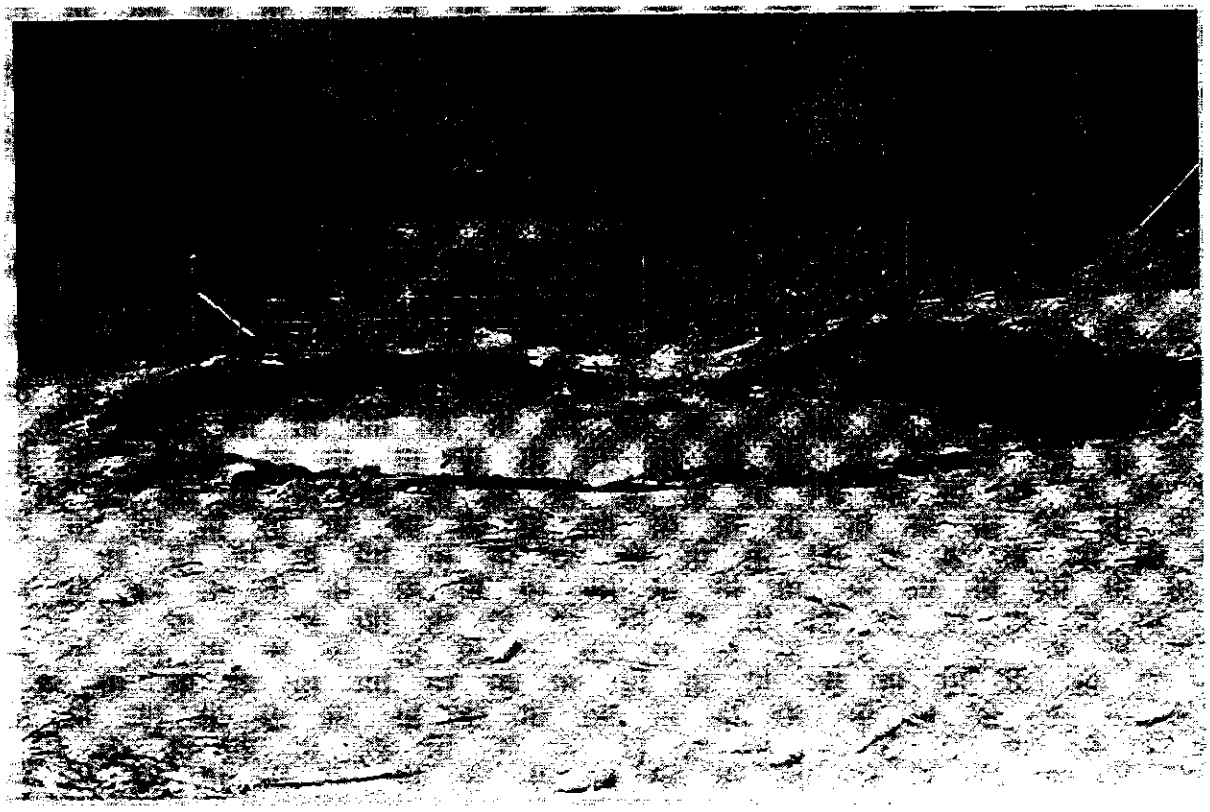
A temporary settling and filtering device for water which is discharged from dewatering activities.

Purpose

To filter sediment-laden water prior to the water being discharged off-site.

Conditions Where Practice Applies

Wherever sediment-laden water must be removed from a construction site by means of pumping.



Planning Considerations

Water which is pumped from a construction site usually contains a large amount of sediment. A dewatering structure is designed to remove the sediment before water is released off-site.

This practice includes several types of dewatering structures which have different applications dependent upon site conditions and types of operation. Other innovative techniques for accomplishing the same purpose are encouraged, but only after specific plans and details are submitted to and approved by the Plan-Approving Authority.

A dewatering structure may not be needed if there is a well- stabilized, vegetated area on-site to which water may be discharged. The area must be stabilized so that it can filter sediment and at the same time withstand the velocity of the discharged water without eroding. A minimum filtering length of 75 feet must be available in order for such a method to be feasible.

Design Criteria

1. A dewatering structure must be sized (and operated) to allow pumped water to flow through the filtering device without overtopping the structure.

2. Material from any required excavation shall be stored in an area and protected in a manner that will prevent sediments from eroding and moving off-site.

3. An excavated basin (applicable to "Straw Bale/Silt Fence Pit") may be lined with filter fabric to help reduce scour and to prevent the inclusion of soil from within the structure.

4. Design criteria more specific to each particular dewatering device can be found in Plates 3.26-1 through 3.26-3.

Construction Specifications

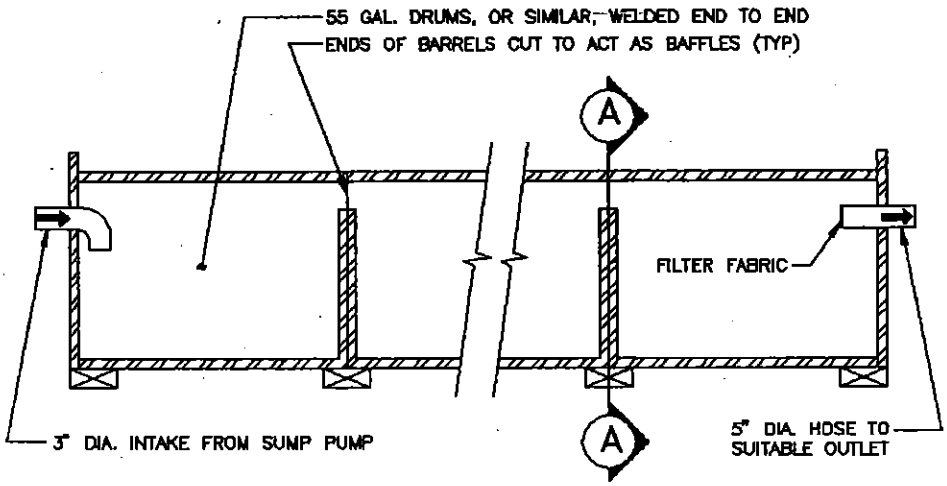
1. Portable Sediment Tank (see Plate 3.26-1)

   a. The structure may be constructed with steel drums, sturdy wood or other material suitable for handling the pressure exerted by the volume of water.

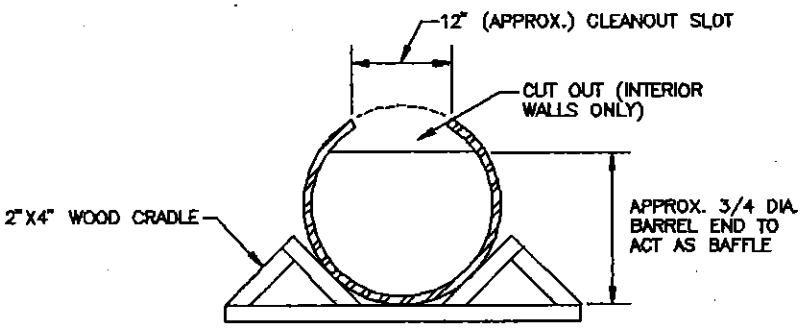
   b. Sediment tanks will have a minimum depth of two feet.

   c. The sediment tank shall be located for easy clean-out and disposal of the trapped sediment and to minimize the interference with construction activities.

PORTABLE SEDIMENT TANK



ELEVATION



CROSS-SECTION A-A

Source: USDA-SCS

Plate 3.26-1

d. The following formula shall be used to determine the storage volume of the sediment tank:

Pump discharge (g.p.m.) x 16 = *cubic feet of storage required*

e. Once the water level nears the top of the tank, the pump must be shut off while the tank drains and additional capacity is made available.

f. The tank shall be designed to allow for emergency flow over top of the tank.

g. Clean-out of the tank is required once one-third of the original capacity is depleted due to sediment accumulation. The tank shall be clearly marked showing the clean-out point.

2. Filter Box (see Plate 3.26-2)

a. The box selected should be made of steel, sturdy wood or other materials suitable to handle the pressure requirements imposed by the volume of water. Fifty-five gallon drums welded top to bottom are normally readily available and, in most cases, will suffice.

b. Bottom of the box shall be made porous by drilling holes (or some other method).

c. VDOT #3 Coarse Aggregate shall be placed over the holes at a minimum depth of 12 inches (metal "hardware" cloth may need to be placed between the aggregate and the holes if holes are drilled larger than the majority of the stone).

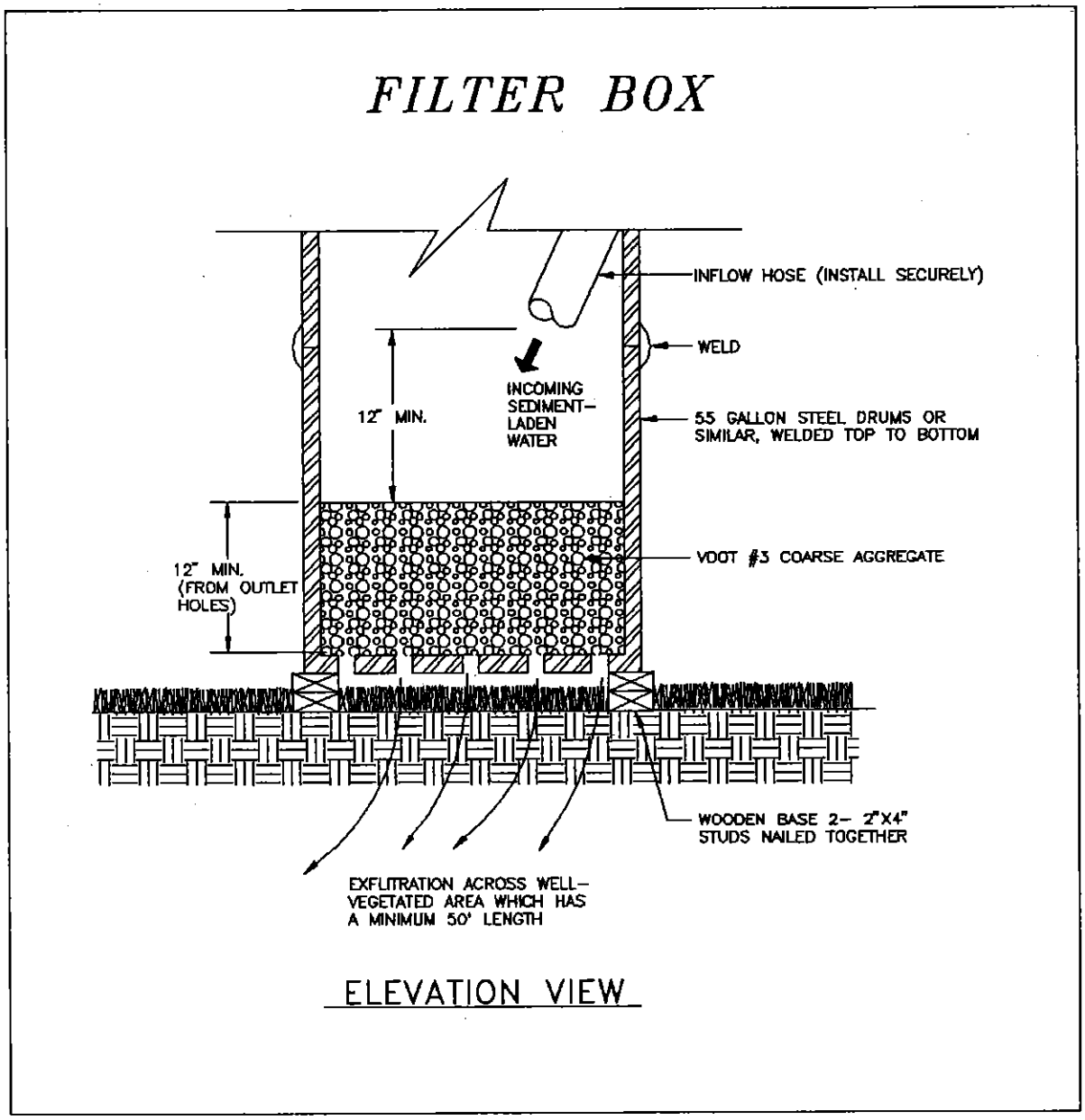
d. As a result of the fast rate of flow of sediment-laden water through the aggregate, the effluent must be directed over a well-vegetated strip of at least 50 feet after leaving the base of the filter box.

e. The box shall be sized as follows:

Pump discharge (g.p.m.) x 16 = *cubic feet of storage required*

f. Once the water level nears the top of the box, the pump must be shut off while the box drains and additional capacity is made available.

g. The box shall be designed/constructed to allow for emergency flow over the top of this box.



Source: Va. DSWC Plate 3.26-2

h. Clean-out of the box is required once one-third of the original capacity is depleted due to sediment accumulation. The tank shall be clearly marked showing the clean-out point.

i. If the stone filter does become clogged with sediment so that it no longer adequately performs its function, the stones must be pulled away from the inlet, cleaned and replaced.

Note: Using a filter box only allows for minimal settling time for sediment particles; therefore, it should only be used when site conditions restrict the use of the other methods.

3. Straw Bale/Silt Fence Pit (see Plate 3.26-3)

a. Measure shall consist of straw bales, silt fence, a stone outlet (a combination of VDOT Class AI Riprap and VDOT #25 or #26 Aggregate) and a wet storage pit oriented as shown in Plate 3.26-3.

b. The structure must have a capacity which is dictated by the following formula:

Pump discharge (g.p.m.) x 16 = *cubic feet of storage required*

In calculating the capacity, one should include the volume available from the floor of the excavation to the crest of the stone weir.

c. In any case, the excavated area should be a minimum of 3 feet below the base of the perimeter measures (straw bales or silt fence).

d. The perimeter measures must be installed as per the guidelines found in Std. & Spec. 3.04, STRAW BALE BARRIER and Std. & Spec. 3.05, SILT FENCE.

e. Once the water level nears the crest of the stone weir (emergency overflow), the pump must be shut off while the structure drains down to the elevation of the wet storage.

f. The wet storage pit may be dewatered only after a minimum of 6 hours of sediment settling time. This effluent should be pumped across a well-vegetated area or through a silt fence prior to entering a watercourse.

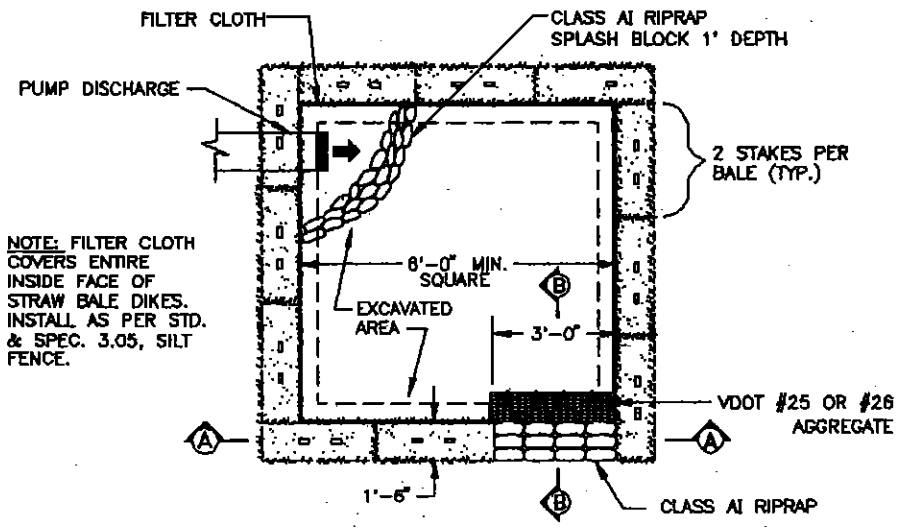
g. Once the wet storage area becomes filled to one-half of the excavated depth, accumulated sediment shall be removed and properly disposed of.

h. Once the device has been removed, ground contours will be returned to original condition.

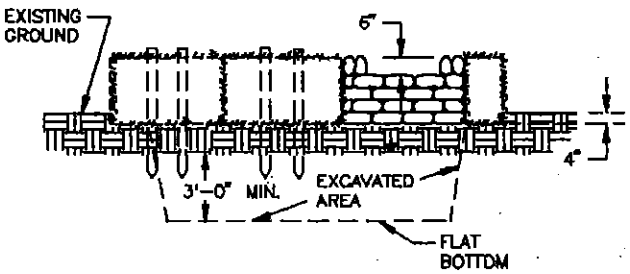
Maintenance
(All dewatering structures)

1. The filtering devices must be inspected frequently and repaired or replaced once the sediment build-up prevents the structure from functioning as designed.

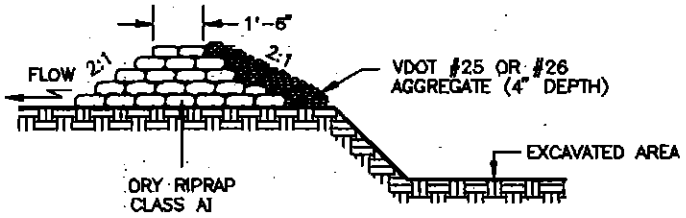
STRAW BALE/SILT FENCE PIT



PLAN VIEW



CROSS-SECTION A-A

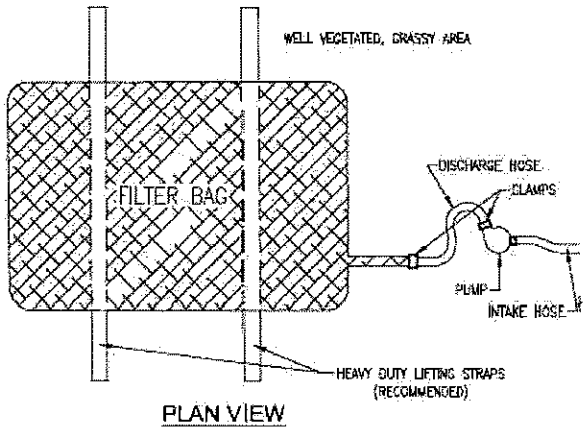


CROSS-SECTION B-B

Source: Va. DSWC

Plate 3.26-3

2. The accumulated sediment which is removed from a dewatering device must be spread on-site and stabilized or disposed of at an approved disposal site as per approved plan.



PLAN VIEW

ELEVATION VIEW

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

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

A SUITABLE MEANS OF ACCESSING THE BAG WITH MACHINERY REQUIRED FOR DISPOSAL PURPOSES SHALL BE PROVIDED. FILTER BAGS SHALL BE REPLACED WHEN THEY BECOME ½ FULL OF SEDIMENT. SPARE BAGS SHALL BE KEPT AVAILABLE FOR REPLACEMENT OF THOSE THAT HAVE FAILED OR ARE FILLED. BAGS SHALL BE PLACED ON STRAPS TO FACILITATE REMOVAL UNLESS BAGS COME WITH LIFTING STRAPS ALREADY ATTACHED.

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

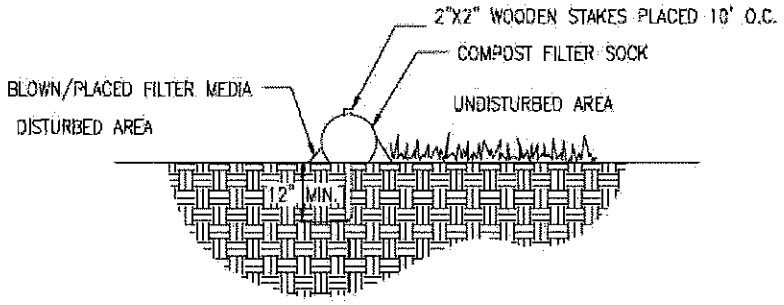
NO DOWNSLOPE SEDIMENT BARRIER IS REQUIRED FOR MOST INSTALLATIONS. COMPOST BERM OR COMPOST FILTER SOCK SHALL BE INSTALLED BELOW BAGS LOCATED IN HQ OR EV WATERSHEDS, WITHIN 50 FEET OF ANY RECEIVING SURFACE WATER OR WHERE GRASSY AREA IS NOT AVAILABLE.

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

THE PUMPING RATE SHALL BE NO GREATER THAN 750 GPM OR ½ THE MAXIMUM SPECIFIED BY THE MANUFACTURER, WHICHEVER IS LESS. PUMP INTAKES SHALL BE FLOATING AND SCREENED.

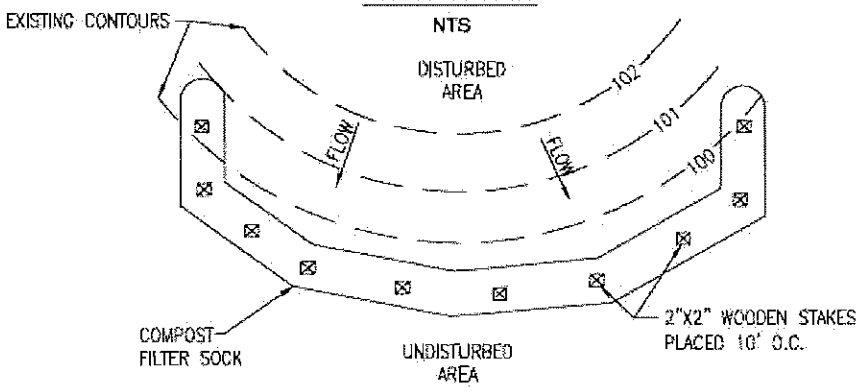
FILTER BAGS SHALL BE INSPECTED DAILY. IF ANY PROBLEM IS DETECTED, PUMPING SHALL CEASE IMMEDIATELY AND NOT RESUME UNTIL THE PROBLEM IS CORRECTED.

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



SECTION VIEW

NTS



PLAN VIEW

NTS

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

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

TRAFFIC SHALL NOT BE PERMITTED TO CROSS FILTER SOCKS.

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

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

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

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

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

TABLE 4.1

Compost Sock Fabric Minimum Specifications

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

TABLE 4.2

Compost Standards

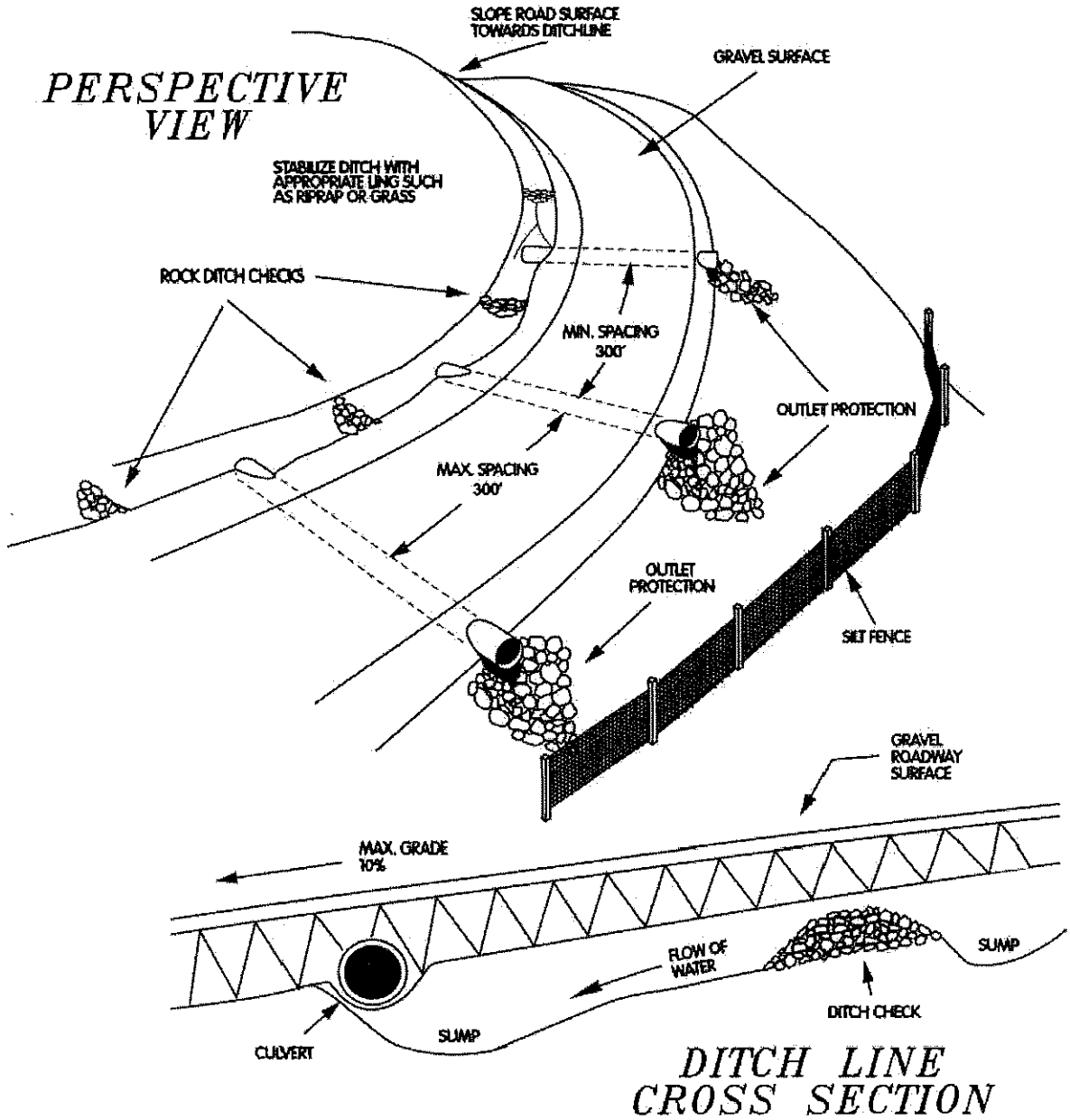
Organic Matter Content	80% - 100% (dry weight basis)
Organic Portion	Fibrous and elongated
pH	5.5 - 8.0
Moisture Content	35% - 55%
Particle Size	98% pass through 1" screen
Soluble Salt Concentration	5.0 dS/m (mmhos/cm) Maximum

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

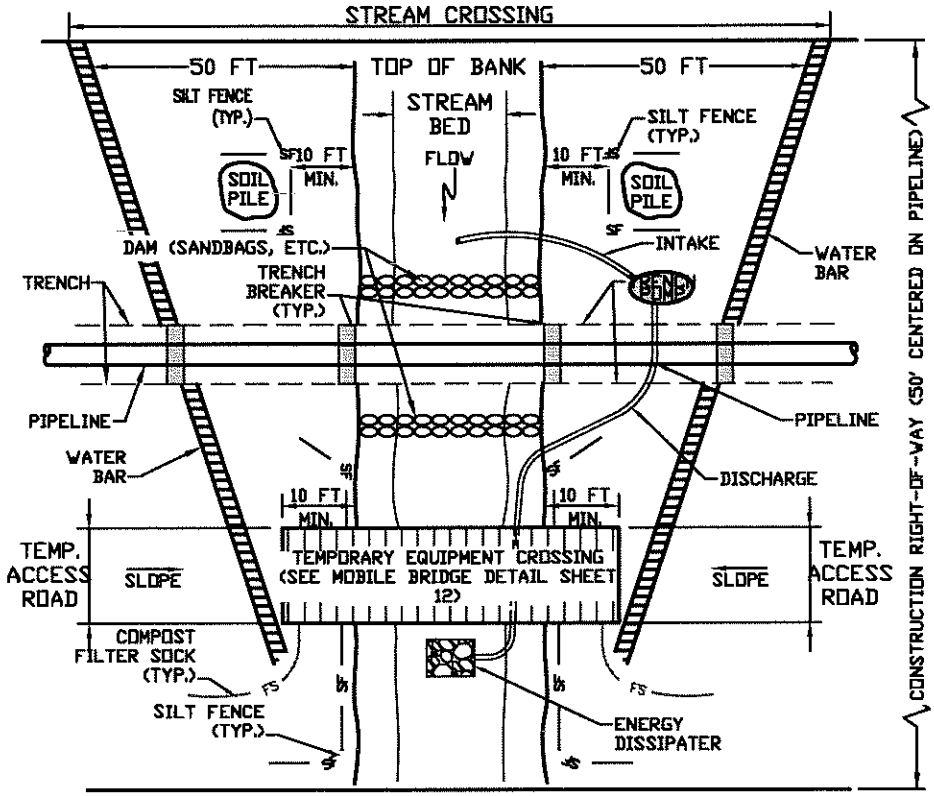
Slope Percent	Maximum Slope Length for Compost Filter Sock in Feet Note: Table developed from Filtrexx Sediment Control product cut sheet by Filtrexx International, LLC. As a general reference. Refer to manufacturers specifications for brand of compost filter sock used.				
	8 in	12 in	18 in	24 in	32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

MAXIMUM SLOPE LENGTH ABOVE COMPOST FILTER SOCK AND RECOMMENDED DIAMETER

DRAWN	DATE	Mountain Valley PIPELINE DESIGN ENGINEERING	ENVIRONMENTAL DETAIL
CHECKED	DATE		COMPOST FILTER SOCK TABLES
APP'D	DATE		
SCALE N.T.S.	SHEET 1 OF 1		
JOB NO.			
PROJECT ID: PXXXX			DRAWING NO. MVP-ES3.2 / REV. 0



DRAWN	DATE	Mountain Valley PIPELINE	ENVIRONMENTAL DETAIL
CHECKED	DATE		ACCESS ROADS
APP'D	DATE		
SCALE N.T.S.	SHEET 1 OF 1		
JOB NO.			
PROJECT ID: PXXXX		DESIGN ENGINEERING	DRAWING NO. MVP–ES6 / REV. 0

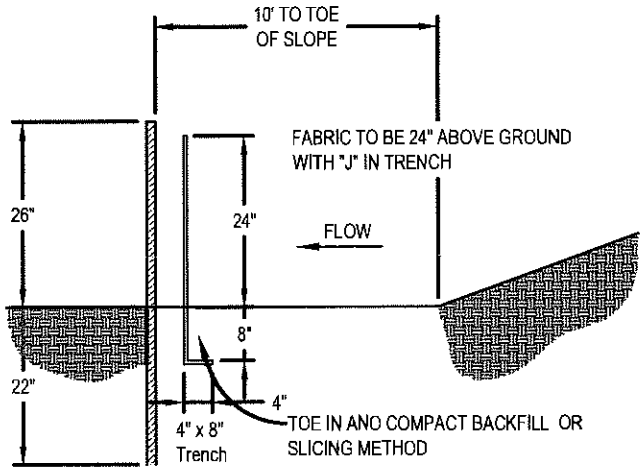


PLAN VIEW

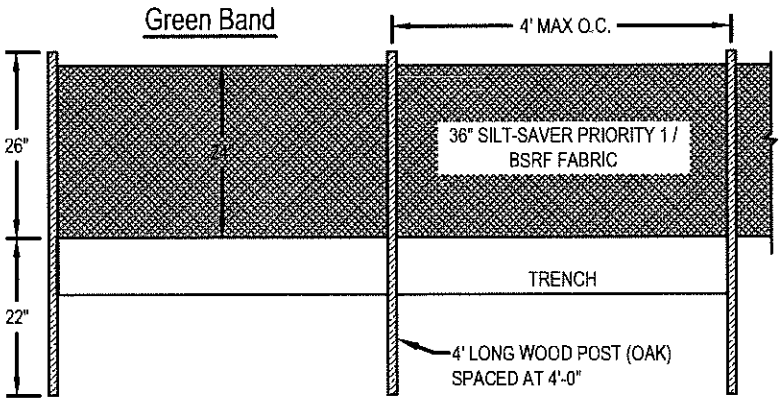
NOTES:

1. INSTALL COMPOST FILTER SOCKS, TRENCH BREAKERS, PUMP, ENERGY DISSIPATER, AND DAMS BEFORE TRENCHING STREAM.
2. PUMP MUST BE OF SUFFICIENT CAPACITY TO CONVEY NORMAL AND/OR EXISTING STREAM FLOW OVER TRENCH. A BACK-UP PUMP OF EQUAL CAPACITY MUST BE AVAILABLE ON-SITE DURING CONSTRUCTION OF THE PIPELINE CROSSING.
3. PLACE SOIL PILES A MINIMUM OF 10 FEET FROM TOP OF BANK.
4. INSTALL WATER BARS AT APPROACHES TO STREAM CROSSING AND COMPOST FILTER SOCKS, SILT FENCE, OR SUPER SILT FENCE (AS INDICATED ON PLAN SHEETS).
5. MAINTAIN SURFACE OF TEMPORARY EQUIPMENT CROSSING TO PREVENT SOIL DISCHARGES TO STREAM.
6. APPROACHES TO CROSSINGS ARE NOT TO EXCEED A DEPTH OF 6 INCHES ABOVE ORIGINAL GRADE.
7. RESTORE AREA TO APPOXIMATE ORIGINAL CONTOURS.

DRAWN	DATE	Mountain Valley PIPELINE	ENVIRONMENTAL DETAIL
CHECKED	DATE		STREAM CROSSING PUMP STATION
APP'D	DATE		
SCALE N.T.S.	SHEET 1 OF 1		
JOB NO.			
PROJECT ID: PXXXX		DESIGN ENGINEERING	DRAWING NO. MVP-ES8 / REV. 0



SIDE VIEW



FRONT ELEVATION

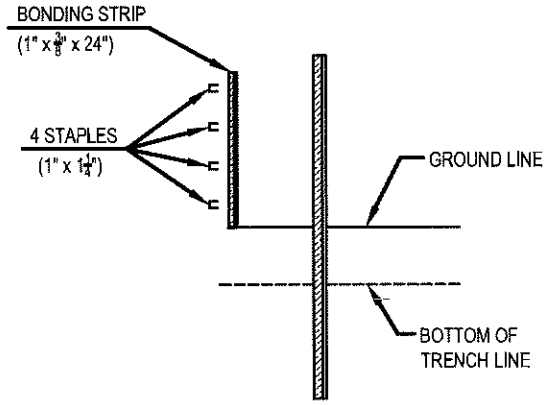
PRIORITY 1

TAKEN FROM SILT-SAVER, INC OR EQUAL

NOTES:

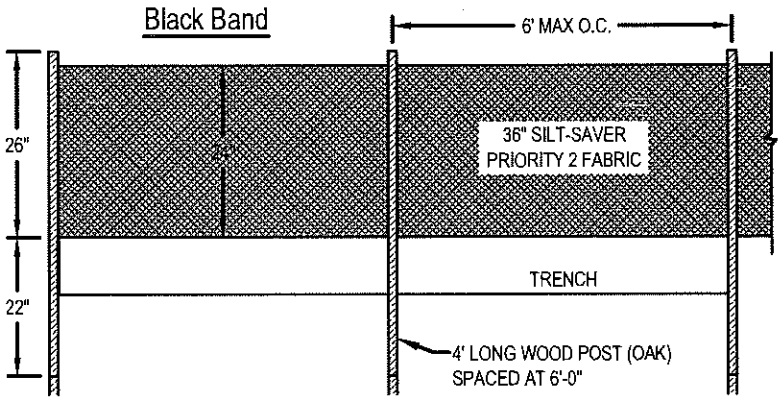
THE TYPE OF REINFORCED FILTRATION DEVICE (PRIORITY 1 OR PRIORITY 2) WILL BE SELECTED BASED ON FIELD CONDITIONS DURING CONSTRUCTION

DRAWN	DATE	Mountain Valley PIPELINE	ENVIRONMENTAL DETAIL
CHECKED	DATE		BELTED SILT RETENTION FENCE (BSRF)
APP'D	DATE 08/11/17		
SCALE N.T.S.	SHEET 1 OF 1		
JOB NO.			
PROJECT ID: MVP – VA PORTION		DESIGN ENGINEERING	DRAWING NO. MVP–ES9 / REV. 0



POST (OAK)

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



FRONT ELEVATION

PRIORITY 2

TAKEN FROM SILT-SAVER, INC OR EQUAL

NOTES:

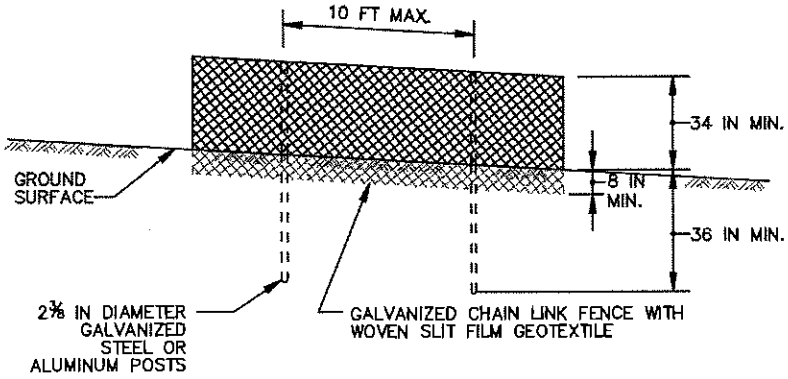
THE TYPE OF REINFORCED FILTRATION DEVICE (PRIORITY 1 OR PRIORITY 2) WILL BE SELECTED BASED ON FIELD CONDITIONS DURING CONSTRUCTION

DRAWN	DATE	Mountain Valley PIPELINE	ENVIRONMENTAL DETAIL
CHECKED	DATE		BELTED SILT RETENTION FENCE (BSRF)
APP'D	DATE 08/11/17		
SCALE N.T.S.	SHEET 1 OF 1		
JOB NO.			
PROJECT ID: MVP – VA PORTION		DESIGN ENGINEERING	DRAWING NO. MVP–ES9.1 / REV. 0

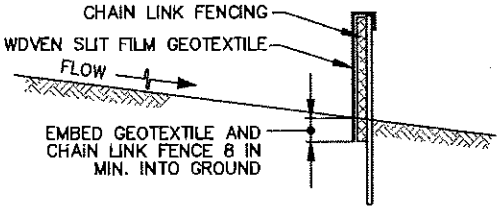
DETAIL E-3 SUPER SILT FENCE

STANDARD SYMBOL

—SSF—



ELEVATION



CROSS SECTION

CONSTRUCTION SPECIFICATIONS

1. INSTALL 2⅜ INCH DIAMETER GALVANIZED STEEL POSTS OF 0.095 INCH WALL THICKNESS AND SIX FOOT LENGTH SPACED NO FURTHER THAN 10 FEET APART. DRIVE THE POSTS A MINIMUM OF 36 INCHES INTO THE GROUND.
2. FASTEN 9 GAUGE OR HEAVIER GALVANIZED CHAIN LINK FENCE (2⅜ INCH MAXIMUM OPENING) 42 INCHES IN HEIGHT SECURELY TO THE FENCE POSTS WITH WIRE TIES OR HUG RINGS.
3. FASTEN WOVEN SLIT FILM GEOTEXTILE AS SPECIFIED IN SECTION H-1 MATERIALS, SECURELY TO THE UPSLOPE SIDE OF CHAIN LINK FENCE WITH TIES SPACED EVERY 24 INCHES AT THE TOP AND MID SECTION. EMBED GEOTEXTILE AND CHAIN LINK FENCE A MINIMUM OF 8 INCHES INTO THE GROUND.
4. WHERE ENDS OF THE GEOTEXTILE COME TOGETHER, THE ENDS SHALL BE OVERLAPPED BY 6 INCHES, FOLDED, AND STAPLED TO PREVENT SEDIMENT BY PASS.
5. EXTEND BOTH ENDS OF THE SUPER SILT FENCE A MINIMUM OF FIVE HORIZONTAL FEET UPSLOPE AT 45 DEGREES TO THE MAIN FENCE ALIGNMENT TO PREVENT RUNOFF FROM GOING AROUND THE ENDS OF THE SUPER SILT FENCE.
6. PROVIDE MANUFACTURER CERTIFICATION TO THE INSPECTION/ENFORCEMENT AUTHORITY SHOWING THAT GEOTEXTILE USED MEETS THE REQUIREMENTS IN SECTION H-1 MATERIALS.
7. REMOVE ACCUMULATED SEDIMENT AND DEBRIS WHEN BULGES DEVELOP IN FENCE OR WHEN SEDIMENT REACHES 25% OF FENCE HEIGHT. REPLACE GEOTEXTILE IF TORN. IF UNDERMINING OCCURS, REINSTALL CHAIN LINK FENCING AND GEOTEXTILE.

MARYLAND STANDARDS AND SPECIFICATIONS FOR SOIL EROSION AND SEDIMENT CONTROL

U.S. DEPARTMENT OF AGRICULTURE NATURAL RESOURCES CONSERVATION SERVICE	2011	MARYLAND DEPARTMENT OF ENVIRONMENT WATER MANAGEMENT ADMINISTRATION

DRAWN	DATE	Mountain Valley PIPELINE	ENVIRONMENTAL DETAIL
CHECKED	DATE		SUPER SILT FENCE
APP'D	DATE 08/11/17		
SCALE N.T.S.	SHEET 1 OF 1		
JOB NO.		DESIGN ENGINEERING	DRAWING NO. MVP-ES9.2 / REV. 0
PROJECT ID: MVP – VA PORTION			

Table E.3: Super Silt Fence Design Constraints

Average Slope Steepness	Maximum Slope Length	Maximum Super Silt Fence Length
Flatter than 10:1 (0 - <10%)	Unlimited	Unlimited
10:1 to 5:1 (10 - 20%)	200 feet	1,500 feet
<5:1 to 3:1 (>20 - 33%)	150 feet	1,000 feet
<3:1 to 2:1 (>33 - 50%)	100 feet	500 feet
Steeper than 2:1 (>50%)	50 feet	250 feet

1. Super silt fence should be placed on the contour. No section of super silt fence is to exceed a grade of 5% for a distance of more than 50 feet.

2. Super silt fence should be used with caution in areas where rocky soils may prevent trenching.

3. The use of super silt fence must conform to the design constraints listed in Table E.3 above.

4. Extend both ends of the silt fence a minimum five (5) feet horizontally upslope at 45 degrees to the main fence alignment to prevent runoff from going around the ends of the silt fence.

Maintenance

Accumulated sediment and debris must be removed when bulges develop in the fence or when sediment reaches 25 percent of the fence height. The geotextile must be replaced if torn. If undermining occurs, reinstall chain link fencing and geotextile.

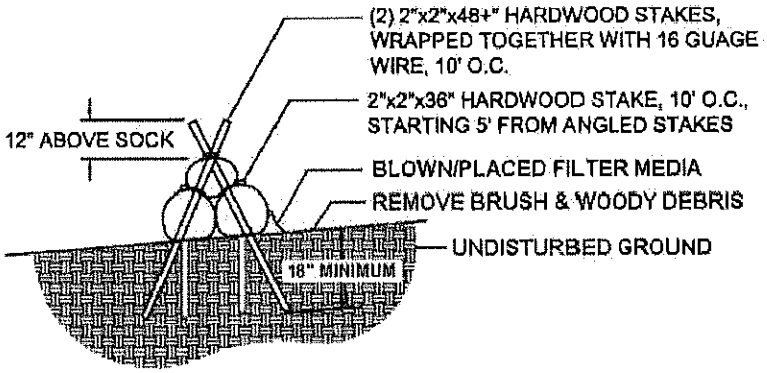
Table H.1: Geotextile Fabrics

		WOVEN SLIT FILM GEOTEXTILE		WOVEN MONOFILAMENT GEOTEXTILE		NONWOVEN GEOTEXTILE	
		MINIMUM AVERAGE ROLL VALUE[1]					
PROPERTY	TEST METHOD	MD	CD	MD	CD	MD	CD
Grab Tensile Strength	ASTM D-4632	200 lb	200 lb	370 lb	250 lb	200 lb	200 lb
Grab Tensile Elongation	ASTM D-4632	15%	10%	15%	15%	50%	50%
Trapezoidal Tear Strength	ASTM D-4533	75 lb	75 lb	100 lb	60 lb	80 lb	80 lb
Puncture Strength	ASTM D-6241	450 lb		900 lb		450 lb	
Apparent Opening Size[2]	ASTM D-4751	U.S. Sieve 30 (0.59 mm)		U.S. Sieve 70 (0.21 mm)		U.S. Sieve 70 (0.21 mm)	
Permittivity	ASTM D-4491	0.05 sec^{-1}		0.28 sec^{-1}		1.1 sec^{-1}	
Ultraviolet Resistance Retained at 500 hours	ASTM D-4355	70% strength		70% strength		70% strength	

[1] All numeric values except apparent opening size (AOS) represent minimum average roll values (MARV). MARV is calculated as the typical minus two standard deviations. MD is machine direction; CD is cross direction.

[2] Values for AOS represent the average maximum opening.

DRAWN	DATE	Mountain Valley PIPELINE	ENVIRONMENTAL DETAIL
CHECKED	DATE		SUPER SILT FENCE
APP'D	DATE 08/11/17		
SCALE N.T.S.	SHEET 1 OF 1		
JOB NO.			
PROJECT ID: MVP – VA PORTION		DESIGN ENGINEERING	DRAWING NO. MVP–ES9.2A / REV. 0

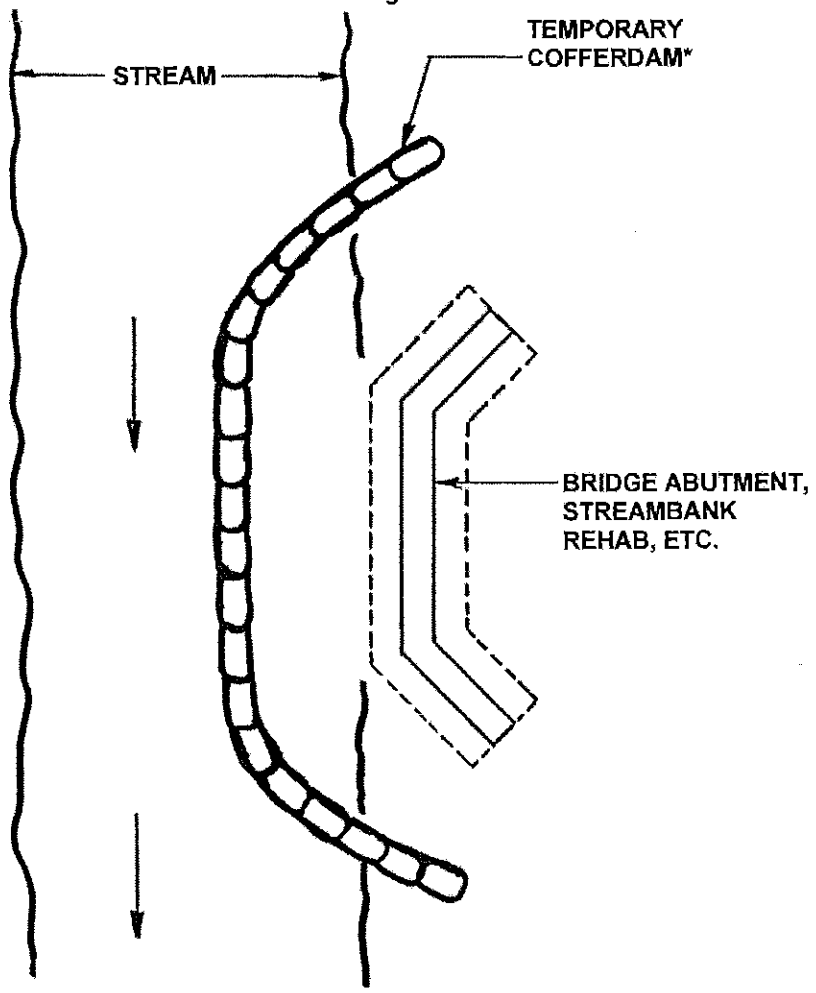


NOTES:

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

DRAWN	DATE	Mountain Valley PIPELINE	ENVIRONMENTAL DETAIL
CHECKED	DATE		STACKED COMPOST FILTER SOCK DETAIL CROSS SECTION VIEW
APP'D	DATE 08/11/17		
SCALE N.T.S.	SHEET 1 OF 1		
JOB NO.			
PROJECT ID: MVP – VA PORTION		DESIGN ENGINEERING	DRAWING NO. MVP–ES9.3 / REV. 0

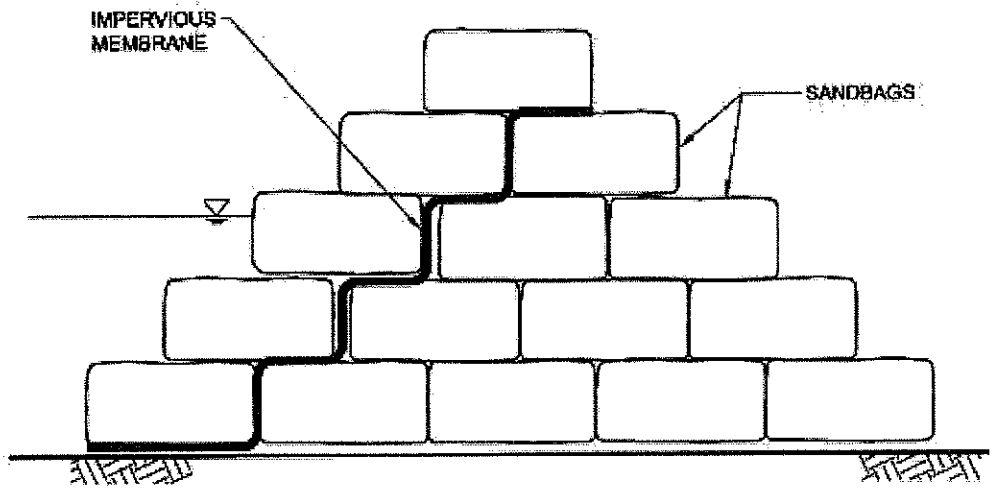
MVP-ES13-Cofferdam Stream
Crossing Methodn



PA DEP

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

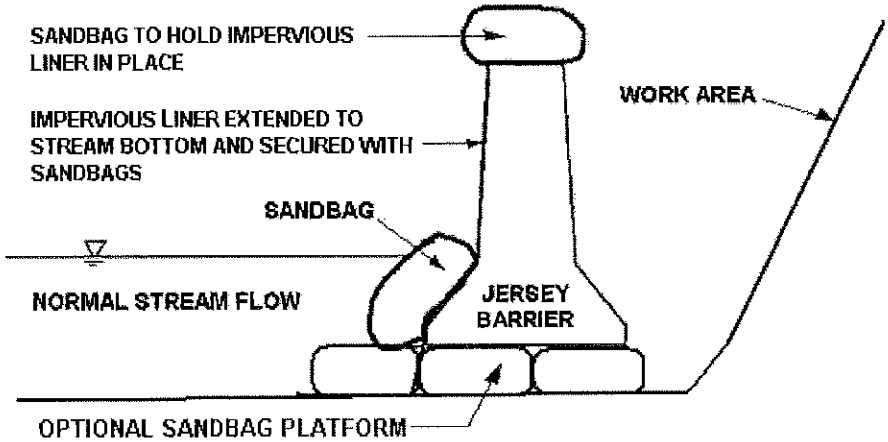
DRAWN	DATE	Mountain Valley PIPELINE	ENVIRONMENTAL DETAIL
CHECKED	DATE		COFFERDAM STREAM CROSSING METHOD
APP'D	DATE		
SCALE N.T.S.	SHEET 1 OF 1		
JOB NO.			
PROJECT ID: PXXXX		DESIGN ENGINEERING	DRAWING NO. MVP–ES13.1 / REV. P



PA DEP

2 BAG MINIMUM HEIGHT ABOVE NORMAL BASE FLOW

FIGURE 3.13
Jersey Barrier Cofferdam – End View



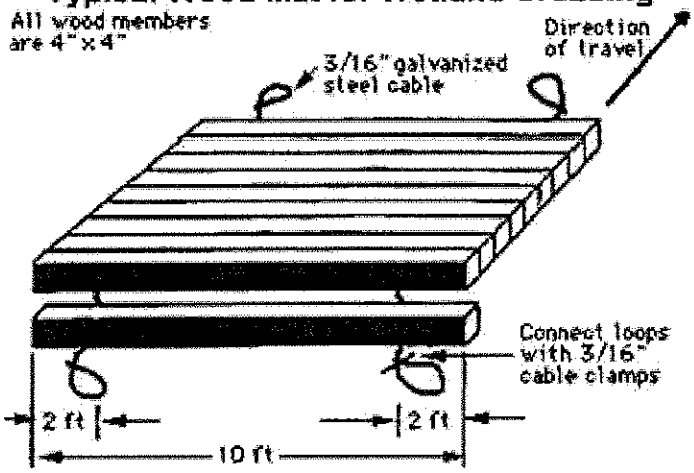
PA DEP

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

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

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

Typical Wood Mat for Wetland Crossing



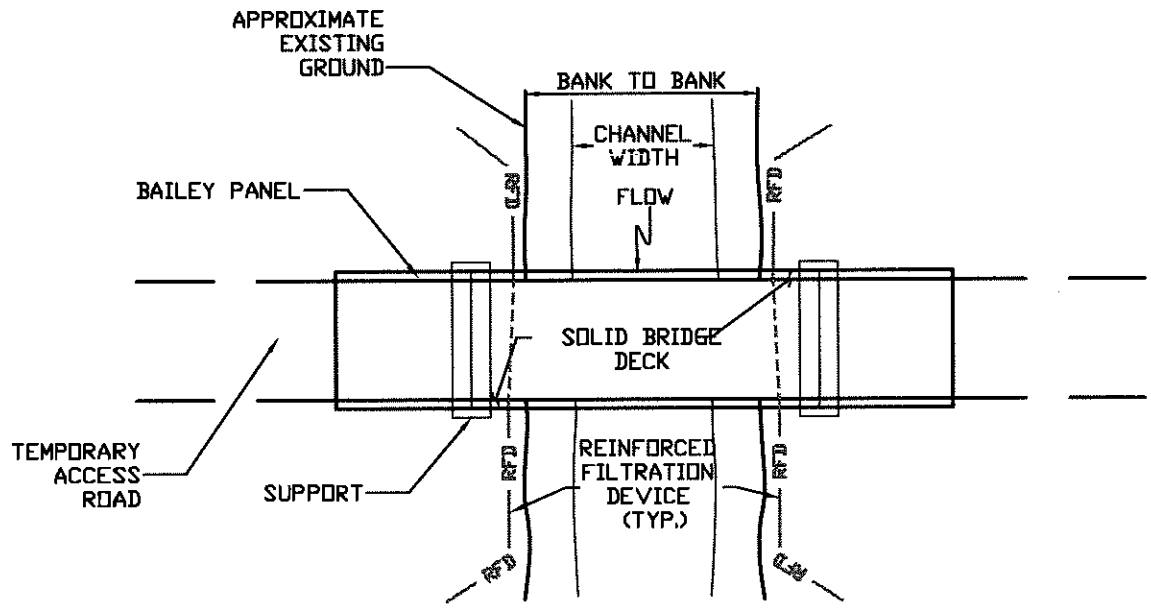
University of Minnesota FS 07009

A geotextile underlayment shall be used under the wood mat.

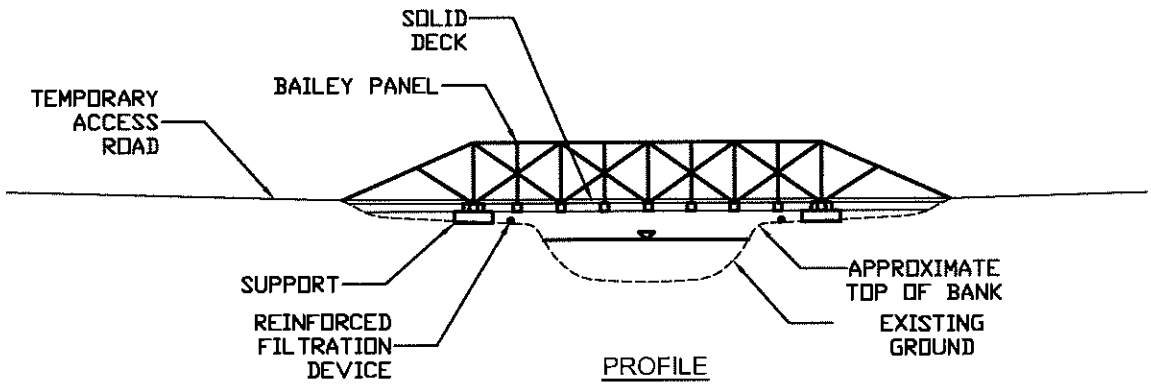
Source: PaDEP, E&S Pollution Control Manual, March 2012

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

DRAWN	DATE	Mountain Valley PIPELINE	ENVIRONMENTAL DETAIL
CHECKED	DATE		TIMBER MAT/WETLAND CROSSING
APP'D	DATE		
SCALE N.T.S.	SHEET 1 OF 1		
JOB NO.			
PROJECT ID: PXXXX		DESIGN ENGINEERING	DRAWING NO. MVP-ES37 / REV. P



PLAN VIEW



PROFILE

DRAWN	DATE	Mountain Valley PIPELINE	ENVIRONMENTAL DETAIL
CHECKED	DATE		MODULAR TEMPORARY BAILEY BRIDGE
APP'D	DATE		
SCALE N.T.S.	SHEET 1 OF 1		
JOB NO.			
PROJECT ID: PXXXX		DESIGN ENGINEERING	DRAWING NO. MVP-ES41 / REV. P

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

Definition

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

Purpose

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

Conditions Where Practice Applies

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

Planning Considerations

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

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

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

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

Design Criteria

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

Water Bars / Slope Breakers

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

Excavation of Sump Filter

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

Compost Filter Sock

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

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

$$Q = CiA$$

where,

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

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

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

where,

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

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

$$v = Q/A$$

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

where,

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

TABLE 3.99-D-A
PERMISSIBLE VELOCITES FOR EARTH LININGS

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

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

Example

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

Solution:

1. Calculate the discharge:
$$Q = CiA = 0.9 * 4.07\ inches/hour * 1\ acre = 3.66\ ft^3/sec$$

2. Rearranging the weir equation to solve for overtopping depth:
$$H = (Q/(C_D * L))^{\frac{2}{3}} = (3.66\ ft^3/sec\,/(2.99 * 8\ ft))^{2/3} = 0.29\ ft$$

3. Calculate the velocity over the compost filter sock:

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

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

Streambank Swale

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

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

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

Solution:
CHANNEL DATA

Q = 3.66 (cfs) P = 3.02 (ft.) n = 0.069

S_o = 1.00 (ft/ft) R = 0.18 (ft.)

d_n = 0.37 (ft.) V_n = 6.81 (fps)

A = 0.54 (ft^2) Side Slope = 4:1

ASSUMED ROCK SIZE - D50 = 0.5 ft

VERIFY ASSUMED ROCK SIZE

ϕ = 41.2° (Appendix 7E-1)

Side Slope = 4: 1 θ = 14°

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

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

For Specific Gravity = 2.65 and Stability Factor = 1.2

$D50 = 0.001 * V_a^3 / (d_{avg}^{0.5} * K_1^{1.5})$

$D50 = 0.001 * 6.81^3 / (0.5^{0.5} * 0.93^{1.5}) = 0.45$ ft.

D50 Computed (0.45) < D50 Assumed (0.5)

Therefore, assumed D50 is appropriate.

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

Construction Specifications

General

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

Water Bars / Slope Breakers

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

Compost Filter Socks

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

Sump Filters

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

Streambank Swales

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

DRAWN	DATE	Mountain Valley PIPELINE	ENVIRONMENTAL DETAIL
CHECKED	DATE		POST CONSTRUCTION STREAM CROSSING STABILIZATION
APP'D	DATE		
SCALE N.T.S.	SHEET 1 OF 1		
JOB NO.			
PROJECT ID: PXXXX		DESIGN ENGINEERING	DRAWING NO. MVP–ES44.4 / REV. P

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

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

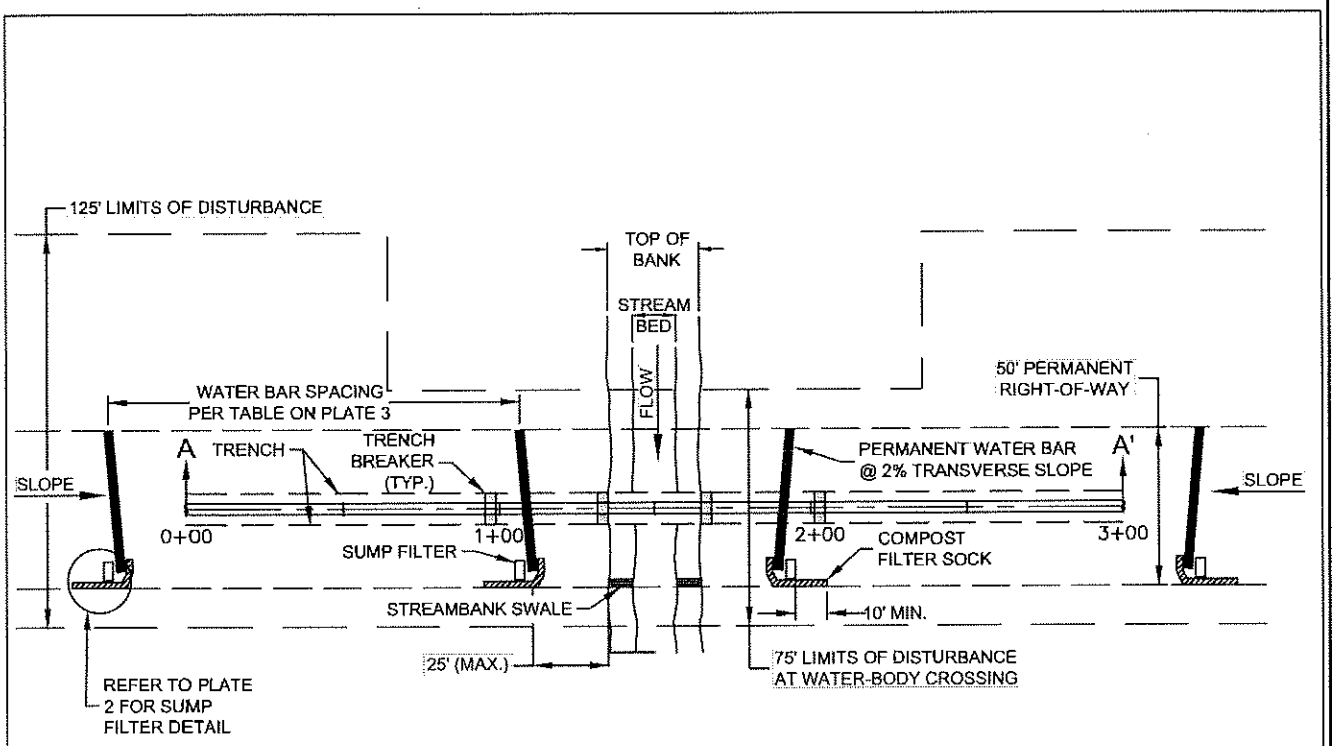
Inspections and Maintenance

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

Post Stabilization

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

DRAWN	DATE	Mountain Valley PIPELINE	ENVIRONMENTAL DETAIL
CHECKED	DATE		POST CONSTRUCTION STREAM CROSSING STABILIZATION
APP'D	DATE		
SCALE N.T.S.	SHEET 1 OF 1		
JOB NO.			
PROJECT ID: PXXXX		DESIGN ENGINEERING	DRAWING NO. MVP–ES44.5 / REV. P

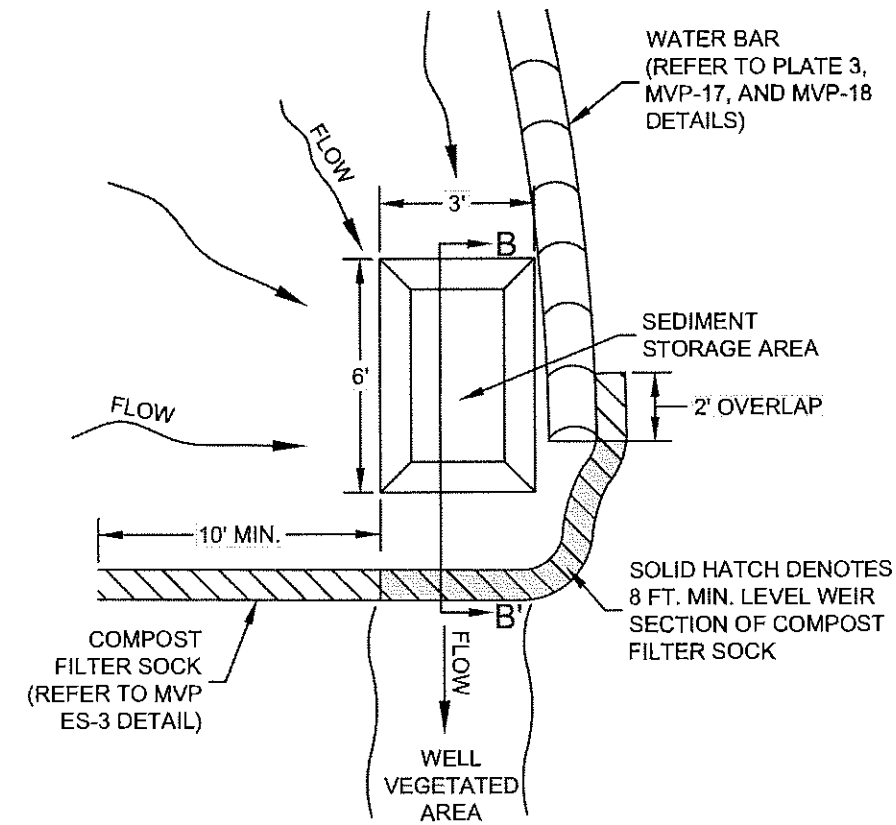


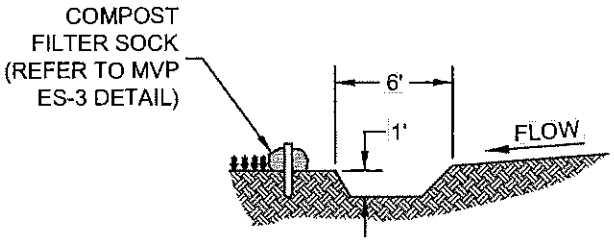
PLAN VIEW
NOT TO SCALE

POST-CONSTRUCTION STREAM CROSSING STABILIZATION DETAIL

PLATE 1

DRAWN	DATE	Mountain Valley PIPELINE	ENVIRONMENTAL DETAIL
CHECKED	DATE		POST CONSTRUCTION STREAM CROSSING STABILIZATION
APP'D	DATE		
SCALE N.T.S.	SHEET 1 OF 1		
JOB NO.		DESIGN ENGINEERING	DRAWING NO. MVP–ES44.6 / REV. P
PROJECT ID: PXXXX			





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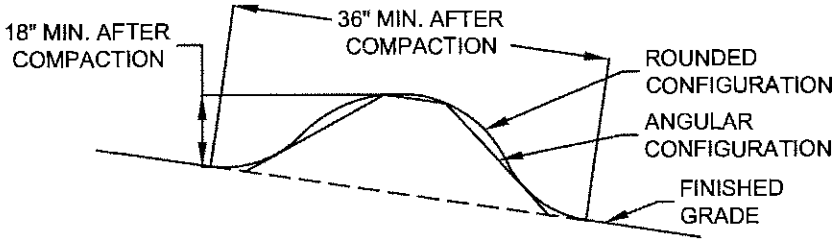
SUMP FILTER DETAIL

NOT TO SCALE

POST-CONSTRUCTION STREAM CROSSING STABILIZATION DETAIL

PLATE 2

DRAWN	DATE	Mountain Valley PIPELINE	ENVIRONMENTAL DETAIL
CHECKED	DATE		POST CONSTRUCTION STREAM CROSSING STABILIZATION
APP'D	DATE		
SCALE N.T.S.	SHEET 1 OF 1		
JOB NO.			
PROJECT ID: PXXXX		DESIGN ENGINEERING	DRAWING NO. MVP–ES44.7 / REV. P

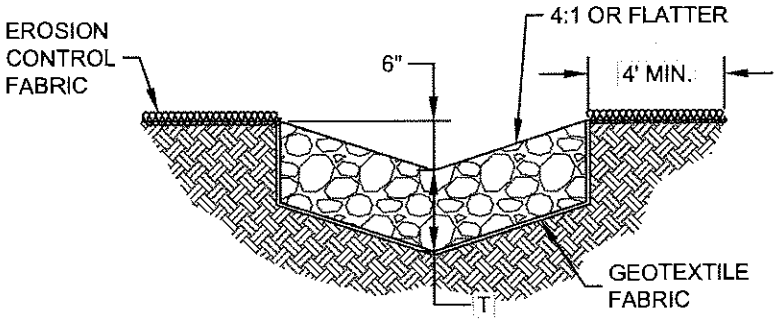


MINIMUM SPACING FOR PERMANENT WATER BARS	
PIPELINE GRADE	DISTANCE (FEET)
<2%	-[2,3]
2-5%	400
6-15%	200
16-30%	100
>31%	50[4]

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

PERMANENT WATER BAR DETAIL

NOT TO SCALE



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

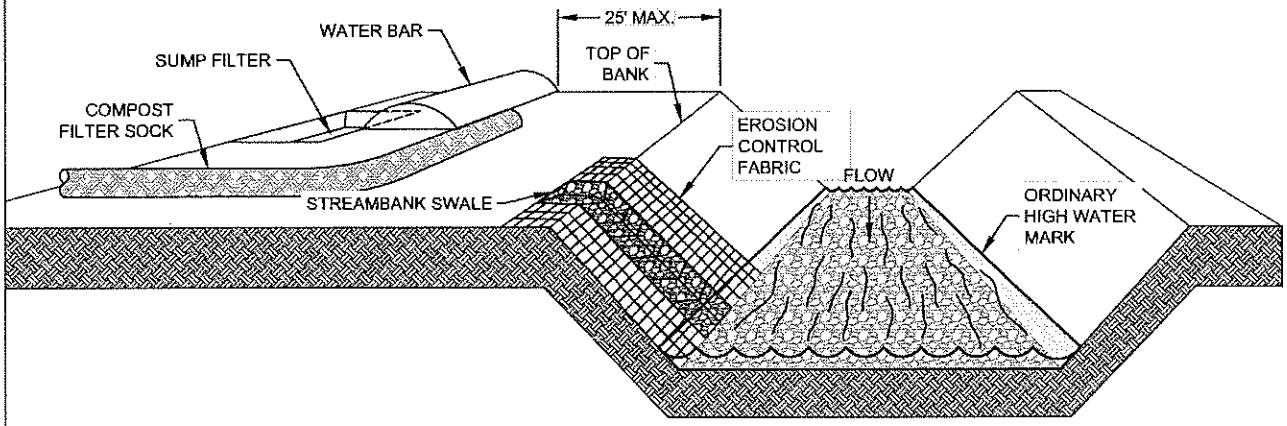
STREAMBANK SWALE TYPICAL CROSS SECTION

NOT TO SCALE

POST-CONSTRUCTION STREAM CROSSING STABILIZATION DETAIL

PLATE 3

DRAWN	DATE	Mountain Valley PIPELINE	ENVIRONMENTAL DETAIL
CHECKED	DATE		POST CONSTRUCTION STREAM CROSSING STABILIZATION
APP'D	DATE		
SCALE N.T.S.	SHEET 1 OF 1		
JOB NO.			
PROJECT ID: PXXXX		DESIGN ENGINEERING	DRAWING NO. MVP–ES44.8 / REV. P



PERSPECTIVE VIEW
NOT TO SCALE

POST-CONSTRUCTION STREAM CROSSING STABILIZATION DETAIL

PLATE 4

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

Mountain Valley PIPELINE

DESIGN ENGINEERING

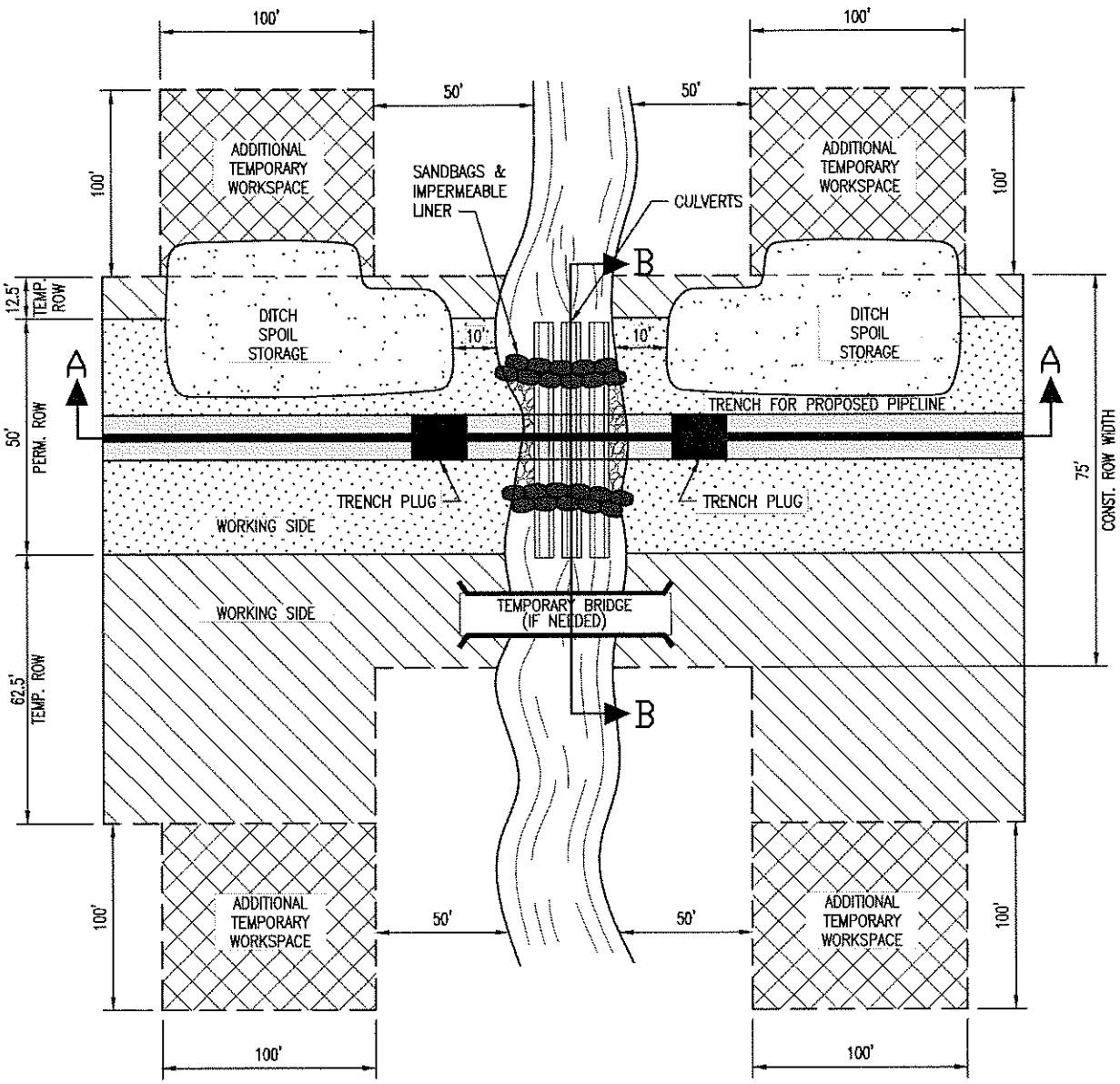
ENVIRONMENTAL DETAIL

POST CONSTRUCTION STREAM CROSSING STABILIZATION

DRAWING NO. MVP–ES44.9

REV. P

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



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

Mountain Valley PIPELINE

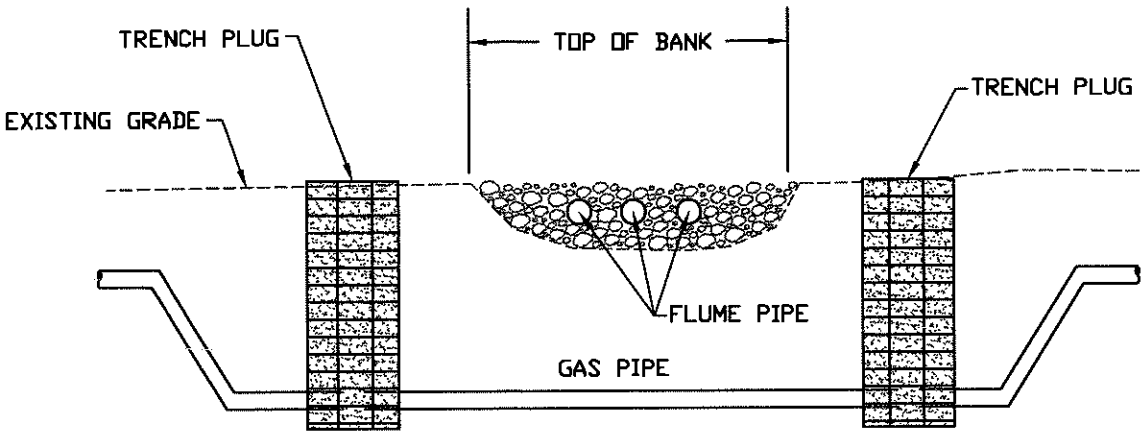
DESIGN ENGINEERING

TYPICAL CONSTRUCTION DETAIL

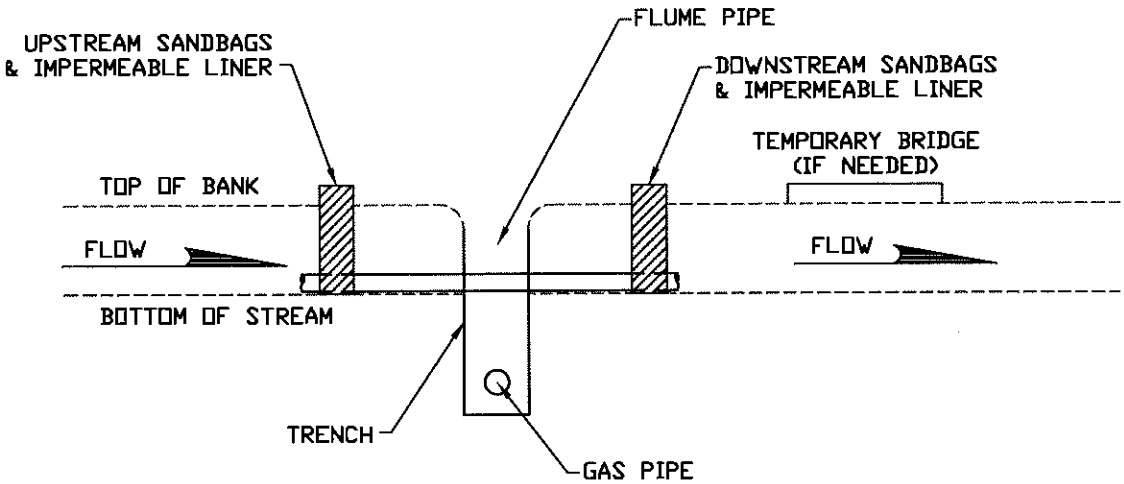
MAINLINE CONSTRUCTION
WATERBODY CROSSING
OPEN CUT – FLUME

DRAWING NO. MVP–6

REV. 0



A-A



B-B

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

DRAWN	MJP	DATE	5/5/2017
CHECKED	PS	DATE	5/5/2017
APP'D	KAL	DATE	5/5/2017
SCALE	N.T.S.	SHEET	1 OF 1
JOB NO.			
PROJECT ID: PXXXX			

Mountain Valley PIPELINE

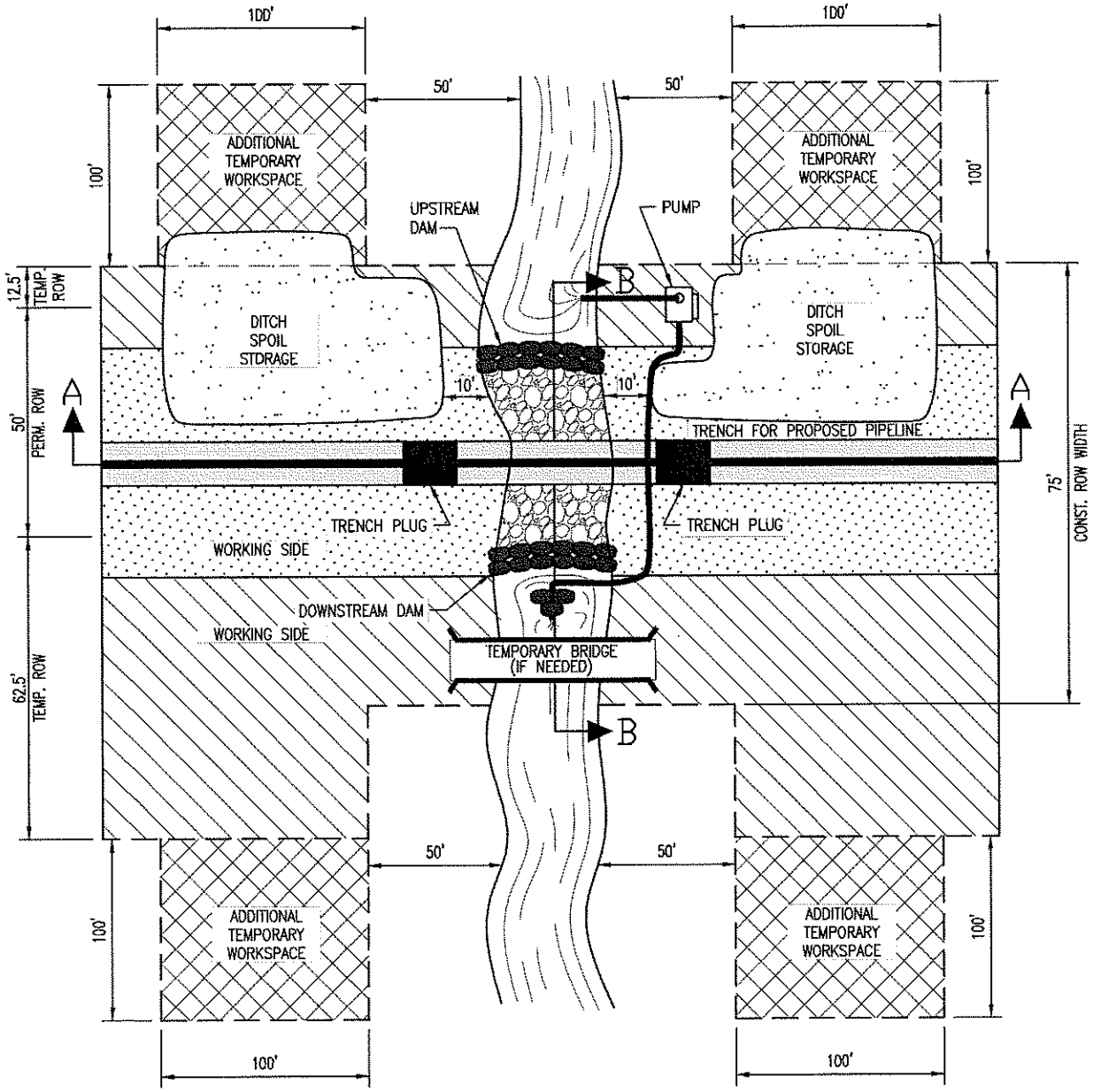
DESIGN ENGINEERING

TYPICAL CONSTRUCTION DETAIL

MAINLINE CONSTRUCTION
WATERBODY CROSSING
OPEN CUT – FLUME

DRAWING NO. MVP-6.1

REV. 0



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

DRAWN	JDM	DATE	08/20/15
CHECKED	RRR	DATE	10/01/15
APP'D	RLM	DATE	10/01/15
SCALE	N.T.S.	SHEET	1 OF 1
JOB NO.			
PROJECT ID: PXXXX			

Mountain Valley PIPELINE

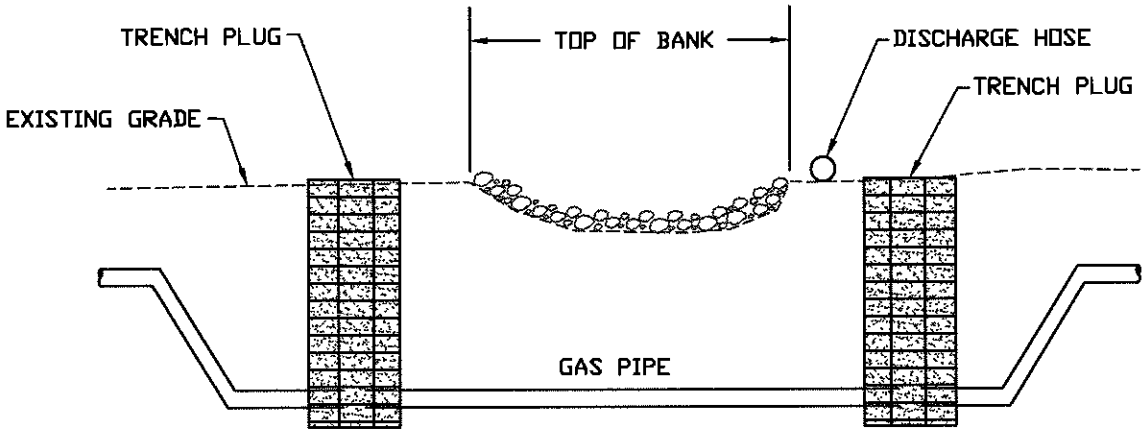
DESIGN ENGINEERING

TYPICAL CONSTRUCTION DETAIL

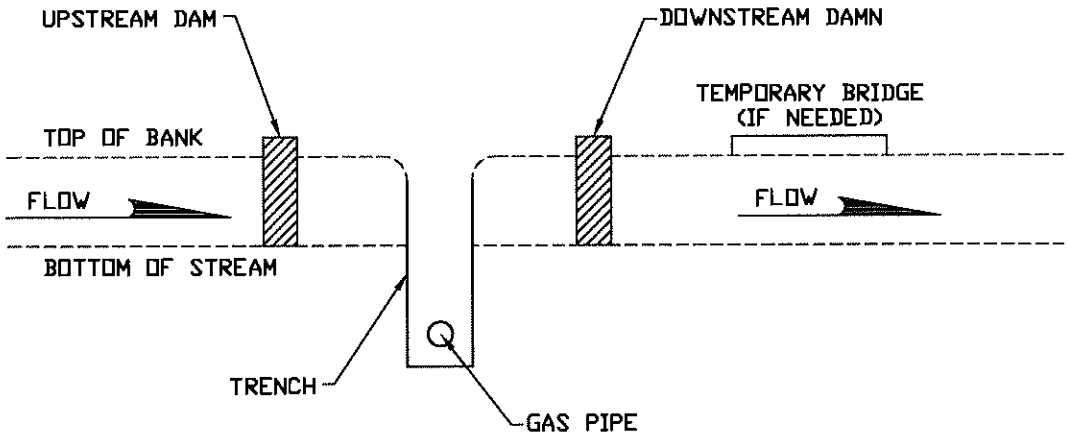
MAINLINE CONSTRUCTION
WATERBODY CROSSING
OPEN CUT – DRY/DAM AND PUMP
RIGHT–OF–WAY

DRAWING NO. MVP–15

REV. 0



A-A



B-B

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

DRAWN	MJP	DATE	5/5/2017
CHECKED	PS	DATE	5/5/2017
APP'D	KAL	DATE	5/5/2017
SCALE	N.T.S.	SHEET	1 OF 1
JOB NO.			
PROJECT ID:	PXXXX		

Mountain Valley PIPELINE

DESIGN ENGINEERING

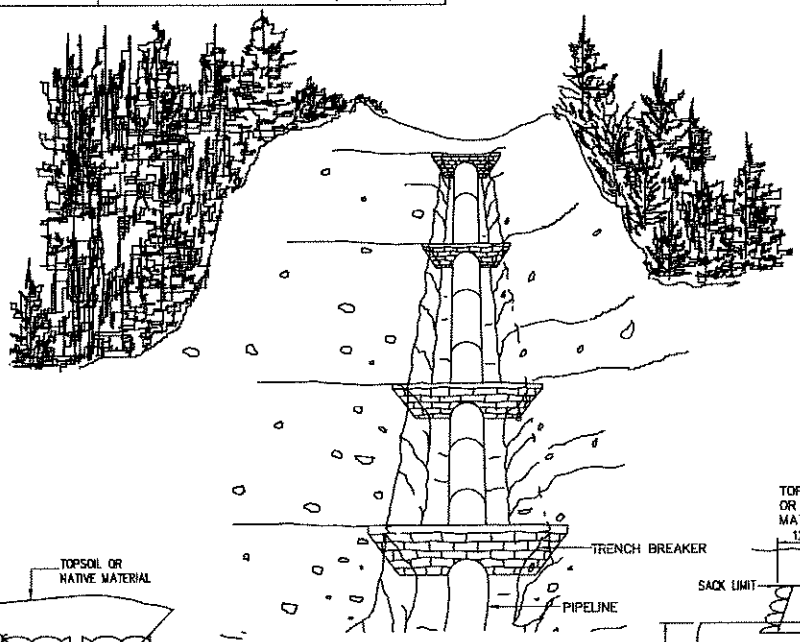
TYPICAL CONSTRUCTION DETAIL

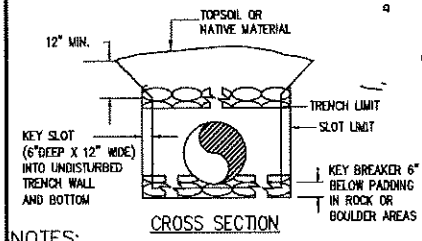
MAINLINE CONSTRUCTION
WATERBODY CROSSING
OPEN CUT – DRY/DAM AND PUMP
RIGHT-OF-WAY

DRAWING NO.	REV.
MVP-15.1	0

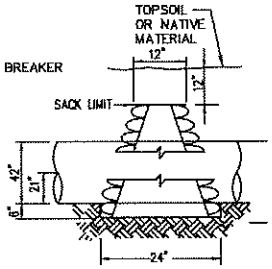
SLOPE %	DISTANCE	PLUG MATERIAL
0% – 5%	SEE NOTE 6	CONCRETE FILLED SACKS
5% – 15%	500 FT	SANDBAGS OR CONCRETE FILLED SACKS
15% – 25%	300 FT	SANDBAGS OR CONCRETE FILLED SACKS
25% – 35%	200 FT	SANDBAGS OR CONCRETE FILLED SACKS
35% – 100%	100 FT	SANDBAGS OR CONCRETE FILLED SACKS
> 100%	50 FT	CONCRETE FILLED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

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





CROSS SECTION



SIDE VIEW

NOTES:

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

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

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

Mountain Valley PIPELINE

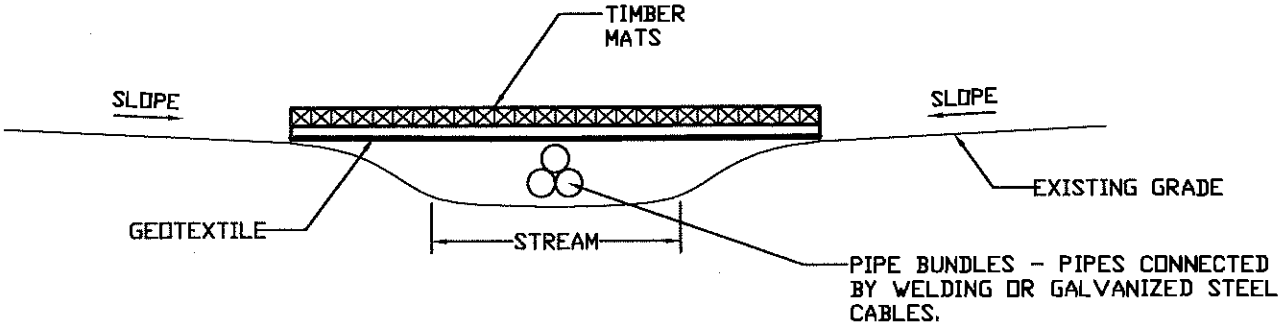
DESIGN ENGINEERING

TYPICAL CONSTRUCTION DETAIL

TYPICAL TRENCH BREAKER REQUIREMENTS

DRAWING NO. MVP–20

REV. 0



NOTE:

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

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

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

Mountain Valley PIPELINE

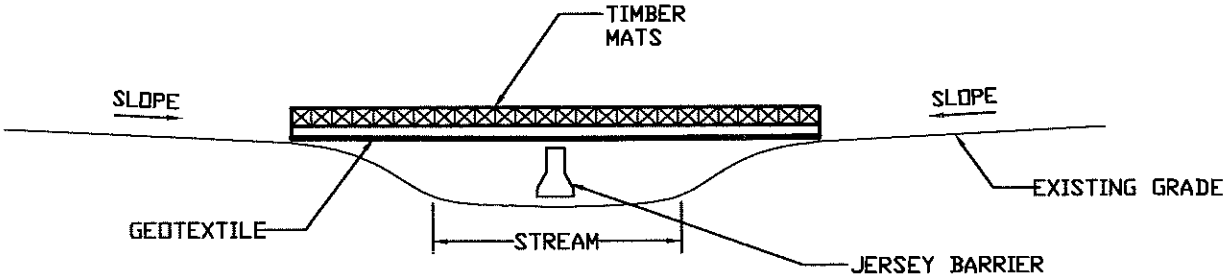
DESIGN ENGINEERING

TYPICAL CONSTRUCTION DETAIL

TIMBER MAT AND PIPE BUNDLE TEMPORARY STREAM CROSSING

DRAWING NO. MVP-47

REV. 0



NOTE:

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

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

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

Mountain Valley PIPELINE

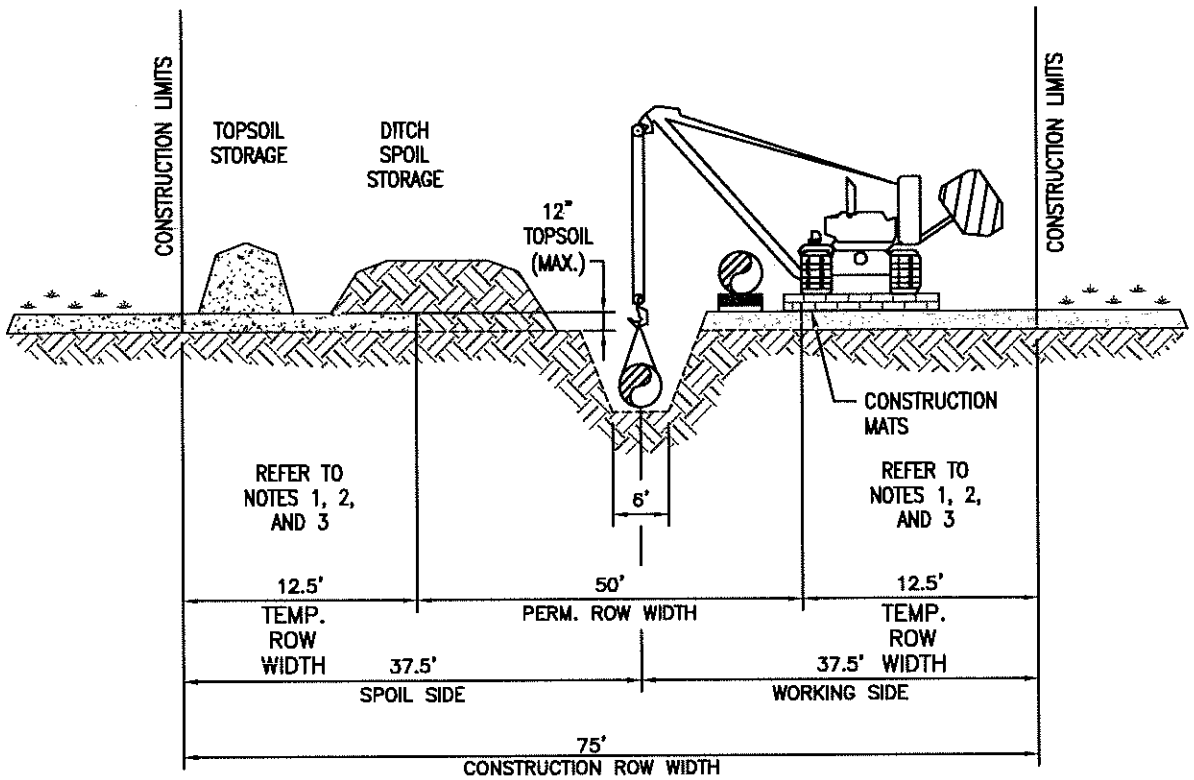
DESIGN ENGINEERING

TYPICAL CONSTRUCTION DETAIL

TIMBER MAT AND JERSEY BARRIER TEMPORARY STREAM CROSSING

DRAWING NO. MVP-48

REV. 0



NOTES:

1. TOPSOIL SEGREGATION/REMOVAL WILL ONLY BE CONDUCTED WITHIN THE PERMANENT EASEMENT AT ALL WETLAND CROSSINGS IN VIRGINIA.

2. GRUBBING ACTIVITIES SHALL BE LIMITED TO THE PERMANENT EASEMENT AT ALL WETLAND CROSSINGS IN VIRGINIA. OUTSIDE OF THE PERMANENT EASEMENT, WETLAND VEGETATION SHALL ONLY BE REMOVED AT OR ABOVE THE GROUND SURFACE. WOODY VEGETATION WITHIN THE TEMPORARY EASEMENT SHALL BE CUT AT GROUND SURFACE WITH THE STUMPS TO REMAIN IN-PLACE.

3. WETLAND CROSSINGS IN VIRGINIA SHALL BE CONDUCTED IN ACCORDANCE WITH NWP12 GENERAL AND NORFOLK DISTRICT REGIONAL CONDITIONS.

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

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

Mountain Valley PIPELINE

DESIGN ENGINEERING

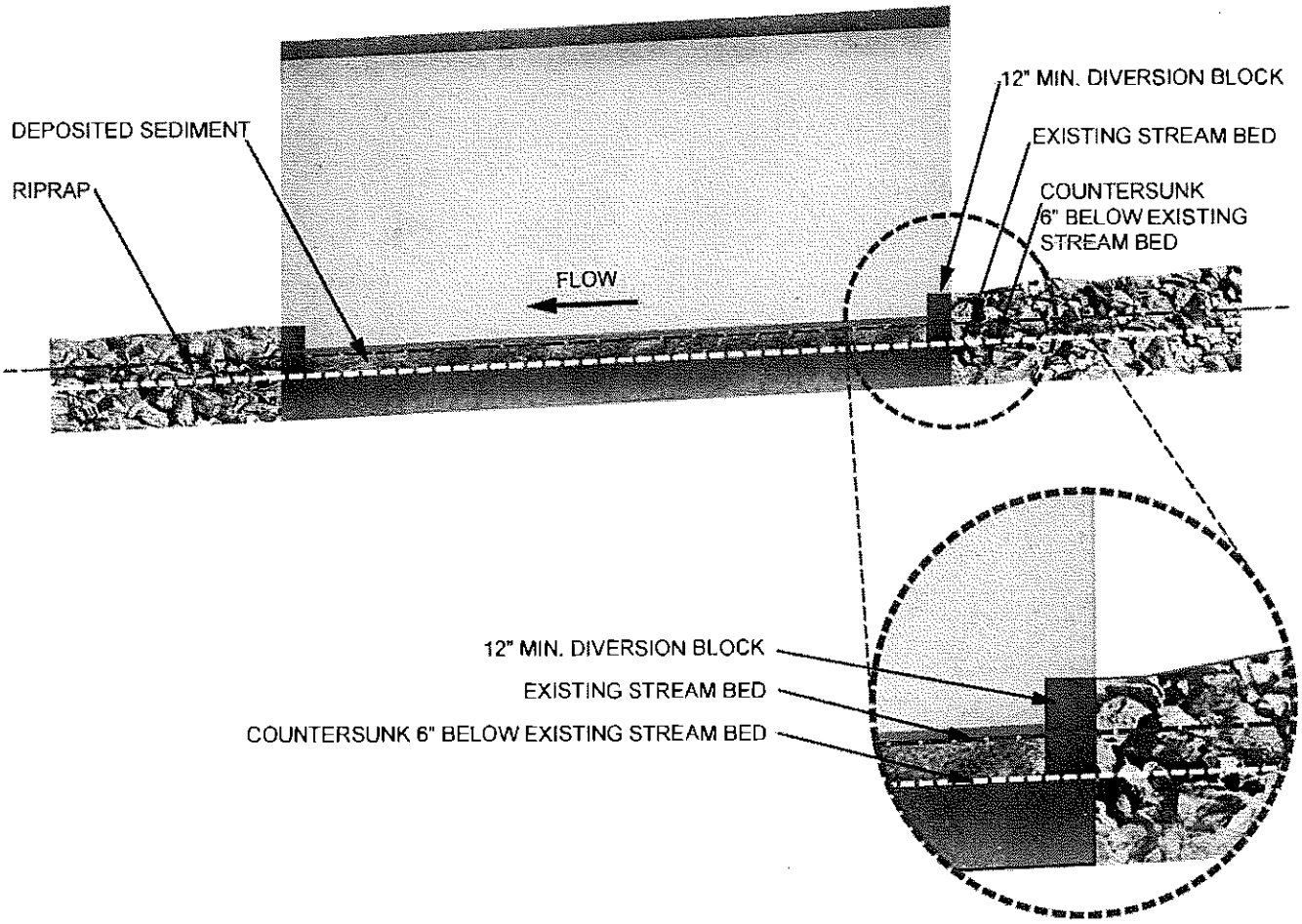
TYPICAL CONSTRUCTION DETAIL

WETLAND CROSSING TYPICAL FOR USACE NORFOLK (VA) DISTRICT

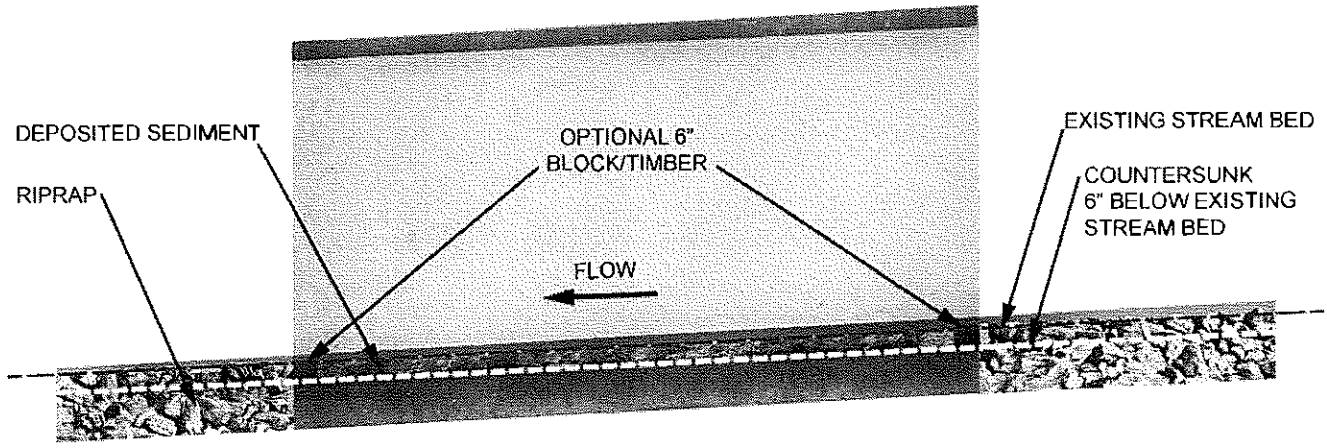
DRAWING NO. MVP-53

REV. 0

HIGH FLOW CULVERT



LOW FLOW CULVERT



Mountain Valley PIPELINE

Typical Access Road Culvert Crossing

Scale: NTS

Sheet: MVP-JPA-1

Mountain Valley Pipeline Project

Standard JPA-NWP12 Pre-Construction Notification, Virginia

Attachment H-5: Virginia Marine Resource Commission (VMRC) Stream Impact Plans and Cross-Sections

September 2017

ATTACHMENT H-5: VIRGINIA MARINE RESOURCE COMMISSION (VMRC) STREAM IMPACT PLANS AND CROSS SECTIONS

Attached is a list of Virginia Marine Resource Commission (VMRC) jurisdictional streams in the Project area with drainage areas greater than 5 square miles (Table 1). The location of VMRC jurisdictional streams in the Project area are shown on the attached VMRC Stream Overview Map (Figures). VMRC Stream Impact Plans and Cross Sections for all streams listed in Table 1 are attached (Drawings). Environmental details and typical construction details for anticipated Project streams crossings are provided in Attachment H-4.

TABLES

Table 1 VMRC Streams

Table 1. VMRC Stream Impacts

Stream ID	NHD Stream Name[1]	County	Crossing Method	Top of Bank Width (ft)	Water Depth (in)	Cross Width	Latitude[2]	Longitude[2]	Drainage Area (sq. mi)	Impact Type	Temporary Impact (sq ft)	Temporary Impact (LF)	Karst Area	Threatened/Endangered Species[3]	Trout Stream Designation[3]	Recommended Timeline for Trout Restrictions
S-NN17	Sinking Creek	Giles	Open Cut	55	12	34	37.311816	-80.615786	66.20	Pipeline ROW	2,620	77	Yes	-	Class V - v (Stockable)	-[4]
S-S5	Stony Creek	Giles	Open Cut	49	35	34	37.350071	-80.683959	47.50	Pipeline ROW	2,739	78	Yes	Green floater; Candy darter; Pistolgrip	Class V - vi (Stockable)	April 15 - June 15; August 15 - September 30; May 15 - July 31; Class V - vi[4]
S-Z13	Little Stony Creek	Giles	Open Cut	25	12	18	37.342172	-80.620099	20.10	Pipeline ROW	1,383	77	No	-	Class VI - ii (Good); Brook & Rainbow Trout	October 1 - March 31; March 15 - May 15
S-C21	Bradshaw Creek	Montgomery	Open Cut	25	24	22	37.251791	-80.258590	17.50	Pipeline ROW	1,553	89	No	Roanoke logperch; Orangefin madtom	-	March 15 - June 30; March 15 - May 31
S-G36	North Fork Roanoke River	Montgomery	Open Cut	29	12	18	37.208582	-80.314416	24.10	Pipeline ROW	1,687	94	Yes	Roanoke logperch; Orangefin madtom	-	March 15 - June 30; March 15 - May 31
S-NN16	Roanoke River	Montgomery	Open Cut	70	24	50	37.233402	-80.197942	256.00	Pipeline ROW	4,308	80	Yes	Roanoke logperch; Orangefin madtom	Class V - ***; no species listed	March 15 - June 30; March 15 - May 31; Class V - *** no species listed[4]
S-OO6	Craig Creek	Montgomery	Open Cut	35	4	30	37.312511	-80.404606	5.07	Pipeline ROW	2,286	75	No	James spiny mussel; Atlantic pigtoe	Class V - vi (Stockable)	May 15 - July 31; May 15 - July 31; Class V - vi[4]
S-IJ43	Mill Creek	Roanoke	Open Cut	18	6	15	37.138636	-80.138715	5.20	Pipeline ROW	1,182	78	No	Orangefin madtom	Class V - vi (Stockable)	March 15 - May 31; Class V - vi[4]
S-C14	Teels Creek	Franklin	Open Cut	50	2	40	37.003956	-79.921985	6.35	Pipeline ROW	3,653	90	No	Roanoke logperch	-	March 15 - June 30
S-C17	Teels Creek	Franklin	Open Cut	30	2	17	37.058290	-79.918015	6.62	Pipeline ROW	1,585	83	No	Roanoke logperch	-	March 15 - June 30
S-C19	Maggodee Creek	Franklin	Open Cut	45	24	40	37.055147	-79.830098	45.40	Pipeline ROW	3,005	75	No	Roanoke logperch	-	March 15 - June 30
S-CD8	Little Creek	Franklin	Open Cut	70	24	56	37.057584	-79.913921	22.60	Pipeline ROW	4,424	77	No	Roanoke logperch	-	March 15 - June 30
S-D6	North Fork Blackwater River	Franklin	Open Cut	18	6	12	37.123698	-80.074673	5.90	Pipeline ROW	942	76	No	Roanoke logperch	-	March 15 - June 30
S-D23	Teels Creek	Franklin	Open Cut	20	2	19	37.070322	-79.931030	5.06	Pipeline ROW	2,065	92	No	Roanoke logperch	-	March 15 - June 30
S-F11	Blackwater River	Franklin	Open Cut	90	7	89	37.052843	-79.625711	165.00	Pipeline ROW	6,798	81	No	Roanoke logperch	-	March 15 - June 30
S-I82	Little Creek	Franklin	Open Cut	60	12	43	37.049219	-79.908513	25.10	Pipeline ROW	3,247	76	No	Roanoke logperch	-	March 15 - June 30
S-C3	Harpen Creek	Pittsylvania	Open Cut	18	6	13	36.929762	-79.526109	7.79	Pipeline ROW	1,064	81	No	Roanoke logperch; Orangefin madtom	-	March 15 - June 30; March 15 - May 31
S-E11[5]	Pigg River	Pittsylvania	Open Cut (if HDD is unsuccessful)	100	36	95	36.933353	-79.528293	349.00	Pipeline ROW	7,131	100	No	Roanoke logperch; Yellow lampmussel; Orangefin Madtom	-	March 15 - June 30; April 15 - June 15; August 15 - September 30; March 15 - May 31
										Total Temporary Impacts	52,090	1,598				

Notes:

1 - For identified streams without a NHD (National Hydrography Dataset) name, the identified stream was given the name, "Unidentified Tributary (UNT)", of the first named receiving waterbody

2 - In decimal degrees

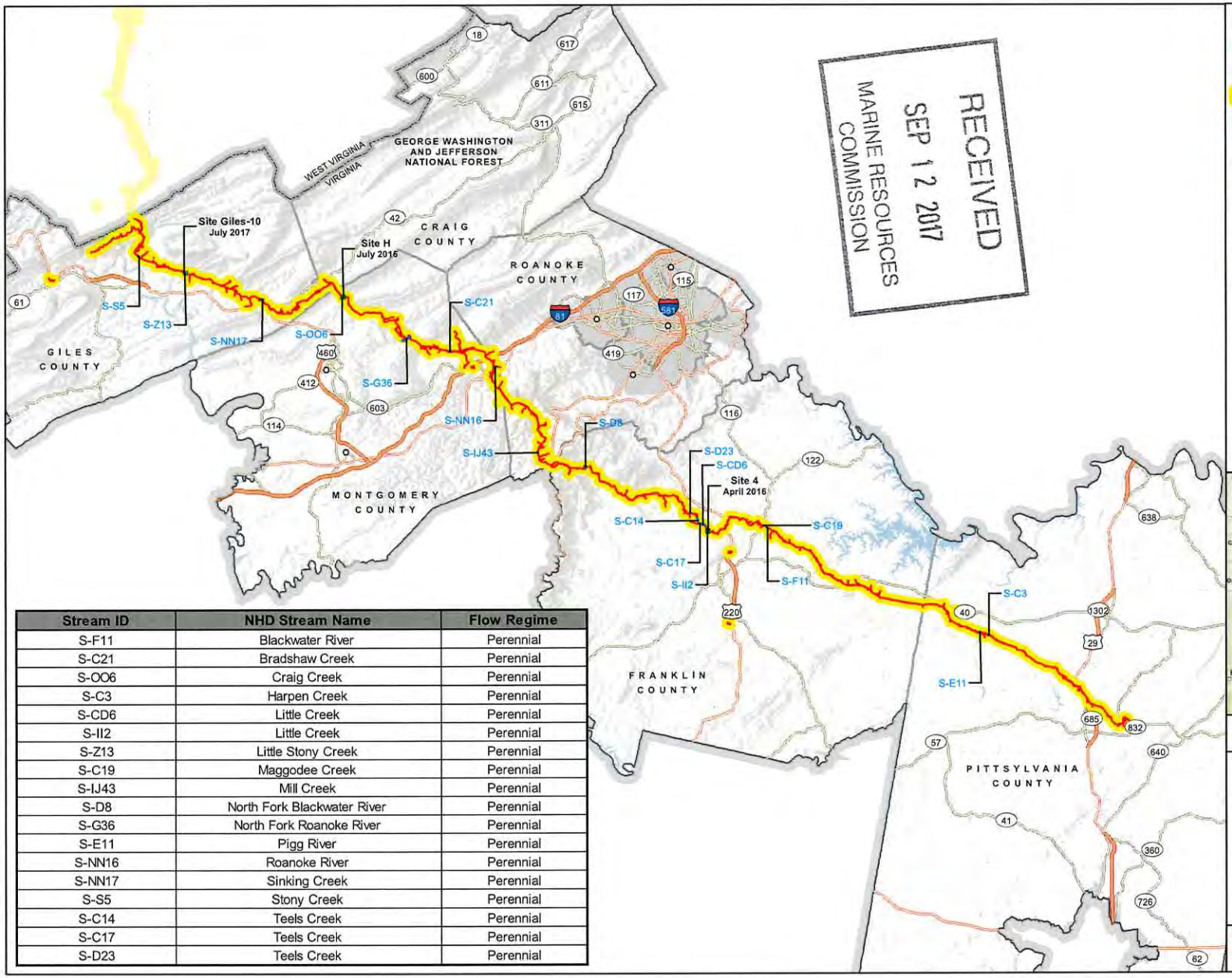
3 - Trout Waters - Virginia Department of Environmental Quality Office of Water Monitoring and Assessment. VEGIS Dataset. http://www.deq.virginia.gov/ConnectWithDEQ/VEGIS/VEGISDatasets.aspx. 2014_Integrated_WQ_Report_Rivers. File Date: 6/2016. File download: 6/2017.
- Wild Trout - VA DGIF Trout Stream Classification Class I-IV (VA DEQ Natural trout waters Class VI)
- Stockable Trout - VA DGIF Trout Stream Classification Class V-VI (VA DEQ Stockable trout waters Class V)

4 - Virginia Department of Game and Inland Fisheries will be contacted regarding time of year restrictions for this crossing

5 - The Federal Energy Regulatory Commission (FERC) recommended in its Final Environmental Impact Statement (June 2017) that MVP use a horizontal directional drill (HDD) as the preferred method to cross the Pigg River (S-E11). This proposed impact will not occur if the FERC-recommended HDD is completed successfully. If the HDD is unsuccessful for any reason, the dry open cut method will be utilized in accordance with an HDD Contingency Plan. The temporary impacts associated with the dry open cut crossing contingency are included here.

FIGURES

VMRC Stream Overview Map



Stream ID	NHD Stream Name	Flow Regime
S-F11	Blackwater River	Perennial
S-C21	Bradshaw Creek	Perennial
S-OO6	Craig Creek	Perennial
S-C3	Harpen Creek	Perennial
S-CD6	Little Creek	Perennial
S-II2	Little Creek	Perennial
S-Z13	Little Stony Creek	Perennial
S-C19	Maggodee Creek	Perennial
S-IJ43	Mill Creek	Perennial
S-D8	North Fork Blackwater River	Perennial
S-G36	North Fork Roanoke River	Perennial
S-E11	Pigg River	Perennial
S-NN16	Roanoke River	Perennial
S-NN17	Sinking Creek	Perennial
S-S5	Stony Creek	Perennial
S-C14	Teels Creek	Perennial
S-C17	Teels Creek	Perennial
S-D23	Teels Creek	Perennial

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Legend

- Anticipated VMRC Stream Impact
- USACE Site Verification
- Study Area - Preliminary Jurisdictional Determination Boundary
- Limit of Distubance
- Cities
- Interstates
- Highways
- Major Roads
- Water Bodies
- Urban Areas
- USDA Forest Service Surface Ownership
- County Boundaries
- State Boundaries

1 in = 7 miles

0 3.5 7 10.5 14 Miles

N W E S

Mountain Valley Pipeline Project

Mountain Valley PIPELINE

VMRC Stream Overview Map

USACE Norfolk District Richmond Field Office
Including Giles, Craig, Montgomery, Roanoke, Franklin, and Pittsylvania Counties

September, 2017

Data Sources: ESRI Streaming Data 2014.

Map Projection: NAD 1983 UTM 17N

Document Path: P:\GIT_Z:\EOT_MVP\Mapdocs\Wetlands\VA\MVP_VA_VMRC_Streams.mxd

DRAWINGS

VMRC Stream Impact Plans and Cross Sections

Stream Crossing Example Drawing

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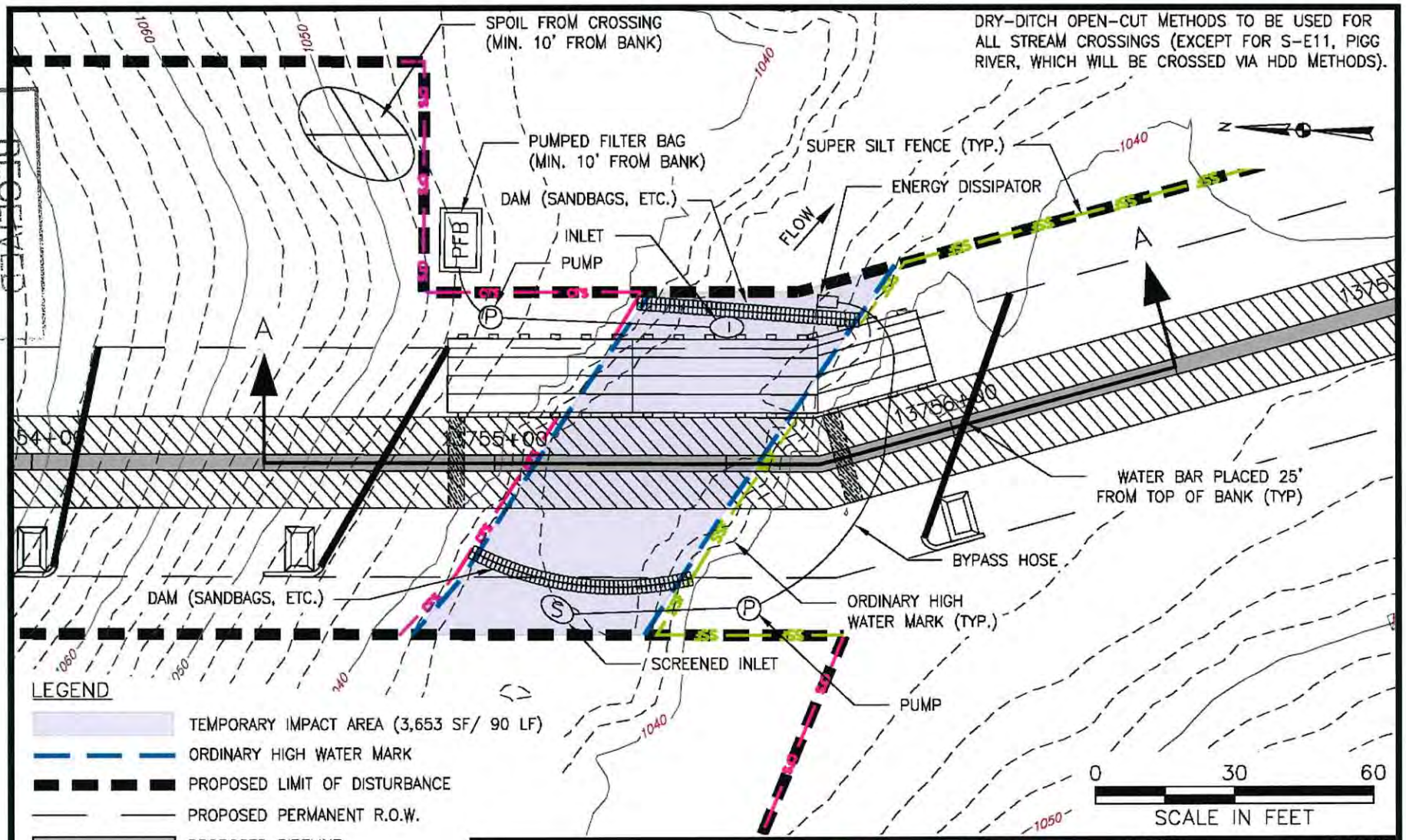

TETRA TECH

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661 ANDERSEN DRIVE – FOSTER PLAZA 7
PITTSBURGH, PA 15220
T: (412) 921-7090 | F: (412) 921-4040

Mountain Valley PIPELINE

STREAM CROSSING)
STREAM NAME: S-C14 (TEELS CREEK)
LAT./LONG. = 37.063956, -79.921985
DRAINAGE AREA = 6.36 SQUARE MILES
STATION = 13755+39
COUNTY: FRANKLIN
REFER TO ATTACHMENT H2, TABLE 2.2 FOR FIELD SURVEY STREAM IMPACTS

DATE:	9/8/17
PROJECT NO.:	112IC07157
DESIGNED BY:	DW
DRAWN BY:	JK
CHECKED BY:	RE
SHEET: 1 OF 2	

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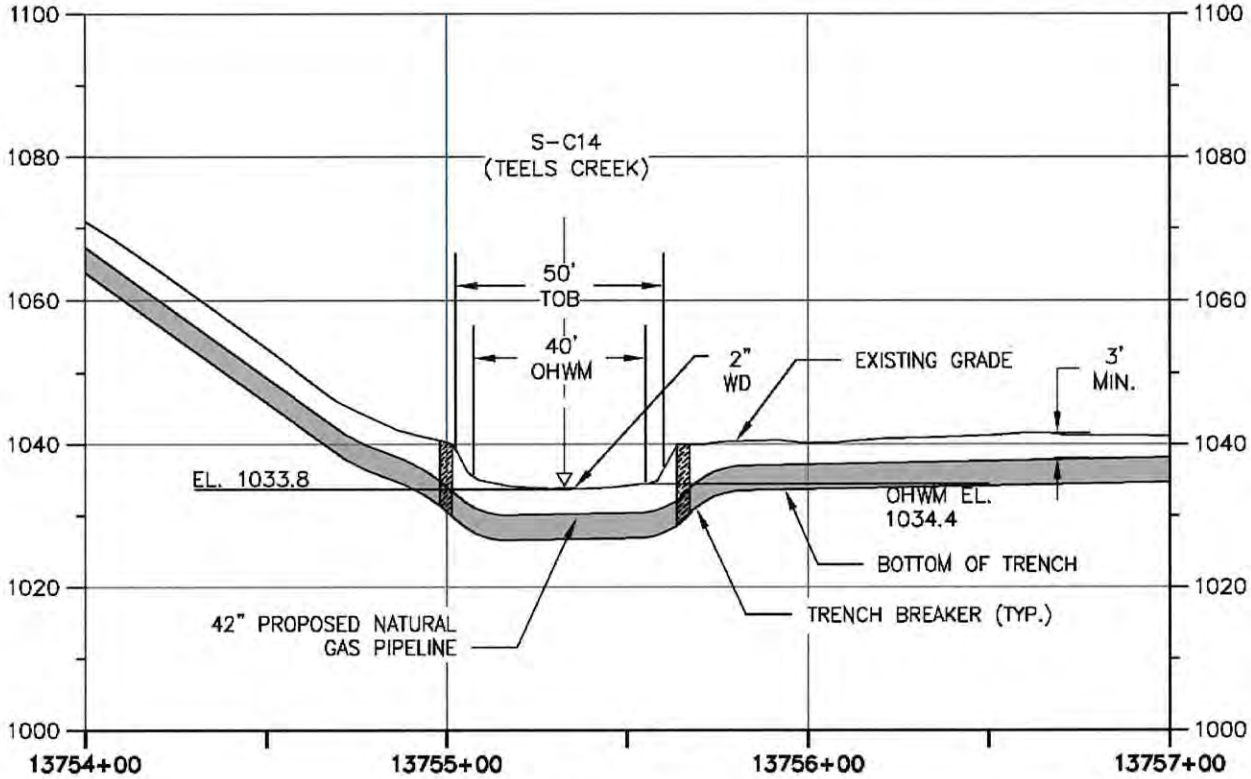

PROFILE A-A

HORIZONTAL

0 50 100

SCALE IN FEET

VERTICAL

0 25 50

SCALE IN FEET

DRY-DITCH OPEN-CUT METHODS TO BE USED FOR ALL STREAM CROSSINGS (EXCEPT FOR S-E11, PIGG RIVER, WHICH WILL BE CROSSED VIA HDD METHODS).

NOTE:
1. MINIMUM 3' OF COVER BETWEEN STREAMBED AND TOP OF PIPELINE.
2. PROPOSED FILL WILL BE IN TRENCH AND WILL BE RESTORED TO PRECONSTRUCTION ELEVATIONS.
3. WATER DEPTH SHOWN ON PROFILE IS NOT TO SCALE.
4. E&SC BMPS HAVE BEEN REMOVED FOR CLARITY AND ARE DISPLAYED ON PLAN VIEW.

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Mountain Valley PIPELINE

STREAM CROSSING)
STREAM NAME: S-C14 (TEELS CREEK)
LAT./LONG. = 37.063956, -79.921985
DRAINAGE AREA = 6.36 SQUARE MILES
STATION = 13755+39
COUNTY: FRANKLIN
REFER TO ATTACHMENT H2, TABLE 2.2 FOR FIELD SURVEY STREAM IMPACTS

DATE:	9/8/17
PROJECT NO.:	112IC07157
DESIGNED BY:	DW
DRAWN BY:	JK
CHECKED BY:	RE
SHEET: 2 OF 2	

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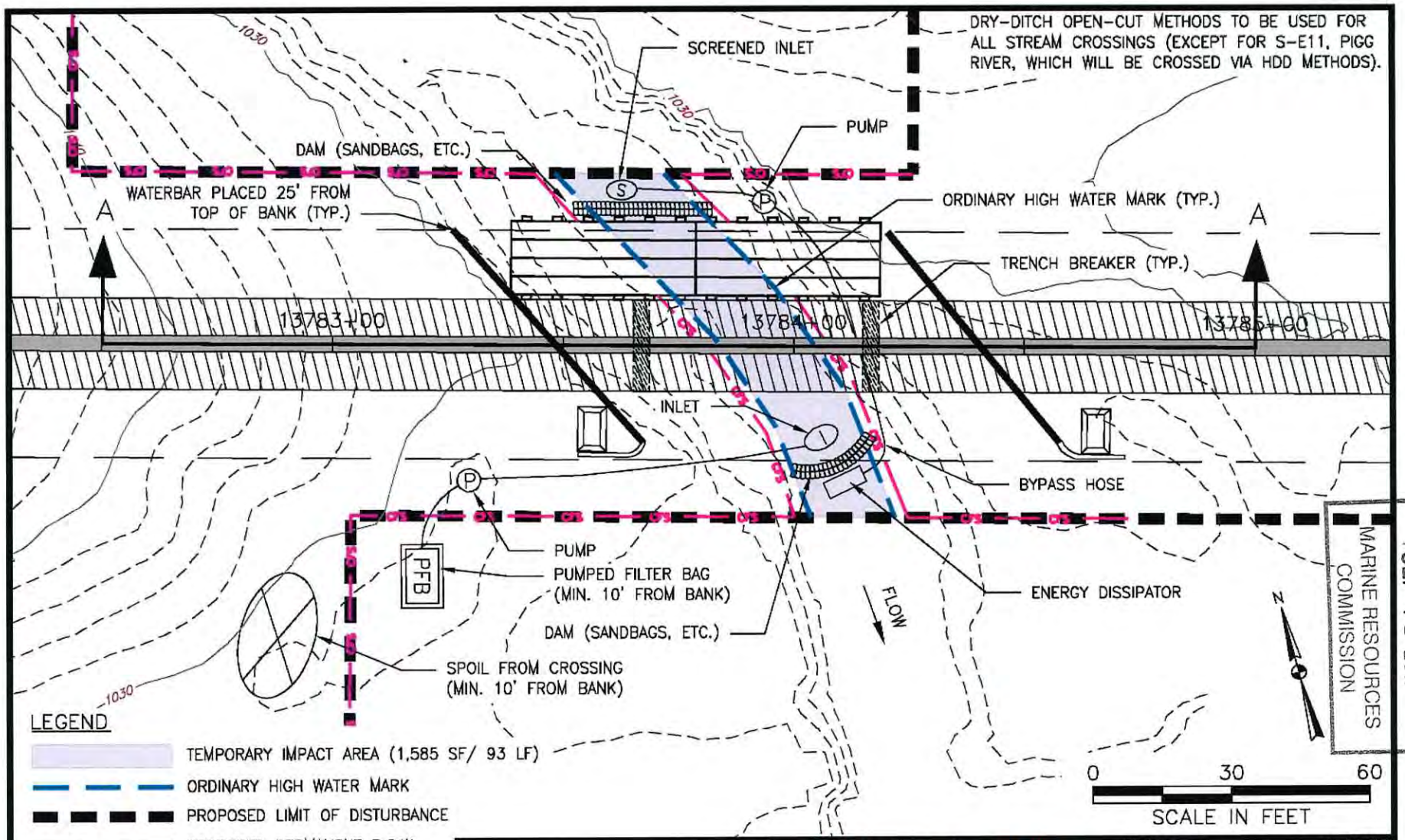

LEGEND

- TEMPORARY IMPACT AREA (1,585 SF/ 93 LF)
- ORDINARY HIGH WATER MARK
- PROPOSED LIMIT OF DISTURBANCE
- PROPOSED PERMANENT R.O.W.
- PROPOSED PIPELINE
- PROPOSED COMPOST FILTER SOCK
- TIMBER MAT/ TEMPORARY CONSTRUCTION ACCESS BRIDGE
- PROPOSED TRENCH BREAKER
- PIPELINE TRENCH

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661 ANDERSEN DRIVE – FOSTER PLAZA 7
PITTSBURGH, PA 15220
T: (412) 921-7090 | F: (412) 921-4040

Mountain Valley PIPELINE

STREAM CROSSING
STREAM NAME: S-C17 (TEELS CREEK)
LAT./LONG. = 37.05839, -79.918015
DRAINAGE AREA = 6.62 SQUARE MILES
STATION = 13783+84
COUNTY: FRANKLIN
REFER TO ATTACHMENT H2, TABLE 2.2 FOR FIELD SURVEY STREAM IMPACTS

DATE:	9/8/17
PROJECT NO.:	112IC07157
DESIGNED BY:	DW
DRAWN BY:	JK
CHECKED BY:	RE
SHEET: 1 OF 2	

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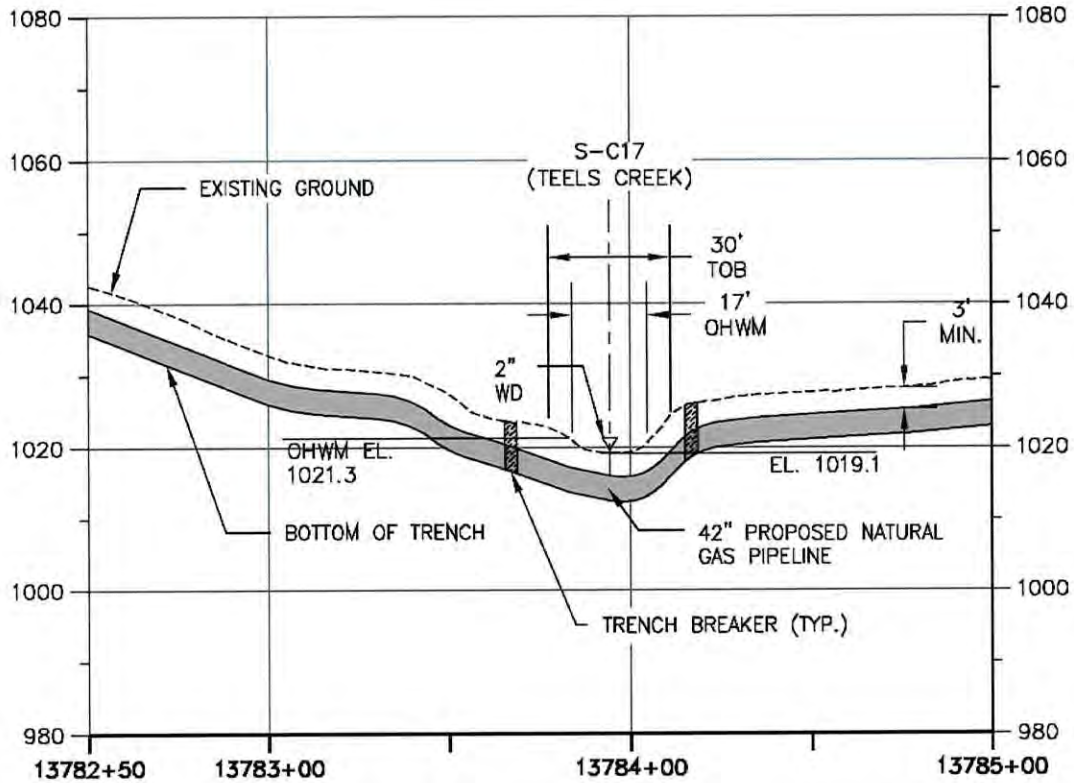
DRY-DITCH OPEN-CUT METHODS TO BE USED FOR ALL STREAM CROSSINGS (EXCEPT FOR S-E11, PIGG RIVER, WHICH WILL BE CROSSED VIA HDD METHODS).



PROFILE A-A

HORIZONTAL

0 50 100

SCALE IN FEET

VERTICAL

0 25 50

SCALE IN FEET

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COMMISSION

NOTE:
1. MINIMUM 3' OF COVER BETWEEN STREAMBED AND TOP OF PIPELINE.
2. PROPOSED FILL WILL BE IN TRENCH AND WILL BE RESTORED TO PRECONSTRUCTION ELEVATIONS.
3. WATER DEPTH SHOWN ON PROFILE IS NOT TO SCALE.
4. E&SC BMPS HAVE BEEN REMOVED FOR CLARITY AND ARE DISPLAYED ON PLAN VIEW.

TETRA TECH
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661 ANDERSEN DRIVE - FOSTER PLAZA 7
PITTSBURGH, PA 15220
T: (412) 921-7090 | F: (412) 921-4040

Mountain Valley PIPELINE

STREAM CROSSING
STREAM NAME: S-C17 (TEELS CREEK)
LAT./LONG. = 37.05839, -79.918015
DRAINAGE AREA = 6.62 SQUARE MILES
STATION = 13783+84
COUNTY: FRANKLIN
REFER TO ATTACHMENT H2, TABLE 2.2 FOR FIELD SURVEY STREAM IMPACTS

DATE:	9/8/17
PROJECT NO.:	112IC07157
DESIGNED BY:	DW
DRAWN BY:	JK
CHECKED BY:	RE
SHEET: 2 OF 2	

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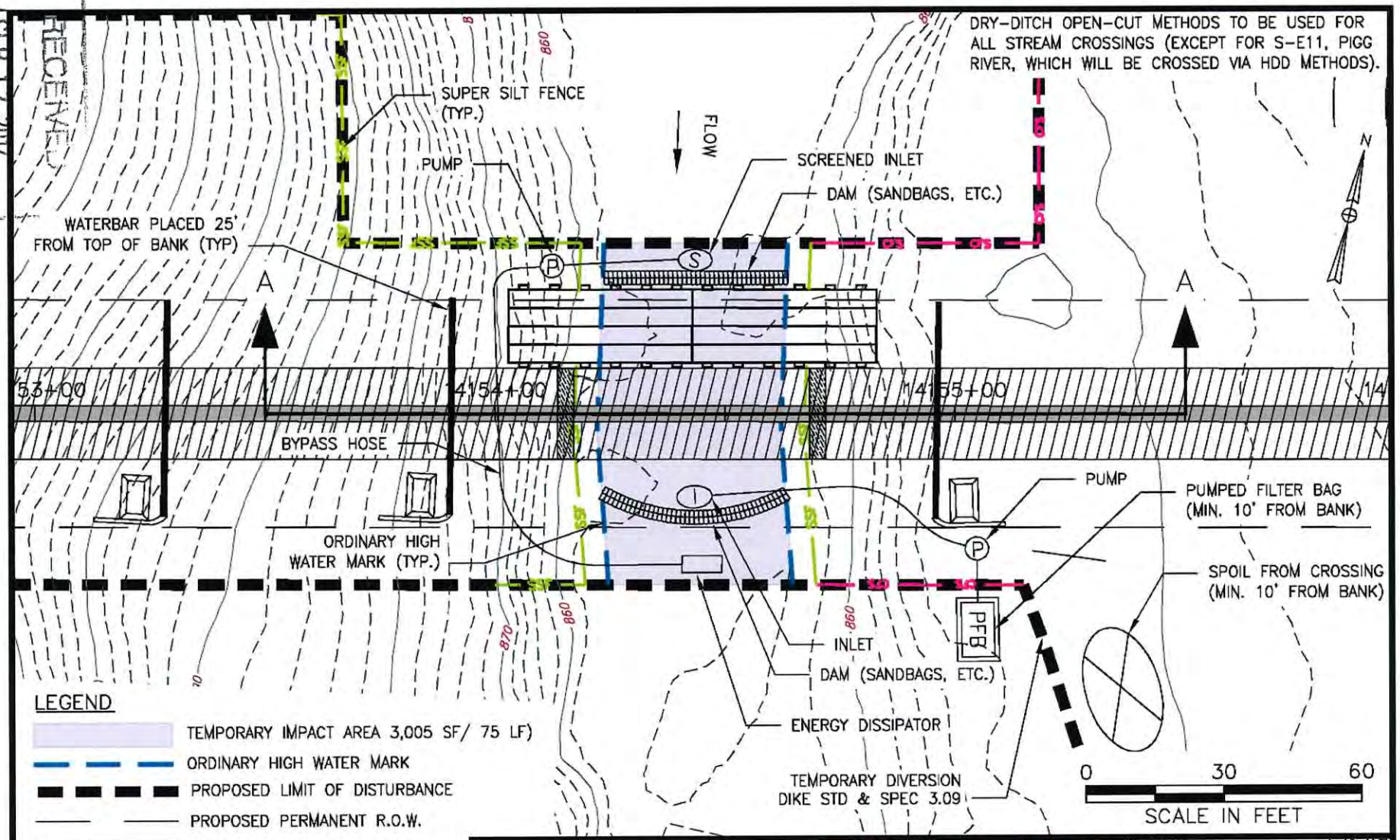

LEGEND

- TEMPORARY IMPACT AREA 3,005 SF/ 75 LF)
- ORDINARY HIGH WATER MARK
- PROPOSED LIMIT OF DISTURBANCE
- PROPOSED PERMANENT R.O.W.
- PROPOSED PIPELINE
- PROPOSED COMPOST FILTER SOCK
- SUPER SILT FENCE
- TIMBER MAT/TEMPORARY CONSTRUCTION ACCESS BRIDGE
- PROPOSED TRENCH BREAKER
- PIPELINE TRENCH

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Mountain Valley PIPELINE

STREAM CROSSING
STREAM NAME: S-C19 (MAGGODEE CREEK)
LAT./LONG. = 37.055147, -79.830098
DRAINAGE AREA = 45.40 SQUARE MILES
STATION = 14154+42.30
COUNTY: FRANKLIN
REFER TO ATTACHMENT H2, TABLE 2.2 FOR FIELD SURVEY STREAM IMPACTS

DATE:	9/8/17
PROJECT NO.:	112IC07157
DESIGNED BY:	DW
DRAWN BY:	JK
CHECKED BY:	RE
SHEET: 1 OF 2	

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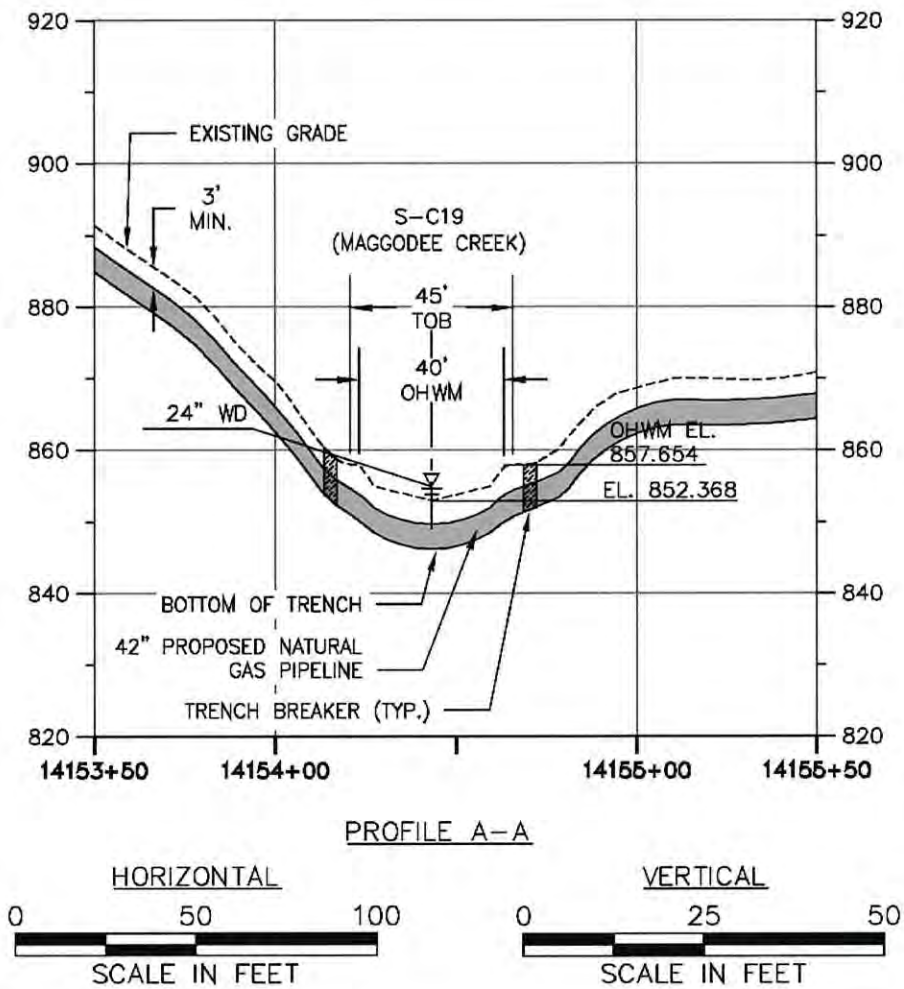

DRY-DITCH OPEN-CUT METHODS TO BE USED FOR ALL STREAM CROSSINGS (EXCEPT FOR S-E11, PIGG RIVER, WHICH WILL BE CROSSED VIA HDD METHODS).

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NOTE:
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2. PROPOSED FILL WILL BE IN TRENCH AND WILL BE RESTORED TO PRECONSTRUCTION ELEVATIONS.
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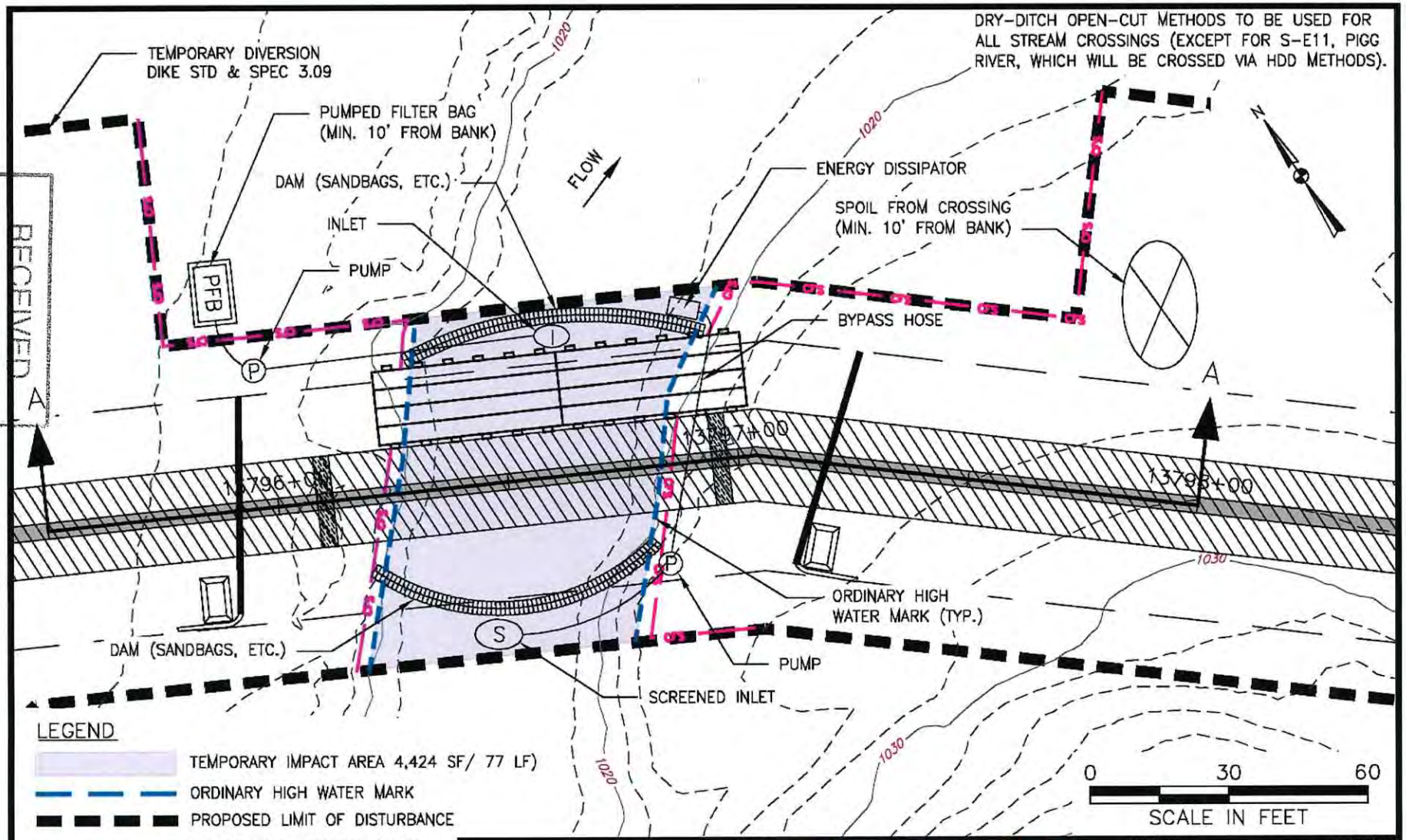

LEGEND

- TEMPORARY IMPACT AREA 4,424 SF/ 77 LF)
- ORDINARY HIGH WATER MARK
- PROPOSED LIMIT OF DISTURBANCE
- PROPOSED PERMANENT R.O.W.
- PROPOSED PIPELINE
- PROPOSED COMPOST FILTER SOCK
- TIMBER MAT/TEMPORARY CONSTRUCTION ACCESS BRIDGE
- PROPOSED TRENCH BREAKER
- PIPELINE TRENCH

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Mountain Valley PIPELINE

STREAM CROSSING
STREAM NAME: S-CD6 (LITTLE CREEK)
LAT./LONG. = 37.057584, -79.913921
DRAINAGE AREA = 22.60 SQUARE MILES
STATION = 13796+49.48
COUNTY: FRANKLIN
REFER TO ATTACHMENT H2, TABLE 2.2 FOR FIELD SURVEY STREAM IMPACTS

DATE:	9/8/17
PROJECT NO.:	112IC07157
DESIGNED BY:	DW
DRAWN BY:	JK
CHECKED BY:	RE
SHEET: 1 OF 2	

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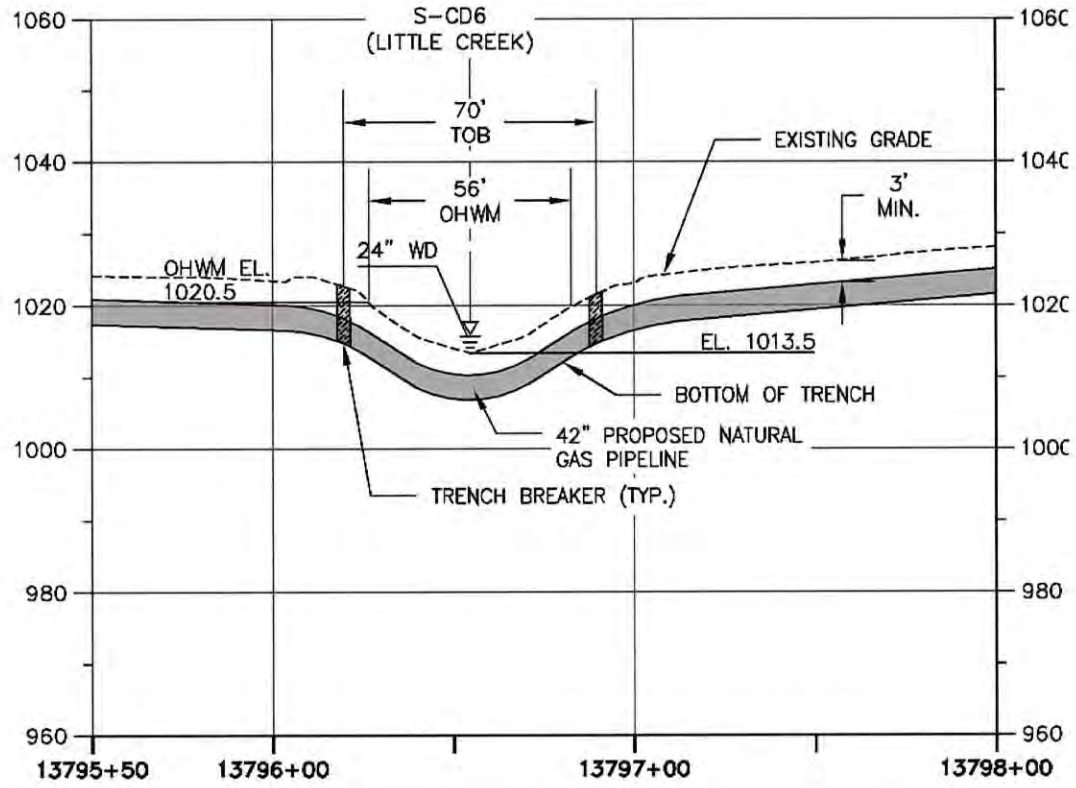
DRY-DITCH OPEN-CUT METHODS TO BE USED FOR ALL STREAM CROSSINGS (EXCEPT FOR S-E11, PIGG RIVER, WHICH WILL BE CROSSED VIA HDD METHODS).



PROFILE A-A

HORIZONTAL

0 50 100

SCALE IN FEET

VERTICAL

0 25 50

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COMMISSION

NOTE:
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Mountain Valley PIPELINE

STREAM CROSSING
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LAT./LONG. = 37.057584, -79.913921
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REFER TO ATTACHMENT H2, TABLE 2.2 FOR FIELD SURVEY STREAM IMPACTS

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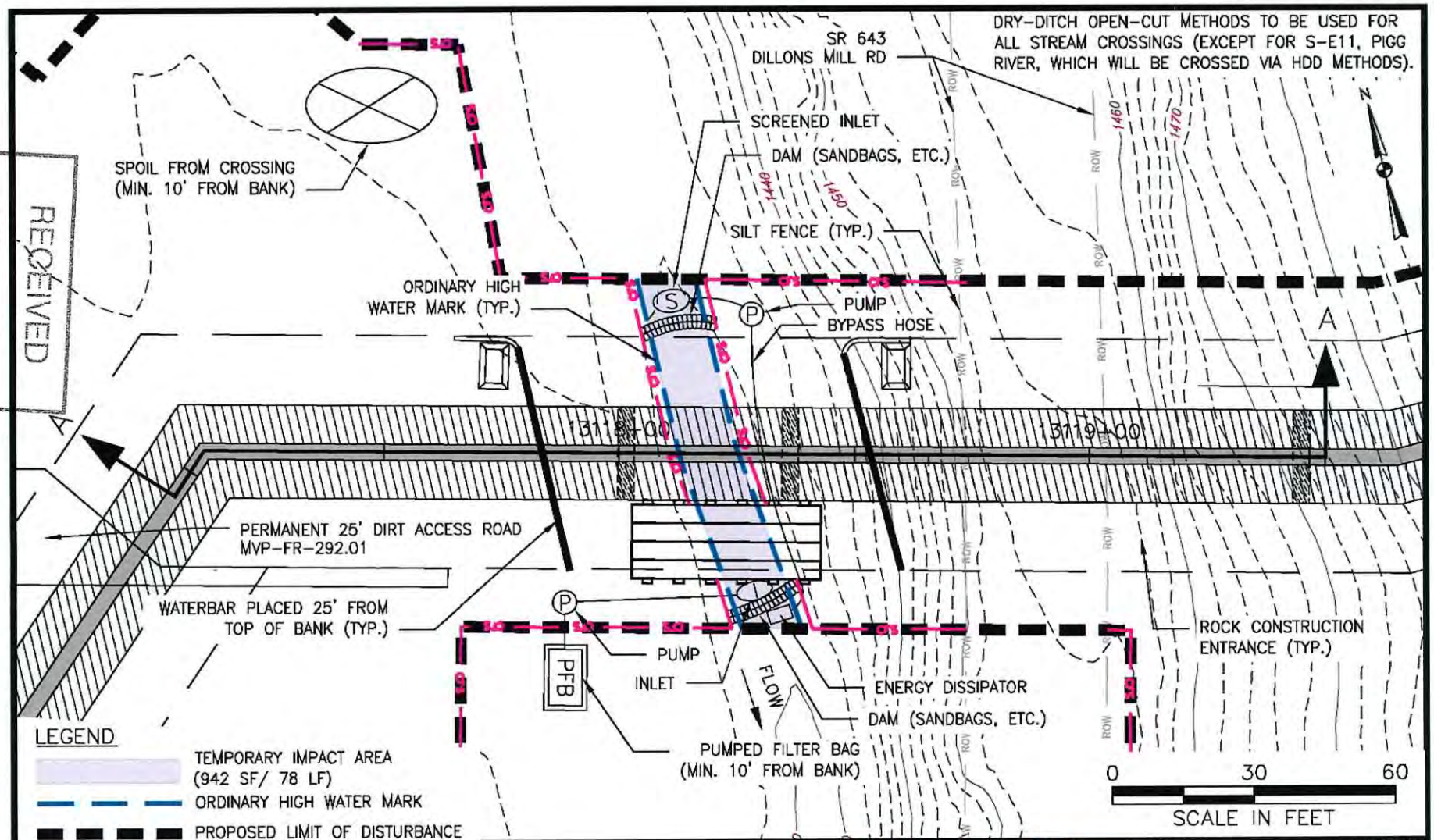

LEGEND

- TEMPORARY IMPACT AREA (942 SF/ 78 LF)
- ORDINARY HIGH WATER MARK
- PROPOSED LIMIT OF DISTURBANCE
- PROPOSED PERMANENT R.O.W.
- PROPOSED PIPELINE
- PROPOSED COMPOST FILTER SOCK
- TIMBER MAT/ TEMPORARY CONSTRUCTION ACCESS BRIDGE
- PROPOSED TRENCH BREAKER
- PIPELINE TRENCH

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Mountain Valley PIPELINE

STREAM CROSSING
STREAM NAME: S-D8
(NORTH FORK BLACKWATER RIVER)
LAT./LONG. = 37.123098, -80.074673
DRAINAGE AREA = 5.90 SQUARE MILES
STATION = 13118+13.46
COUNTY: FRANKLIN
REFER TO ATTACHMENT H2, TABLE 2.2 FOR FIELD SURVEY STREAM IMPACTS

DATE:	9/8/17
PROJECT NO.:	112IC07157
DESIGNED BY:	DW
DRAWN BY:	JK
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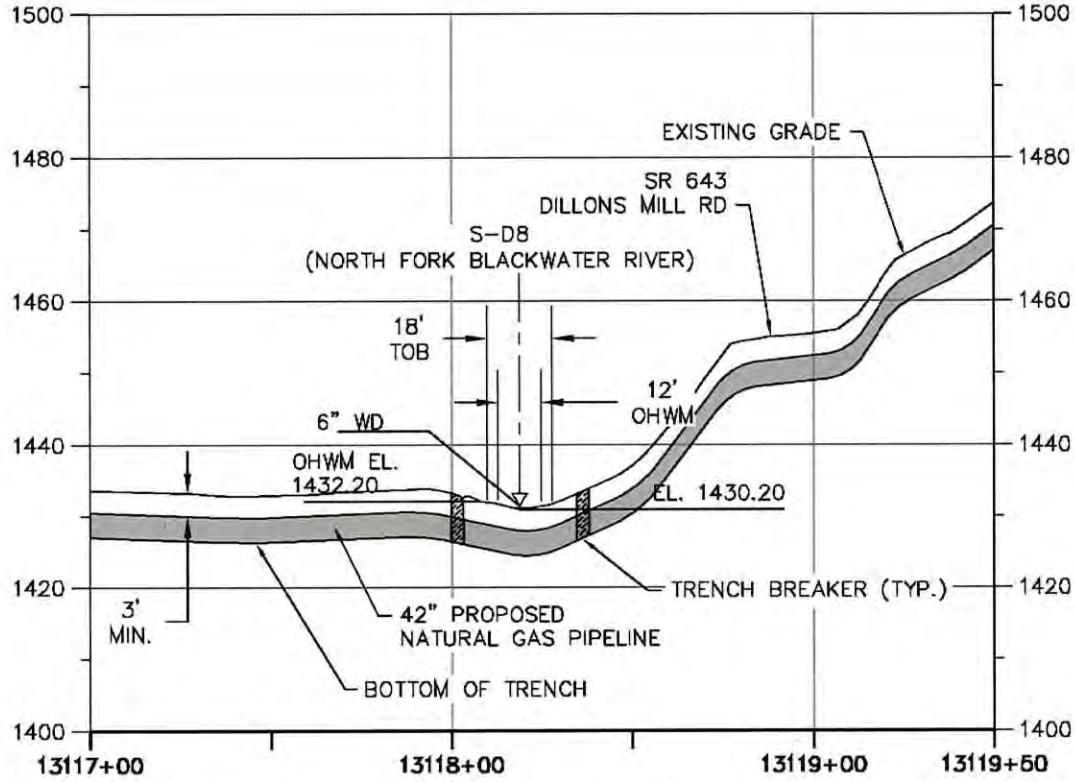

PROFILE A-A

HORIZONTAL

0 50 100

SCALE IN FEET

VERTICAL

0 25 50

SCALE IN FEET

DRY-DITCH OPEN-CUT METHODS TO BE USED FOR ALL STREAM CROSSINGS (EXCEPT FOR S-E11, PIGG RIVER, WHICH WILL BE CROSSED VIA HDD METHODS).

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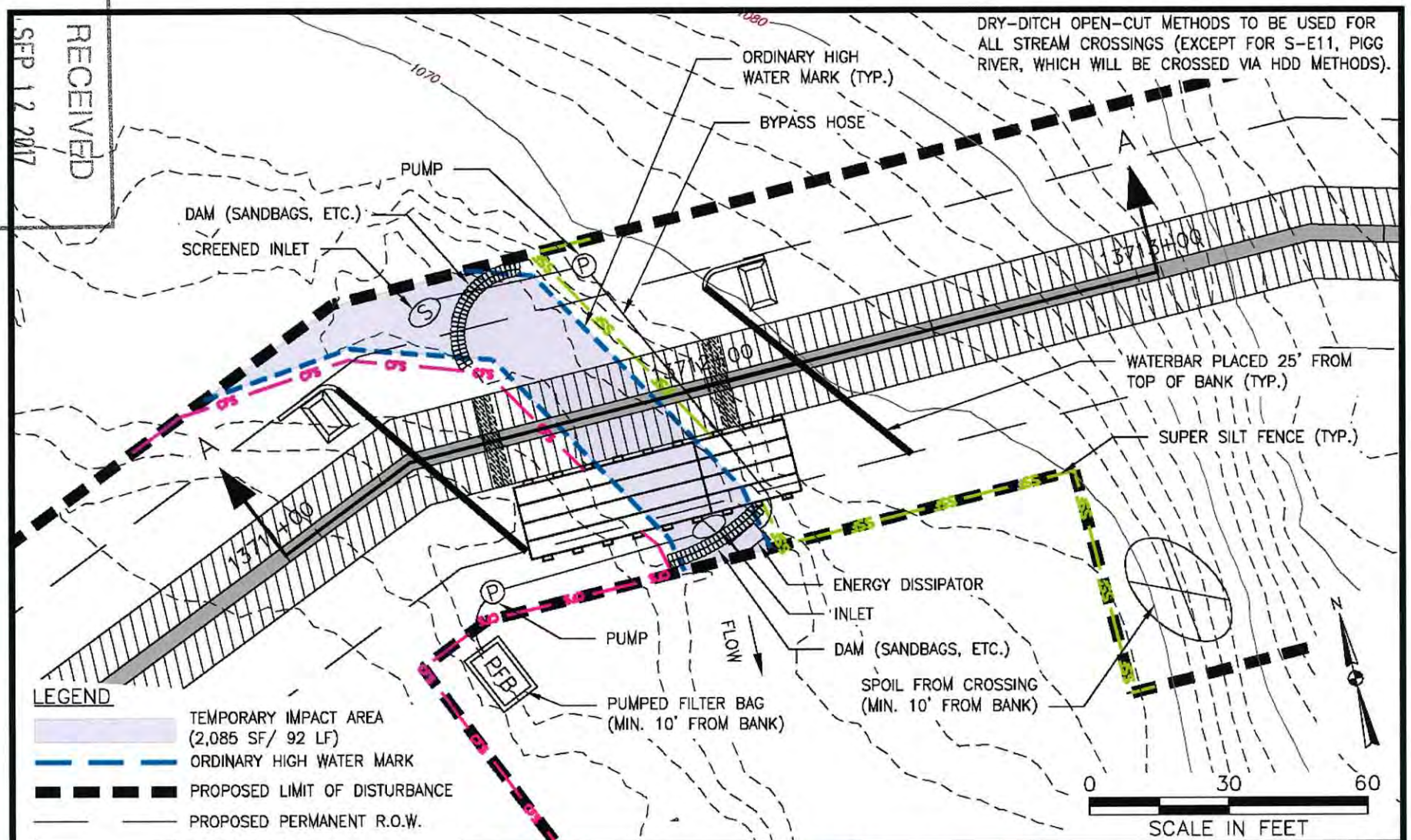

LEGEND

- TEMPORARY IMPACT AREA (2,085 SF/ 92 LF)
- ORDINARY HIGH WATER MARK
- PROPOSED LIMIT OF DISTURBANCE
- PROPOSED PERMANENT R.O.W.
- PROPOSED PIPELINE
- CFS — PROPOSED COMPOST FILTER SOCK
- SSF — PROPOSED SUPER SILT FENCE
- TIMBER MAT/ TEMPORARY CONSTRUCTION ACCESS BRIDGE
- PROPOSED TRENCH BREAKER
- PIPELINE TRENCH

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Mountain Valley PIPELINE

STREAM CROSSING
STREAM NAME: S-D23 (TEELS CREEK)
LAT./LONG. = 37.070322, -79.931039
DRAINAGE AREA = 5.06 SQUARE MILES
STATION = 131711+63.13
COUNTY: FRANKLIN
REFER TO ATTACHMENT H2, TABLE 2.2 FOR FIELD SURVEY STREAM IMPACTS

DATE:	9/8/17
PROJECT NO.:	112IC07157
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SHEET: 1 OF 2	

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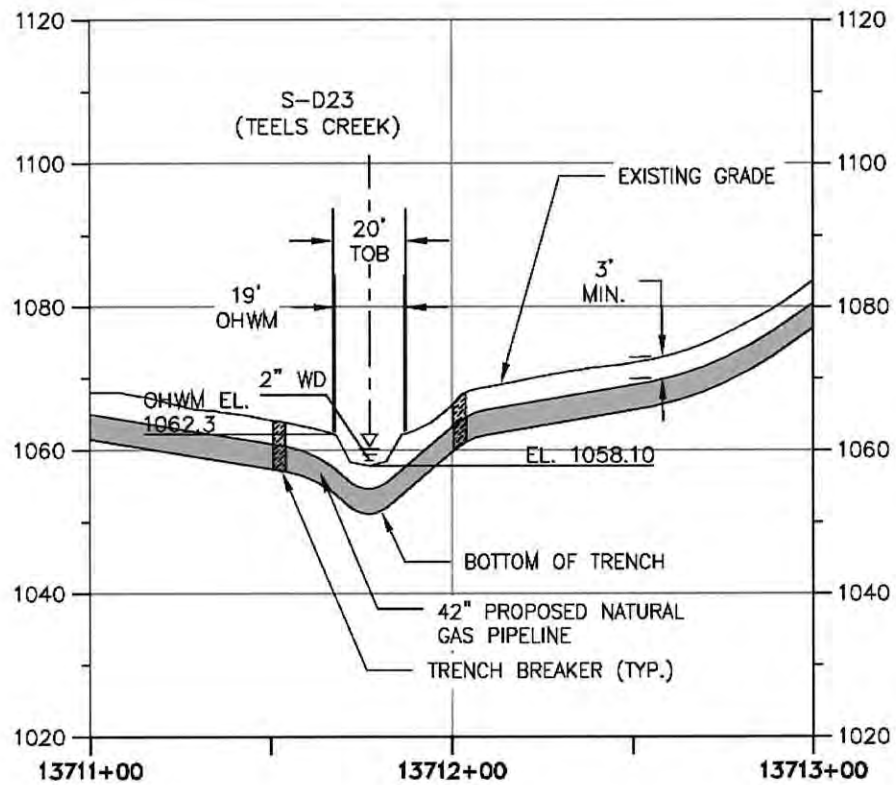

PROFILE A-A

HORIZONTAL

0 50 100

SCALE IN FEET

VERTICAL

0 25 50

SCALE IN FEET

RECEIVED
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COMMISSION

NOTE:
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Mountain Valley PIPELINE

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LAT./LONG. = 37.070322, -79.931039
DRAINAGE AREA = 5.06 SQUARE MILES
STATION = 131711+63.13
COUNTY: FRANKLIN
REFER TO ATTACHMENT H2, TABLE 2.2 FOR FIELD SURVEY STREAM IMPACTS

DATE:	9/8/17
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DRY-DITCH OPEN-CUT METHODS TO BE USED FOR ALL STREAM CROSSINGS (EXCEPT FOR S-E11, PIGG RIVER, WHICH WILL BE CROSSED VIA HDD METHODS).

SPOIL FROM CROSSING (MIN. 10' FROM BANK)

PUMPED FILTER BAG (MIN. 10' FROM BANK)

PFB

ORDINARY HIGH WATER MARK (TYP.)

PUMP

FLOW

DAM (SANDBAGS, ETC.)

INLET

ENERGY DISSIPATOR

A

A

14170+00

14171+00

14172+

WATERBAR PLACED 25' FROM TOP OF BANK (TYP.)

SUPER SILT FENCE (TYP.)

BYPASS HOSE

SCREENED INLET

PUMP

DAM (SANDBAGS, ETC.)

860

860

870

N

0 30 60

SCALE IN FEET

LEGEND

- TEMPORARY IMPACT AREA (6,766 SF/ 91 LF)
- ORDINARY HIGH WATER MARK
- PROPOSED LIMIT OF DISTURBANCE
- PROPOSED PERMANENT R.O.W.
- PROPOSED PIPELINE
- CFS — PROPOSED COMPOST FILTER SOCK
- SSF — PROPOSED SUPER SILT FENCE
- TIMBER MAT/ TEMPORARY CONSTRUCTION ACCESS BRIDGE
- PROPOSED TRENCH BREAKER
- PIPELINE TRENCH

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Mountain Valley PIPELINE

STREAM CROSSING
STREAM NAME: S-F11 (BLACKWATER RIVER)
LAT./LONG. = 37.052843, -79.825711
DRAINAGE AREA = 165.0 SQUARE MILES
STATION = 14170+72
COUNTY: FRANKLIN
REFER TO ATTACHMENT H2, TABLE 2.2 FOR FIELD SURVEY STREAM IMPACTS

DATE:	9/8/17
PROJECT NO.:	112IC07157
DESIGNED BY:	DW
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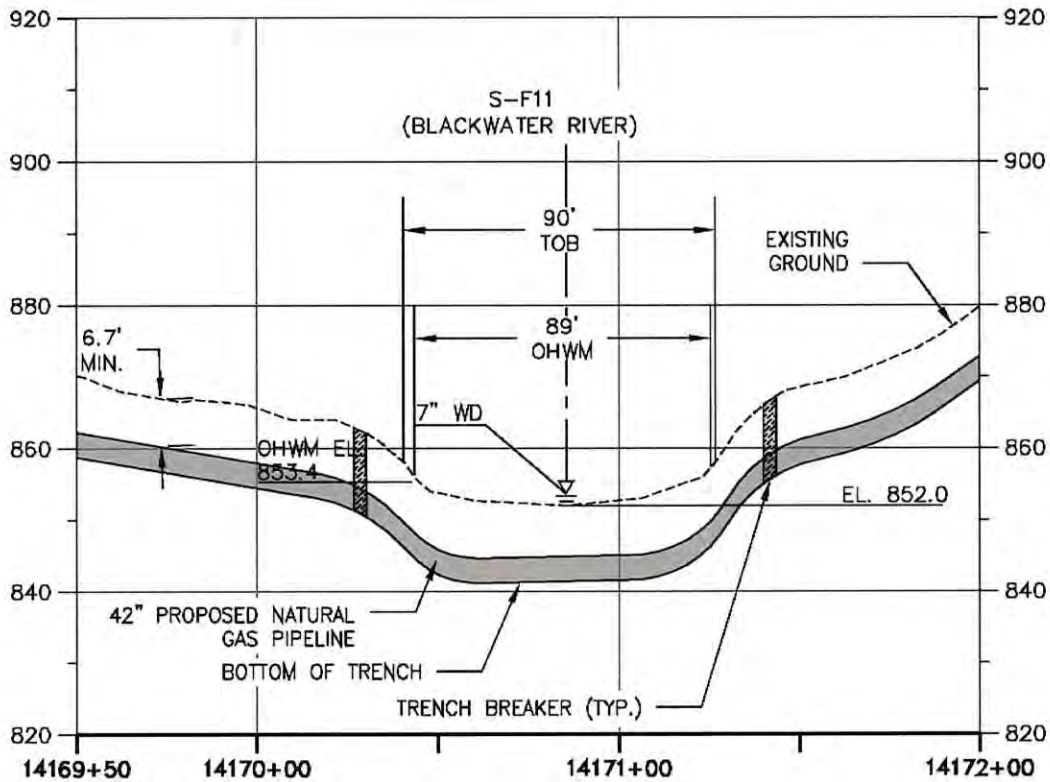
DRY-DITCH OPEN-CUT METHODS TO BE USED FOR ALL STREAM CROSSINGS (EXCEPT FOR S-E11, PIGG RIVER, WHICH WILL BE CROSSED VIA HDD METHODS).



PROFILE A-A

HORIZONTAL

0 50 100

SCALE IN FEET

VERTICAL

0 25 50

SCALE IN FEET

RECEIVED
SEP 12 2017
MARINE RESOURCES
COMMISSION

NOTE:
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STATION = 14170+72
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REFER TO ATTACHMENT H2, TABLE 2.2 FOR FIELD SURVEY STREAM IMPACTS

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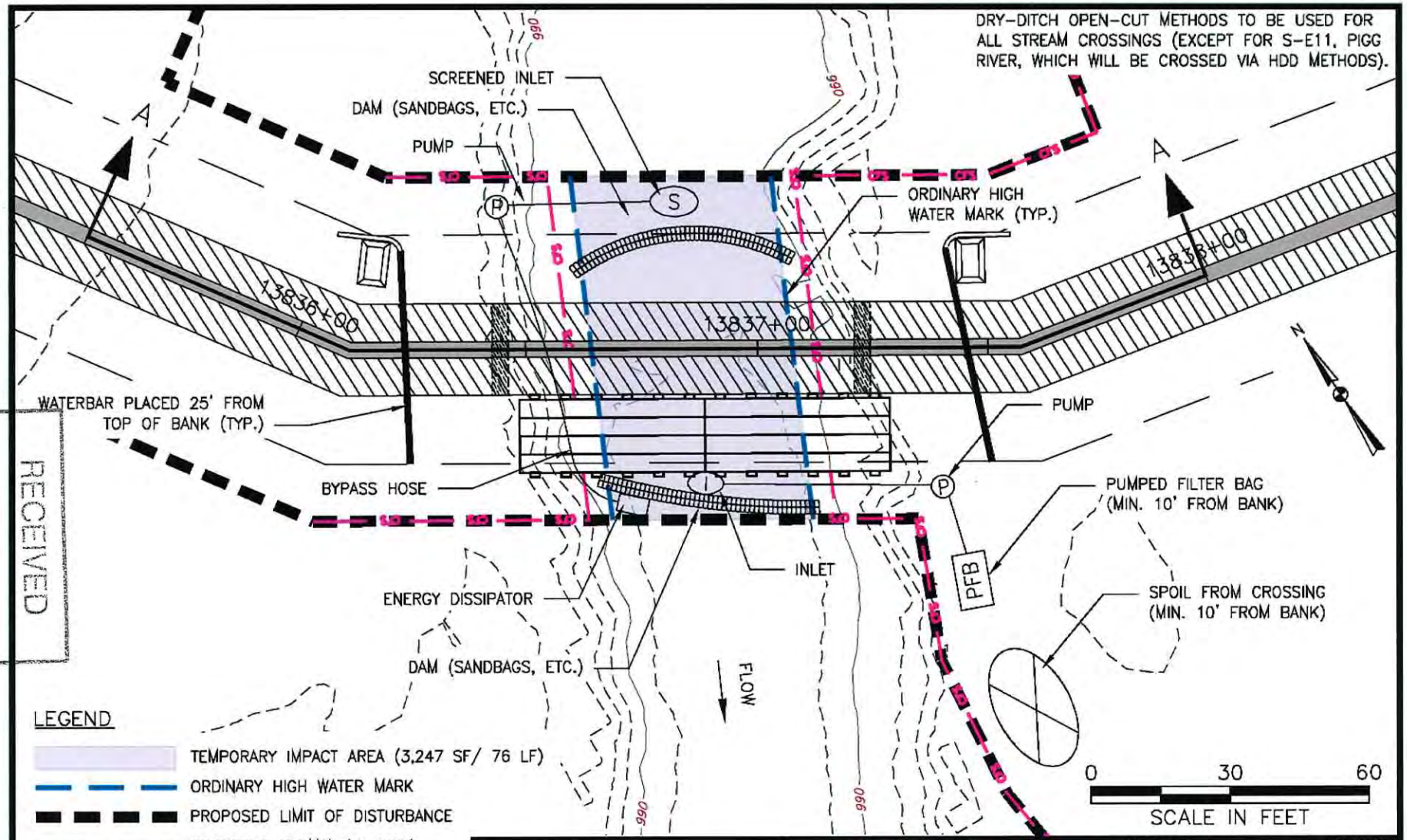

LEGEND

- TEMPORARY IMPACT AREA (3,247 SF/ 76 LF)
- ORDINARY HIGH WATER MARK
- PROPOSED LIMIT OF DISTURBANCE
- PROPOSED PERMANENT R.O.W.
- PROPOSED PIPELINE
- CFS — PROPOSED COMPOST FILTER SOCK
- TIMBER MAT/TEMPORARY CONSTRUCTION ACCESS BRIDGE
- PROPOSED TRENCH BREAKER
- PIPELINE TRENCH

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Mountain Valley PIPELINE

STREAM CROSSING)
STREAM NAME: S-112 (LITTLE CREEK)
LAT./LONG. = 37.049219, -79.908513
DRAINAGE AREA = 25.10 SQUARE MILES
STATION = 13836+86
COUNTY: FRANKLIN
REFER TO ATTACHMENT H2, TABLE 2.2 FOR FIELD SURVEY STREAM IMPACTS

DATE:	9/8/17
PROJECT NO.:	112IC07157
DESIGNED BY:	DW
DRAWN BY:	JK
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SHEET: 1 OF 2	

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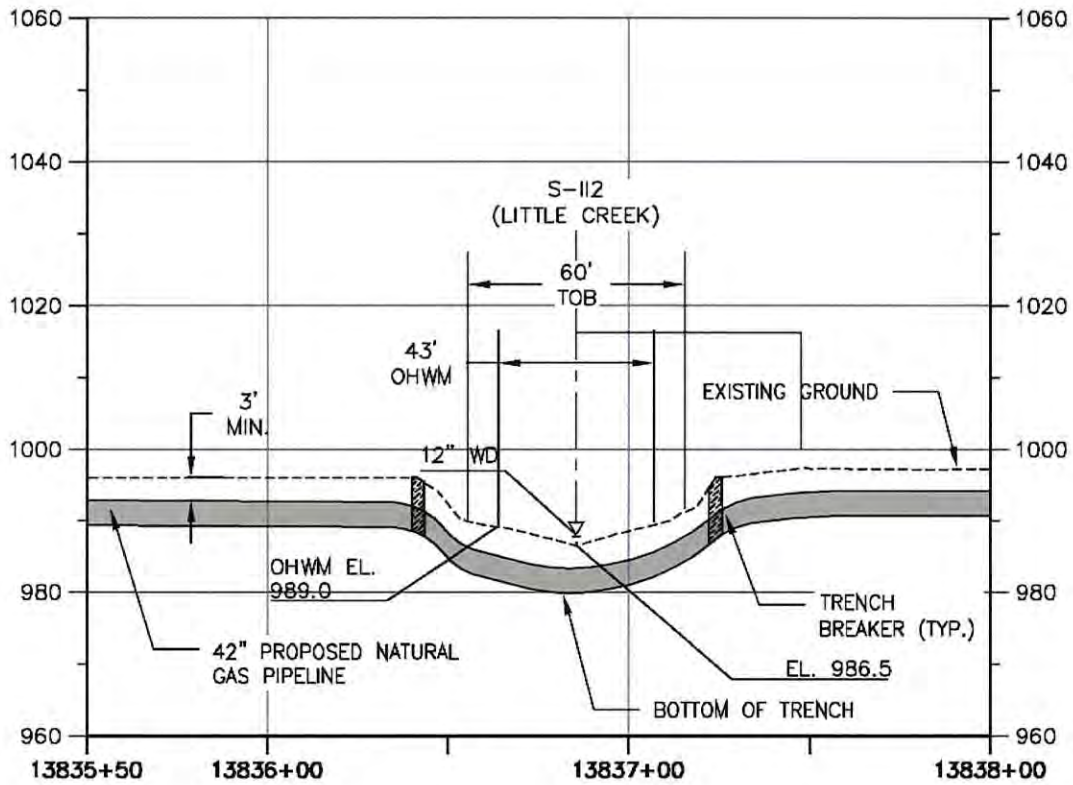

PROFILE VIEW

HORIZONTAL

0 50 100

SCALE IN FEET

VERTICAL

0 25 50

SCALE IN FEET

RECEIVED
SEP 12 2017
MARINE RESOURCES
COMMISSION

NOTE:
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Mountain Valley PIPELINE

STREAM CROSSING)
STREAM NAME: S-112 (LITTLE CREEK)
LAT./LONG. = 37.049219, -79.908513
DRAINAGE AREA = 25.10 SQUARE MILES
STATION = 13836+86
COUNTY: FRANKLIN
REFER TO ATTACHMENT H2, TABLE 2.2 FOR FIELD SURVEY STREAM IMPACTS

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SHEET: 2 OF 2	

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MARINE RESOURCES COMMISSION
RECEIVED
SEP 12 2017

DRY-DITCH OPEN-CUT METHODS TO BE USED FOR ALL STREAM CROSSINGS (EXCEPT FOR S-E11, PIGG RIVER, WHICH WILL BE CROSSED VIA HDD METHODS).

ST RTE 700 (MOUNTAIN LAKE RD.)

ROCK CONSTRUCTION ENTRANCE, (TYP.)

ORDINARY HIGH WATER MARK (TYP.)

DAM (SANDBAGS, ETC.)

FLOW

SCREENED INLET

SPOIL FROM CROSSING (MIN. 10' FROM BANK)

PUMP

BYPASS HOSE

11066+00

11067+00

11068+00

EXISTING 25' PERMANENT ACCESS ROAD MVP-GI-249.03

WATERBAR PLACED 25' FROM TOP OF BANK (TYP)

PUMPED FILTER BAG (MIN. 10' FROM BANK)

PFB

PUMP

ENERGY DISSIPATOR

INLET

DAM (SANDBAGS, ETC.)

0 30 60
SCALE IN FEET

LEGEND

- TEMPORARY IMPACT AREA (2,620 SF/ 77 LF)
- ORDINARY HIGH WATER MARK
- PROPOSED LIMIT OF DISTURBANCE
- PROPOSED R.O.W.
- PROPOSED PIPELINE
- PROPOSED COMPOST FILTER SOCK
- TIMBER MAT/ TEMPORARY CONSTRUCTION ACCESS BRIDGE
- PROPOSED TRENCH BREAKER
- PIPELINE TRENCH

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Mountain Valley PIPELINE

STREAM CROSSING)
STREAM NAME: S-NN17 (SINKING CREEK)
LAT./LONG. = 37.311616, -80.515786
DRAINAGE AREA = 66.20 SQUARE MILES
STATION = 11066+89.47
COUNTY: GILES
REFER TO ATTACHMENT H2, TABLE 2.2 FOR FIELD SURVEY STREAM IMPACTS

DATE:	9/8/17
PROJECT NO.:	112IC07157
DESIGNED BY:	DW
DRAWN BY:	JK
CHECKED BY:	RE
SHEET: 1 OF 2	

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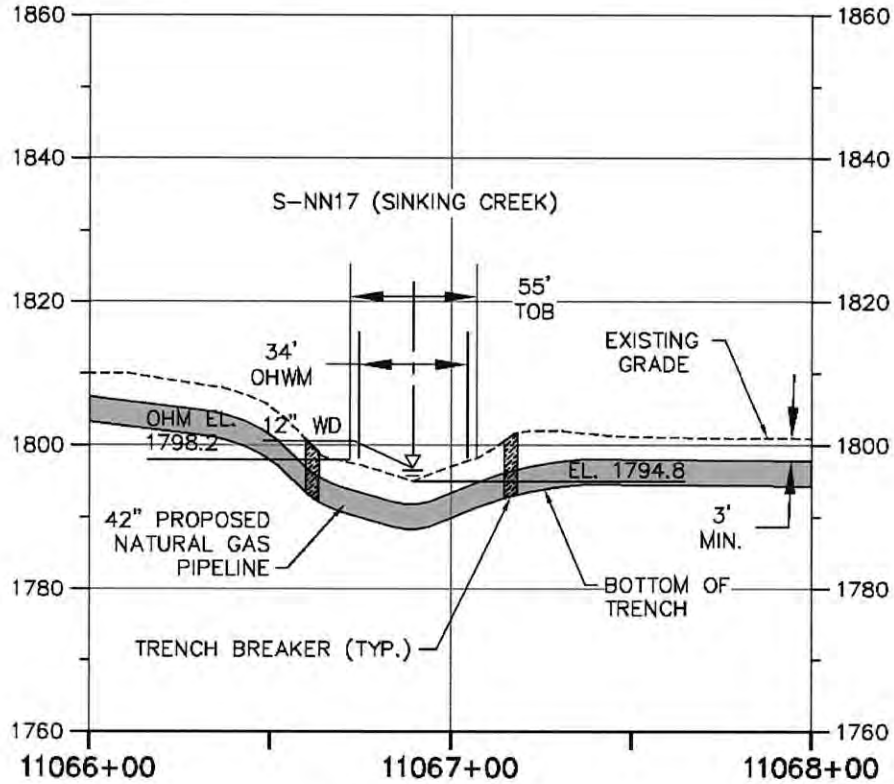
DRY-DITCH OPEN-CUT METHODS TO BE USED FOR ALL STREAM CROSSINGS (EXCEPT FOR S-E11, PIGG RIVER, WHICH WILL BE CROSSED VIA HDD METHODS).



PROFILE A-A

HORIZONTAL

0 50 100

SCALE IN FEET

VERTICAL

0 25 50

SCALE IN FEET

RECEIVED
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NOTE:
1. MINIMUM 3' OF COVER BETWEEN STREAMBED AND TOP OF PIPELINE.
2. PROPOSED FILL WILL BE IN TRENCH AND WILL BE RESTORED TO PRECONSTRUCTION ELEVATIONS.
3. WATER DEPTH SHOWN ON PROFILE IS NOT TO SCALE.
4. E&SC BMPS HAVE BEEN REMOVED FOR CLARITY AND ARE DISPLAYED ON PLAN VIEW.

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Mountain Valley PIPELINE

STREAM CROSSING)
STREAM NAME: S-NN17 (SINKING CREEK)
LAT./LONG. = 37.311616, -80.515786
DRAINAGE AREA = 66.20 SQUARE MILES
STATION = 11066+89.47
COUNTY: GILES
REFER TO ATTACHMENT H2, TABLE 2.2 FOR FIELD SURVEY STREAM IMPACTS

DATE:	9/8/17
PROJECT NO.:	112IC07157
DESIGNED BY:	DW
DRAWN BY:	JK
CHECKED BY:	RE
SHEET: 2 OF 2	

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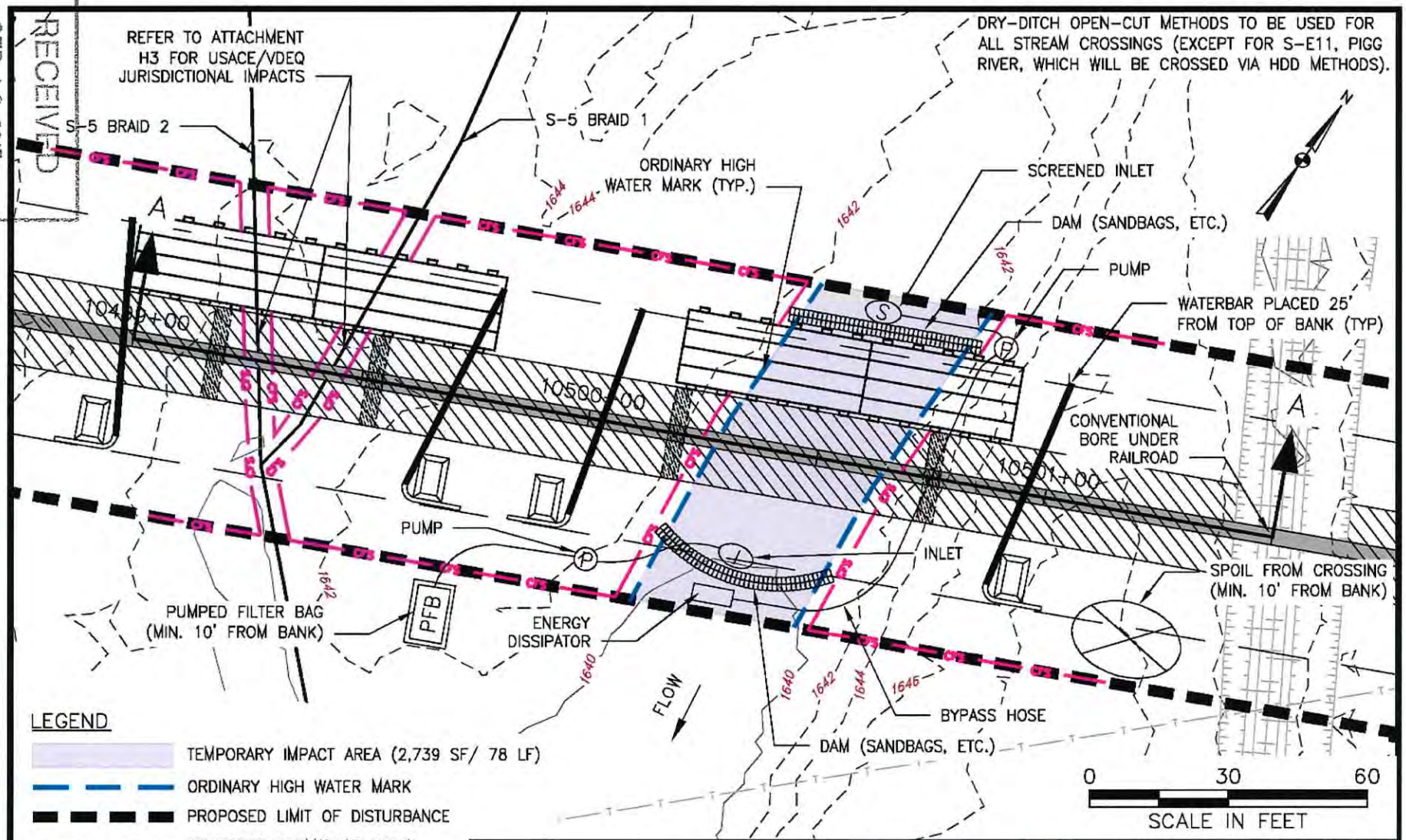

LEGEND

- TEMPORARY IMPACT AREA (2,739 SF/ 78 LF)
- ORDINARY HIGH WATER MARK
- PROPOSED LIMIT OF DISTURBANCE
- PROPOSED PERMANENT R.O.W.
- PROPOSED PIPELINE
- PROPOSED COMPOST FILTER SOCK
- TIMBER MAT/ TEMPORARY CONSTRUCTION ACCESS BRIDGE
- PROPOSED TRENCH BREAKER
- PIPELINE TRENCH

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Mountain Valley PIPELINE

STREAM CROSSING)
STREAM NAME: S-S5 (STONY CREEK)
LAT./LONG. = 37.360071, -80.683960
DRAINAGE AREA = 47.50 SQUARE MILES
STATION = 10500+43.99
COUNTY: GILES
REFER TO ATTACHMENT H2, TABLE 2.2 FOR FIELD SURVEY STREAM IMPACTS

DATE:	9/8/17
PROJECT NO.:	112IC07157
DESIGNED BY:	DW
DRAWN BY:	JK
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SHEET: 1 OF 2	

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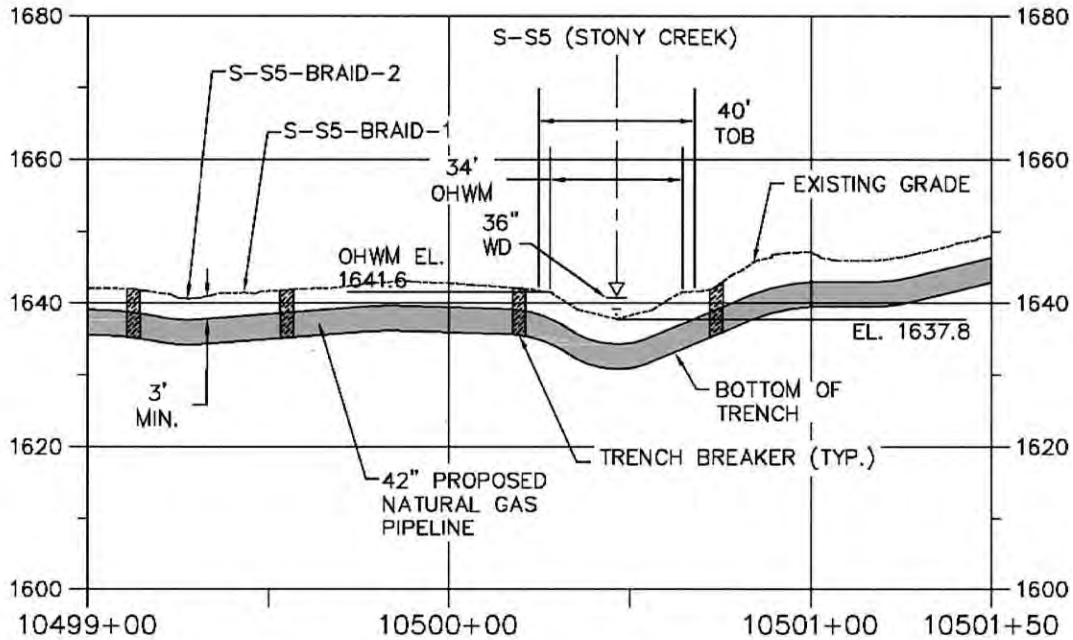
DRY-DITCH OPEN-CUT METHODS TO BE USED FOR ALL STREAM CROSSINGS (EXCEPT FOR S-E11, PIGG RIVER, WHICH WILL BE CROSSED VIA HDD METHODS).



PROFILE A-A

HORIZONTAL

0 50 100

SCALE IN FEET

VERTICAL

0 25 50

SCALE IN FEET

RECEIVED
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NOTE:
1. MINIMUM 3' OF COVER BETWEEN STREAMBED AND TOP OF PIPELINE.
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Mountain Valley PIPELINE

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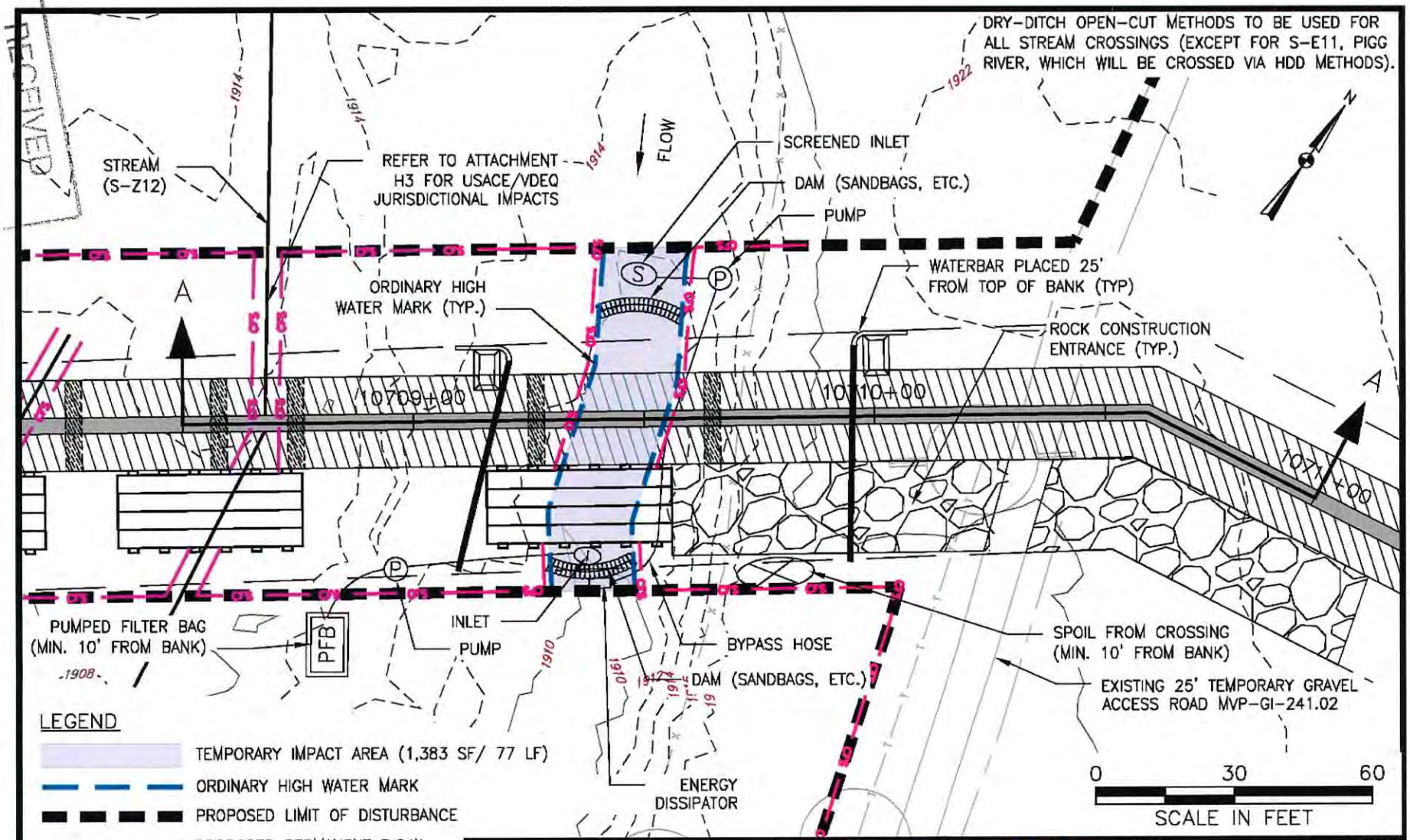

LEGEND

- TEMPORARY IMPACT AREA (1,383 SF/ 77 LF)
- ORDINARY HIGH WATER MARK
- PROPOSED LIMIT OF DISTURBANCE
- PROPOSED PERMANENT R.O.W.
- PROPOSED PIPELINE
- PROPOSED COMPOST FILTER SOCK
- TIMBER MAT/ TEMPORARY CONSTRUCTION ACCESS BRIDGE
- PROPOSED TRENCH BREAKER
- PIPELINE TRENCH

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Mountain Valley PIPELINE

STREAM CROSSING

STREAM NAME: S-Z13 (LITTLE STONY CREEK)
LAT./LONG. = 37.342172, -80.620090
DRAINAGE AREA = 20.10 SQUARE MILES
STATION = 10709+32.52
COUNTY: GILES
REFER TO ATTACHMENT H2, TABLE 2.2 FOR FIELD SURVEY STREAM IMPACTS

DATE:	9/8/17
PROJECT NO.:	112IC07157
DESIGNED BY:	DW
DRAWN BY:	JK
CHECKED BY:	RE
SHEET: 1 OF 2	

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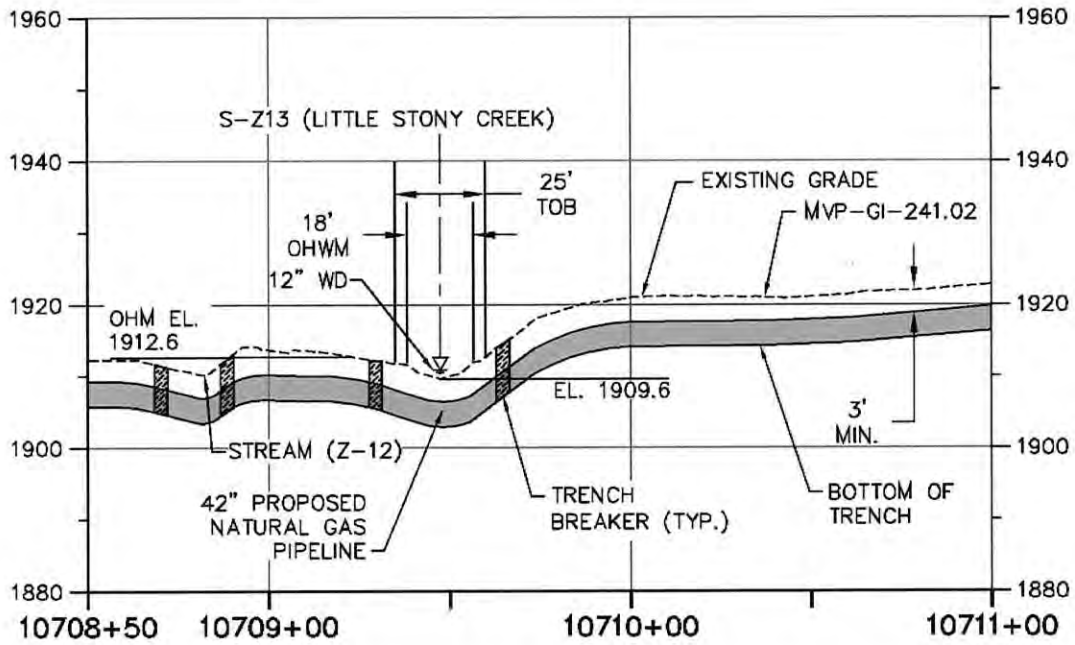
DRY-DITCH OPEN-CUT METHODS TO BE USED FOR ALL STREAM CROSSINGS (EXCEPT FOR S-E11, PIGG RIVER, WHICH WILL BE CROSSED VIA HDD METHODS).



PROFILE A-A

HORIZONTAL

0 50 100

SCALE IN FEET

VERTICAL

0 25 50

SCALE IN FEET

RECEIVED
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NOTE:
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Mountain Valley PIPELINE

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DRY-DITCH OPEN-CUT METHODS TO BE USED FOR ALL STREAM CROSSINGS (EXCEPT FOR S-E11, PIGG RIVER, WHICH WILL BE CROSSED VIA HDD METHODS).

SCREENED INLET
ORDINARY HIGH WATER MARK, (TYP.)
FLOW
DAM (SANDBAGS, ETC.)
PUMP
BYPASS HOSE
A
A
12113+00
12114+00
12115+00
WATERBAR PLACED 25' FROM TOP OF BANK (TYP)
PUMP
INLET
DAM (SANDBAG, ETC.)
ENERGY DISSIPATOR
PFB
ROCK CONSTRUCTION ENTRANCE
PUMPED FILTER BAG (MIN. 10' FROM BANK)
SPOIL FROM CROSSING (MIN. 10' FROM BANK)
N
0 30 60
SCALE IN FEET

LEGEND

- TEMPORARY IMPACT AREA (1,983 SF/ 89 LF)
- ORDINARY HIGH WATER MARK
- PROPOSED LIMIT OF DISTURBANCE
- PROPOSED PERMANENT R.O.W.
- PROPOSED PIPELINE
- PROPOSED COMPOST FILTER SOCK
- TIMBER MAT/ TEMPORARY CONSTRUCTION ACCESS BRIDGE
- PROPOSED TRENCH BREAKER
- PIPELINE TRENCH

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Mountain Valley PIPELINE

STREAM CROSSING
STREAM NAME: S-C21 (BRADSHAW CREEK)
LAT./LONG. = 37.251791, -80.258990
DRAINAGE AREA = 17.60 SQUARE MILES
STATION = 12113+75
COUNTY: MONTGOMERY
REFER TO ATTACHMENT H2, TABLE 2.2 FOR FIELD SURVEY STREAM IMPACTS

DATE:	9/8/17
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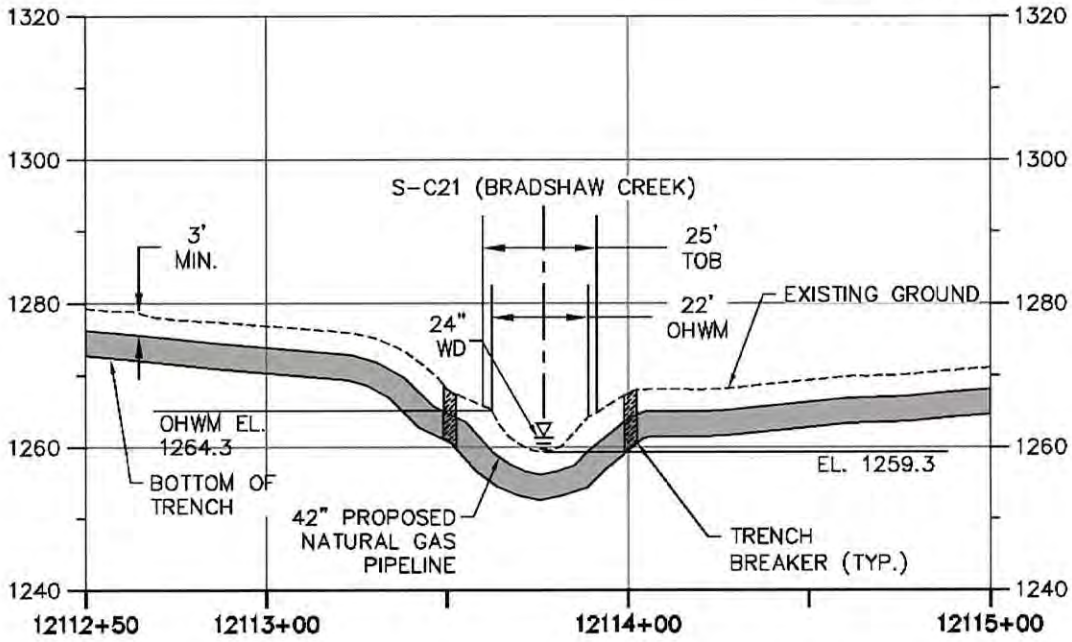

PROFILE A-A

HORIZONTAL

0 50 100

SCALE IN FEET

VERTICAL

0 25 50

SCALE IN FEET

NOTE:
1. MINIMUM 3' OF COVER BETWEEN STREAMBED AND TOP OF PIPELINE.
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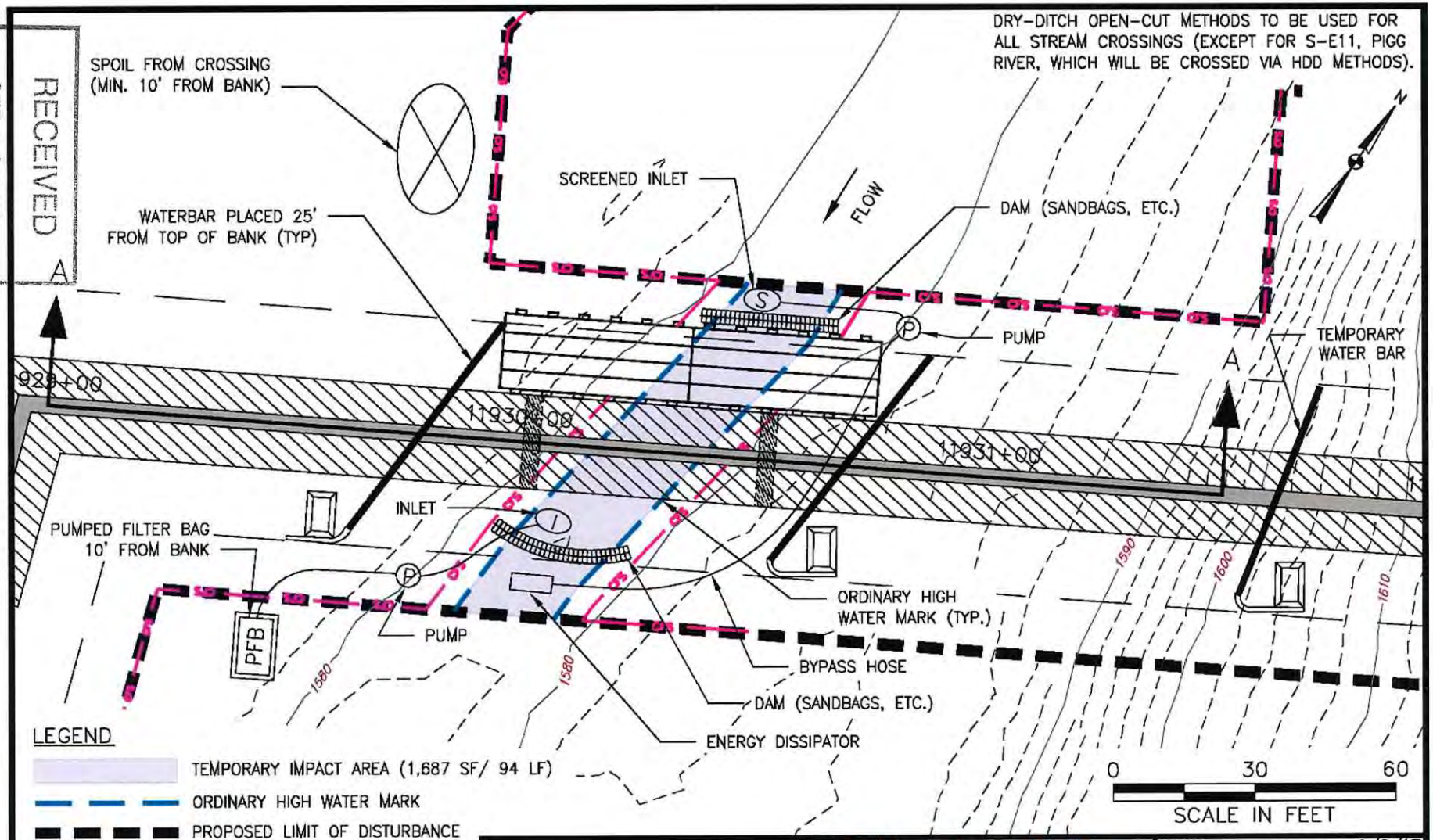

LEGEND

- TEMPORARY IMPACT AREA (1,687 SF/ 94 LF)
- ORDINARY HIGH WATER MARK
- PROPOSED LIMIT OF DISTURBANCE
- PROPOSED PERMANENT R.O.W.
- PROPOSED PIPELINE
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Mountain Valley PIPELINE

STREAM CROSSING)
STREAM NAME: S-G36 (NORTH FORK ROANOKE RIVER)
LAT./LONG. = 37.268562, -80.314416
DRAINAGE AREA = 24.10 SQUARE MILES
STATION = 11930+27.88
COUNTY: MONTGOMERY
REFER TO ATTACHMENT H2, TABLE 2.2 FOR FIELD SURVEY STREAM IMPACTS

DATE:	9/8/17
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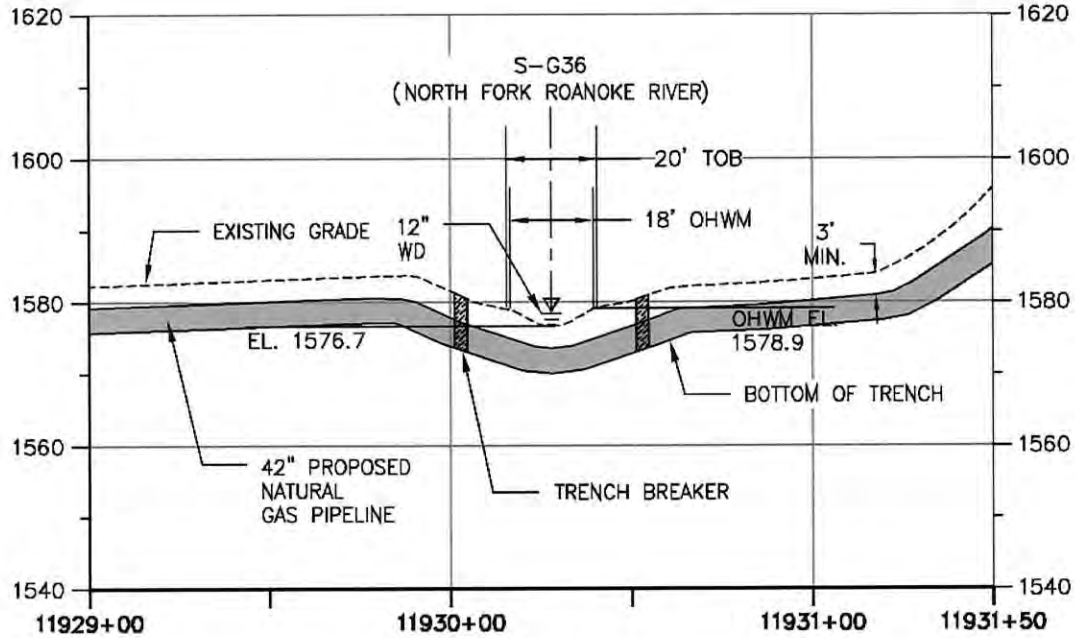

PROFILE A-A

HORIZONTAL

0 50 100

SCALE IN FEET

VERTICAL

0 25 50

SCALE IN FEET

NOTE:
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COUNTY: MONTGOMERY
REFER TO ATTACHMENT H2, TABLE 2.2 FOR FIELD SURVEY STREAM IMPACTS

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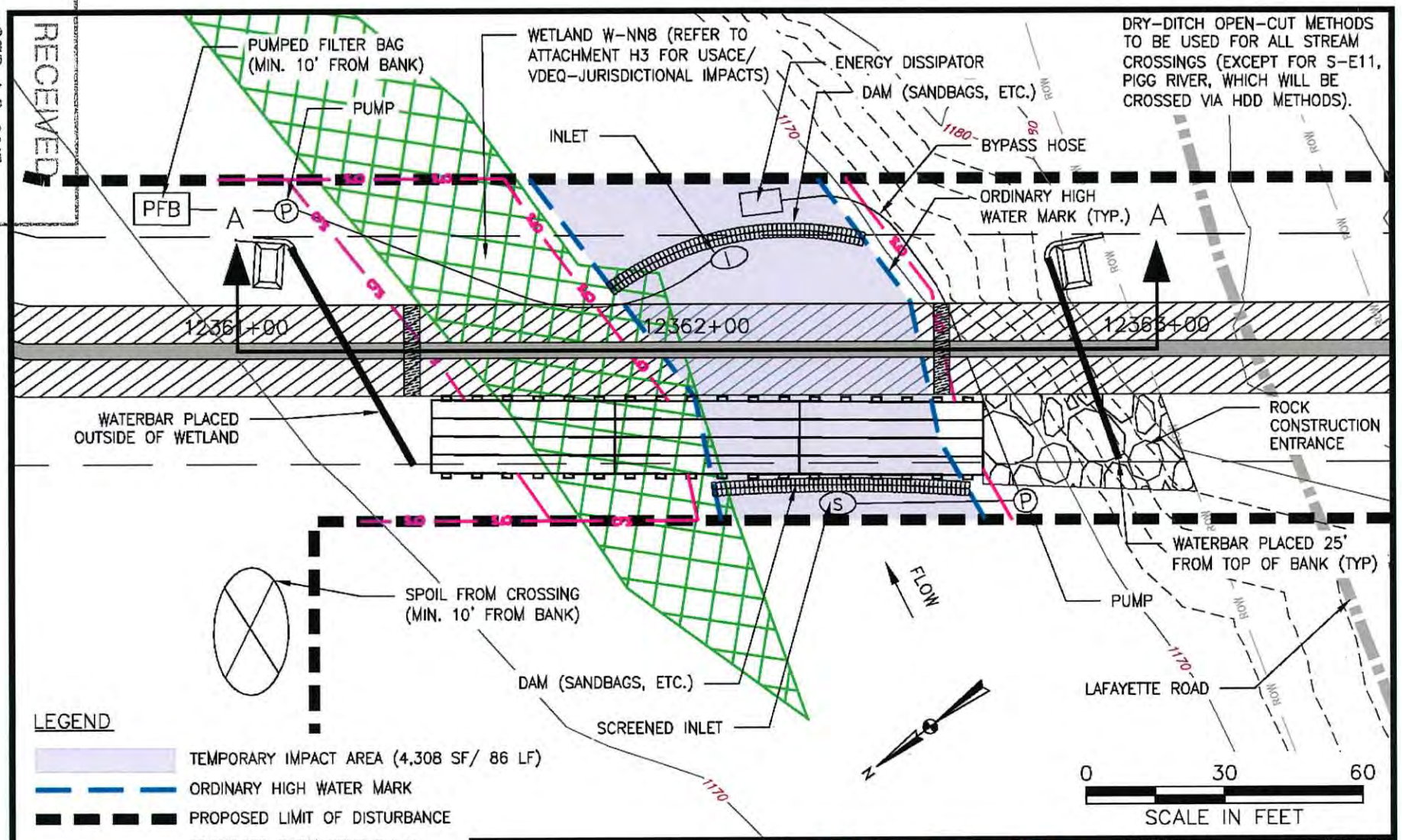

LEGEND

- TEMPORARY IMPACT AREA (4,308 SF/ 86 LF)
- ORDINARY HIGH WATER MARK
- PROPOSED LIMIT OF DISTURBANCE
- PROPOSED PERMANENT R.O.W.
- PROPOSED PIPELINE
- PROPOSED COMPOST FILTER SOCK
- TIMBER MAT/TEMPORARY CONSTRUCTION ACCESS BRIDGE
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Mountain Valley PIPELINE

STREAM CROSSING
STREAM NAME: S-NN16 (ROANOKE RIVER)
LAT./LONG. = 37.233402, -80.197942
DRAINAGE AREA = 256.00 SQUARE MILES
STATION = 12362+22
COUNTY: MONTGOMERY
REFER TO ATTACHMENT H2, TABLE 2.2 FOR FIELD SURVEY STREAM IMPACTS

DATE:	9/8/17
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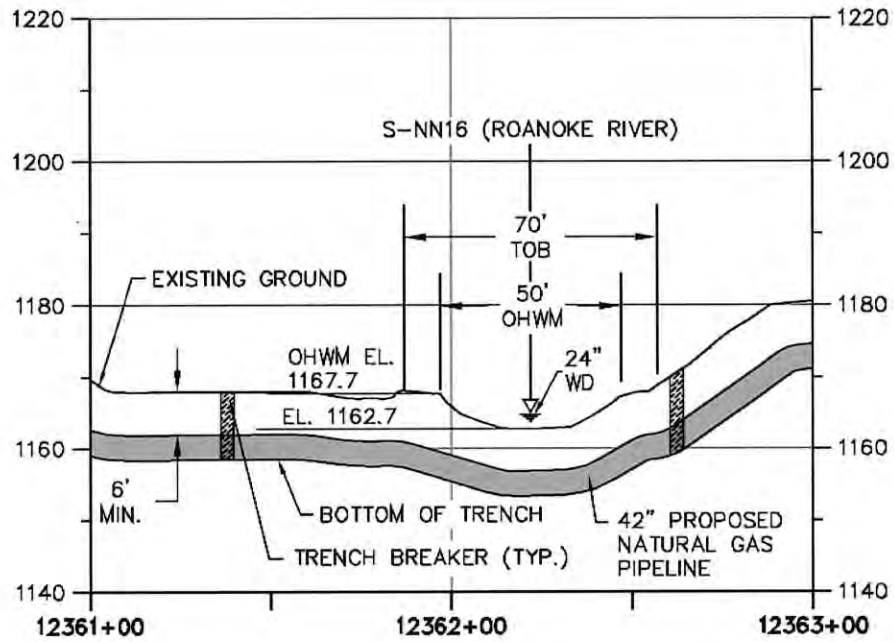

DRY-DITCH OPEN-CUT METHODS TO BE USED FOR ALL STREAM CROSSINGS (EXCEPT FOR S-E11, PIGG RIVER, WHICH WILL BE CROSSED VIA HDD METHODS).

PROFILE A-A

HORIZONTAL

0 50 100

SCALE IN FEET

VERTICAL

0 25 50

SCALE IN FEET

NOTE:
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REFER TO ATTACHMENT H2, TABLE 2.2 FOR FIELD SURVEY STREAM IMPACTS

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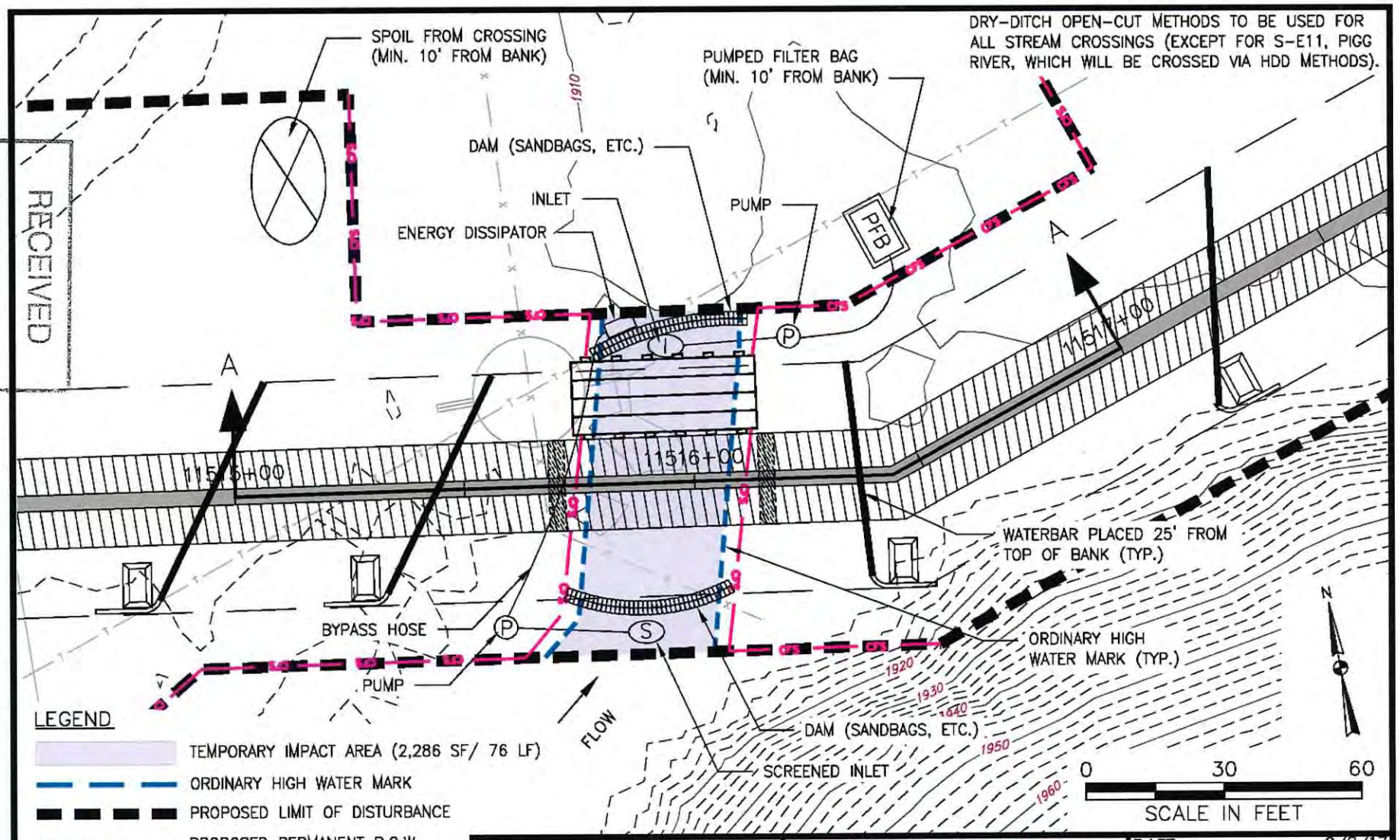

LEGEND

- TEMPORARY IMPACT AREA (2,286 SF/ 76 LF)
- ORDINARY HIGH WATER MARK
- PROPOSED LIMIT OF DISTURBANCE
- PROPOSED PERMANENT R.O.W.
- PROPOSED PIPELINE
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Mountain Valley PIPELINE

STREAM CROSSING
STREAM NAME: S-006 (CRAIG CREEK)
LAT./LONG. = 37.31351, -80.40461
DRAINAGE AREA = 5.07 SQUARE MILES
STATION = 11515+92
COUNTY: MONTGOMERY
REFER TO ATTACHMENT H2, TABLE 2.2 FOR FIELD SURVEY STREAM IMPACTS

DATE:	9/8/17
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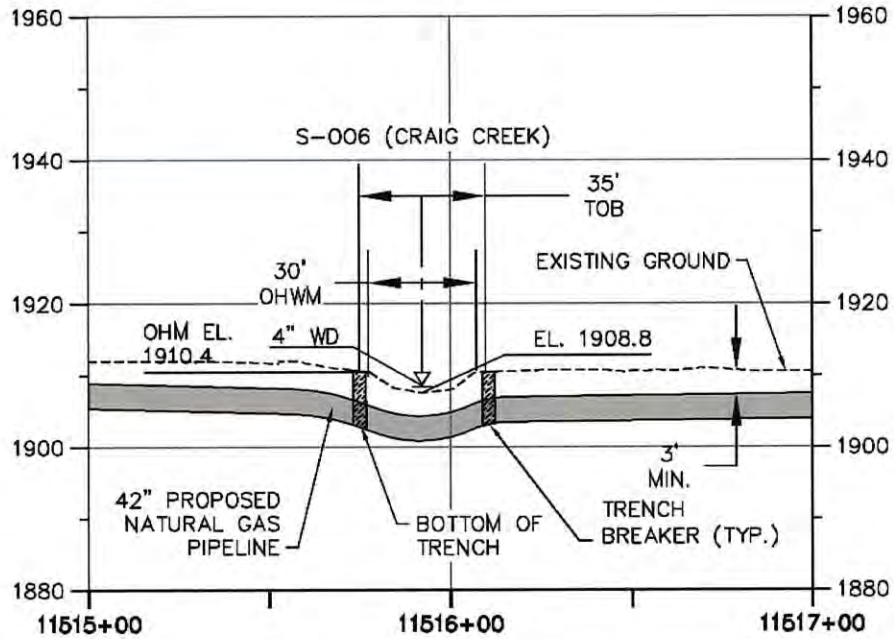

PROFILE A-A

HORIZONTAL

0 50 100

SCALE IN FEET

VERTICAL

0 25 50

SCALE IN FEET

NOTE:
1. MINIMUM 3' OF COVER BETWEEN STREAMBED AND TOP OF PIPELINE.
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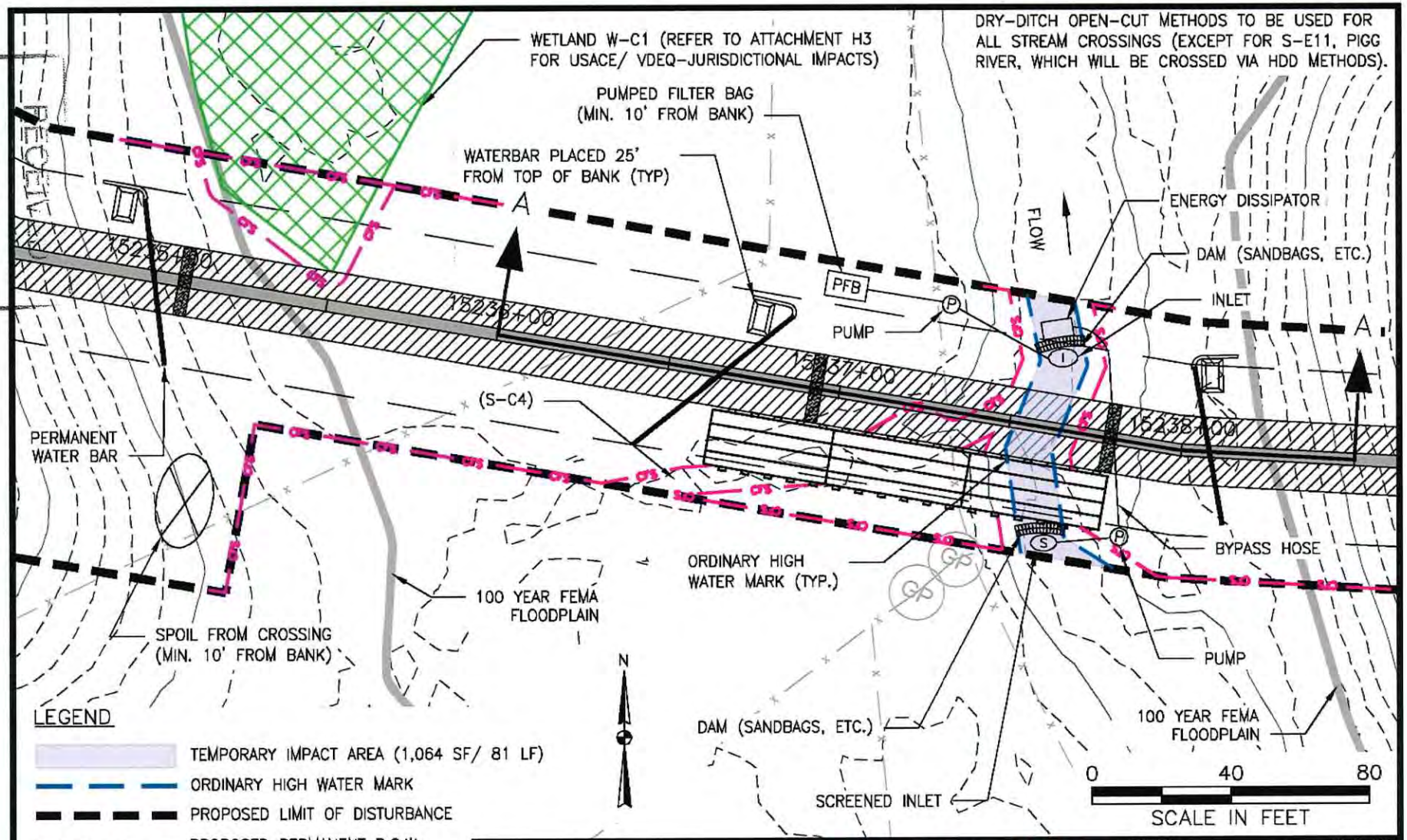

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Mountain Valley PIPELINE

STREAM CROSSING
STREAM NAME: S-C3 (HARPEN CREEK)
LAT./LONG. = 36.929762, -79.526109
DRAINAGE AREA = 7.79 SQUARE MILES
STATION = 15237+58
COUNTY: PITTSYLVANIA
REFER TO ATTACHMENT H2, TABLE 2.2 FOR FIELD SURVEY STREAM IMPACTS

DATE:	9/8/17
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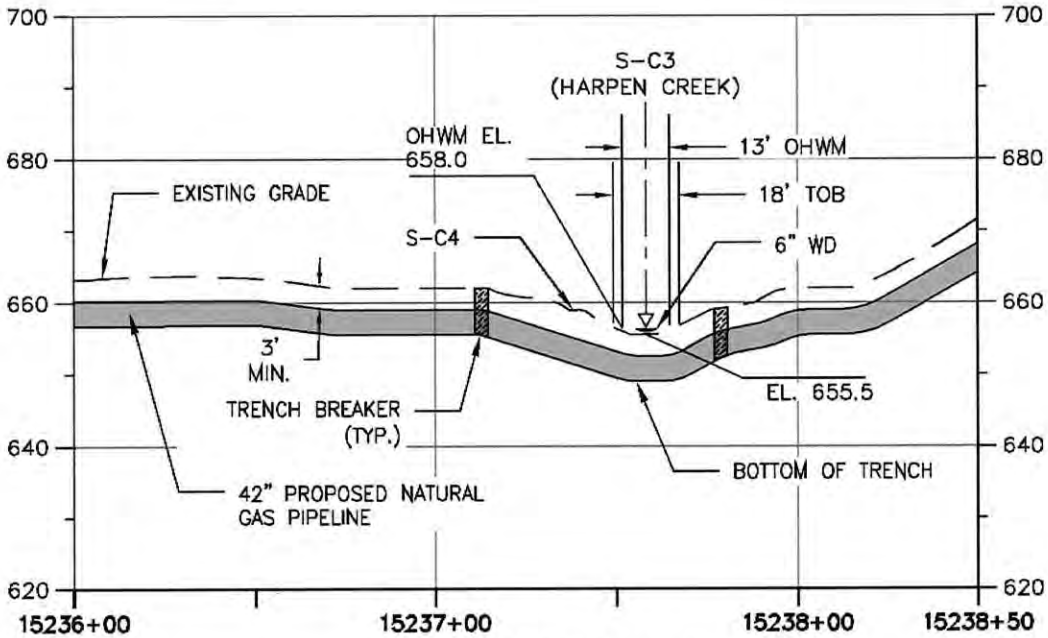

PROFILE A-A

HORIZONTAL

0 50 100

SCALE IN FEET

VERTICAL

0 25 50

SCALE IN FEET

NOTE:
1. MINIMUM 3' OF COVER BETWEEN STREAMBED AND TOP OF PIPELINE.
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PITTSBURGH, PA 15220
T: (412) 921-7090 | F: (412) 921-4040

Mountain Valley PIPELINE

STREAM CROSSING
STREAM NAME: S-C3 (HARPEN CREEK)
LAT./LONG. = 36.929762, -79.526109
DRAINAGE AREA = 7.79 SQUARE MILES
STATION = 15237+58
COUNTY: PITTSYLVANIA
REFER TO ATTACHMENT H2, TABLE 2.2 FOR FIELD SURVEY STREAM IMPACTS

DATE:	9/8/17
PROJECT NO.:	112IC07157
DESIGNED BY:	DW
DRAWN BY:	JK
CHECKED BY:	RE
SHEET: 2 OF 2	

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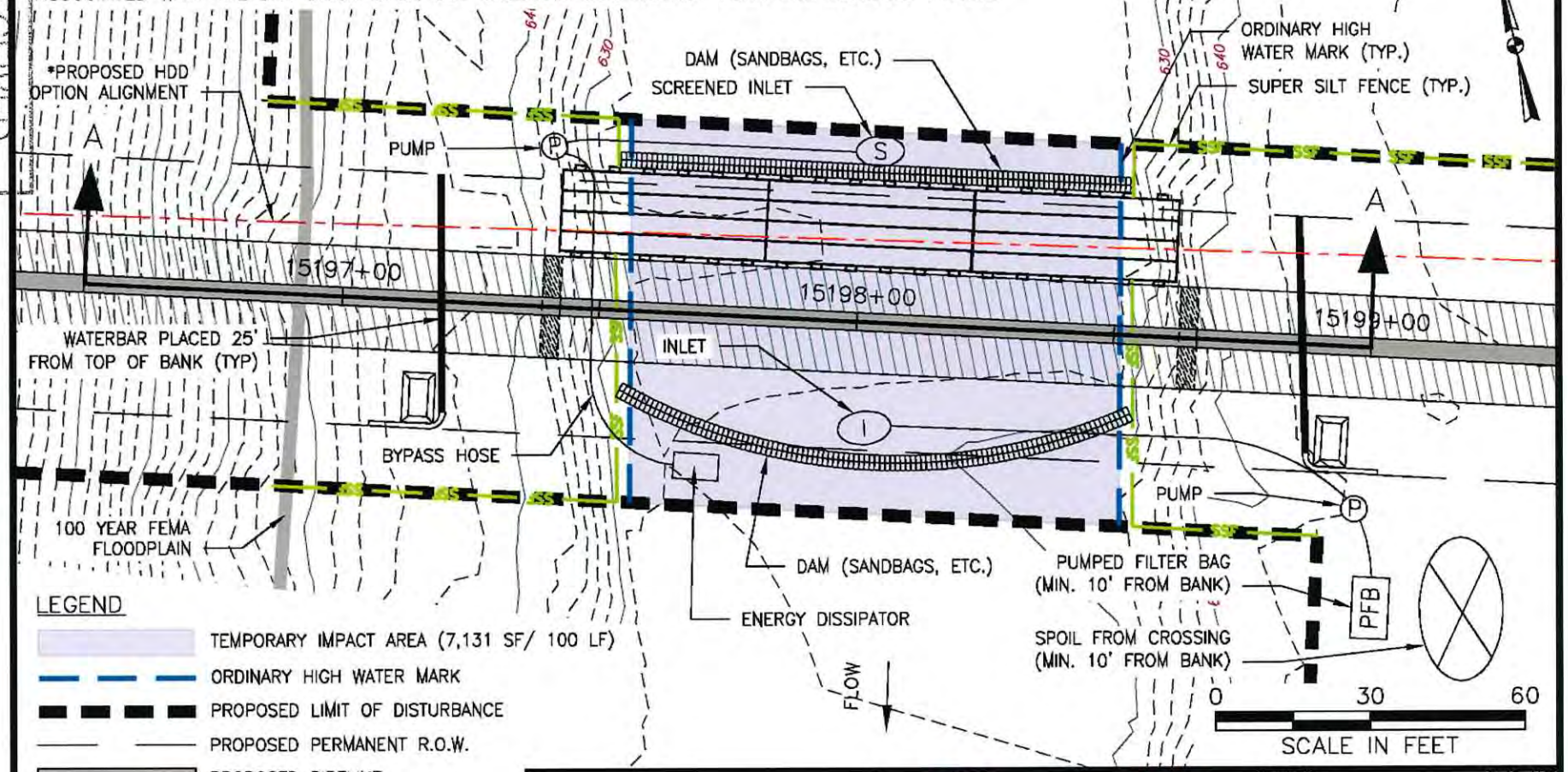
*THE FEDERAL ENERGY REGULATORY COMMISSION (FERC) RECOMMENDED IN ITS FINAL ENVIRONMENTAL IMPACT STATEMENT (JUNE 2017) THAT MVP USE A HORIZONTAL DIRECTIONAL DRILL (HDD) AS THE PREFERRED METHOD TO CROSS THE PIGG RIVER. THE PROPOSED IMPACTS TO THESE WATERS SHOWN ON THIS EXHIBIT WILL NOT OCCUR IF THE FERC-RECOMMENDED HDD IS COMPLETED SUCCESSFULLY. IF THE HDD IS UNSUCCESSFUL FOR ANY REASON, THE DRY DITCH OPEN CUT METHOD (SHOWN ON THIS PLAN VIEW) WILL BE UTILIZED IN ACCORDANCE WITH AN HDD CONTINGENCY PLAN. THE TEMPORARY IMPACTS ASSOCIATED WITH THE DRY DITCH OPEN CUT CROSSING CONTINGENCY PLAN ARE INCLUDED HEREIN.

DRY-DITCH OPEN-CUT METHODS TO BE USED FOR ALL STREAM CROSSINGS (EXCEPT FOR S-E11, PIGG RIVER, WHICH WILL BE CROSSED VIA HDD METHODS).



LEGEND

- TEMPORARY IMPACT AREA (7,131 SF/ 100 LF)
- ORDINARY HIGH WATER MARK
- PROPOSED LIMIT OF DISTURBANCE
- PROPOSED PERMANENT R.O.W.
- PROPOSED PIPELINE
- PROPOSED SUPER SILT FENCE
- TIMBER MAT/ TEMPORARY CONSTRUCTION ACCESS BRIDGE
- PROPOSED TRENCH BREAKER
- PIPELINE TRENCH
- PROPOSED HDD OPTION ALIGNMENT

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Mountain Valley PIPELINE

STREAM CROSSING
STREAM NAME: S-E11 (PIGG RIVER)
LAT./LONG. = 36.933353, -79.538293
DRAINAGE AREA = 340.0 SQUARE MILES
STATION = 15197+92
COUNTY: PITTSYLVANIA
REFER TO ATTACHMENT H2, TABLE 2.2 FOR FIELD SURVEY STREAM IMPACTS

DATE:	9/8/17
PROJECT NO.:	112IC07157
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DRY-DITCH OPEN-CUT METHODS TO BE USED FOR ALL STREAM CROSSINGS (EXCEPT FOR S-E11, PIGG RIVER, WHICH WILL BE CROSSED VIA HDD METHODS).

HORIZONTAL

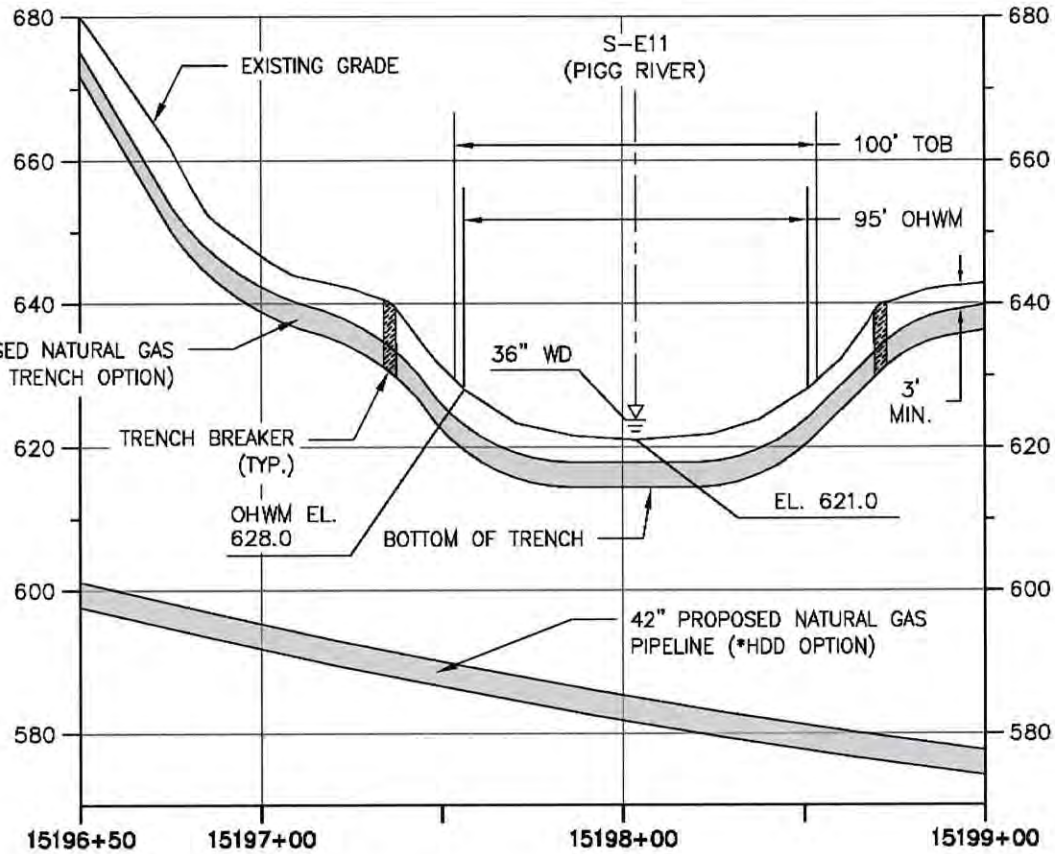
0 50 100

SCALE IN FEET

VERTICAL

0 25 50

SCALE IN FEET



PROFILE A-A

*THE FEDERAL ENERGY REGULATORY COMMISSION (FERC) RECOMMENDED IN ITS FINAL ENVIRONMENTAL IMPACT STATEMENT (JUNE 2017) THAT MVP USE A HORIZONTAL DIRECTIONAL DRILL (HDD) AS THE PREFERRED METHOD TO CROSS THE PIGG RIVER. THE PROPOSED IMPACTS TO THESE WATERS SHOWN ON THIS EXHIBIT WILL NOT OCCUR IF THE FERC-RECOMMENDED HDD IS COMPLETED SUCCESSFULLY. IF THE HDD IS UNSUCCESSFUL FOR ANY REASON, THE DRY DITCH OPEN CUT METHOD (SHOWN ON THIS PROFILE VIEW) WILL BE UTILIZED IN ACCORDANCE WITH AN HDD CONTINGENCY PLAN. THE TEMPORARY IMPACTS ASSOCIATED WITH THE DRY DITCH OPEN CUT CROSSING CONTINGENCY PLAN ARE INCLUDED HEREIN. BOTH THE DRY DITCH OPEN CUT AND THE HDD METHOD ARE SHOWN ON THIS EXHIBIT FOR REVIEW PURPOSES.

DRY OPEN TRENCH NOTES:

1. MINIMUM 3' OF COVER BETWEEN STREAMBED AND TOP OF PIPELINE.
2. PROPOSED FILL WILL BE IN TRENCH AND WILL BE RESTORED TO PRECONSTRUCTION ELEVATIONS.
3. WATER DEPTH SHOWN ON PROFILE IS NOT TO SCALE.
4. E&SC BMPS HAVE BEEN REMOVED FOR CLARITY AND ARE DISPLAYED ON PLAN VIEW.

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Mountain Valley PIPELINE

STREAM CROSSING
STREAM NAME: S-E11 (PIGG RIVER)
LAT./LONG. = 36.933353, -79.538293
DRAINAGE AREA = 340.0 SQUARE MILES
STATION = 15197+92
COUNTY: PITTSYLVANIA
REFER TO ATTACHMENT H2, TABLE 2.2 FOR FIELD SURVEY STREAM IMPACTS

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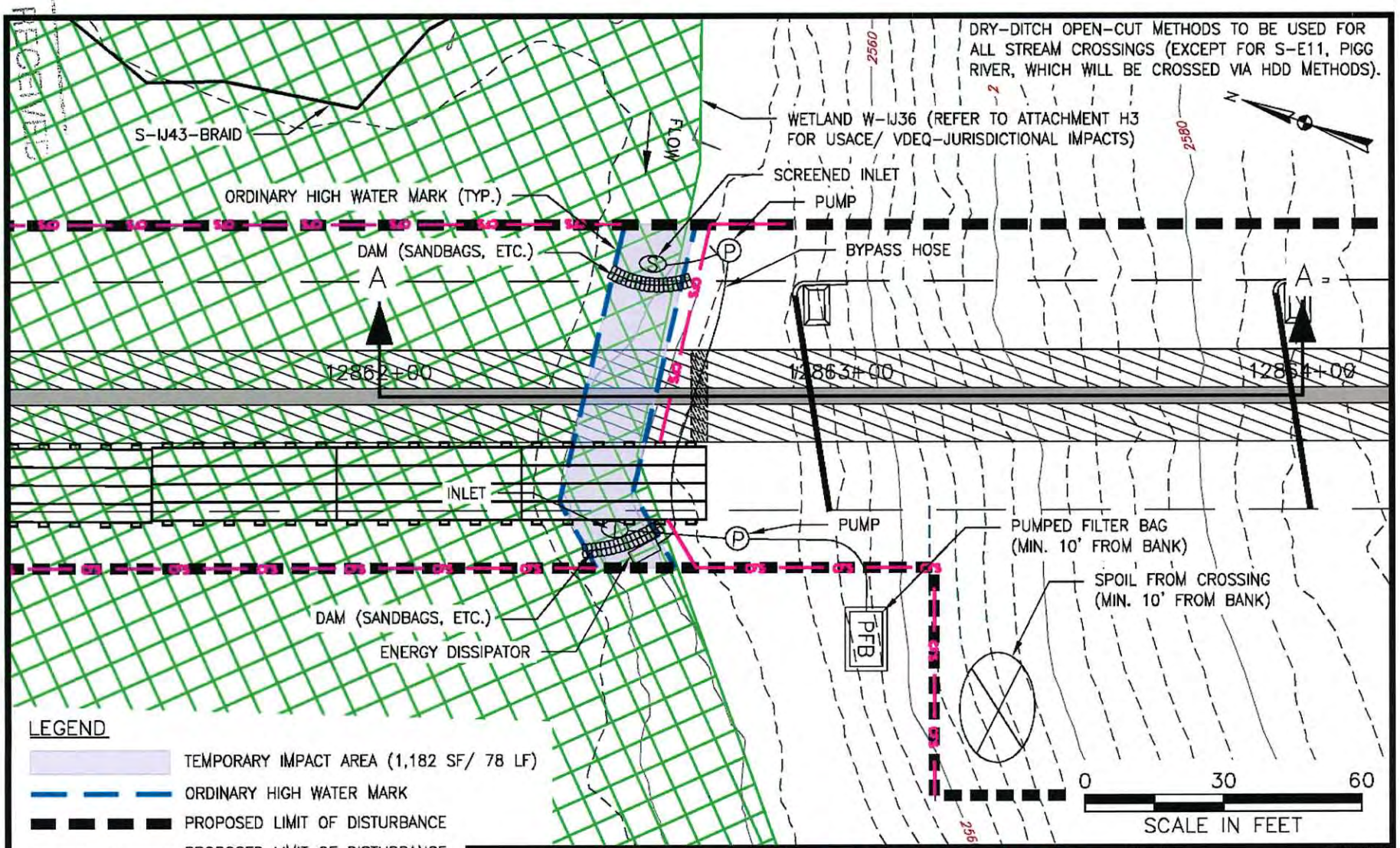

LEGEND

- TEMPORARY IMPACT AREA (1,182 SF/ 78 LF)
- ORDINARY HIGH WATER MARK
- PROPOSED LIMIT OF DISTURBANCE
- PROPOSED LIMIT OF DISTURBANCE
- PROPOSED PIPELINE
- PROPOSED COMPOST FILTER SOCK
- TIMBER MAT/ TEMPORARY CONSTRUCTION ACCESS BRIDGE
- PROPOSED TRENCH BREAKER
- PIPELINE TRENCH

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Mountain Valley PIPELINE

STREAM CROSSING
STREAM NAME: S-IJ43 (MILL CREEK)
LAT./LONG./ = 37.138636, -80.139715
DRAINAGE AREA = 5.20 SQUARE MILES
STATION = 12862+44
COUNTY: ROANOKE
REFER TO ATTACHMENT H2, TABLE 2.2 FOR FIELD SURVEY STREAM IMPACTS

DATE:	9/8/17
PROJECT NO.:	112IC07157
DESIGNED BY:	DW
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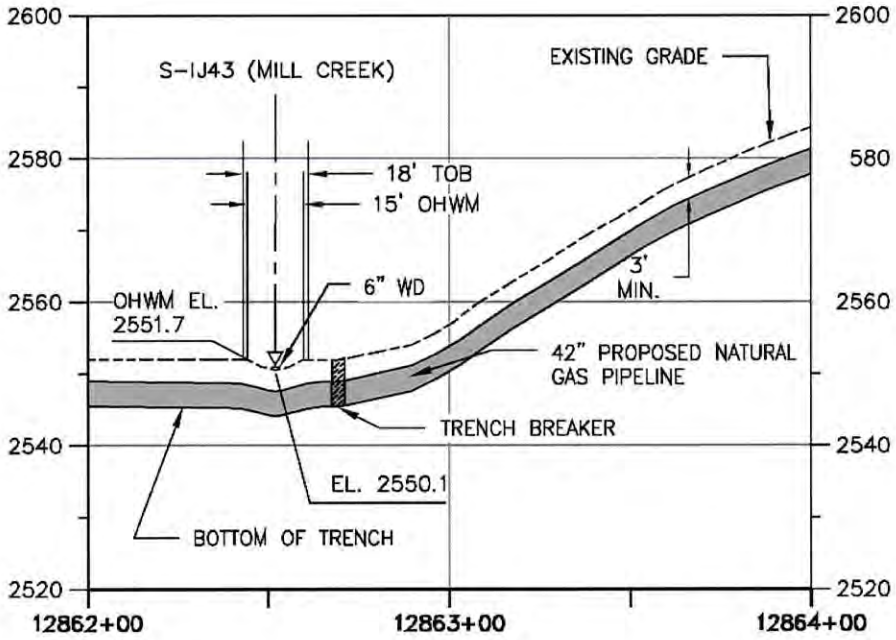
DRY-DITCH OPEN-CUT METHODS TO BE USED FOR ALL STREAM CROSSINGS (EXCEPT FOR S-E11, PIGG RIVER, WHICH WILL BE CROSSED VIA HDD METHODS).



PROFILE A-A

HORIZONTAL

0 50 100

SCALE IN FEET

VERTICAL

0 25 50

SCALE IN FEET

NOTE:
1. MINIMUM 3' OF COVER BETWEEN STREAMBED AND TOP OF PIPELINE.
2. PROPOSED FILL WILL BE IN TRENCH AND WILL BE RESTORED TO PRECONSTRUCTION ELEVATIONS.
3. WATER DEPTH SHOWN ON PROFILE IS NOT TO SCALE.
4. E&SC BMPS HAVE BEEN REMOVED FOR CLARITY AND ARE DISPLAYED ON PLAN VIEW.

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Mountain Valley PIPELINE

STREAM CROSSING
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LAT./LONG./ = 37.138636, -80.139715
DRAINAGE AREA = 5.20 SQUARE MILES
STATION = 12862+44
COUNTY: ROANOKE
REFER TO ATTACHMENT H2, TABLE 2.2 FOR FIELD SURVEY STREAM IMPACTS

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Mountain Valley Pipeline Project

Attachment J: USACE NWP 12 Pre-Construction Notification Condition Compliance

September 2017

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ATTACHMENT J: USACE NWP 12 CONDITION COMPLIANCE

1.0 USACE NWP 12 CONDITION COMPLIANCE

1.1 NWP 12 Specific Regional Conditions

This section summarizes the proposed Project compliance with the Norfolk District of the U.S. Army Corps of Engineers (USACE) Nationwide Permit (NWP) 12 Specific Regional Conditions, as listed below in the order they appear on the USACE NWP:

1. **Construction of access roads may not result in more than 1/3 acre of impacts to waters of the United States.**
    a. The proposed Project will not result in greater than 1/3 acre of impact to waters of the United States from the construction of access roads per single and complete project. See Attachment H-2, Tables 2.2, 3.2, and 3.3 for anticipated Project impacts on waters of the United States.
2. **A PCN is required for discharges associated with the construction of utility line substations that result in the permanent loss of greater than 5,000 square feet of waters of the United States.**
    a. The Project does not include the construction of new utility line substations within the Norfolk District. See Attachment B for a description of the Project.
3. **For utility activities requiring a Pre-Construction Notification (PCN) the prospective permittee shall provide the following information: a) a map of the entire utility corridor including a delineation of all wetlands and waters of the United States within the corridor; b) an alternatives analysis that addresses, i) the avoidance and minimization of wetland and stream impacts to the maximum extent practicable, ii) the avoidance of fragmenting large tracts of forested wetlands, iii) minimizing clearing of wetlands, iv) for overhead utility lines, the allowance of natural succession to restore and maintain the corridor in scrub-shrub wetlands except for a minimum corridor needed for access, to the maximum extent practicable, and v) for buried utility lines, the allowance of natural succession to restore the area to tree and scrub-shrub except for a 20-foot wide access corridor, to the maximum extent practicable; and, c) compensatory mitigation may be required for permanent conversion of wetlands within the utility line corridor.**
    a. See Attachment H-1 for the Wetlands and Waterbodies Impact Overview Map showing the portion of the Project in the USACE Norfolk District. See Attachment H-3 for Impact Detail Figures with plan view maps showing anticipated impacts to delineated wetlands and waters of the United States.
    b. See Attachment I for an Alternatives Analysis addressing i – v.
    c. Compensatory mitigation is proposed for anticipated permanent fill of PEM wetlands and permanent conversion of PFO and PSS wetlands as a result of Project activities. See the Compensatory Mitigation Plan in Attachment H-2 for compensatory mitigation proposed for anticipated Project impacts.
4. **For all submerged utility lines across navigable waters of the United States, a location map and cross-sectional view showing the utility line crossing from bank to bank is required. In addition, the location and depth of any Federal Navigation Channels shall be shown in relation to the proposed utility line. In general, all utility lines shall be buried at least six (6) feet below the authorized bottom depth of Federal Navigation Channel and at least three (3) feet below the bottom depth in all subaqueous areas. When circumstances prevent the placement of at least three feet of cover over the line (outside of the Federal Navigation Channel), then written justification and an alternative method must be provided with the notification and the deviation must be reviewed and approved by the Corps. Section 408 permission may be required (see Regional Condition 13 under Section I).**
    a. The Project pipeline crosses two Traditionally Navigable Waters (TNW), the Roanoke River (S-NN16) and Blackwater River (S-F11), as identified in Attachment H-2 Table 2.2 and shown on the Impact Detail Figures provided in Attachment H-3. Plan and cross-sectional

views, showing pipeline crossing from bank to bank, of S-NN16 and S-F11 are provided in Attachment H-5. As shown on cross-sectional views provided in Attachment H-5, pipeline burial depth will be at least six (6) feet below the authorized bottom depth of the Federal Navigation Channel and at least three (3) feet below the bottom depth in all subaqueous areas.

5. **Whenever practicable, excavated material shall be placed on a Corps confirmed upland site. However, when this is not practicable, temporary stockpiling is hereby authorized provided that:**
    a. **All excavated material stockpiled in a vegetated wetland area is placed on filter cloth, mats, or some other semi-permeable surface.**
        i. Whenever practicable, excavated material will be placed on a Corps confirmed upland site. However, when it is not practicable to place excavated material on an upland site, any excavated material stockpiled in vegetated wetland areas will be placed on a matted straw layer, for use as a semi-permeable surface (See Attachment H-2).
    b. **All excavated material must be placed back into the trench to the original contour and all excess excavated material must be completely removed from within wetland within 30 days after the pipeline has been laid through the wetland areas.**
        i. All excavated material will be placed back into the trench to the original contour and all excess excavated material will be completely removed from within wetland within 30 days after the pipeline has been laid (See Attachment H-2).
6. **When open-cut trenching in designated anadromous fish use areas or hydrostatic testing of a pipeline involving water withdrawals from tidal waters are proposed, the Corps will coordinate with the NOAA Fisheries Service and/or the Virginia Department of Game and Inland Fisheries. Written verification from this office must be received before performing the proposed work.**
   No activities will occur in designated anadromous fish use areas or tidal waters. See Table 2.2 of Attachment H-2 and discussion in Attachment E.
7. **Aerial Transmission Lines Crossing Navigable Waters**
   The Project will not involve aerial transmission line crossings of navigable waters.
8. **For utility lines landing in Virginia, from the Outer Continental Shelf (OCS), the applicant shall send the PCN to the following federal agencies: Director, Naval Seafloor Cable Protection Office & Bureau of Ocean Energy Management (BOEM)**
   The Project will not involve a utility line landing in Virginia from the Outer Continental Shelf.
9. **For utility line projects completed by horizontal directional drilling or other boring methods, a plan to address the prevention, containment, and cleanup of sediment or other materials caused by inadvertent returns of drilling fluids to waters of the U.S. through sub-soil fissures or fractures needs to be included with the PCN (if a PCN is required). If an inadvertent return of drilling fluids to waters of the U.S. occurs, and the remediation requires work within waters of the U.S., then the applicant must notify the Corps immediately and submit a remediation plan as soon as possible, regardless of whether a PCN was required for the original work.**
   The Project will involve the crossing of one waters of the United States (Pigg River, S-E11) using horizontal directional drilling or other boring methods; all other Project crossings of waters of the United States will be open-cut or conventional bore. Details on crossing construction options and analysis are provided in Attachment I. A plan to address the prevention, containment, and cleanup of sediment or other materials caused by inadvertent returns of drilling fluids to waters of the U.S. through sub-soil fissures or fractures is provided in Attachment K.
10. **When an intake is proposed in designated anadromous fish waters, the following design parameters will be incorporated as permit conditions to protect the sensitive life stages of anadromous fish: a) Screening over the mouth of the intake with mesh size that does not exceed 1mm; b) Intake velocities that do not exceed 0.25 feet per second; c) Intake must be positioned such that an unimpeded flow of water parallel to the screen surface occurs along the entire surface of the screen to take advantage of sweeping velocity.**
    a. No Project activities will occur in designated anadromous fish use areas. See Table 2.2 of Attachment H-2 and discussion in Attachment E.

1.2 NWP General Regional Conditions

This section summarizes the proposed Project compliance with the USACE NWP General Regional Conditions, as listed below in the order they appear on the Norfolk District USACE NWP:

1. **Conditions for Waters Containing Submerged Aquatic Vegetation (SAV) Beds**
   The Project does not cross any major waterbodies that support known SAV beds.
2. **Conditions for Anadromous Fish Use Areas**
   The Project will not impact waterways documented to provide spawning habitat or a migratory pathway for anadromous fish according to the Anadromous Fish Use Area file provided by the Virginia Department of Game and Inland Fisheries (VDGIF) at https://www.dgif.virginia.gov/gis/data/download/. See Table 2.2 of Attachment H-2 and discussion in Attachment E.
3. **Conditions for Designated Critical Resource Waters, which include National Estuarine Research Reserves**
   The Project will not impact the Chesapeake Bay National Estuarine Research Reserve in Virginia.
4. **Conditions for Federally Listed Species and Designated Critical Habitat**
   Additional information regarding the potential for Project impacts on federal listed species and designated critical habitat can be found in Attachment E.
5. **Conditions for Waters with Federally Listed Endangered or Threatened Species, Waters Federally Designated as Critical Habitat, and One-mile Upstream (including tributaries) of Any Such Waters**
   Additional information regarding the potential for Project impacts on waters with federal listed species, designated critical habitat, and one-mile upstream (including tributaries) of any such waters can be found in Attachment **E**.
6. **Conditions for Designated Trout Waters**
   In-stream work in Designated Trout Waters will be required by the proposed Project in the USACE Norfolk District (Table 2.2 in Attachment H-2). Unless expressly permitted by the appropriate agency, in-stream work within wild trout waters will not take place during time of year restrictions set forth by the VDGIF (Attachment E).
7. **Conditions Regarding Invasive Species**
   Plant species listed by the most current Virginia Department of Conservation and Recreation's Invasive Alien Plant List will not be used to revegetate the pipeline ROW and other temporarily disturbed area. See the Project Erosion and Sediment Control Plan (ESCP) for additional details.
8. **Conditions Pertaining to Countersinking of Pipes and Culverts**
   Permanent and temporary crossings of waterbodies will be suitably culverted, bridged, or otherwise designed and constructed to be countersunk as appropriate, and to maintain low flows to sustain the movement of aquatic species. Details on access road culverts are provided in Attachment H-4.
9. **Conditions for the Repair of Pipes**
   The replacement of some existing culverts is anticipated on existing access roads proposed for use by the Project. Details on the repair of existing culverts along existing access roads are provided in Attachment I.
10. **Condition for Impacts Requiring a Mitigation Plan**
    A Compensatory Mitigation Plan is provided in Attachment H-2 detailing proposed compensatory mitigation for permanent stream impacts in addition to permanent wetland loss and conversion of PFO and PSS wetlands.
11. **Condition for Temporary Impacts**
    Temporarily disturbed waters and wetlands will be restored to their pre-construction contours within 12 months of commencing the temporary impact. After restored to their natural contours, soil will be mechanically loosened to a depth of 12 inches and wetland areas will be seeded with appropriate native vegetation (Attachment H-2).
12. **Condition for Transportation Projects Funded in Part or in Total by State or Federal Funds**
    The Project is not funded in part or in total by state or federal funds.
13. **Condition for Projects Requiring Coordination Under Section 408**
    The Project will not temporarily or permanently occupy or use a U.S. Army Corps of Engineers federally authorized civil works project.

1.3 NWP General Conditions

This section summarizes the proposed Project compliance with the USACE NWP General Conditions, as listed below in the order they appear on the Norfolk District USACE NWP:

1. **Navigation**
   MVP is proposing that two Traditional Navigable Waterways (TNWs), the Blackwater River (S-F11) and Roanoke River (S-NN16) will be crossed by the pipeline using an open cut, dry ditch crossing using a Portable dam system (Portadam) or equivalent structure in two stages. The structure will be installed in half of the river to allow excavation of the trench and installation of the pipe. Once the pipeline is installed the structure will be moved to the other half of the river and the pipeline installation will be completed in that section. The proposed half-width construction method will allow continual downstream flow, navigation, and recreational access at the Project area. The structure will be removed when the pipeline crossing construction is complete. The Project will utilize an existing bridge on Reese Mountain Road as a temporary access road to cross another TNW, the North Fork Roanoke River (S-GH16). The pipeline will not cross the North Fork Roanoke River, therefore, there is no anticipated impact on the North Fork Roanoke River.
2. **Aquatic Life Movements**
   Permanent and temporary crossings of waterbodies will be suitably culverted, bridged, or otherwise designed and constructed to maintain low flows to sustain the movement of aquatic species. Stream crossing methods are detailed in Attachment I.
3. **Spawning Areas**
   Activities in spawning areas during spawning seasons will be avoided to the maximum extent practicable. Activities that result in the physical destruction of an important spawning area will be avoided. Stream crossing methods are detailed in Attachment I. Information on activities in streams during spawning season and time of year restrictions can be found in Attachment E.
4. **Migratory Bird Breeding Areas**
   Activities in waters of the United States that serve as breeding areas for migratory birds will be avoided to the maximum extent practicable.
5. **Shellfish Beds**
   No Project activities will occur in areas of known concentrated shellfish beds. Freshwater mussel surveys are ongoing as of the submission of this permit application; if upcoming surveys identify concentrated shellfish areas in the Project area, the Project will be modified to avoid impact to concentrated shellfish areas. Additional information regarding threatened and endangered species coordination can be found in Attachment E.
6. **Suitable Material**
   All material used for construction or discharged will be free from toxic pollutants in toxic amounts. After pipeline installation, previously excavated material will be used to backfill the pipeline trench and restore the grade to pre-excavation conditions. Any additional fill required will be clean fill.
7. **Water Supply Intakes**
   Only one public water supply has a surface water intake located within three miles downstream of a pipeline crossing; the Roanoke River intake for the Spring Hollow Reservoir (Roanoke County, Virginia). The Western Virginia Water Authority (WVWA) operates a surface water intake on the Roanoke River approximately 1.2 miles downstream of the crossing at MP 235.6 (see Attachment I).
8. **Adverse Effects from Impoundments**
   Water impoundments will be minimized to the maximum extent practicable. Stream crossing methods are detailed in Attachment I.
9. **Management of Water Flows**
   To the maximum extent practicable, the pre-construction course, condition, capacity, and location of open waters will be maintained for each activity, including storm water management activities and temporary and permanent road crossings. Stream crossing activities will be constructed to withstand expected high flows and in a manner than will not restrict or impede the passage of normal or high flows. Stream crossing methods are detailed in Attachment I.
10. **Fills Within 100-Year Floodplains**
    Activities within the 100-year floodplain will comply with Federal Emergency Management Agency (FEMA) approved state or local floodplain management requirements. Coordination with localities

regarding potential floodplain impacts and management strategy is ongoing and updates will be provided as appropriate.

11. **Equipment**
    Heavy equipment working in wetlands or mudflats will be placed on mats, or other measures to minimize soil disturbance. Additional details are included in Attachment H-2
12. **Soil Erosion and Sediment Controls**
    Appropriate soil erosion and sediment controls will be used and maintained in effective operating condition during construction, and exposed soil and other fills, as well as any work below the ordinary high water mark or high tide line, will be permanently stabilized at the earliest practicable date. Where practicable, work within waters of the Unites States will be conducted in no-flow or low-flow conditions. The Project ESCP contains further details on erosion and sediment controls.
13. **Removal of Temporary Fills**
    Temporary fills will be removed in their entirety and the affected areas returned to pre-construction elevations. The affected areas will be revegetated, as appropriate. The ESCP contains further details on the removal of temporary fills.
14. **Proper Maintenance**
    Authorized fill shall be properly maintained to ensure public safety and compliance with applicable NWP general conditions, as well as activity-specific conditions that may be added to the NWP authorization by the district engineer.
15. **Single and Complete Project**
    MVP is submitting one application for Project authorization under NWP 12 to conduct crossings of wetlands and waters of the United States in Virginia. As defined in Note 2 of the Nationwide Permit (12) Utility Line Activities guidance effective 3/19/17: for utility line activities crossing a single waterbody more than one time at separate and distant locations, or multiple waterbodies at separate and distant locations, each crossing is considered a single and complete project for the purposes of NWP authorization.
16. **Wild and Scenic Rivers**
    No National Wild and Scenic Rivers occur within the Project area, and therefore, no Wild and Scenic Rivers will be impacted by this Project.
17. **Tribal Rights**
    See Attachment F for information regarding cultural and historic resources coordination efforts which addressed potential Project impacts on reserved tribal rights, tribal resources, and tribal lands.
18. **Endangered Species**
    See Attachment E for additional information regarding potential Project impacts on federal threatened and endangered species.
19. **Migratory Birds and Bald and Golden Eagles**
    See Attachment E for additional information regarding threatened and endangered species coordination efforts which addressed potential Project impacts on migratory birds, bald eagles, and golden eagles.
20. **Historic Properties**
    See Attachment F for information regarding cultural and historic resources coordination efforts which addressed potential Project impacts on historic properties.
21. **Discovery of Previously Unknown Remains and Artifacts**
    If any previously unknown historic, cultural or archeological remains or artifacts are discovered the district engineer will be immediately notified. Construction activities that may affect the remains or artifacts will be avoided to the maximum extent practicable until the required coordination has been completed. Additional information regarding cultural resource surveys completed for the project can be found in Attachment F.
22. **Designated Critical Resource Waters**
    No known Critical Resource Waters occur within the Project area. Therefore, there are no anticipated Project-related discharges of dredged or fill material into waters of the United States within, or directly affecting, Critical Resource Waters.

23. **Mitigation**

MVP is proposing to mitigate for unavoidable permanent impacts through the purchase of credits from mitigation banks for impacts within service areas of approved mitigation banks. For impacts outside of the service areas of approved mitigation banks, MVP is proposing to purchase credits from the Virginia Aquatic Resource Trust Fund (VARTF). In the event VARTF credits are not available, MVP proposes to further mitigate the cumulative impacts of the project by obtaining credits at a higher ratio from a bank whose service area includes portions of the pipeline route. See Attachment H-2 for the Project Compensatory Mitigation Plan.

24. **Safety of Impoundment Structures**
    The proposed Project does not require permanent impoundment structures.
25. **Water Quality**
    See VA 401 Water Quality Certification Special Conditions, below.
26. **Coastal Zone Management**
    The Project is not located in a coastal zone.
27. **Regional and Case-By-Case Conditions**
    This Attachment details NWP Specific and General Regional Condition compliance measures.
28. **Use of Multiple Nationwide Permits**
    MVP is submitting one PCN to the USACE Norfolk District for the use of NWP 12 for the portions of the proposed Project in the USACE Norfolk District.
29. **Transfer of Nationwide Permit Verifications**
    MVP understands that nationwide permit verification can be transferred by submitting a letter to the USACE District office to validate the transfer.
30. **Compliance Certification**
    MVP will provide a signed certification documenting completion of the authorized activity and required compensatory mitigation.
31. **Activities Affecting Structures or Works Built by the United States**
    The Project will not temporarily or permanently occupy or use a U.S. Army Corps of Engineers federally authorized civil works project.
32. **Pre-Construction Notification**
    a. MVP understands the timetable for the PCN submission(s), review, and request for additional information.
    b. The PCN submission is in writing and contains;
        i. Name, address and telephone numbers for MVP are provided in the Standard Joint Permit Application Form submitted for the Project.
        ii. Proposed Project location details and overview map are provided in Attachment A.
        iii. MVP is seeking to permit the Project under USACE Nationwide Permit (NWP) 12 – Utility Line Activities for the discharge of dredged and fill material into Waters of the United States under Section 404 of the Clean Water Act and under Section 10 of the Rivers and Harbors Act of 1899.
        iv. A description of the proposed project is provided in Attachment B; the project's purpose is provided in Attachment B; information regarding direct and indirect adverse environmental effects the project would cause, including the anticipated amount of loss of waters of the United States are provided in Attachment H.
        v. Results of a Wetland Delineation and Waters of the U.S. survey are provided in Attachment G.
        vi. Mitigation/Compensation Plan is provided in Attachment H-2.
        vii. Additional information regarding endangered species surveys can be found in Attachment E.
        viii. Additional information regarding historic property surveys can be found in Attachment F.
        ix. No National Wild and Scenic Rivers occur within the Project area, and therefore, no Wild and Scenic Rivers will be impacted by this Project.
        x. The Project will not temporarily or permanently occupy or use a U.S. Army Corps of Engineers federally authorized civil works project.
    c. The Standard Joint Permit Application is included.
    d. MVP understands the district engineer will consider comments from Federal and state agencies concerning the proposed activity's compliance with the terms and conditions of

the NWPs and the need for mitigation to reduce the project's adverse environmental effects to a minimal level. MVP also agrees to coordinate with Federal and state agencies regarding the Project.

1.4 Virginia §401 Water Quality Certification Special Conditions

The State Water Control Board issued conditional §401 Water Quality Certification for NWP 12 as meeting the requirements of the Virginia Water Protection Permit Regulation, which serves as the Commonwealth's §401 Water Quality Certification, provided that:

1. **The activities are not associated with a surface water withdrawal or the transport of non-potable raw surface water, except for the purposes of hydrostatic testing and when the associated discharges are authorized by a Virginia Pollutant Discharge Elimination System (VPDES) permit, if required**
    a. The project does not involve surface water withdrawal. There will be no transport of non-potable raw surface water, except for the purpose of hydrostatic testing. See Attachment B for project description and for information on hydrostatic testing of the utility line. Because MVP does not intend to release any hydrostatic test water to waterbodies, the Project does not require coverage under a Virginia Pollutant Discharge Elimination System (VPDES) permit.
2. **Any compensatory mitigation meets the requirements in the Code of Virginia, Section 62. 1-44.15:23 A through C, except in the absence of same river watershed alternatives in Hydrologic Unit Codes (HUC) 02040303 and 02040304, single family dwellings or locality projects may use compensatory mitigation in HUC 02080102, 02080108, or 02080111 in Virginia**
    a. Attachment I details the methods utilized by MVP to avoid and minimize impacts to waters of the United States. For unavoidable Project impacts, the Compensatory Mitigation Plan in Attachment H-2 provides permanent impacts and proposed mitigation. MVP proposes to utilize mitigation banks, approved by Interagency Review Team (IRT), for the purchase of credits in mitigation bank service areas approved by the IRT. Approved mitigation bank service areas are generally the area covered by the HUC 8 watershed the approved mitigation bank is located in, in addition to adjacent HUC 8 watersheds, unless otherwise specified by the IRT.
3. **Temporary diversions of surface waters associated with "pump arounds" during the construction of utility crossings are specifically allowed**
    a. See Attachment I for details on Project wetland and stream crossing methods. MVP is proposing to use dam and pump, flume, and cofferdam crossing methods to temporarily divert surface waters during construction

1.5 VMRC Standard Permit Conditions

In a letter dated November 8, 2016 from VMRC staff to the Department of Environmental Quality, VMRC recommended that MVP adhere to the following standard permit conditions for all stream crossings under VRMC's jurisdiction.

1. **A "frac-out" contingency plan must be provided for any crossings utilizing the directional drill method to address potential frac-outs or related spills associated with any directional drilling activities;**

A plan to address the prevention, containment, and cleanup of sediment or other materials caused by inadvertent returns of drilling fluids to waters of the U.S. through sub-soil fissures or fractures is provided in Attachment K.

2. **In an effort to minimize adverse impacts to threatened and endangered fish and mussel species, instream surveys and species relocations may be required. No instream**

construction shall be conducted during any recommended time-of-year restrictions of any year unless waived by VDGIF in writing;

VDGIF's recommended time-of-year restrictions will be adhered to. See Attachment E and H-5.

3. **The instream construction activities shall be accomplished during low flow periods utilizing dam and pump, flume around or within cofferdams constructed of nonerodible materials in such a manner that no more than half the width of the waterway is obstructed at any point in time. All areas of State-owned bottom and adjacent lands disturbed by this activity shall be restored to their original contours and natural conditions within thirty (30) days from the date of completion of the authorized work. All excess materials shall be removed to an upland site and contained in such a manner to prevent its reentry into State waters;**

Appropriate soil erosion and sediment controls will be used and maintained in effective operating condition during construction, and exposed soil and other fills, as well as any work below the ordinary high water mark or high tide line, will be permanently stabilized at the earliest practicable date. Where practicable, work within waters of the Unites States will be conducted in no-flow or low-flow conditions. The Project ESCP contains further details on erosion and sediment controls. Temporarily disturbed waters and wetlands will be restored to their pre-construction contours. After restored to their natural contours, soil will be mechanically loosened to a depth of 12 inches and wetland areas will be seeded with appropriate native vegetation (Attachment H-2). Stream crossing methods utilized for the project are consistent with this condition (Attachment I).

4. **Erosion and sediment control measures shall be in conformance with the 1992 Third Edition of the Virginia Erosion and Sediment Control Handbook and shall be employed throughout construction.;**

Erosion and sediment controls measures will be implemented in accordance with Standards and Specifications and site-specific Erosion and Sediment Control Plans approved by the Virginia Department of Environmental Quality.

5. **If it is determined that blasting is necessary at any of the crossings, DGIF shall be notified a minimum of 48 hours in advance of the blasting;**

Blasting will be avoided at all waterbody crossings unless deemed necessary. If necessary, blasting will be conducted in accordance with a General Blasting Plan approved by FERC.

6. **The Department of Conservation and Recreation shall be contacted for any stream crossings where karst landscape features are encountered during installation;**

Karst areas have been surveyed and karst features catalogued in a Karst Hazard Assessment. All construction through karst areas will be conducted in accordance with a Karst Mitigation Plan approved by FERC. The Virginia Department of Conversation and Recreation has been consulted in the process of developing the assessment and plan. Table H-5 identifies the impacts within karst areas.

7. **VDGIF shall be contacted for any work in trout waters to avoid conflicts with trout stocking activities;**

Unless expressly permitted by the appropriate agency, in-stream work within wild trout waters will not take place during time of year restrictions set forth by the VDGIF. VDGIF will be contacted in advance for any streams designated as stockable.

Mountain Valley Pipeline Project

Standard JPA-NWP12 Pre-Construction Notification, Virginia

Attachment K: HDD Contingency Plan

September 2017

HORIZONTAL DIRECTIONAL DRILLING (HDD) CONTINGENCY PLAN

PITTSYLVANIA COUNTY, VIRGINIA

Submitted by:

Mountain Valley Pipeline
625 Liberty Avenue, Suite 1700 Pittsburgh, PA 15222-3111

AUGUST 2017

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ACRONYMS AND DEFINITIONS

FERC	Federal Energy Regulatory Commission
HDD	Horizontal Directional Drilling
MVP	Mountain Valley Pipeline, LLC
Project	Mountain Valley Pipeline Project

PROJECT NARRATIVE

HDD is a trenchless excavation method that is accomplished in three phases. The first phase consists of drilling a small diameter pilot hole along a designed directional path. The second phase consists of enlarging the pilot hole to a diameter suitable for installation of the pipe. The third phase consists of pulling the pipe into the enlarged hole. HDD is accomplished using a specialized horizontal drilling rig with ancillary tools and equipment. A properly executed HDD crossing will allow for the pipeline to be installed in a minimally invasive manner.

HDD is proposed for the Mountain Valley Pipeline (MVP) Project crossing of the Pigg River in Pittsylvania County, Virginia. The HDD crossing is the preferred method of construction intended to minimize direct impacts to the Pigg River.

The inadvertent release (IR) of drilling lubricant is a potential concern when HDD methods are utilized. The HDD procedure for this crossing will utilize Bentonite for Drilling Lubricant. In general, IRs can occur as a result of existing rock fractures, low density soils, or unconsolidated geology. There is a potential for inadvertent returns to directly impact surface and ground waters via existing or enhanced fracture zones or if there is a release upland which flows over ground into wetlands or streams. Chemical impacts can vary depending on the composition of the drilling mud, but often is composed of benign material. Physical impacts can occur to private water supplies in the form of increased suspended solids.

In accordance with MVP's Water Resources Identification and Testing Plan, private water resources (wells and springs) were identified within 150 feet in non-karst areas, and within 500 feet in karst areas, of MVP work spaces. Private water supply resources were identified during route alignment civil surveyors along the Project corridor, as well as through desktop review and field observation (where property access was granted). Where necessary, additional desktop review procedures were used to identify private wells and springs. Landowner notification letters have also been sent to request approval for testing of private water supplies.

Specifically regarding the Pigg River HDD, one existing private water well supply was located and sampled to date adjacent to the Pigg River HDD. MVP is currently working to identify and sample any and all remaining water supplies near the proposed Pigg River HDD.

Public water supplies (wells, springs, surface water intakes) were identified at minimum within 3 miles of the MVP alignment and more comprehensively with the larger watershed. As noted in the Environmental Impact Statement issued by the FERC on June 23, 2017, no public water supplies are located within 3 miles of the proposed Pigg River HDD activities near Project milepost 290.0.

PURPOSE

The purpose of this Contingency Plan is to:

- Minimize the potential for an IR associated with horizontal directional drilling activities.
- Provide for the timely detection of an IR.
- Protect areas that are considered environmentally sensitive (streams, wetlands, other biological resources, cultural resources).
- Provide an organized, timely, and "minimum-impact" response in the event of an IR.
- Provide that all appropriate notifications are made to the Virginia Department of Environmental Quality, MVP, and other appropriate regulatory agencies, and that documentation is completed.

PREPARATION

Prior to implementation of the HDD, MVP and the contractor shall identify the potential for inadvertent releases at the HDD location. The review shall include a visual review of entry and exit points, and if accessible, stream bed composition (bedrock or alluvial deposits). The contractor shall review the RK&K Geotechnical HDD Data Report Pigg River Pipeline Crossing (October 16, 2016) reports, which may include descriptions of subsurface conditions, laboratory testing, design recommendations, and construction recommendations.

In addition, private water supplies within 150 feet, sensitive cultural and biological resources will be protected by implementing the following measures:

- The drilling contractor shall review the site conditions prior to the start of work. The execution of HDD operations and actions for detecting and controlling drilling fluid seepage are the responsibility of the drilling contractor.
- Construction limits will be clearly marked.
- Barriers (18" Fabric Filter Fence or Compost Filter Sock, as per the on-site inspector) will be erected between the bore site and nearby sensitive resources prior to drilling to prevent released material from reaching the resource.
- On-site briefings will be conducted for the workers to identify and locate sensitive resources at the site.
- Provide that all field personnel understand their responsibility for timely reporting of IR's.
- Maintaining necessary response equipment on-site and in good working order.

The primary areas of concern for IR's occur at the entrance and exit points where the drilling equipment is generally at their shallowest depths. The likelihood of an IR decreases as the depth of the pipe increases.

To minimize the potential extent of impacts from an IR, HDD operations will be continuously monitored to look for observable IR conditions or lowered pressure readings on the drilling equipment. Early detection is essential to minimizing the area of potential impact.

TRAINING

Prior to the start of construction, the Site Supervisor/Foreman shall ensure that the crew members receive training on the following:

- The provisions of this Contingency Plan.
- Inspection procedures for IR prevention and containment equipment materials.
- Contractor/crew obligation to immediately stop the drilling operation upon first evidence of the occurrence of an IR and to immediately report any IRs to EQT's Environmental Coordinator.
- Contractor/crew member responsibilities in the event of an IR.
- Operation of release prevention and control equipment and the location of release control materials, as necessary and appropriate.
- Protocols for communication with agency representatives who might be on site during the clean-up effort.
- Copies of this contingency plan and the contractor's site specific contingency plan will be maintained at the bore site in a visible and accessible location at all times.

EQUIPMENT

The Site Supervisor shall verify that:

- All equipment and vehicles are inspected and maintained daily to prevent leaks of hazardous materials.
- Spill kits and spill containment materials are available on-site at all times and that the equipment is in good working order.
- Equipment required to contain and clean up an IR is available at the bore site during drilling activities.

  *Note: It is the drilling contractor's responsibility to provide any IR containment materials that are necessary to respond to the release of drill fluids. The materials listed in this contingency plan are not to be considered inclusive and may require additional equipment depending on site conditions.

DRILLING PROCEDURES

Drilling pressures shall be closely monitored so they do not exceed those needed to penetrate the formation. Pressure levels shall be monitored continuously by the operator. Pressure levels shall be set at a minimum level to prevent IRs. During the pilot bore, maintain the drilled annulus. Cutters and reamers will be pulled back into previously drilled sections after each joint of pipe is added.

Entry and exit pits shall be enclosed by 18" Fabric Filter Fence or Compost Filter Sock and straw bales. A spill kit shall be on-site and used if an IR occurs. Except as noted below, a vacuum truck shall be readily available on-site prior to and during all drilling operations. Containment materials (straw, fabric filter fence, sand bags, spill kits, boom and turbidity curtain, etc.) shall be staged on-site at a location where they are readily available and easily mobilized for immediate use in the event of an IR. Filter Fence or Filter Sock will be installed between the bore site and the edge of water sources prior to drilling.

*NOTE: If the site is not able to be accessed by a vacuum truck, a pump with sufficient power to convey the released drill fluid to a containment area will be used instead. Along with the pump, an adequate amount of hose, several filter bags, straw bales, sand bags, and 18" Fabric Filter Fence (or Compost Filter Sock) will be kept on site to create a containment area on site.

Once the drill rig is in place and drilling begins, the drill operator shall stop work immediately whenever the pressure in the drill rig drops or there is a lack of returns in the entrance pit. At this time the Site Supervisor/Foreman shall be informed of the potential IR. The Site Supervisor/Foreman and the drill rig operator(s) shall work to coordinate the likely location of the IR. The location shall be recorded and notes made on the location and measures taken to address the concern. Measures will then be taken according to the type of IR (i.e. Terrestrial or Aquatic) as listed below. The Site Supervisor/Foreman will then begin notifying the appropriate parties as listed in the "Contacts" section of this document.

Water containing mud, silt, drilling fluid, or other pollutants from equipment washing or other activities, shall not be allowed to enter a lake, flowing stream, or any other water source. The bentonite used in the drilling process shall be either disposed of at an approved disposal facility or recycled in an approved manner. Other construction materials and wastes shall be recycled, or disposed of, as appropriate.

INADVERTENT RELEASE (IR) PROCEDURES

In the event of an IR, MVP's Project PM, Environmental Inspector, Chief (i.e. whoever is on site) is required to IMMEDIATELY notify the Project's **MVP Environmental Coordinator (Mr. Brian Clauto, 412-295-4184)** with the following information: What occurred; Where it occurred (Terrestrial or Aquatic); When it occurred; Who was responsible; and Quantity released.

TERRESTRIAL IR PROCEDURES

- Stop work immediately.
- The bore stem will be pulled back to relieve pressure on the IR.
- Isolate the area with hay bales, sand bags, filter sock, or silt fencing to surround and contain the drilling mud.
- Determine and document the following to the extent reasonably possible:
    - Quantity (gallons) of material released
    - Distance (feet) to the nearest waterbody
    - Name of the waterbody affected, if any
- Contact the appropriate parties as listed in the "Required Notifications" section at the end of this document.
- A mobile vacuum truck (or pump if in an inaccessible area) will be used to pump the drilling mud from the contained area and into either a return pit or (if using a pump) into a filter bag surrounded by 18" Fabric Filter Fence or Compost Filter Sock.
- Once excess drilling mud is removed, the area will be seeded and/or replanted using species similar to those in the adjacent area, or allowed to re-grow from existing vegetation.
- When there is no visible indication of flow at the IR location, the IR will be considered stabilized.

After the IR is stabilized, document the IR from discovery through post-cleanup conditions with photographs and prepare an IR incident report describing time, place, actions taken to remediate IR, and measures implemented to prevent recurrence. The incident report will be provided to the MVP Environmental Coordinator within 24 hours of the occurrence.

AQUATIC (UNDER WATER) IR PROCEDURES

- Stop work immediately.
- The bore stem will be pulled back to relieve pressure on the IR.
- Contact the appropriate parties as listed in the "Required Notifications" section at the end of this document.
- Isolate the area with hay bales, sand bags (cofferdam), plastic sheeting, filter sock, silt fence or other appropriate containment structure to surround and contain the IR;
- Utilize clean water pumps to establish a pump around to convey upstream flow around the IR;
- Turbidity curtains may be deployed (depending on site conditions at time of IR);
- Determine and document the following to the extent reasonably possible:
    - Quantity (gallons) of the IR
    - Quantity (gallons) that was released to the waterbody
    - Distance (feet) the material traveled down the waterbody
    - Name of the affected waterbody

- A mobile vacuum truck (or pump if in an inaccessible area) will be used to pump the drilling mud from the contained area and into either a return pit or (if using a pump) into a filter bag surrounded by 18" Fabric Filter Fence or Compost Filter Sock.
- Drilling mud will be collected and typically recycled through the drilling mud reclaimer, reused or disposed of at a licensed disposal facility.
- If the IR affects an area that is vegetated, the area will be seeded and/or replanted using species similar to those in the adjacent area, or allowed to re-grow from existing vegetation.
- When there is no visible indication of flow at the IR location, the IR will be considered stabilized.

After the IR is stabilized, document the IR from discovery through post-cleanup conditions with photographs and prepare an IR incident report describing time, place, actions taken to remediate IR, and measures implemented to prevent recurrence. The incident report will be provided to the MVP Environmental Coordinator within 24 hours of the occurrence.

POTENTIAL PRIVATE WATER SUPPLY IMPACTS

If an IR impacts a private drinking water supply, MVP will supply temporary drinking water supply in accordance with MVP's Water Resources Identification and Testing Plan (Water Resources Plan) immediately after the problem is discovered. The temporary water would be supplied until testing confirms that the water quality of the water supply is similar to pre-existing conditions. Additional long-term measures will be employed in accordance with the Water Resources Plan if necessary, including the installation of permanent treatment, connection to a secondary water source, or establishment of a new on-site source.

ABANDONMENT AND ALTERNATIVE CROSSINGS

If the HDD installation is unsuccessful and MVP determines abandonment of the HDD is necessary, MVP's contingency plan will be implemented. The contingency plan includes implementation of an open cut dry ditch crossing method. Implementation of the HDD Contingency Plan will require permitting approvals to be secured before action is taken. Contact the MVP Environmental Coordinator for the Project.

REQUIRED NOTIFICATIONS

In the event of an IR, the following parties are to be notified IMMEDIATELY:

MVP Environmental Department:

Mr. Brian Clauto

Senior Environmental Coordinator

724-873-3465 (office)

412-295-4184 (cell)

Ms. Megan Stahl

Environmental Permitting - Supervisor

412-553-7783 (office)

412-737-2587 (cell)

Mr. John Centofanti

Corporate Director - Environmental Affairs

412-395-3305 (office)

412-417-3729 (cell)

Include the following information:

- Time the spill was first identified
- Description of where the spill occurred – Project MP/Station
- Latitude and Longitude of spill
- Size of spill and control measures in place
- Name of affected water resource (if known/applicable)
- Photographs of spill area and corrective measures – when available. (Do not wait to notify MVP until pictures are available. Photo documentation should begin immediately upon detection and continued throughout the duration of the cleanup).

The Environmental Department will contact State and/or Federal environmental agencies (if applicable) for notification requirements in the event of an IR.

As appropriate, in the event of an unsuccessful HDD, the Environmental Department will also follow the notification and evaluation procedures in the Plan for Unanticipated Historic Properties and Human Remains, Mountain Valley Pipeline Project, Virginia and West Virginia.

REFERENCES

This Contingency Plan was adapted from the following websites:

<http://www.blm.gov/pgdata/etc/medialib/blm/wy/information/NEPA/cfodocs/greencore.Par.0871.File.dat/PODappH.pdf>

<https://www.csx.com/index.cfm/library/files/customers/property-real-estate/permitting/sample-fraction-mitigation-plan/ >

http://www.energy.ca.gov/sitingcases/smud/documents/applicants_files/Data_Response_Set-1Q/APPENDIX_C_FRAC_OUT_PLAN3.PDF

Mountain Valley Pipeline Project

Standard JPA-NWP 12, Virginia

Attachment I: Alternative Analysis

September 2017

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ATTACHMENT I: ALTERNATIVES ANALYSIS

1.0 EXECUTIVE SUMMARY

This Nationwide Permit 12 Alternatives Analysis is submitted in accordance with NWP 12 Regional Condition 3.b. This analysis presents a site-specific evaluation of reasonable alternatives for each stream and wetland in Virginia crossed by the pipeline or an access road with the objective of identifying all methods that are practicable for each crossing in light of the project purpose and in consideration of technical, logistical, and cost factors. Attachment H-1 provides a map depicting each planned crossing evaluated in this Alternatives Analysis and Attachment H-2 provide the corresponding impact characteristics.

1.1 Pipeline Crossing Alternatives

MVP considered five alternative stream and wetland crossing methods for pipeline crossings (Sec. 3.3.2):

1. Bridging
2. Dry Open Cut
3. Conventional Bore
4. Horizontal Directional Drilling (HDD)
5. Microtunneling/Direct Pipe

The analysis outlines five technical, logistical, and cost criteria that have a bearing on the practicability of the crossing methods in various situations (Sec. 3.3.3). These criteria are:

1. Karst Geology
2. Steep Slopes Adjacent to Stream/Wetland Crossings
3. Aquatic Endangered and Threatened Species and Designated Trout Waters
4. Private Wells
5. Cost

To conduct the analysis for pipeline crossings, each of the five criteria were reduced to practicable logic tables (Table 5) that identify the conditions for when each crossing method is or is not practicable. The relevant characteristics for each stream and wetland crossed by the pipeline were then entered into a spreadsheet model. The practicable logic tables were incorporated into the model to determine, based on the relevant characteristics of each stream and wetland, which method or methods were practicable for each crossing. The result is an individual assessment of practicable alternatives for every proposed stream crossing (Exhibit 5) and wetland crossings (Exhibit 6).

1.2 Access Road Crossing Alternatives

During design of the Project, MVP reviewed existing infrastructure that would facilitate transportation of materials to the project site without the need to construct new roads in order to minimize or avoid impacts to streams, wetlands, and upland areas. This included review and identification of existing public roads and private drives (including driveways, logging roads/trails, farm roads and other existing corridors that would provide adequate areas for access. Where the existing road or drive is suitable, MVP plans to use it as is. Minor upgrades to private roads may be needed in select areas to facilitate Project use. Upgrades may include:

- Placement of clean gravel to maintain the existing road surface
- Minor temporary widening in select areas to allow vehicle passage
- Replacement/upgrades to existing stream culverts (where necessary)
- Tree removal or trimming

- Placement of temporary equipment bridges or equipment mats at wetland or waterbody crossing locations
- Placement of equipment mats or steel plates to protect existing culverts (where necessary)
- Reduction of Project Limit of Disturbance to protect adjacent resources (waterbodies and wetlands)
- Placement of appropriate erosion and sediment control best management practices to protect adjacent resources

MVP identified a total of 139 access roads that will be utilized during implementation of the Project. Throughout the infrastructure review process described above, only nine locations were identified for which a new access road would be needed due to the unavailability of a suitable existing road in those locations. During analysis of the Project access roads, a total of 12 existing stream crossing culverts were identified that will require replacement and/or upgrades on permanent access roads needed to facilitate installation and operation of the Project. This will minimize impacts to the aquatic resources by reducing the need for culvert installation in previously affected areas. For the proposed temporary use access roads, a total of 29 streams will be crossed where no culverts exist on the existing private roads. In these locations, MVP's preferred alternative is to span the crossing (from bank to bank) using timber mats or prefabricated equipment bridges in order to avoid instream impacts. In the event that topography (steep slope areas) precludes the safe installation of equipment mats or bridges without significant grading, the only available practicable alternative is to install a temporary stream culvert and clean rock fill in those locations.

1.3 Other Conditions Relevant to the Selection of Alternatives

In addition to the alternatives analysis discussed above, this document addresses other General, Regional, and Clean Water Act § 401 conditions for NWP 12 that pertain to the avoidance and minimization of impacts and/or selection of offsite or onsite alternatives. The purpose is to document the application's compliance with each of these conditions. More specifically, this alternatives analysis documents the application's compliance with the following conditions:

- NWP 12 and NWP 12 Regional Condition 1's limitations on the scope of aquatic impacts for each single and complete project in (Sec. 2.2)
- NWP General Condition 23's requirement to avoid and minimize impacts at the project site to the maximum extent practicable (Sec. 2.3)
- NWP 12 Regional Condition 3.b.i's requirement to select an alignment that avoids and minimizes wetland impacts to the maximum extent practicable (Sec. 3.1)
- NWP 12 Regional Condition 3.b.i's requirement to cross streams perpendicularly to the maximum extent practicable (Sec. 3.2)
- NWP 12 Regional Condition 3.b.ii's requirement to avoid fragmentation of large tracts of forested wetlands (Sec. 3.4)
- NWP 12 Regional Condition 3.b.iii's requirement to minimize clearing of wetlands (Sec. 3.5)
- NWP 12 Regional Condition 3.b.iv's requirement to allow the natural succession of the right-of-way for overhead utility lines (Sec. 3.6)
- NWP 12 Regional Condition 3.b.v's requirement to allow the natural succession of the right-of-way for buried utility lines (Sec. 3.7)
- NWP General Condition 7's restriction on the use of a NWP in proximity to a public water supply intake (Sec. 3.8)

Additionally, various federal and state agencies with jurisdiction over aspects of the Project may mandate the selection of a particular alternative in specific cases. These are noted on the attached alternatives summaries in Exhibits 6 and 7.

2.0 INTRODUCTION

2.1 Scope of Alternatives Analysis

The purpose of this analysis is to demonstrate that each of the proposed projects meet all applicable General, Regional, and Clean Water Act § 401 conditions for NWP 12 relevant to the avoidance and minimization of impacts. This analysis is guided by General Condition #23(a), which states:

> *The activity must be designed and constructed to avoid and minimize adverse effects, both temporary and permanent, to waters of the United States to the maximum extent practicable at the project site (i.e., on site).*[1]

Practicable is defined as "available and capable of being done after taking into consideration cost, existing technology, and logistics in light of overall project purposes."[2]

Satisfaction of this condition is provided in an alternatives analysis that specifically addresses the criteria of the Norfolk District NWP 12 Regional Condition 3.b.[3]. These criteria are as follows:

(i) [1] Selection of an alignment, which avoids and minimizes wetland impacts to the maximum extent practicable.

[2] The utility line should make a direct or perpendicular crossing of a stream.

[3] Directional drilling should be reviewed as an option. However, the Norfolk District recognizes that in certain areas (e.g. karst areas) directional drilling may not be the environmentally preferred option.

(ii) Selection of an alignment which avoids fragmenting large tracts of forested wetlands by routing utility lines outside of forested tracts or on the edges of forested tracts. Consult the Virginia Conservation Vision, a GIS analysis for identifying and prioritizing areas of un-fragmented natural cover in Virginia http://www.dcr.virginia.gov/natural-heritage/vaconvision.

(iii) Minimizing clearing of wetlands. Grubbing shall be limited to the permanent easement for underground utility lines. Outside of the permanent easement, wetland vegetation shall only be removed at or above the ground surface unless written justification is provided and the impacts are reviewed and approved by the Corps.

(iv) For overhead utility lines, allowance of natural succession to restore and maintain the corridor in scrub-shrub wetlands except for a minimum corridor needed for access, to the maximum extent practicable.

(v) For buried utility lines, allowance of natural succession to restore the area to tree and scrub/shrub except for a 20-foot wide access corridor, to the maximum extent practicable.

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[1] 82 Fed. Reg. 1860, 2001 (Jan. 6, 2017).
[2] 40 C.F.R. § 230.10(a)(2); *see also* 82 Feg. Reg. at 2006.
[3] U.S. Army Corps of Engineers. Norfolk District Final Regional Conditions for the 2017 Nationwide Permits (NWPs) Applicable in Virginia (Including Northern Virginia Military Installations within Baltimore District's Area of Responsibility). February 28, 2017.

3.0 ALTERNATIVES ANALYSIS

3.1 Alignment Selection (Reg. Cond. 3.b.1.[1])

3.1.1 Regional Condition 3.b.i.[1] states: Selection of an alignment, which avoids and minimizes wetland impacts to the maximum extent practicable.

3.1.2 Alignment Selection Process

The final proposed pipeline route and access roads are the result of an iterative process involving numerous environmental considerations and consultation with third parties. Since the initial route was proposed, there have been 267 route revisions in Virginia to avoid or minimize impacts to specific resources. In addition, for about 35.8 miles (33 percent of the route), the pipeline will follow other existing right-of-way for the Virginia portion of the project. FERC also considered the practicability and comparative environmental advantages of additional route alternatives through its National Environmental Policy Act review. FERC, Mountain Valley Project and Equitrans Expansion Project Final Environmental Impact Statement § 3.0 (June 2017) (FEIS).[4] The result of this process is an alignment that avoids and minimizes environmental impacts to the maximum extent practicable.

Of particular relevance to Regional Condition 3.b.i.[1], MVP made all practicable efforts to avoid and minimize impacts to waters during the route development process. FERC acknowledged this in its FEIS, concluding that the impacts to streams and wetlands have been "avoided to the extent practicable" and have been reduced to a level that is not "significant." FEIS 4-149 (streams), 4-159 (wetlands).

For wetlands that could not be avoided altogether through the alignment selection process, MVP will avoid wetlands impacts within the Project corridor by reducing the width of the construction right-of-way within wetlands from 150 feet to 75 feet. Wetlands impacts will be avoided and minimized further through compliance with FERC's Wetland and Waterbody Construction Procedures and MVP's Compensatory Wetland Mitigation Plan that accompanies the Joint Permit Application. Furthermore, the FERC Procedures do not allow the use of additional temporary workspace (ATWS) within wetlands unless a variance is granted. MVP will submit a variance request to FERC for any locations that do not meet this condition.

[4] The Final Environmental Impact Statement was issued on June 23, 2017.

3.2 Stream Crossing Geometry (Reg. Cond. 3.b.1.[2])

3.2.1 Regional Condition 3.b.i.[2] states: The utility line should make a direct or perpendicular crossing of a stream.

3.2.2 During Project development, MVP conducted an extensive review of potential routes to identify potential pipeline corridors, and then further refined the review to determine the most feasible route within the most favorable corridor. One of MVP's primary objectives with respect to pipeline routing was to avoid or minimize environmental impacts related to stream crossings where practicable. Historically, public utilities have at times sited buried utility lines to run under and follow the course of streams for significant distances. Consistent with NWP 12 Regional Condition 3.b.i and avoidance and minimization considerations, all of MVP's proposed stream crossings are direct. MVP did not consider any potential alignments that would have the pipeline running under the course of a stream bed. Furthermore, the alignment corridor was developed to make stream approach angles as close to perpendicular as practicable. This process has resulted in 29 locations in which a stream intersects the right-of-way corridor at a low angle. This number represents the maximum number of direct stream crossings that potentially may occur at low angles. However, as explained further below, field adjustments to the placement of pipeline within the approved right-of-way are expected to increase the crossing angles for these streams to maximum extent practicable in light of the site conditions, thereby reducing or eliminating the number of low-angle crossings.

Analysis began with the identification of a study area which encompassed the project length and was wide enough to cover a range of potential corridor locations. Analysis then identified corridors for the length of the pipeline which were wide enough to include multiple route alternative reviews to allow avoidance of certain exclusion areas (e.g. cities and towns). Then publicly available information was used to review potential co-location options (i.e. transportation and utility corridors), natural and cultural resources, sensitive species, Federal and State lands, and geologic formations. This analysis resulted in a preferred alternative which resulted in the basis for field identification and survey.

During route survey, the pipeline alignment was finalized based on multiple field reviewed criteria including natural resources, cultural resources, topographic conditions, available land options and potential access. Due to the multiple elements required for installation and operation of the Project, MVP was not able to cross all streams at or near to perpendicular.

Where crossings were proposed at less than 90-degrees, MVP reviewed alternative crossing locations to the extent possible based on the previously described constraints, and where possible re-located and re-aligned the pipeline. Regardless of the crossing alignment and angle, MVP reduced associated workspace to 75-feet at all pipeline crossings to minimize Project environmental impacts.

The result of the alignment revisions is that 29 of the 313 direct streams intersect the right-of-way alignment at angles of 45-degrees or less. Specific reasons why these individual crossings could not be completed closer to perpendicular include: steep slope areas, landowner requirements/avoidances, presence of other sensitive resources (waterbody or wetland, cultural or historic resources, or sensitive species), and collocation requirements presented by other utility owners. During construction, the field crew is instructed to make adjustments to the location and orientation of the pipeline within the right-of-way wherever practicable to minimize crossing angles. Locations where stream crossings potentially may be less than 45-degree angle are provided in Exhibit 1.

3.3 Crossing Construction Options (Reg. Cond. 3.b.1.[3])

3.3.1 Regional Condition 3.b.i.[3] states: Directional drilling should be reviewed as an option. However, the use of directional drilling in karst areas may not be recommended.

3.3.2 Analysis of Pipeline Crossing Options Methodology

There are five generally accepted categories of methods for crossing a stream with a pipeline:

1. Bridging
2. Dry Open Cut
3. Conventional Bore
4. Horizontal Directional Drilling (HDD)
5. Microtunneling/Direct Pipe

3.3.2.1 Bridging

Bridging a natural gas pipeline across spans has limited utility in special situations, such as crossing deep gorges or geologic faults. Bridging a gas pipeline is reserved for special situations due to unique safety and maintenance concerns. Because aerial crossings are visible and easy to access they are subject to threats of terrorism and vandalism. Aboveground pipelines are also subject to inadvertent damage from storm events. Exposure to the elements also presents additional maintenance requirements and increased likelihood of corrosion[5]. For these reasons, bridging is typically considered only when other crossing methods are ruled out as infeasible.

MVP has not encountered any crossings for which other traditional crossing methods are infeasible or for which aerial crossing methods appear necessary. Accordingly, bridging has been ruled out as a practicable crossing option for this pipeline and this option is not carried forward in the alternatives analyses for any of the crossings evaluated.

[5] 72 Fed. Reg. 20055, 20058 (Apr. 23, 2007)

3.3.2.2 Dry Open Cut

Dry open cut crossings combine traditional trench construction techniques with erosion and sediment control best management practices (silt fence, compost filter socks, turbidity curtains, pumped water filter bags) and water management techniques (damming, pumping, etc.) to install pipeline across waterways.[6] The open cut method is recognized as the fastest method to cross a waterbody, thus minimizing the potential threats (releases) to the resource. During construction the section (or sections of pipe) to be installed will be prepared and readied for installation. Following dam installation, the excavation area will be dewatered and the trench prepared for receiving the pipe. The pipe is placed in the trench to a length of at least 10-feet beyond the high bank of the stream and will be installed to provide a minimum of four feet of cover from the waterbody bottom to the top of the pipeline. In areas of consolidated rock, MVP will excavate rock using hydraulic hammers (to the extent feasible) to maintain the minimum depth of cover at three feet at waterbody crossings to meet Norfolk District NWP12 Regional Condition #4. However, in the event that blasting would be required to achieve the minimum three-foot depth of cover, in lieu of implementing blasting activity within any waterbody or wetland crossing, MVP would install the pipeline to allow a minimum two feet of cover as required by PHMSA and FERC.[7] Following construction, the area will be restored with materials native to the waterbody. Prior to construction, any previously identified crossing conditions (mussel relocation or time of year restrictions) will be satisfied.

With the dry open cut crossing method, there are several available techniques to temporarily divert flow around the construction area. These techniques are not considered "alternatives" because site-specific conditions generally dictate which one is used to divert flow around the worksite and there is no material difference in the area or duration of the impact to the aquatic resource associated with the different techniques. Accordingly, they are considered collectively as the dry open cut option for the purposes of this alternatives analysis. A brief summary of the three methods considered for the project are described below:

[6] It is possible to cross streams using a wet open cut method. The primary difference with the wet open cut method is that the trench is cut through the stream without diverting the flow around the excavation. The wet open cut method has not been considered for as an alternative for any crossings in Virginia to comply with the state's Erosion and Sediment Control Regulation, 9 VAC 25-840-40. Reference to "open cut" in this application refer to solely to the dry open cut method.

[7] FERC has accepted the minimum standard of two feet of cover for waterbody crossings in consolidated rock. FEIS 2-39.

a) Dam and Pump Crossing Method

The dam and pump method involves installation of temporary dams upstream and downstream of the proposed waterbody crossing. The temporary dams will typically be constructed using sandbags and plastic sheeting. Following dam installation, appropriately sized pumps will be used to dewater and transport the stream flow around the construction work area and trench. Intake screens will be installed at the pump inlets to prevent entrainment of aquatic life, intakes can be "floated" to prevent intake of sediment on the upstream side and energy dissipating devices will be installed at the pump discharge point to minimize erosion and stream bed scour. Trench excavation and pipeline installation will then commence through the dewatered portion of the waterbody channel. Following completion of pipeline installation, backfill of the trench, and restoration of stream banks, the temporary dams will be removed, and flow through the construction work area will be restored. This method is generally only appropriate for those waterbody crossings where pumps can adequately transfer the stream flow volume around the work area. See figure below for an example.

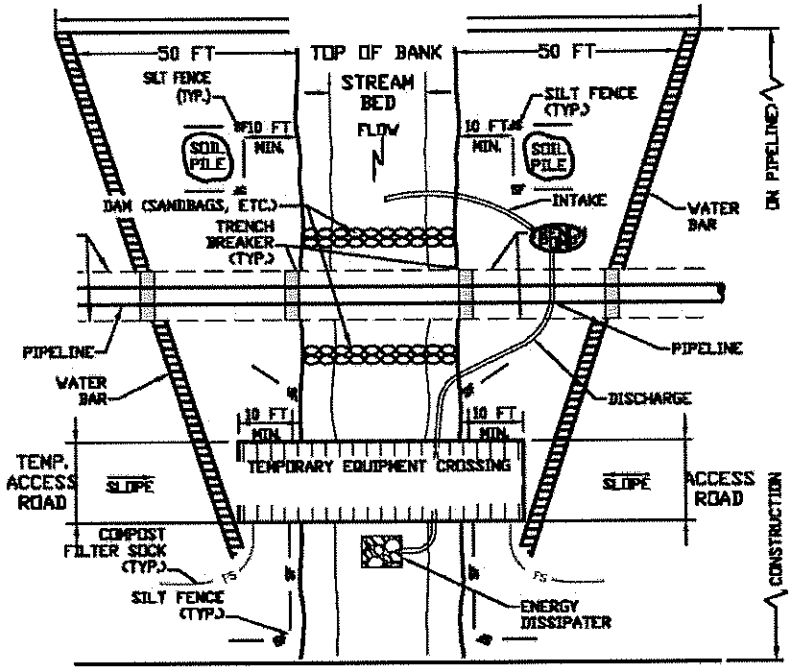


Figure 1 – Dam and Pump Crossing Method

b) Flume Crossing Method

The flume crossing method will consist of temporarily directing the flow of water through one or more flume pipes placed over the area to be excavated. This method will allow excavation of the pipe trench across the waterbody completely underneath the flume pipes without disruption of water flow in the stream. Stream flow will be diverted through the flumes by constructing two bulkheads and using sand bags or plastic dams to direct the stream flow through the flume pipes. Following completion of pipeline installation, backfill of the trench, and restoration of stream banks, the bulkheads and flume pipes will be removed. This crossing method generally minimizes the duration of downstream turbidity by allowing excavation of the pipeline trench under relatively dry conditions. See figure below for an example.

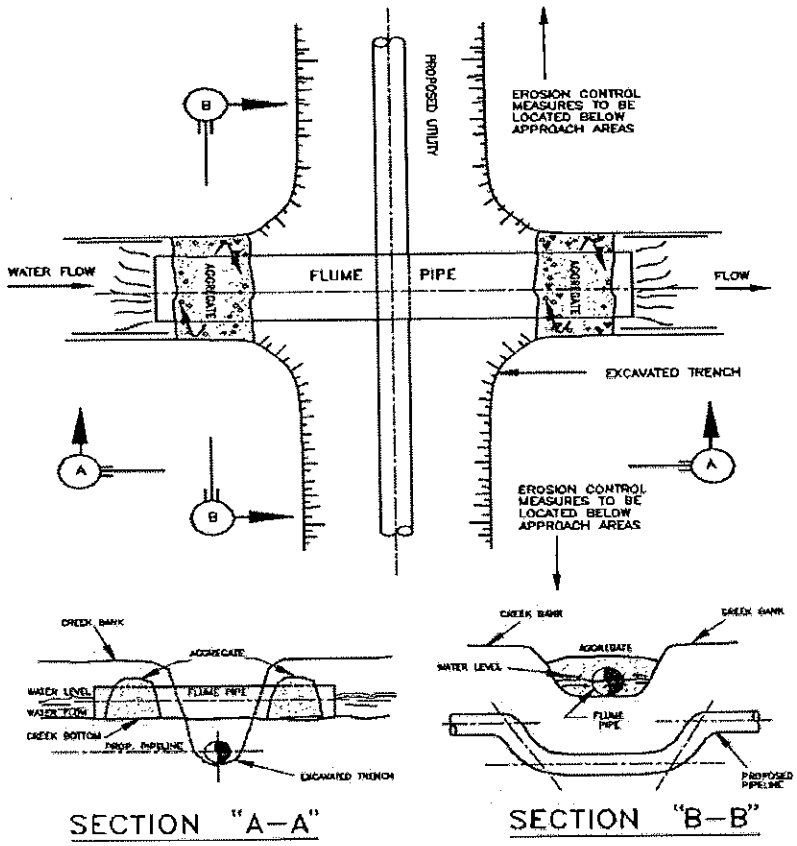


Figure 2 – Flume Crossing Method

c) Cofferdam

This method may be used for crossing channels 10 feet or wider, and will be designed so as not to prevent the flow of the stream. A cofferdam will be constructed within the construction ROW (using cofferdam products, etc.), enclosing approximately half the streambed in a semi-circle. The cofferdam seals tightly to the streambed to minimize water from entering the construction area. Pumps are used to remove water from within the cofferdam and to keep water out of excavations. This water is pumped to the upland area adjacent to the crossing and is released through pumped water filter bags places behind silt fence or similar devices. All earth disturbance will occur in the dry area behind the cofferdam. The pipe will be installed and the disturbed area backfilled and stabilized. Sediment barriers at the waterline will be in good working order before the cofferdam is removed. Stabilization will be with either riprap or vegetation. The cofferdam is then set up from the opposite bank and extends far enough to include the tie-in point in mid-stream. The remainder of the pipe is installed and the tie-in weld is made. Clean up follows the same procedures described above. See figure below for an example.

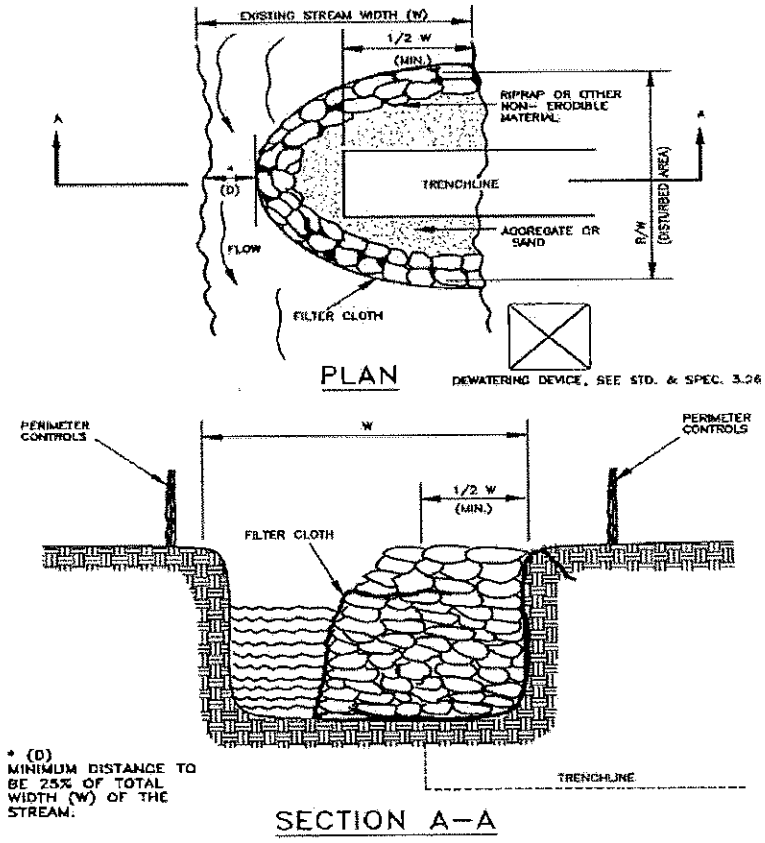


Figure 3 – Cofferdam Crossing

3.3.2.3 Conventional Bore

Conventional boring is a collection of techniques that allows for trenchless construction across an area. These methods can include pre-drilling a pilot hole(s)/reaming, drilling full diameter holes, and direct jacking pipe. To complete a conventional bore, two pits will be excavated, one on each side of the feature to be bored. These pits are typically much closer to the feature being crossed than they would be for an HDD due to design length constraints for a conventional bore. A boring machine will be lowered into one pit, and a horizontal hole (or series of holes with increasing diameter) will be bored at the depth of the pipeline installation. The pipeline section and/or casing will then be pushed through the bore to the opposite pit. If additional pipeline sections are required to span the length of the bore, they will be welded to the first section of the pipeline in the bore pit before being pushed through the bore.

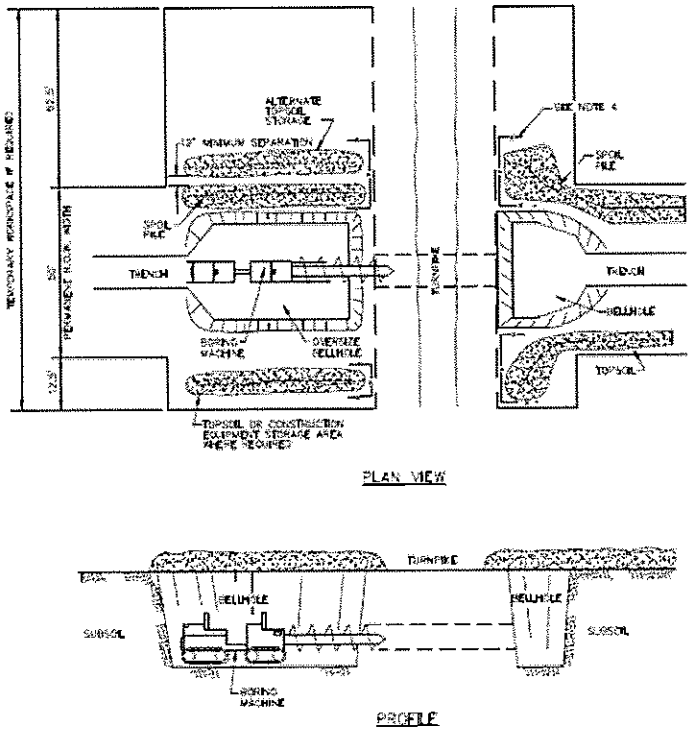


Figure 4 – Conventional Bore

3.3.2.4 Horizontal Directional Drilling (HDD)

Horizontal directional drilling (HDD) is a method that allows for trenchless construction across an area by pre-drilling a pilot (or guide) hole below the depth of a conventional pipeline lay and then pulling the pipeline through the pre-drilled borehole. The HDD method has been in use since the 1970s as a means to install pipelines across rivers and at shore approaches to eliminate pipeline exposure from erosion and scour. Pipelines up to 60 inches in diameter have been successfully installed using this method. The length of pipeline that can be installed by HDD depends upon soil conditions and pipe diameters and is limited by available technology and equipment design capacity limits.

For most HDD crossings, electric-grid guide wires will be hand-laid across the land surface along the pipeline right-of-way to help guide the drill bit along the predetermined HDD route. In thickly vegetated areas, a swath approximately two to three feet wide may be cut across the land surface using hand tools to lay these electric-grid guide wires, resulting in minimal ground and vegetation disturbance. Following guide wire installation, a HDD rig is set up and a small-diameter pilot hole will be drilled along a prescribed profile.

A steerable drill assembly is used to drill the pilot hole using a combination of tracking wires and bit sensors to maintain the drill path determined during the design phase. Once the pilot hole is completed, it is enlarged, using reaming tools to provide access for the pipe. The reaming tools are attached to the drill string at the exit point of the pilot hole and then rotated and drawn back to the drilling rig, thus progressively enlarging the pilot hole with each pass. During this process, drilling fluid is continuously pumped into the hole to remove cuttings and maintain the integrity of the hole. Drilling fluid typically consists of bentonite clay, drilling additives and water. Once the hole has been sufficiently enlarged, a prefabricated segment of pipe is attached behind the reaming tool on the exit side of the crossing and pulled back through the drill hole to the drill rig, completing the crossing.

The HDD method involves less disturbance of the surface between the entry and exit points of the HDD (limited to the temporary deployment of telemetry cable and water pipe), provided there is reasonable access to the entry and exit points for the drilling rig and fluids handling equipment. Additional workspace is needed at the exit side of the HDD to allow the pullback string to be assembled. It is necessary that the workspace is oriented in a straight line and sized (length) concurrent with the HDD alignment to facilitate the pullback activity. In areas where pullback space is limited due to topographic constraints, adjacent resources, encroachment or other utilities, the pullback string may be broken into several segments for assembly during the pullback activity. However, the process of breaking an HDD in multiple pullback sequences significantly increases the amount of time the borepits and associated disturbance exist due to the time required for welding the seams mid-pull. This in turn can also increase the potential for failure of the HDD due to pipe failure and borehole caving. Finally, due to limitations in equipment capacity or design limitations of the pipe materials, the HDD method may not be appropriate for every site condition encountered. A typical HDD installation is provided in the Figure below.

Although the HDD method is a proven technology for pipe installation, the potential exists for a HDD installation to fail. Reasons for failure include: encountering soil conditions not conducive to boring, caving of the borehole, losing the drill string in the borehole, loss of drilling fluid return or inadvertent return to surface of drilling fluid, and pullback refusal. Specific geology, such as karst, fractures or fissures, and the presence of underground waterways can increase the potential of an inadvertent return. Proximity to public drinking water sources, private wells and mining activities (both active and abandoned) also should be considered during the HDD feasibility analysis. Many of these potential failures, such as cave-ins, pullback refusal, and unstable rock may be avoided or mitigated by making appropriate adjustments to the operation of the HDD equipment or HDD location. However, impacts on aquatic resources, water supplies, and sensitive species in the event of a loss of drilling mud and/or inadvertent return are unpredictable and may be difficult to mitigate, minimize, or restore during or after the HDD process.

In addition to the potential for an inadvertent release, the minimum bend radius of the pipe must also be considered in design. Based on the conservative industry practice of calculating a bending radius using the formula of 100 times the pipe outer diameter for a HDD, the allowable bending radius for 42-inch steel pipe is 4,200 feet. This is a typical conservative industry rule of thumb and is not based on any actual stress analysis. MVP performed a stress analysis for the pipe grade and wall thickness to be used for the MVP project and the resulting calculations show a minimum bend radius without over stressing the pipe is 1,510 feet. For assessment, RK&K used an allowable minimum bend radius of 2,500 feet for the HDD methodology, with some exceptions made on a case by case basis. An HDD with an entry angle of 12°, exit angle of 6° and a bend radius of 2,500 feet would require a minimum length of at least 1,287 feet if the terrain was flat. Changes in site elevation from entry to exit may cause the minimum required length to change. A bend radius of 2,500 feet is an aggressive radius for 42" pipe, but would be necessary to traverse crossings within the MVP's proposed alignment. Use of a 2,500-foot radius will increase the risk associated with successfully completing the crossings by HDD. The analyses were based on pipeline depths of at least 25 feet below rivers for HDD construction. The pipeline depth for HDD was based on minimizing the potential for inadvertent returns. Additionally, the bend radius will affect the catenary, or the curve formed where the pipe is hanging at the pullback point. Topography, bend radius, and entry/exit angles will all be factors in the catenary height from the ground.

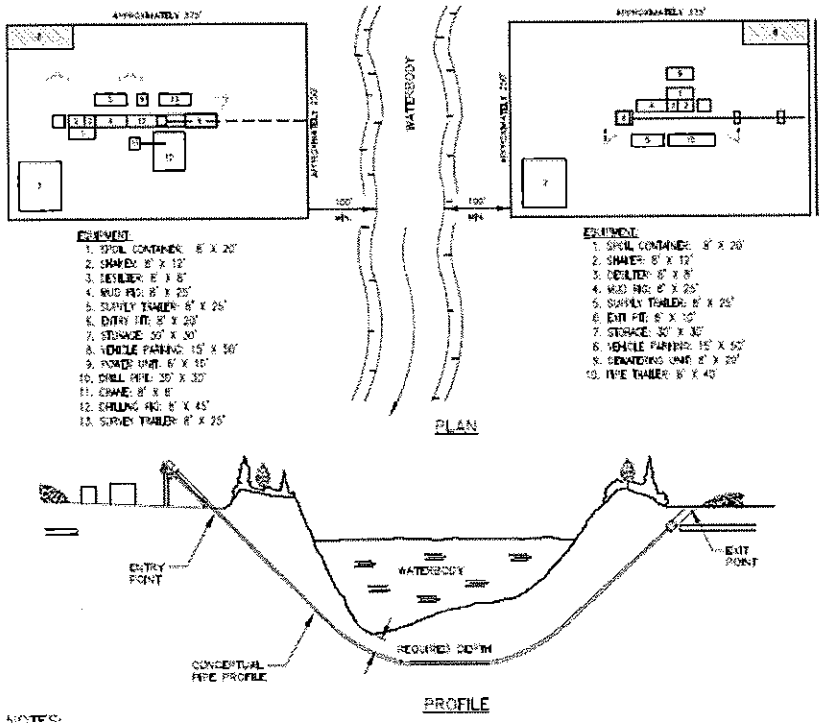


Figure 5 – Horizontal Directional Drill

3.3.2.5 Microtunneling/Direct Pipe

Microtunneling is a pipeline installation method that consists of jacking a pipe behind a remotely controlled, steerable, guided, articulated microtunnel boring machine. Microtunneling projects can range in diameter from 10 to 136 inches. Drive lengths for MT installations can range from 200 to 1,500 feet in length. A wide range of soil types are suitable for installation by MT, including boulders and rock. Boulders and cobbles up to one third the diameter of the installed pipe can be accommodated by the boring machine.

Direct Pipe is a trenchless installation method that combines features of Horizontal Directional Drilling and Microtunneling. Direct Pipe was developed to provide a one-step pipe jacking method that offered the advantages of both HDD and microtunneling. Direct Pipe utilizes a Microtunnel Boring Machine connected to the leading edge of an assembled length of pipe and a Pipe Thruster to jack the pipeline into place, similar to, but in the opposite direction of HDD pullback operations. Direct Pipe projects can range in diameter from 30 to 60 inches with drilling lengths for Direct Pipe projects ranging from 900 to 4,900 feet. A wide range of soil types are suitable for installation by Direct Pipe, including boulders and rock. Boulders and cobbles up to one third the diameter of the installed pipe can be accommodated by the boring machine at the front end of the pipeline.

A gyro compass is used for steering control of the microtunnel boring machine which utilize a minimum bend radius similar to the HDD. These methods also have the same limitations related to pipe layout requirements, space required to support the drilled crossing, use of drilling muds under pressure to support the bore face and topographic issues related to both length of bore due to increasing slope angle and catenary height due to rapidly changing topography.

3.3.3 Pipeline Crossing Constraints Criteria

Each crossing technique has cost, technological, and logistical constraints that affect the practicability of a particular method for various crossings.

3.3.3.1 Technological Criteria

3.3.3.1.1 Karst Geology

Karst geologies are areas of limestone rock that have a potential for the presence of solution fractures in the rock that may be connected to both the surface and to groundwater sources. These solution fractures present a potential pathway for drilling fluids to be diverted from the bore hole resulting in a loss of return of introduced fluids. An HDD uses fluid pressure to transport drilling fluids and drill cuttings back to the drill rig. Using pressurized liquids and drilling muds in geology with known or increased potential for unknown fractures increases the potential movement of drilling mud to adjacent strata and/or inadvertent returns to the surface.

In addition to increased environmental considerations, inadvertent returns in karst areas present logistical risks as well. The action to respond to and remediate an inadvertent return entails significant time and expense, and has the potential to significantly delay pipeline construction.

Due to a relatively greater risk of for inadvertent returns, the use of HDD, microtunneling and direct pipe are not considered to be a practicable alternative in karst areas. This is consistent with guidance from the Corps (NWP 12 Reg. Cond. 3.b.i), the Virginia Cave Board ("[T]he Virginia Cave Board does not

recommend horizontal directional drilling within karst settings."),[8] and others. Exhibit 2 provides a map of all karst areas in the vicinity of the project, and Exhibit 3 contains a column identifying each NWP 12 project in a karst area.

There are no material logistical constraints on or considerations for the use of open cut or conventional bore in karst areas.

3.3.3.1.2 Steep Slopes Adjacent to Stream/Wetland Crossings

Technical limitations make the use of any stream or wetland crossing method in steep slopes that requires the excavation of a deep bore pit (i.e., conventional bore, HDD and microtunnel) to be impracticable. Consistent with industry practice, MVP considers any area with an entry or exit slope of 15% or greater to be a steep slope. Key reasons for why it is not practicable to excavate deep bore pits on steep slopes include safety of construction personnel entering the trench, duration of crossing implementation and construction restraints including but not limited to available workspace for staging of support equipment, spoil placement, etc.

Conventional bores require significant excavations (bore pits) to allow room for the necessary equipment utilized for boring operations. The bore pits need to be deep enough to obtain the required amount depth below the stream bed, the carrier pipe diameter plus the additional depth for the auger tracks. Given the 42-inch diameter of the proposed line, the excavation will need to be approximately 9 feet deep below the bottom of the stream channel or wetland. The depth of the stream banks or relief adjacent to the wetland will add to the depth of the excavation along with the additional cover that is gained as the slope rises away from the feature. The bore pit must be approximately 50 feet long to accommodate the boring machine, tracks, augers, etc. Therefore, the excavation depth can increase quickly at the rear of the bore pit as the slope increases. For instance, assuming a feature with 3-foot deep banks, 15-foot buffer, and a 15% slope on the entry side will result in an excavation depth of 22 feet at the rear of the bore pit. Among other issues, this presents significant safety concerns for workers within the excavations.

Conventionally boring a stream or wetland crossing requires operations to occur below the feature depth which results in groundwater infiltration on the bore pits. This lowers the slope stability capacity of the soil, decreasing the safety of the excavation and increasing benching requirements. MVP has agreed to reduce the ROW working width at stream and wetland crossings so this forces the contractor into a trench shoring or shielding scenario as there is not enough room to allow for traditional benching techniques. The presence of groundwater requires the bore pit either be pumped continuously or the boring equipment be removed after every shift, increasing crossing duration. This dramatically increases the cost of this method in steep slopes, and the potential risks to worker safety.

In addition, the use of boring techniques may significantly increase the time necessary to complete a crossing. This can be particularly problematic in steep slopes due to the increased safety, slope stability, continuous groundwater infiltration, and cost challenges associated with operating in this environment. For the sake of comparison, open cut crossings can typically be completed within two working days on average size crossings (slightly longer if consolidated rock is encountered). The subsequent boring and pipe installation process typically will take from several days to a few weeks depending upon conditions encountered. Horizontal Directional Drills typically take months to complete.

[8] Va. Cave. Bd., Frequently Asked Questions About Natural Gas Pipelines Through Karst Terrains, *available at* http://dcr.virginia.gov/natural-heritage/documents/faq-nat-gas-trans-pipeline-karst.pdf.

Most construction constraints are related to the amount of workspace available. MVP has agreed to reduce the temporary ROW width to 75 feet for the length of the feature buffer (for a distance of 50 feet on either side of the crossing). This limits the amount of workspace available to excavate and stockpile spoils. When coupled with entry or exit slopes of 15% or greater, it makes it very difficult to perform the large excavations necessary for conventional bore pits and maintain a safe ditch that is suitable for worker entry. The additional spoils excavated from these locations also have to be relayed away from the crossing to locations where the 125-foot ROW is available to use. This results in large spoils piles being staged upslope of workers and increased duration.

HDD's are greatly impacted by slope restraints, especially on large diameter pipeline projects due to the large bend radius necessary for pipe installation. HDDs require large workspaces at the entry location for drilling equipment and long, straight workspaces at the exit point to allow for welding and "pull back" of the pipe segment. Changes in elevation directly impact drill length due to the maximum acceptable bend radius and stream crossings compound the issue due to the additional depth needed under the crossing. The typical depth preferred under the waterbody is at least 40 feet to minimize the chance of inadvertent returns with shallower depths (25') possible in competent material.

HDD, microtunneling and direct pipe are dependent on the maximum curve that can be imparted on the pipeline material, and as discussed in Section 3.3.2.4, a minimum bending radius of 2500-feet is specified for this project. This radius controls the length of the drill and the catenary height of the suspended welded pipeline prior to being pulled back through the bore. Therefore, steep slopes are considered because as the slope becomes steeper, the drill becomes increasingly longer due to the divergence (see Exhibit 7A) and may become impossible to design and implement. Steep slopes and varying topographies also affect the length of pipe that pipe may require suspension by creating working heights that either are unsafe due to equipment tipping or are beyond existing equipment vertical limits (see Exhibit 7B).

As slopes exceed 15% - these figures show how the geometry constraints of entry and exit angles, and associated catenary suspension of the pipe being pulled into the drilled shaft, become infeasible.

Accordingly, the conventional bore, HDD and microtunnel crossing methods are considered impracticable for crossings in steep slope areas.

3.3.3.2 Logistical Criteria

3.3.3.2.1 Aquatic Endangered and Threatened Species and Designated Trout Waters

To preclude any potential impact to aquatic endangered and threatened species (ETS) and designated trout waters, crossing methods that could cause an inadvertent return - HDD and microtunnel, are considered neither practicable nor environmentally beneficial.

Inadvertent returns can release bentonite drilling mud and drill cuttings into sensitive resources including streams and wetlands. Bentonite is clay and directly fills in the substrate and interstitial pore spaces within the stream bed when released. Additionally, bentonite also deposits into floodplains along stream where inadvertent returns occur. These releases can have significant negative impacts to both aquatic and, indirectly, terrestrial fauna. Sensitive species such as freshwater mussels can be directly smothered by bentonite resulting in death from oxygen depletion. Other aquatic species such as fish can also be impacted, particularly by reducing spawning areas, refuge sites, and bentonite collecting in fish gills, and also from death of food sources such as benthic macroinvertebrates and algae.

MVP anticipates 47 crossings of designated wild and stockable trout streams, or streams with known listed threatened or endangered species populations (See Attachment H2). Occurrences of rare, threatened or endangered mussels and fish should be considered prior to selection of HDD or microtunnel as a crossing method of any aquatic resource. Likewise, the logistics and expense of remediating an inadvertent return in such waters would be greatly elevated over less sensitive waters. Accordingly, MVP has determined that it would be imprudent to use HDD or microtunnel techniques to cross waters with endangered or threatened aquatic species and designated trout waters.

Practicable crossing methods include open cut (with appropriate TOY restrictions) and conventional bore. While there are logistical constraints associated with adhering to designated Time of Year restrictions associated with these waters when using an open cut crossing method – the construction duration of the pipeline allows for such crossing activities to be staged within the allowable TOY windows, making open cut a practicable option.

3.3.3.2.2 Private Wells

Due to the potential for inadvertent return from HDD through rock fractures or is karst features into drinking water wells. HDD and microtunneling are not considered practicable options when a private well is within 150-feet or 500-feet in karst areas.

Based on the above criteria and the use of desktop reconnaissance, it has been determined that there are 8 stream crossings and 6 wetland crossings that are likely within these distances (150-feet and 500-feet in karst) and thus preclude the use of HDD or microtunneling in these locations.

Tables 1 and 2 below provide lists of each stream and wetland crossing:

Table 1: Stream Crossings in Proximity to Private Wells					
Stream Crossing ID	**NHD Stream Name**	**Stream Crossing Milepost**	**County**	**Distance to Private Water Supply***	**Karst**
S-KL43	UNT to Sinking Creek	214.8	Giles	397	Yes
S-YZ7	UNT to Mill Creek	221.9	Montgomery	257	Yes
S-C21	Bradshaw Creek	230.9	Montgomery	119	No
S-NN19	UNT to Roanoke River	234.4	Montgomery	271	Yes
S-NN16	Roanoke River	235.6	Montgomery	365	Yes
	Roanoke River	235.6	Montgomery	432	Yes
S-AB16	UNT to Roanoke River	235.7	Montgomery	274	Yes
S-KL25	UNT to Mill Creek	243.1	Roanoke	47	No
S-IJ12	UNT to Mill Creek	244.2	Roanoke	84	No

*Actual locations will be verified during baseline sampling program.

Table 2: Wetland Crossings in Proximity to Private Wells					
Stream Crossing ID	**NGM Code**	**Stream Crossing Milepost**	**County**	**Distance to Private Water Supply***	**Karst**
W-NN8	Riverine	235.6	Montgomery	413	Yes
	Riverine	235.6	Montgomery	380	Yes
W-AB7	Slope	235.7	Montgomery	308	No
W-EF21	Slope	241.5	Roanoke	131	No
	Slope	241.6	Roanoke	80	No
	Slope	241.6	Roanoke	131	No
W-KL17	Slope	243.1	Roanoke	43	No
W-EF46	Riverine	243.7	Roanoke	132	No
TTVA-W-IJ9-PEM	Riverine	244.2	Roanoke	78	No

*Actual locations will be verified during baseline sampling program.

3.3.3.3. Cost Criteria

Stream and wetland crossings are costly elements of a pipeline construction project. Irrespective of the method utilized, crossings are significantly costlier on a per-foot basis than construction in typical uplands due to, among other things, the need to procure and transport specialized equipment and personnel to the site, implementation of increased erosion and sediment and related environmental measures, constraints associated with working within a narrower right of way, and necessary post-construction restoration activities. These increased costs are reflected in MVP's construction bidding process, which treats each stream and wetland crossing as a separate cost item to be included in bids in addition to standard per-foot construction costs.

There are significant differences in cost structure among different crossing methods. The fixed costs of site preparation and equipment setup, as well as the costs for each foot crossed, can vary significantly among the different crossing methods. These widely varying costs may be determinative of the practicability of a crossing method for a given crossing, and therefore cost is an appropriate criterion to include in this alternatives analysis.

Although activities authorized by nationwide permit are not subject to the 404(b) Guidelines, 82 Fed. Reg. 1860, 1899 (Jan. 6, 2017), the Guidelines provide useful guidance on determining when an alternative is impracticable on the basis of cost. The Guidelines provide that "[a]n alternative is practicable if it is available and capable of being done after taking into consideration cost, existing technology, and logistics in light of overall project purposes." 40 C.F.R. § 230.10(a)(2). An alternative that is "unreasonably expensive" is not practicable. 45 Fed. Reg. 85336, 85343 (Dec. 24, 1980). Whether the cost of an alternative is practicable is determined on a case-by-case basis.

Because each crossing is a single and complete project, and to be consistent with how the technical and logistical criteria are applied, this analysis evaluates the estimated cost of the crossing method alternatives for each stream and wetland crossing independently. There is no standard or presumptive threshold of practicability. MVP has employed the conservative assumption that when two or more crossing methods are technically and logistically practicable for a given crossing, any method that is 300% or greater of the cost of another technically and logistically practicable option is unreasonable, and therefore not practicable in light of the project purpose.

For each of the crossing methods evaluated in this analysis, MVP has calculated average cost parameters to apply to stream and wetland crossings based on the length of each respective crossing. To develop the cost parameters, MVP compiled stream and wetland crossing costs estimates in the bids of prospective contractors. These were used to develop an estimate of average unit costs of alternatives included in bids. For crossing alternatives that were not included in bids for this project, MVP obtained costs from one prospective contractor independent of the previously mentioned bidding process due to the specialized nature of the construction techniques. The information compiled from these bids[9] have been is summarized in the tables below.

[9] The bids used to prepare this analysis are considered confidential business information and are not appended to this analysis.

For the conventional bore, HDD, and Microtunneling bore options there are significant fixed costs for each crossing in addition to the variable ($/LF) costs as described below:

- Mobilization
- Bore pit shoring
- Water handling out of the bore pit
- Environmental control systems
- Demobilization
- Bentonite mud disposal

The following key assumptions were built into the cost model for the stream and wetland crossings.

- Open Cut
  - Length of crossing is top of bank to top of bank for streams and rivers and the wetland delineation footage for wetlands.
  - No fixed costs (consistent with bidding practice for open cut crossings).

- Conventional Bore
  - Length of crossing is same as open cut, with an additional (1) 15-foot setback on both sides of the crossing for a buffer between construction activities and the feature to allow room for erosion and sediment controls and (2) 5-foot additional bore length on each side of the crossing for adequate footage into the bore pits for construction tie-in procedures.
  - Bore pits dimensions of 30-feet wide by 55-feet long by 20-feet deep for shoring. Because the bore pits would be below the elevation of the water table, water handling was an additional cost. Mobilization and demobilization includes detailed design, equipment selection and transportation, on-site set-up and breakdown.
  - Fixed costs in addition to a per-foot cost, as detailed in table below.
- HDD
  - The minimum bore length is 1,250 feet as described in Section 3.3.2.3, meaning that 1,250 feet is used as the distance for any stream or wetland that is less than 1,250 feet wide.
  - Fixed costs in addition to a per-foot cost, as detailed in table below. Mobilization and demobilization includes detailed design, equipment selection and transportation, on-site set-up and breakdown.
- Microtunnel
  - Length of crossing is same as conventional bore.
  - Bore pit dimensions and cost same as conventional bore.
  - Fixed costs in addition to a per-foot cost, as detailed in table below. Mobilization and demobilization includes detailed design, equipment selection and transportation, on-site set-up and breakdown.

Table 3 below provides a detailed breakdown of the fixed and per-foot costs for the crossing methods:

Table 3: Alternatives Cost Model			
Stream Crossing Type	**Buffer Width**	**Stream Crossing Unit Costs***	
		Cost per Foot	**Fixed Costs**
Open-Cut Method (width < 10')	N/A	$ 3,500.00	$ -
Open-Cut Method (11'< width <20')	N/A	$ 3,600.00	$ -
Open-Cut Method (21'< width <30')	N/A	$ 3,650.00	$ -
Open-Cut Method (width > 30')	N/A	$ 4,200.00	$ -
Conventional Bore Method	15	$ 1,500.00	$ 1,275,000
HDD Method	N/A	$ 1,800.00	$ 1,225,000
Microtunnel Method	15	$ 8,000.00	$ 1,400,000
Wetland Crossing Type	**Buffer Width**	**Stream Crossing Unit Costs**	
		Cost per Foot	**Fixed Costs**
Open-Cut Method	N/A	$ 700.00	$ -
Conventional Bore Method	15	$ 1,500.00	$ 1,275,000
HDD Method	N/A	$ 1,800.00	$ 1,225,000
Microtunnel Method	15	$ 8,000.00	$ 1,400,000

*Costs in excess of the base cost of open cut 42" pipeline installation in upland areas

Table 4 below provides a detailed view of the fixed costs for the bore crossing methods:

Table 4: Detailed Fixed Costs of a Pipeline Bore for 42" Gas Pipeline			
Pipeline Bore Bid Line Items	**Bore Methodology**		
	Conventional Bore	**HDD Bore**	**Microtunnel Bore**
Mobilization	$50,000	$150,000	$150,000
Bore Pit Shoring	$990,000	$300,000	$990,000
Water Handling	$160,000	$0	$160,000
Environmental Control Systems	$25,000	$50,000	$25,000
Demobilization	$50,000	$75,000	$75,000
Bentonite (Mud) Disposal	$0	$650,000	$0
TOTAL FIXED COSTS	**$1,275,000**	**$1,225,000**	**$1,400,000**

3.3.3.4 Results of Pipeline Crossing Constraints Analysis

The previous narratives have documented the cost, technological, and logistical constraints associated with four potential methodologies of crossing streams and wetlands with a 42" gas pipeline.

The increased costs of each crossing methodology is summarized in Table 3 above. The technological, logistical, and cost constraints are summarized in Table 5 in the form of

"Practicable Logic Tables". For a given constraint, the table provides which technique can be used if said constraint is present or not, as shown below:

Table 5: Practicable Logic Tables

Located in Karst Area	N	Y
Crossing Option:	Practicable?	Practicable?
Open Cut	Y	Y
Bore	Y	Y
HDD	Y	
Microtunnel	Y	

Slopes at WOTUS (>= 15%)	N	Y
Crossing Option:	Practicable?	Practicable?
Open Cut	Y	Y
Bore	Y	
HDD	Y	
Microtunnel	Y	

Aquatic ETS Presence	N	Y
Crossing Option:	Practicable?	Practicable?
Open Cut	Y	*TOY*
Bore	Y	Y
HDD	Y	
Microtunnel	Y	

Trout Presence	N	Y
Crossing Option:	Practicable?	Practicable?
Open Cut	Y	*TOY*
Bore	Y	Y
HDD	Y	
Microtunnel	Y	

Located in Proximity to Private Wells	N	Y
Crossing Option:	Practicable?	Practicable?
Open Cut	Y	Y
Bore	Y	Y
HDD	Y	
Microtunnel	Y	

Cost Effectiveness Test (300%)	N	Y
Crossing Option:	Practicable?	Practicable?
Open Cut	Y	
Bore	Y	
HDD	Y	
Microtunnel	Y	

For every stream and wetland crossing, the cost data, technological, and logistical logic tables have been assessed in conjunction with the presence (or lack of) of the constraints' potential at each crossing. The result is an individual assessment of practicable alternatives for every proposed stream crossing (Exhibit 5) and wetland crossings (Exhibit 6).

3.3.4 Analysis of Access Road Impacts

During routing of the Project, MVP co-located Project access roads to utilize existing public and private roads to the extent practical. The availability of existing public and private roads is sufficient to provide Project access to most work areas; however, the construction of new access roads is required in several locations that do not parallel existing infrastructure. As result, MVP will utilize a total of 139 existing and proposed access roads during implementation of the Project within the Commonwealth of Virginia. Minor upgrades (i.e. temporary widening, grading, gravel placement, etc.) will be necessary on some existing roads prior to Project use. Existing dirt or gravel access roads will be maintained with the addition of gravel and minor grading of the road surface to prevent rutting. Erosion and sediment control (ESC) BMPs will be installed on Project access roads that require upgrades. All ESC BMPs will be installed and maintained in accordance with the Project's VADEQ approved Annual Standards and Specifications and the ESC Plan.

MVP has considered the avoidance of potential impacts to wetlands and waterbodies in selecting and locating proposed access roads. Where wetlands and waterbodies cannot be avoided, MVP will minimize impacts by reducing the construction limit-of-disturbance (LOD) and through the use of temporary wetland and waterbody crossing structures during construction activities. This includes the use of timber mats and prefabricated bridges and culvert pipes (where necessary). MVP will not utilize temporary placement of earthen fill material within waterbodies or wetlands during use of Project access roads.

Access roads are necessary for the safe and efficient construction of the Project and to its ongoing inspection and maintenance once it is put into service. MVP has taken all practicable measures to avoid impacts to streams and wetlands associated with its temporary and permanent access roads. In areas where impacts could not be avoided, the impacts were minimized to the fullest extent while still providing safe access to the project. There are a total of 79 streams and wetlands crossed by permanent or temporary access roads.

3.3.4.1 Stream Crossing Alternatives

MVP identified the following avoidance, minimization and mitigation measures when designing the Project's access road alignments and construction methods:

(1) Eliminate proposed access roads that impacted resources (avoidance)

(2) Use existing culvert as is if possible (avoidance)

(3) Reduce Limits of Disturbance (avoidance)

(4) Temporarily bridge if culvert determined to be too narrow (temporary road only) (avoidance)

(5) Replace or Bridging of existing culvert (minimization)

(6) Temporary Crossings via Equipment Bridge or Timber mat (temporary road only) (minimization)

(7) Upgrade and Replacement of existing culvert (mitigate as necessary)

3.3.4.1.1. Eliminate Proposed Access Roads that Impacted Resources

During routing of Project access roads, MVP avoided new access road construction or use of existing roads that would require significant upgrades through areas that contained potential stream or wetland resources where feasible.

3.3.4.1.2. Use of Existing Culvert Crossings

During design of the Project, MVP conducted extensive research (both field verification and desktop review) to identify existing corridors that could be utilized for access during both construction and post-construction operation (inspection and maintenance). As result, MVP identified 50 existing access road stream crossings that will not require replacement or upgrades. MVP reviewed each of these locations and where feasible, reduced the Project limits of disturbance to further avoid impacts to the existing crossing. As result, no Project impacts will be incurred at these locations.

3.3.4.1.3. Reduced Limit of Disturbance

For all Project waterbody crossings, MVP reviewed each stream crossing location with the intent to minimize impacts to streams and wetlands. As result, MVP's typical access road LOD was reduced at most stream crossings from the standard 40-foot width to 25-feet where feasible. In areas where further reduction of the LOD was deemed feasible, the access road LOD was further reduced. See Table 6 for summary of stream impacts as result of the LOD reduction:

Table 6: Stream Impact summary for Access Road LOD Reduction

Stream Impact Type	Rev 4.0 (Previous Alignment)	Rev5Hybrid Alignment	Change
Temporary Impacts (linear feet)	5,212	1,858	-3,354
Permanent Impacts (linear feet)	997	493	-504
Total Impacts (linear feet)	6,209	2351	-3,858

3.3.4.1.4. Temporary Bridge Areas Where Culvert Deemed Too Narrow

For existing access roads with stream culvert installations that are determined too narrow to facilitate equipment passage, MVP would utilize timber mats to span the stream channel outside of the existing culvert (where feasible). This method may not be feasible in all areas of the project (steep slope areas) due to safety concerns. Prior to implementation of this method, MVP will review field conditions at each location to determine if this method of minimization is feasible.

3.3.4.1.5. Replacement of Bridging of Existing Culverts

In the event MVP identifies an existing culvert that may not facilitate Project use but is otherwise serviceable for non-project use, MVP would install a temporary steel plate or timber mat across the culvert for added support. The temporary steel plate or timber mat installation will not result in impacts to the resource and would be installed as a precautionary measure to protect the existing culvert and avoid impacts. In these instances, no impacts (either permanent or temporary) would occur where this method of minimization is implemented.

3.3.4.1.6 Temporary Crossings Via Equipment Bridges or Timber Mat

For all temporary Project access roads that do not currently have a culvert or bridge installed at the stream crossing, MVP proposes to utilize prefabricated

bridges (where necessary) and/or timber mat bridges. MVP identified 40 crossing locations where timber mat or prefabricated bridges would be installed. Bridge or timber mat installations would require no impact within the waterbody channel and the crossing would span the resource from top of bank to top of bank. In the event a center support structure is needed (due to length of the span), MVP would install a temporary pipe bundle or jersey barrier in the stream channel.

MVP identified two existing ford (i.e. wetted stream) crossings on existing private roads proposed for Project construction use. In order to utilize the existing road and to minimize impacts, MVP has committed to install temporary equipment bridges adjacent to the ford crossings. The equipment bridges will span the waterbody from top of bank to top of bank and no in-stream disturbances are anticipated at these locations.

3.3.4.1.7. Upgrade and Replacement of Existing Culverts

MVP identified 12 culvert installations that were determined to be inadequate to facilitate Project use. All of these culverts are located within the limits of Jefferson National Forest. As required by the US Forest Service, culverts that are located on existing USFS roadways must be sized in accordance with TR-55 Urban Hydrology for Small Watersheds. As result, 12 existing stream crossing culverts will be upsized and lengthened to address USFS requirements and to facilitate Project use. Permanent impacts will be incurred at these four locations.

3.3.4.2. Wetland Crossing Alternatives

MVP identified the following avoidance, minimization and mitigation measures when designing the Project's access road alignments and construction methods across wetland resources:

(1) Use existing road as is with no widening (avoidance)

(2) Temporarily widen road using timber mats (minimization)

(3) Widen permanent access road with earthen or rock fill (mitigate)

3.3.4.2.1 Use Existing Roads as Is

During design of the Project, MVP committed to utilizing existing public and private roadway corridors (where feasible) to minimize temporary and permanent impacts to wetland resources. This included utilizing existing crossing structures (culverts, bridges, existing road way fill, etc.) to the extent practicable. While MVP would typically utilize a 40-foot LOD through upland areas, the LOD will be reduced to the existing road width at wetland crossings where feasible. A total of 7 wetlands were avoided by this measure on existing roads.

3.3.4.2.2. Temporarily Widen Road Using Timber Mats

For all temporary access road as well as permanent access road (where feasible) crossings of wetlands, MVP will minimize impacts through the use of timber mats and equipment bridges. Temporary earthen or gravel fill will not be used by for temporary roads crossing wetland areas. As result of the use of timber mat installations at access road crossings of wetlands, MVP reduced or eliminated permanent impacts due to placement of fill material at 24 wetland crossings. No permanent loss due to placement of fill would occur.

Although use of timber mats will be used at all access road wetland crossings, permanent impacts will occur at five locations as result of habitat conversion

from PSS or PFO habitats to PEM habitat. See Table 7 below for summary of permanent habitat conversion areas:

Table 7: Access Road Wetland Impacts (Permanent Conversion)	
Habitat Type	Area of Conversion (square feet)
PSS	97,306
PFO	90,368

A compensatory mitigation plan for all permanent wetland is being prepared as part of the Nationwide Permit 12 Pre-Construction Notification package submitted to the U.S. Army Corps of Engineers Norfolk District.

3.3.4.2.3. Widen Road with Earthen or Rock Fill

MVP committed to avoid placement of earthen or rock fill in wetland areas during project use of temporary access roads. As result, no temporary or permanent impacts are incurred to wetland areas resulting from placement of fill material during use of Project temporary access roads and no mitigation is required. For permanent access roads, the use of earthen or rock fill is the only practicable alternative analysis available in some situations to widen the road for necessary construction access. A total of 0.02 acre of wetlands will be impacted for permanent road widening.

3.4 Avoidance of Forested Wetlands

3.4.1 Regional Condition 3.b.ii states: Selection of an alignment, which avoids fragmenting large tracts of forested wetlands by routing utility lines outside of forested tracts or on the edges of forested tracts. Consult the Virginia Conservation Vision, a GIS analysis for identifying and prioritizing areas of un-fragmented natural cover in Virginia *http://www.dcr.virginia.gov/natural-heritage/vaconvision.*

3.4.2. MVP has avoided fragmenting large tracts of forested wetlands to the maximum extent practicable through the route selection process. More generally, MVP endeavored to minimize fragmentation of large forest cores by, for example, maximizing the use of existing rights-of-way through forests. FEIS 4-146. With respect to palustrine forested (PFO) wetlands in particular, MVP made a number of minor route modifications to avoid or minimize potential impacts and fragmentation. A reduction of the standard Limit of Disturbance (LOD) width from 125 feet to 75 feet at wetland and waterbody crossings in the right-of-way, and a reduction of the LOD width from 40 feet to 25 feet at wetland crossings in access roads will be utilized to further avoid or minimize potential impacts to wetlands and waterbodies. Additionally, no permanent access roads or above-ground facilities will be constructed in PFO wetlands.

NWP 12 Regional Condition 3.b.ii does not define a "large tracts of forested wetlands." For the purpose of assessing compliance with this condition, MVP has employed two alternative definitions of "large tract." Any PFO that meets *either* of these definitions would be considered a large tract.

(1) Standalone PFO wetland ≥7.8 acres. This figure is based on the common assumption that any area of a forest within 100 meters of the edge of the forest tract is subject to edge effects. The smallest hypothetical forested wetland that could have interior conditions subject to adverse effects from fragmentation would be a circular tract with a radius of 100 meters. The area of this hypothetical tract would be 7.8 acres.

(2) PFO wetland ≥2.0 acre within a Forest Core. The Virginia Department of Conservation and Recreation's Virginia Natural Landscape Assessment (VaNLA) project defines Ecological Core Areas, for the purpose of evaluating forest fragmentation, as forested tracts with at least 100 acres of interior forest conditions. For any PFO within a core forest area, MVP used a more conservative assumption that any PFO wetland with an area of at least 2.0 acres is a "large tract of forested wetland."

Efforts were made through the route selection process to avoid fragmentation of large contiguous PFO wetlands. Where avoidance of PFO wetlands was not practicable, the alignment was sited to impact the PFO edge where practicable. Impacts to PFO wetlands have been minimized to 23 locations (Attachment H-2). Of the 16.98 acres of PFO wetland delineated in the project area in Virginia, MVP anticipates approximately 12% (2.01 acres) will be impacted by the proposed alignment. Of the 23 anticipated PFO wetland impacts, 15 PFO wetlands will not be divided (i.e., fragmented); the project will impact one edge of the wetland or, in the case of two relatively small PFO wetlands (W-Z3 (0.0268 ac) and W-H26 (0.015)), the entire wetland.

It is anticipated that the project will divide eight PFO wetlands. However, using wetland size derived from field-delineated wetland acreage and acreage of mapped National Wetlands Inventory (NWI) wetlands, none of these divided PFO wetlands are large tracts. That is, none of the divided PFO wetlands are either standalone PFO wetlands greater than 7.8 acres in size or PFO wetlands ≥2.0 acre within a VaNLA-defined forest core.

3.5 Minimizing Clearing of Wetlands

3.5.1. Regional Condition 3.b.iii states: Minimizing clearing of wetlands. Grubbing shall be limited to the permanent easement for underground utility lines. Outside of the permanent easement, wetland vegetation shall be removed at or above the ground surface unless written justification is provided and the impacts are reviewed and approved by the Corps.

3.5.2. The project's Project Specific Standards and Specifications for Virginia (PS&S) are intended to govern all erosion and sediment control and stormwater practices for the Virginia portion of the project, including the clearing of wetlands. The PS&S were submitted to the Virginia Department of Environmental Quality for review and approval on April 17, 2017. The sections of the PS&S cited below demonstrate compliance with Regional Condition 3.b.iii:

- Section 2.4 Grubbing and Grading and Section 5.1 Waterbody and Wetland Crossings – Grubbing and Grading: Clearing of vegetation in wetlands will be limited to trees and shrubs, which will be cut flush with the surface of the ground and removed from the wetland. Stump removal, topsoil segregation and excavation will be limited to the area immediately over the trench line within the permanent easement.

- Section 5.1 Waterbody and Wetland Crossings – Clearing: Clearing will be limited to the permanent easement. Generally, the construction ROW in wetlands will be limited to 75 feet or less.

- Section 5.1 Waterbody and Wetland Crossings – Spoil Pile Placement and Control: All spoil from waterbody crossings will be placed in the construction right-of-way at least 10 feet from the water's edge or in additional extra work area as described above.

3.6 Natural Succession for Overhead Utility Lines

3.6.1. Regional Condition 3.b.iv states: For overhead utility lines, allowance of natural succession to restore and maintain the corridor in scrub-shrub wetlands except for a minimum corridor needed for access, to the maximum extent practicable.

3.6.2. Regional Condition 3.b.iv is not applicable to the Project. MVP will not be constructing or operating any overhead utility lines.

3.7 Natural Succession for Buried Utility Lines

3.7.1. Regional Condition 3.b.v states: For buried utility lines, allowance of natural succession to restore the area to tree and scrub/shrub except for a 20-foot wide access corridor, to the maximum extent practicable.

3.7.2. MVP will allow for the natural succession of its permanent right-of-way to the maximum extent practicable. It is not practicable, however, to limit the access corridor to 20 feet.

Maintenance of a right-of-way is critically important to the safe operation of a natural gas transmission pipeline. Proper management of vegetation through periodic clearing in the permanent right-of-way is required by FERC and Pipeline and Hazardous Materials Safety Administration (PHMSA) regulations to facilitate the inspection, maintenance, and repair of the pipeline. 18 C.F.R. § 380.15(f); 49 C.F.R. § 192.705(a). Woody vegetation cannot be allowed to grow in close proximity to the pipeline because roots may damage the coating and adversely affect pipeline integrity. The industry standard for maintaining a right-of-way is 25 feet on both sides of a natural gas pipeline (i.e., a 50-foot corridor). *See* PIPA Recommended Practice BL12. FERC has determined that maintenance of a 50-foot corridor is appropriate for this project. FEIS 2-25.

MVP has reduced the clearing of its right-of-way with respect to area and frequency to the maximum extent practicable. The construction right-of-way for most of the route is 125 feet in width. As discussed above, the right-of-way is reduced in size in certain sensitive areas, such as stream and wetlands crossings. The temporary right-of-way (75 feet) will be restored to pre-construction vegetative conditions. Only a 50-foot corridor will be maintained during pipeline operation. To minimize impacts associated with this 50-foot corridor, MVP will adhere to the standards for mowing and clearing set forth in FERC's Upland Erosion Control, Revegetation, and Maintenance Plan (May 2013). That is, the entire 50-foot right-of-way will be cleared no more frequently than once every three years. To facilitate periodic corrosion/leak surveys, a corridor not exceeding 10 feet in width centered on the pipeline may be cleared at a frequency necessary to maintain the 10-foot corridor in an herbaceous state. In no case shall routine vegetation mowing or clearing occur during the migratory bird nesting season between April 15 and August 1 of any year unless specifically approved in writing by the responsible land management agency or the U.S. Fish and Wildlife Service. Lastly, in forested and scrub-shrub wetlands, MVP will utilize a reduced 30-foot corridor (centered over the pipeline) that will be kept clear of trees.

3.8 Proximity to Public Water Supply

NWP General Condition 7 provides "*No activity may occur in the proximity of a public water supply intake, except where the activity is for the repair or improvement of public water supply intake structures or adjacent bank stabilization.*" There is no definition of "proximity" in the NWP or the Corps' regulations. However, the Corps has stated in the preamble to NWP 12 (2017) that it should be given a commonsense meaning and apply to crossings that are "very near, or close to, the public water supply intake." 82 Fed.Reg. at 1948. In earlier guidance, the Corps further clarified that the "term 'proximity' should defined on a case-by-case basis, after taking into account site characteristics and the nature of the waterbody and activity," and that the key consideration is whether the proposed activity will "adversely affect a public water supply intake." 72 Fed. Reg. 11091, 11156 (Mar. 12, 2007).

For screening purposes, MVP identified and evaluated all public water supplies with an intake within three miles of the pipeline (see Water Supply Identification and Testing Plan, Resource Report #2, latest update February 2017). There is no reasonable possibility of an adverse impact to public water supply intakes that are *upstream* from a crossing point. Surface water intakes located within three miles *downstream* of a pipeline crossing were subjected to further evaluation, only one of which is in Virginia: The Western Virginia Water Authority's intake on the Roanoke River for the Spring Hollow Reservoir (Roanoke County, Virginia). *See* FEIS Tbl 4.3.2-4. See Exhibit 4 for a map of the public water supply intake compared to the proposed stream crossing.

The Western Virginia Water Authority operates a surface water intake on the Roanoke River approximately 1.2 miles downstream of the crossing at MP 235.6. The intake partially supplies the Spring Hollow Reservoir. Spring Hollow Reservoir is a 3.2 billion-gallon offline storage reservoir that is maintained by pumping water from the Roanoke River, when available, based on a withdrawal permit issued by the Virginia Department of Environmental Quality (DEQ). In all, the Western Virginia Water Authority operates several interconnected (planned redundancy) public water sources and treatment plants, including Spring

Hollow Reservoir, Carvins Cove Reservoir, Falling Creek and Beaver Creek, Smith Mountain Lake, Crystal Spring, and groundwater wells.

Following standard erosion and sediment controls for the project and crossings, there is no reasonable possibility for more than de micromis levels sediment and turbidity from crossing this stream would reach the public water supply intake on the Roanoke River more than 1.2 miles from the crossing at MP 235.6. Accordingly, the construction of this crossing will not adversely affect the water intake to the Spring Hollow Reservoir.

As an added precaution, Mountain Valley contacted the Western Virginia Water Authority on November 11, 2015 to discuss the project and any concerns that the Authority may have. The Authority indicated that, at that time, they had no specific concerns. Mountain Valley will be contacting the Authority again in mid-2017 to update the Authority, and again address any concerns they may have.

This application complies with NWP General Condition 7 because no crossings are in proximity to a public water supply intake.

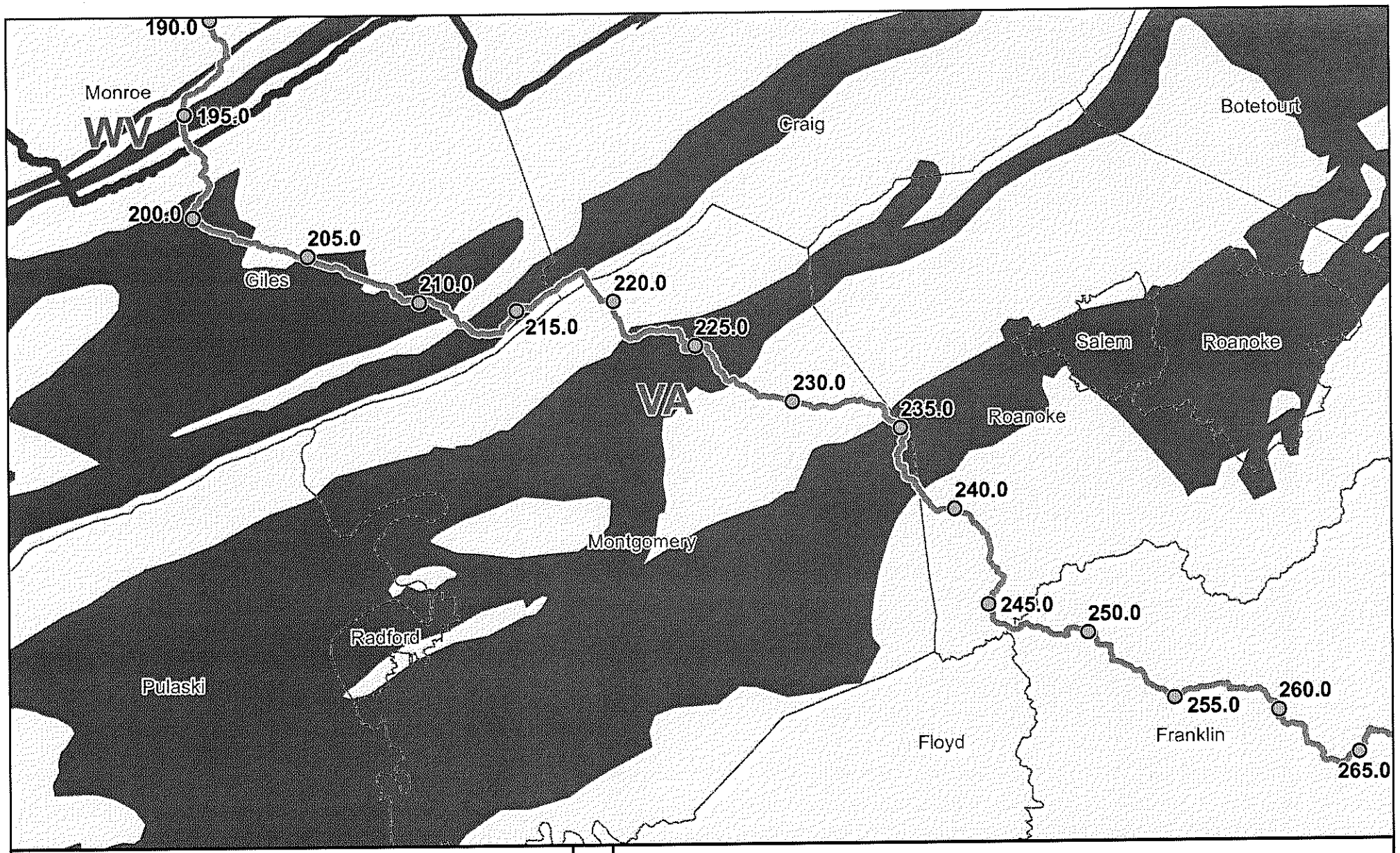
4.0 CONCLUSION

For each separate and complete project, this document provides an analysis of a reasonable range of alternative crossing methods based on relevant technical, logistical, and cost factors that have a bearing on the practicability of each method for each stream and wetland crossing in Virginia. The results of this analysis for each stream and wetland proposed to be crossed by the pipeline or an access road follow in Exhibits 5 and 6, respectively.

This alternatives analysis documents the application's compliance with all General, Regional, and Clean Water Act § 401 conditions for NWP 12 that pertain to the avoidance and minimization of impacts and/or selection of offsite or onsite alternatives.

Exhibit 1: Streams with Pipeline Crossing Angle > 45-degrees				
Stream ID	**Latitude**	**Longitude**	**Stream Type**	**Explanation of Crossing Angle**
S-EF65	37.295755	-80.376025	Intermittent	Topography and JNF avoidance
S-B25	37.12849	-80.132601	Ephemeral	Crossing alignment oriented to avoid a large wetland feature and additional stream crossings to the immediate north
S-H44	36.829823	-79.346016	Perennial	Topography not conducive to perpendicular crossing.
S-F9a	37.047172	-79.813	Intermittent	Another stream crossing nearby controls the alignment of this crossing.
S-A38	37.036271	-79.799442	Intermittent	Stream meanders within the LOD and crossing width
S-G32	37.349095	-80.65204	Intermittent	Alignment orientation is due to co-location requirements with existing utility corridor.
S-E28	37.089108	-79.96141	Perennial	Alignment minimizes tree clearing in this area by utilizing open pasture areas.
S-GH44	37.028392	-79.773359	Perennial	Another stream crossing nearby controls the alignment of this crossing.
S-D13	37.121513	-80.08568	Intermittent	Alignment avoids cultural resources found in the surrounding area while minimizing impacts to adjacent aquatic resources.
S-D4	36.9656	-79.604894	Intermittent	Another stream crossing nearby controls the alignment of this crossing.
S-A33	37.337639	-80.605571	Ephemeral	Alignment orientation is due to co-location requirements with existing utility corridor.
S-H36	36.988008	-79.714922	Perennial	Alignment at this crossing established to minimize impacts to adjacent resources (wetland) to the extent practical. Meandering nature of the stream prevents realigning to a more perpendicular crossing
S-C25	37.254342	-80.267895	Intermittent	Alignment orientation is due to co-location requirements with existing utility corridor.
S-A20	36.98771S	-79.698555	Perennial	Another stream crossing nearby controls the alignment of this crossing.
S-C4	36.929745	-79.52629	Perennial	Another stream crossing nearby controls the alignment of this crossing.
S-C24	37.254135	-80.266743	Intermittent	Alignment orientation is due to co-location requirements with existing utility corridor.
S-KL35	37.052125	-79.886182	Perennial	Alignment crosses between two structures while maintaining tree screen for the house to the east and separation from the barn to the west.

S-Q15	36.95758	-79.583492	Ephemeral	Alignment orientation is due to nearby stream crossing and minimizing impacts to adjacent wetlands.
S-CC5	36.899411	-79.462483	Perennial	The meandering nature of the stream banks prevent MVP from realigning at a more perpendicular angle.
S-D11	37.124149	-80.086169	Perennial	Alignment at this crossing established to avoid/minimize impacts to cultural resources found in the surrounding area.
S-EF34	37.180909	-80.1435	Perennial	Another stream crossing nearby controls the alignment of this crossing
S-A18	36.987818	-79.700634	Intermittent	Alignment at this crossing established due to topography and co-location utility constraints to the north, adjacent wetland and meandering nature of the stream to the south.
S-EF35	37.179397	-80.141344	Intermittent	Alignment established to minimize impacts to existing wetland crossed at this location. The meandering nature of the stream inhibits realigning at a more perpendicular angle.
S-IJ35-EPH	36.891451	-79.433781	Ephemeral	The topography in the area is controlling the alignment and MVP has kept the pipeline to the east to take advantage of slightly lesser slopes.
S-F15	37.258198	-80.286029	Intermittent	Alignment established at this crossing location due to co-location requirements. Alignment has been adjusted to the extent practicable to minimize impacts to wetland resources to the south.
S-MM22	37.205284	-80.187282	Ephemeral	Alignment established at this crossing location due to topography.
S-GH39	37.030861	-79.778069	Intermittent	Pipeline is routed to avoid/minimize impacts to adjacent resources to the north and to the south.
S-GH7	37.106614	-80.054219	Perennial	Crossing is aligned to avoid a delineated cultural resource site.
S-H24	36.978025	-79.680682	Perennial	Mountain Valley cannot realign this crossing due to co-location requirements.



Mountain Valley PIPELINE

N W E S

MVP Virginia Karst Area

0 5 10 15

Miles

4/11/2017

LEGEND

- MVP October 2016 Proposed Route Milepost
- MVP October 2016 Proposed Route
- Karst Area

STREAM CROSSINGS WITHIN KARST TOPOGRAPHY									
Point_ID	Waterbody_	Point_Type	Waters_Typ	Flow_Regim	Flow_Direc	Water_Dept	Bankfull_W	State	County
S-G32	Stream	Centerline	RPW	Intermittent	SW	0.5	6	Virginia	Giles
S-G30	Stream	Centerline	NRPW	Ephemeral	S	0.5	8	Virginia	Giles
S-G36	Stream	Centerline	RPW	Perennial	W	12	20	Virginia	Montgomery
S-P6	Stream	Centerline	NRPW	Ephemeral	SW	0	6	Virginia	Giles
S-A33	Stream	Centerline	NRPW	Ephemeral	E	0	7	Virginia	Giles
S-I1	Stream	Centerline	RPW	Intermittent	E	3	14	Virginia	Montgomery
S-H44	Stream	Centerline	RPW	Perennial	S	4	8	Virginia	Pittsylvania
S-H42	Stream	Centerline	RPW	Perennial	S	0.5	5	Virginia	Pittsylvania
S-Q12	Stream	Centerline	NRPW	Ephemeral	S	0	4	Virginia	Giles
S-Q13	Stream	Centerline	RPW	Perennial	S	8	15	Virginia	Giles
S-PP1	Stream	Centerline	RPW	Intermittent	N	2	3	Virginia	Craig
S-PP3	Stream	Centerline	RPW	Perennial	NW	1	3	Virginia	Craig
S-PP4	Stream	Centerline	RPW	Intermittent	N	1	2	Virginia	Craig
S-NN11	Stream	Centerline	RPW	Intermittent	N	0.5	5	Virginia	Giles
S-NN12	Stream	Centerline	NRPW	Ephemeral	NW	0	2	Virginia	Giles
S-OO13	Stream	Centerline	RPW	Perennial	NW	3	20	Virginia	Giles
S-NN19	Stream	Centerline	RPW	Intermittent	W	1	3.5	Virginia	Montgomery
S-OO16	Stream	Centerline	RPW	Perennial	SW	2	4	Virginia	Montgomery
S-OO14	Stream	Centerline	RPW	Perennial	S	2	4	Virginia	Giles
S-MM18	Stream	Centerline	NRPW	Ephemeral	NW	0	5	Virginia	Giles
S-MM22	Stream	Centerline	NRPW	Ephemeral	N	0	15	Virginia	Montgomery
S-A34	Stream	Centerline	NRPW	Ephemeral	SW	0	7	Virginia	Giles
S-NN17	Stream	Centerline	RPW	Perennial	SW	12	55	Virginia	Giles
S-A32	Stream	Centerline	RPW	Perennial	S	2	16	Virginia	Giles
S-NN16	Stream	Centerline	TNW	Perennial	E	24	70	Virginia	Montgomery
S-RR2	Stream	Centerline	RPW	Perennial	N	6	8	Virginia	Giles
S-Y2	Stream	Centerline	RPW	Perennial	SW	18	25	Virginia	Giles
S-S5	Stream	Centerline	RPW	Perennial	W	3	40	Virginia	Giles
S-S5-Braid-2	Stream	Centerline	NRPW	Ephemeral	W	0	3	Virginia	Giles
S-SS-Braid-1	Stream	Centerline	NRPW	Ephemeral	W	0	4	Virginia	Giles
S-CD12	Stream	Centerline	RPW	Perennial	N	7	3	Virginia	Montgomery
S-AB16	Stream	Centerline	RPW	Intermittent	E	1	5	Virginia	Montgomery
S-EF20a	Stream	Centerline	RPW	Perennial	NE	8	5	Virginia	Montgomery
S-EF19	Stream	Centerline	NRPW	Ephemeral	W	0	1	Virginia	Montgomery
S-IJ16-b	Stream	Centerline	NRPW	Ephemeral	SE	0	5	Virginia	Giles
S-Y3	Stream	Centerline	NRPW	Ephemeral	S	0	10	Virginia	Giles
S-IJ52	Stream	Centerline	RPW	Perennial	SE	3	7	Virginia	Montgomery
S-KL43	Stream	Centerline	RPW	Perennial	NW	3	8	Virginia	Giles
S-EF62	Stream	Centerline	RPW	Perennial	S	5	9	Virginia	Montgomery
S-EF65	Stream	Centerline	RPW	Intermittent	E	2	12	Virginia	Montgomery
S-YZ7	Stream	Centerline	RPW	Intermittent	SE	0	18	Virginia	Montgomery

WETLAND CROSSINGS WITHIN KARST TOPOGRAPHY							
Point_ID	Waters_Typ	HGM_Code	Cowardin	State	County	Acres	USACE_Dist
W-NN8	RPWWD	RIVERINE	PFO	Virginia	Montgomery	0.18468	Norfolk
W-RR1b	RPWWD	RIVERINE	PEM	Virginia	Giles	0.045626	Norfolk
W-AB7	RPWWD	SLOPE	PEM	Virginia	Montgomery	0.074016	Norfolk
W-CD11	RPWWD	RIVERINE	PEM	Virginia	Montgomery	0.187904	Norfolk
W-EF5-PFO	RPWWD	RIVERINE	PFO	Virginia	Montgomery	0.618389	Norfolk
W-CD12	RPWWD	RIVERINE	PEM	Virginia	Giles	0.020756	Norfolk
W-IJ46-PEM	RPWWD	RIVERINE	PEM	Virginia	Montgomery	0.05554	Norfolk

Mountain Valley PIPELINE

MVP Virginia Public Water Supply

Spring Hollow Reservoir

0 0.2 0.4 0.6 0.8 1 Miles

LEGEND

- Stream Crossing
- Water Supply Intake
- MVP October 2016 Proposed Route Milepost
- MVP October 2016 Proposed Route

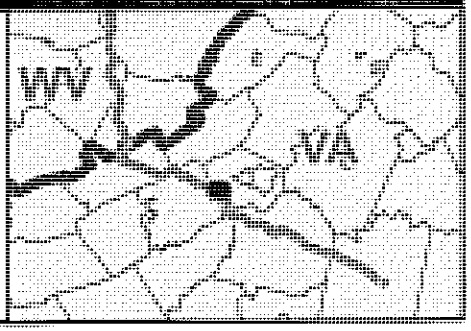


Exhibit 5: Alternatives Analysis Summary (Pipeline Stream Crossings)

Stream ID	Width (ft)	Crossing Option	Footage	Cost	Karst Area	15% or Greater Slopes at WOTUS	Aquatic ETS	Trout	Proximity to Private Wells	Cost Effectiveness		Practicable	Most Practicable Option
										Test (300%)	Ratio		
S-Q13	15	---	---	---	Y	Y	N	N	N	---	---	---	---
		Open Cut	15	$ 54,000.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	55	$1,357,500.00	Y		Y	Y	Y				
		HDD	1,250	$3,475,000.00			Y	Y	Y				
		Tunnel	55	$1,840,000.00			Y	Y	Y				
S-Q12	4	---	---	---	Y	Y	N	N	N	---	---	---	---
		Open Cut	4	$ 14,000.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	44	$1,341,000.00	Y		Y	Y	Y				
		HDD	1,250	$3,475,000.00			Y	Y	Y				
		Tunnel	44	$1,752,000.00			Y	Y	Y				
S-P6	6	---	---	---	Y	Y	N	N	N	---	---	---	---
		Open Cut	6	$ 21,000.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	46	$1,344,000.00	Y		Y	Y	Y				
		HDD	1,250	$3,475,000.00			Y	Y	Y				
		Tunnel	46	$1,768,000.00			Y	Y	Y				
S-S5-Braid-2	3	---	---	---	Y	Y	N	N	N	---	---	---	---
		Open Cut	3	$ 10,500.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	43	$1,339,500.00	Y	Y	Y	Y	Y				
		HDD	1,250	$3,475,000.00			Y	Y	Y				
		Tunnel	43	$1,744,000.00			Y	Y	Y				
S-S5-Braid-1	4	---	---	---	Y	Y	N	N	N	---	---	---	---
		Open Cut	4	$ 14,000.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	44	$1,341,000.00	Y	Y	Y	Y	Y				
		HDD	1,250	$3,475,000.00			Y	Y	Y				
		Tunnel	44	$1,752,000.00			Y	Y	Y				
S-S5	40	---	---	---	Y	Y	Y	N	N	---	---	---	---
		Open Cut	40	$ 168,000.00	Y	Y	TOY	Y	Y	Y	1.0	TOY	TOY Open Cut
		Bore	80	$1,395,000.00	Y	Y	Y	Y	Y				
		HDD	1,250	$3,475,000.00				Y	Y				
		Tunnel	80	$2,040,000.00				Y	Y				
S-G29	4	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	4	$ 14,000.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	44	$1,341,000.00	Y		Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	44	$1,752,000.00	Y		Y	Y	Y				
S-G30	8	---	---	---	Y	Y	N	N	N	---	---	---	---
		Open Cut	8	$ 28,000.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	48	$1,347,000.00	Y		Y	Y	Y				
		HDD	1,250	$3,475,000.00			Y	Y	Y				
		Tunnel	48	$1,784,000.00			Y	Y	Y				

Stream ID	Width (ft)	Crossing Option	Footage	Cost	Karst Area	15% or Greater Slopes at WOTUS	Aquatic ETS	Trout	Proximity to Private Wells	Cost Effectiveness		Practicable	Most Practicable Option
										Test (300%)	Ratio		
S-G32	6	---	---	---	Y	Y	N	N	N	---	---	---	---
		Open Cut	6	$ 21,000.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	46	$1,344,000.00	Y		Y	Y	Y				
		HDD	1,250	$3,475,000.00			Y	Y	Y				
		Tunnel	46	$1,768,000.00			Y	Y	Y				
S-G33	8	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	8	$ 28,000.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	48	$1,347,000.00	Y		Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	48	$1,784,000.00	Y		Y	Y	Y				
S-G35	25	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	25	$ 91,250.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	65	$1,372,500.00	Y		Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	65	$1,920,000.00	Y		Y	Y	Y				
S-G35	25	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	25	$ 91,250.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	65	$1,372,500.00	Y		Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	65	$1,920,000.00	Y		Y	Y	Y				
S-G35	25	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	25	$ 91,250.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	65	$1,372,500.00	Y		Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	65	$1,920,000.00	Y		Y	Y	Y				
S-SS4	3	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	3	$ 10,500.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	43	$1,339,500.00	Y		Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	43	$1,744,000.00	Y		Y	Y	Y				
S-Z7	3	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	3	$ 10,500.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	43	$1,339,500.00	Y		Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	43	$1,744,000.00	Y		Y	Y	Y				
S-Z7-Braid-1	3	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	3	$ 10,500.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	43	$1,339,500.00	Y		Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	43	$1,744,000.00	Y		Y	Y	Y				

Stream ID	Width (ft)	Crossing Option	Footage	Cost	Karst Area	15% or Greater Slopes at WOTUS	Aquatic ETS	Trout	Proximity to Private Wells	Cost Effectiveness		Practicable	Most Practicable Option
										Test (300%)	Ratio		
S-Z9	4	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	4	$ 14,000.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	44	$1,341,000.00	Y		Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	44	$1,752,000.00	Y		Y	Y	Y				
S-Z10	12	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	12	$ 43,200.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	52	$1,353,000.00	Y	Y	Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	52	$1,816,000.00	Y		Y	Y	Y				
S-Z11	5	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	5	$ 17,500.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	45	$1,342,500.00	Y		Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	45	$1,760,000.00	Y		Y	Y	Y				
S-Z12-EPH	6	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	6	$ 21,000.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	46	$1,344,000.00	Y	Y	Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	46	$1,768,000.00	Y		Y	Y	Y				
S-Z13	25	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	25	$ 91,250.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	65	$1,372,500.00	Y		Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	65	$1,920,000.00	Y		Y	Y	Y				
S-Z14	4	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	4	$ 14,000.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	44	$1,341,000.00	Y		Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	44	$1,752,000.00	Y		Y	Y	Y				
S-Y2	25	---	---	---	Y	Y	N	N	N	---	---	---	---
		Open Cut	25	$ 91,250.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	65	$1,372,500.00	Y		Y	Y	Y				
		HDD	1,250	$3,475,000.00			Y	Y	Y				
		Tunnel	65	$1,920,000.00			Y	Y	Y				
S-A34	7	---	---	---	Y	Y	N	N	N	---	---	---	---
		Open Cut	7	$ 24,500.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	47	$1,345,500.00	Y		Y	Y	Y				
		HDD	1,250	$3,475,000.00			Y	Y	Y				
		Tunnel	47	$1,776,000.00			Y	Y	Y				

Stream ID	Width (ft)	Crossing Option	Footage	Cost	Karst Area	15% or Greater Slopes at WOTUS	Aquatic ETS	Trout	Proximity to Private Wells	Cost Effectiveness		Practicable	Most Practicable Option
										Test (300%)	Ratio		
S-A33	7	---	---	---	Y	Y	N	N	N	---	---	---	---
		Open Cut	7	$ 24,500.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	47	$1,345,500.00	Y		Y	Y	Y				
		HDD	1,250	$3,475,000.00			Y	Y	Y				
		Tunnel	47	$1,776,000.00			Y	Y	Y				
S-A32	16	---	---	---	Y	Y	N	N	N	---	---	---	---
		Open Cut	16	$ 57,600.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	56	$1,359,000.00	Y		Y	Y	Y				
		HDD	1,250	$3,475,000.00			Y	Y	Y				
		Tunnel	56	$1,848,000.00			Y	Y	Y				
S-NN17	55	---	---	---	Y	Y	Y	N	N	---	---	---	---
		Open Cut	55	$ 231,000.00	Y	Y	TOY	Y	Y	Y	1.0	TOY	TOY Open Cut
		Bore	95	$1,417,500.00	Y		Y	Y	Y				
		HDD	1,250	$3,475,000.00				Y	Y				
		Tunnel	95	$2,160,000.00				Y	Y				
S-Y3	10	---	---	---	Y	Y	N	N	N	---	---	---	---
		Open Cut	10	$ 35,000.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	50	$1,350,000.00	Y		Y	Y	Y				
		HDD	1,250	$3,475,000.00			Y	Y	Y				
		Tunnel	50	$1,800,000.00			Y	Y	Y				
S-PP4	2	---	---	---	Y	Y	N	N	N	---	---	---	---
		Open Cut	2	$ 7,000.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	42	$1,338,000.00	Y		Y	Y	Y				
		HDD	1,250	$3,475,000.00			Y	Y	Y				
		Tunnel	42	$1,736,000.00			Y	Y	Y				
S-PP3	3	---	---	---	Y	Y	N	N	N	---	---	---	---
		Open Cut	3	$ 10,500.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	43	$1,339,500.00	Y		Y	Y	Y				
		HDD	1,250	$3,475,000.00			Y	Y	Y				
		Tunnel	43	$1,744,000.00			Y	Y	Y				
S-E24	20	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	20	$ 72,000.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	60	$1,365,000.00	Y		Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	60	$1,880,000.00	Y		Y	Y	Y				
S-E25-Downstream	8	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	8	$ 28,000.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	48	$1,347,000.00	Y		Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	48	$1,784,000.00	Y		Y	Y	Y				

Stream ID	Width (ft)	Crossing Option	Footage	Cost	Karst Area	15% or Greater Slopes at WOTUS	Aquatic ETS	Trout	Proximity to Private Wells	Cost Effectiveness		Practicable	Most Practicable Option
										Test (300%)	Ratio		
S-E25-Upstream	10	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	10	$ 35,000.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	50	$1,350,000.00	Y		Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	50	$1,800,000.00	Y		Y	Y	Y				
S-E25-Downstream	8	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	8	$ 28,000.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	48	$1,347,000.00	Y		Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	48	$1,784,000.00	Y		Y	Y	Y				
S-E25-Downstream	8	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	8	$ 28,000.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	48	$1,347,000.00	Y		Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	48	$1,784,000.00	Y		Y	Y	Y				
S-PP1	3	---	---	---	Y	Y	N	N	N	---	---	---	---
		Open Cut	3	$ 10,500.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	43	$1,339,500.00	Y	Y	Y	Y	Y				
		HDD	1,250	$3,475,000.00			Y	Y	Y				
		Tunnel	43	$1,744,000.00			Y	Y	Y				
S-RR5	10	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	10	$ 35,000.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	50	$1,350,000.00	Y		Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	50	$1,800,000.00	Y		Y	Y	Y				
S-PP22	2.5	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	2.5	$ 8,750.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	42.5	$1,338,750.00	Y		Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	42.5	$1,740,000.00	Y		Y	Y	Y				
S-CD14	5.5	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	5.5	$ 19,250.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	45.5	$1,343,250.00	Y		Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	45.5	$1,764,000.00	Y		Y	Y	Y				
S-OO12	2	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	2	$ 7,000.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	42	$1,338,000.00	Y		Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	42	$1,736,000.00	Y		Y	Y	Y				

Stream ID	Width (ft)	Crossing Option	Footage	Cost	Karst Area	15% or Greater Slopes at WOTUS	Aquatic ETS	Trout	Proximity to Private Wells	Cost Effectiveness		Practicable	Most Practicable Option
										Test (300%)	Ratio		
S-OO13	20	---	---	---	Y	Y	N	N	N	---	---	---	---
		Open Cut	20	$ 72,000.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	60	$1,365,000.00	Y		Y	Y	Y				
		HDD	1,250	$3,475,000.00			Y	Y	Y				
		Tunnel	60	$1,880,000.00			Y	Y	Y				
S-OO14	4	---	---	---	Y	Y	N	N	N	---	---	---	---
		Open Cut	4	$ 14,000.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	44	$1,341,000.00	Y		Y	Y	Y				
		HDD	1,250	$3,475,000.00			Y	Y	Y				
		Tunnel	44	$1,752,000.00			Y	Y	Y				
S-IJ17	8	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	8	$ 28,000.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	48	$1,347,000.00	Y		Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	48	$1,784,000.00	Y		Y	Y	Y				
S-IJ16-b	10	---	---	---	Y	Y	N	N	N	---	---	---	---
		Open Cut	10	$ 35,000.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	50	$1,350,000.00	Y		Y	Y	Y				
		HDD	1,250	$3,475,000.00			Y	Y	Y				
		Tunnel	50	$1,800,000.00			Y	Y	Y				
S-PP21	4	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	4	$ 14,000.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	44	$1,341,000.00	Y		Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	44	$1,752,000.00	Y		Y	Y	Y				
S-PP20	6	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	6	$ 21,000.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	46	$1,344,000.00	Y	Y	Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	46	$1,768,000.00	Y		Y	Y	Y				
S-OO6	35	---	---	---	N	Y	Y	N	N	---	---	---	---
		Open Cut	35	$ 147,000.00	Y	Y	TOY	Y	Y	Y	1.0	TOY	TOY Open Cut
		Bore	75	$1,387,500.00	Y		Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y			Y	Y				
		Tunnel	75	$2,000,000.00	Y			Y	Y				
S-HH18	6	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	6	$ 21,000.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	46	$1,344,000.00	Y		Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	46	$1,768,000.00	Y		Y	Y	Y				

Stream ID	Width (ft)	Crossing Option	Footage	Cost	Karst Area	15% or Greater Slopes at WOTUS	Aquatic ETS	Trout	Proximity to Private Wells	Cost Effectiveness		Practicable	Most Practicable Option
										Test (300%)	Ratio		
S-RR14	7	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	7	$ 24,500.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	47	$1,345,500.00	Y		Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	47	$1,776,000.00	Y		Y	Y	Y				
S-KL43	10	---	---	---	Y	Y	N	N	Y	---	---	---	---
		Open Cut	10	$ 35,000.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	50	$1,350,000.00	Y	Y	Y	Y	Y				
		HDD	1,250	$3,475,000.00			Y	Y					
		Tunnel	50	$1,800,000.00			Y	Y					
S-NN11	5	---	---	---	Y	Y	N	N	N	---	---	---	---
		Open Cut	5	$ 17,500.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	45	$1,342,500.00	Y		Y	Y	Y				
		HDD	1,250	$3,475,000.00			Y	Y	Y				
		Tunnel	45	$1,760,000.00			Y	Y	Y				
S-NN12	2	---	---	---	Y	Y	N	N	N	---	---	---	---
		Open Cut	2	$ 7,000.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	42	$1,338,000.00	Y		Y	Y	Y				
		HDD	1,250	$3,475,000.00			Y	Y	Y				
		Tunnel	42	$1,736,000.00			Y	Y	Y				
S-MN21	7	---	---	---	N	N	N	N	N	---	---	---	---
		Open Cut	7	$ 24,500.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	47	$1,345,500.00	Y	Y	Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y	Y	Y	Y	Y				
		Tunnel	47	$1,776,000.00	Y	Y	Y	Y	Y				
S-MN22	2	---	---	---	N	N	N	N	N	---	---	---	---
		Open Cut	2	$ 7,000.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	42	$1,338,000.00	Y	Y	Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y	Y	Y	Y	Y				
		Tunnel	42	$1,736,000.00	Y	Y	Y	Y	Y				
S-RR2	8	---	---	---	Y	Y	N	N	N	---	---	---	---
		Open Cut	8	$ 28,000.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	48	$1,347,000.00	Y		Y	Y	Y				
		HDD	1,250	$3,475,000.00			Y	Y	Y				
		Tunnel	48	$1,784,000.00			Y	Y	Y				
S-YZ6	6	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	6	$ 21,000.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	46	$1,344,000.00	Y		Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	46	$1,768,000.00	Y		Y	Y	Y				

Stream ID	Width (ft)	Crossing Option	Footage	Cost	Karst Area	15% or Greater Slopes at WOTUS	Aquatic ETS	Trout	Proximity to Private Wells	Cost Effectiveness		Practicable	Most Practicable Option
										Test (300%)	Ratio		
S-EF62	11	---	---	---	Y	Y	N	N	N	---	---	---	---
		Open Cut	11	$ 39,600.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	51	$1,351,500.00	Y		Y	Y	Y				
		HDD	1,250	$3,475,000.00			Y	Y	Y				
		Tunnel	51	$1,808,000.00			Y	Y	Y				
S-MM18	5	---	---	---	Y	Y	N	N	N	---	---	---	---
		Open Cut	5	$ 17,500.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	45	$1,342,500.00	Y	Y	Y	Y	Y				
		HDD	1,250	$3,475,000.00			Y	Y	Y				
		Tunnel	45	$1,760,000.00			Y	Y	Y				
S-IJ52	16	---	---	---	Y	Y	N	N	N	---	---	---	---
		Open Cut	16	$ 57,600.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	56	$1,359,000.00	Y		Y	Y	Y				
		HDD	1,250	$3,475,000.00			Y	Y	Y				
		Tunnel	56	$1,848,000.00			Y	Y	Y				
S-EF65	6	---	---	---	Y	Y	Y	N	N	---	---	---	---
		Open Cut	6	$ 21,000.00	Y	Y	TOY	Y	Y	Y	1.0	TOY	TOY Open Cut
		Bore	46	$1,344,000.00	Y		Y	Y	Y				
		HDD	1,250	$3,475,000.00				Y	Y				
		Tunnel	46	$1,768,000.00				Y	Y				
S-IJ43	18	---	---	---	N	Y	Y	N	N	---	---	---	---
		Open Cut	18	$ 64,800.00	Y	Y	TOY	Y	Y	Y	1.0	TOY	TOY Open Cut
		Bore	58	$1,362,000.00	Y		Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y			Y	Y				
		Tunnel	58	$1,864,000.00	Y			Y	Y				
S-G36	20	---	---	---	Y	Y	Y	N	N	---	---	---	---
		Open Cut	20	$ 72,000.00	Y	Y	TOY	Y	Y	Y	1.0	TOY	TOY Open Cut
		Bore	60	$1,365,000.00	Y		Y	Y	Y				
		HDD	1,250	$3,475,000.00				Y	Y				
		Tunnel	60	$1,880,000.00				Y	Y				
S-G38	3	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	3	$ 10,500.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	43	$1,339,500.00	Y		Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	43	$1,744,000.00	Y		Y	Y	Y				
S-G40	3	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	3	$ 10,500.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	43	$1,339,500.00	Y		Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	43	$1,744,000.00	Y		Y	Y	Y				

Stream ID	Width (ft)	Crossing Option	Footage	Cost	Karst Area	15% or Greater Slopes at WOTUS	Aquatic ETS	Trout	Proximity to Private Wells	Cost Effectiveness		Practicable	Most Practicable Option
										Test (300%)	Ratio		
S-PP23	2.5	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	2.5	$ 8,750.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	42.5	$1,338,750.00	Y		Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	42.5	$1,740,000.00	Y		Y	Y	Y				
S-G39	6	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	6	$ 21,000.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	46	$1,344,000.00	Y		Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	46	$1,768,000.00	Y		Y	Y	Y				
S-MM14	7	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	7	$ 24,500.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	47	$1,345,500.00	Y		Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	47	$1,776,000.00	Y		Y	Y	Y				
S-MM1S	6	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	6	$ 21,000.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	46	$1,344,000.00	Y		Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	46	$1,768,000.00	Y		Y	Y	Y				
S-MM11	8	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	8	$ 28,000.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	48	$1,347,000.00	Y	Y	Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	48	$1,784,000.00	Y		Y	Y	Y				
S-F15	6	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	6	$ 21,000.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	46	$1,344,000.00	Y	Y	Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	46	$1,768,000.00	Y		Y	Y	Y				
S-MM13	5	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	5	$ 17,500.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	45	$1,342,500.00	Y		Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	45	$1,760,000.00	Y		Y	Y	Y				
S-F16a/F16b	3	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	3	$ 10,500.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	43	$1,339,500.00	Y		Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	43	$1,744,000.00	Y		Y	Y	Y				

Stream ID	Width (ft)	Crossing Option	Footage	Cost	Karst Area	15% or Greater Slopes at WOTUS	Aquatic ETS	Trout	Proximity to Private Wells	Cost Effectiveness		Practicable	Most Practicable Option
										Test (300%)	Ratio		
S-C36	3	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	3	$ 10,500.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	43	$1,339,500.00	Y	Y	Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	43	$1,744,000.00	Y		Y	Y	Y				
S-C36	3	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	3	$ 10,500.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	43	$1,339,500.00	Y	Y	Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	43	$1,744,000.00	Y		Y	Y	Y				
S-C33	6	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	6	$ 21,000.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	46	$1,344,000.00	Y	Y	Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	46	$1,768,000.00	Y		Y	Y	Y				
S-MM31	4	---	---	---	N	N	N	N	N	---	---	---	---
		Open Cut	4	$ 14,000.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	44	$1,341,000.00	Y	Y	Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y	Y	Y	Y	Y				
		Tunnel	44	$1,752,000.00	Y	Y	Y	Y	Y				
S-C29	1.2	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	1.2	$ 4,200.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	41.2	$1,336,800.00	Y	Y	Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	41.2	$1,729,600.00	Y		Y	Y	Y				
S-C25	3	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	3	$ 10,500.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	43	$1,339,500.00	Y		Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	43	$1,744,000.00	Y		Y	Y	Y				
S-C24	3	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	3	$ 10,500.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	43	$1,339,500.00	Y		Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	43	$1,744,000.00	Y		Y	Y	Y				
S-C21	25	---	---	---	N	Y	Y	N	Y	---	---	---	---
		Open Cut	25	$ 91,250.00	Y	Y	TOY	Y	Y	Y	1.0	TOY	TOY Open Cut
		Bore	65	$1,372,500.00	Y	Y	Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y			Y					
		Tunnel	65	$1,920,000.00	Y			Y					

Stream ID	Width (ft)	Crossing Option	Footage	Cost	Karst Area	15% or Greater Slopes at WOTUS	Aquatic ETS	Trout	Proximity to Private Wells	Cost Effectiveness		Practicable	Most Practicable Option
										Test (300%)	Ratio		
S-OO11	2	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	2	$ 7,000.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	42	$1,338,000.00	Y		Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	42	$1,736,000.00	Y		Y	Y	Y				
S-OO16	4	---	---	---	Y	Y	N	N	N	---	---	---	---
		Open Cut	4	$ 14,000.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	44	$1,341,000.00	Y		Y	Y	Y				
		HDD	1,250	$3,475,000.00			Y	Y	Y				
		Tunnel	44	$1,752,000.00			Y	Y	Y				
S-NN19	3.5	---	---	---	Y	Y	N	N	Y	---	---	---	---
		Open Cut	3.5	$ 12,250.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	43.5	$1,340,250.00	Y		Y	Y	Y				
		HDD	1,250	$3,475,000.00			Y	Y					
		Tunnel	43.5	$1,748,000.00			Y	Y					
S-NN16	70	---	---	---	Y	Y	Y	N	Y	---	---	---	---
		Open Cut	70	$ 294,000.00	Y	Y	TOY	Y	Y	Y	1.0	TOY	TOY Open Cut
		Bore	110	$1,440,000.00	Y	Y	Y	Y	Y				
		HDD	1,250	$3,475,000.00				Y					
		Tunnel	110	$2,280,000.00				Y					
S-AB16	5	---	---	---	Y	Y	N	N	Y	---	---	---	---
		Open Cut	5	$ 17,500.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	45	$1,342,500.00	Y	Y	Y	Y	Y				
		HDD	1,250	$3,475,000.00			Y	Y					
		Tunnel	45	$1,760,000.00			Y	Y					
S-I1	14	---	---	---	Y	Y	N	N	N	---	---	---	---
		Open Cut	14	$ 50,400.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	54	$1,356,000.00	Y	Y	Y	Y	Y				
		HDD	1,250	$3,475,000.00			Y	Y	Y				
		Tunnel	54	$1,832,000.00			Y	Y	Y				
S-CD12	18	---	---	---	Y	Y	N	N	N	---	---	---	---
		Open Cut	18	$ 64,800.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	58	$1,362,000.00	Y		Y	Y	Y				
		HDD	1,250	$3,475,000.00			Y	Y	Y				
		Tunnel	58	$1,864,000.00			Y	Y	Y				
S-EF19	5	---	---	---	Y	Y	N	N	N	---	---	---	---
		Open Cut	5	$ 17,500.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	45	$1,342,500.00	Y		Y	Y	Y				
		HDD	1,250	$3,475,000.00			Y	Y	Y				
		Tunnel	45	$1,760,000.00			Y	Y	Y				

Stream ID	Width (ft)	Crossing Option	Footage	Cost	Karst Area	15% or Greater Slopes at WOTUS	Aquatic ETS	Trout	Proximity to Private Wells	Cost Effectiveness		Practicable	Most Practicable Option
										Test (300%)	Ratio		
S-EF20a	6	---	---	---	Y	Y	N	N	N	---	---	---	---
		Open Cut	6	$ 21,000.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	46	$1,344,000.00	Y		Y	Y	Y				
		HDD	1,250	$3,475,000.00			Y	Y	Y				
		Tunnel	46	$1,768,000.00			Y	Y	Y				
S-MM22	15	---	---	---	Y	Y	N	N	N	---	---	---	---
		Open Cut	15	$ 54,000.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	55	$1,357,500.00	Y		Y	Y	Y				
		HDD	1,250	$3,475,000.00			Y	Y	Y				
		Tunnel	55	$1,840,000.00			Y	Y	Y				
S-IJ50	25	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	25	$ 91,250.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	65	$1,372,500.00	Y		Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	65	$1,920,000.00	Y		Y	Y	Y				
S-Y13	8	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	8	$ 28,000.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	48	$1,347,000.00	Y		Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	48	$1,784,000.00	Y		Y	Y	Y				
S-Y14	14	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	14	$ 50,400.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	54	$1,356,000.00	Y		Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	54	$1,832,000.00	Y		Y	Y	Y				
S-EF34	10	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	10	$ 35,000.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	50	$1,350,000.00	Y		Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	50	$1,800,000.00	Y		Y	Y	Y				
S-EF35	8	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	8	$ 28,000.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	48	$1,347,000.00	Y	Y	Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	48	$1,784,000.00	Y		Y	Y	Y				
S-EF33	9	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	9	$ 31,500.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	49	$1,348,500.00	Y		Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	49	$1,792,000.00	Y		Y	Y	Y				

Stream ID	Width (ft)	Crossing Option	Footage	Cost	Karst Area	15% or Greater Slopes at WOTUS	Aquatic ETS	Trout	Proximity to Private Wells	Cost Effectiveness		Practicable	Most Practicable Option
										Test (300%)	Ratio		
S-IJ81	3	---	---	---	N	N	N	N	N	---	---	---	---
		Open Cut	3	$ 10,500.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	43	$1,339,500.00	Y	Y	Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y	Y	Y	Y	Y				
		Tunnel	43	$1,744,000.00	Y	Y	Y	Y	Y				
S-IJ82	15	---	---	---	N	N	N	N	N	---	---	---	---
		Open Cut	15	$ 54,000.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	55	$1,357,500.00	Y	Y	Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y	Y	Y	Y	Y				
		Tunnel	55	$1,840,000.00	Y	Y	Y	Y	Y				
S-IJ83	5	---	---	---	N	N	N	N	N	---	---	---	---
		Open Cut	5	$ 17,500.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	45	$1,342,500.00	Y	Y	Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y	Y	Y	Y	Y				
		Tunnel	45	$1,760,000.00	Y	Y	Y	Y	Y				
S-IJ88	20	---	---	---	N	N	N	N	N	---	---	---	---
		Open Cut	20	$ 72,000.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	60	$1,365,000.00	Y	Y	Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y	Y	Y	Y	Y				
		Tunnel	60	$1,880,000.00	Y	Y	Y	Y	Y				
S-IJ84	15	---	---	---	N	N	N	N	N	---	---	---	---
		Open Cut	15	$ 54,000.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	55	$1,357,500.00	Y	Y	Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y	Y	Y	Y	Y				
		Tunnel	55	$1,840,000.00	Y	Y	Y	Y	Y				
S-IJ89	10	---	---	---	N	N	N	N	N	---	---	---	---
		Open Cut	10	$ 35,000.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	50	$1,350,000.00	Y	Y	Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y	Y	Y	Y	Y				
		Tunnel	50	$1,800,000.00	Y	Y	Y	Y	Y				
S-IJ90	5	---	---	---	N	N	N	N	N	---	---	---	---
		Open Cut	5	$ 17,500.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	45	$1,342,500.00	Y	Y	Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y	Y	Y	Y	Y				
		Tunnel	45	$1,760,000.00	Y	Y	Y	Y	Y				
S-KL25	5	---	---	---	N	Y	N	N	Y	---	---	---	---
		Open Cut	5	$ 17,500.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	45	$1,342,500.00	Y	Y	Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y		Y	Y					
		Tunnel	45	$1,760,000.00	Y		Y	Y					

Stream ID	Width (ft)	Crossing Option	Footage	Cost	Karst Area	15% or Greater Slopes at WOTUS	Aquatic ETS	Trout	Proximity to Private Wells	Cost Effectiveness		Practicable	Most Practicable Option
										Test (300%)	Ratio		
S-ST9b	15	---	---	---	N	N	N	N	N	---	---	---	---
		Open Cut	15	$ 54,000.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	55	$1,357,500.00	Y	Y	Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y	Y	Y	Y	Y				
		Tunnel	55	$1,840,000.00	Y	Y	Y	Y	Y				
S-KL55	15	---	---	---	N	N	N	N	N	---	---	---	---
		Open Cut	15	$ 54,000.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	55	$1,357,500.00	Y	Y	Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y	Y	Y	Y	Y				
		Tunnel	55	$1,840,000.00	Y	Y	Y	Y	Y				
S-IJ12	13	---	---	---	N	Y	N	N	Y	---	---	---	---
		Open Cut	13	$ 46,800.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	53	$1,354,500.00	Y		Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y		Y	Y					
		Tunnel	53	$1,824,000.00	Y		Y	Y					
5-EF44	7	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	7	$ 24,500.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	47	$1,345,500.00	Y	Y	Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	47	$1,776,000.00	Y		Y	Y	Y				
S-Y9	4	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	4	$ 14,000.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	44	$1,341,000.00	Y	Y	Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	44	$1,752,000.00	Y		Y	Y	Y				
S-Y7	4	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	4	$ 14,000.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	44	$1,341,000.00	Y	Y	Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	44	$1,752,000.00	Y		Y	Y	Y				
S-Y8	4	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	4	$ 14,000.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	44	$1,341,000.00	Y	Y	Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	44	$1,752,000.00	Y		Y	Y	Y				
5-B22	4	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	4	$ 14,000.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	44	$1,341,000.00	Y	Y	Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	44	$1,752,000.00	Y		Y	Y	Y				

Stream ID	Width (ft)	Crossing Option	Footage	Cost	Karst Area	15% or Greater Slopes at WOTUS	Aquatic ETS	Trout	Proximity to Private Wells	Cost Effectiveness		Practicable	Most Practicable Option
										Test (300%)	Ratio		
S-B23	2	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	2	$ 7,000.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	42	$1,338,000.00	Y	Y	Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	42	$1,736,000.00	Y		Y	Y	Y				
S-B25	5	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	5	$ 17,500.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	45	$1,342,500.00	Y	Y	Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	45	$1,760,000.00	Y		Y	Y	Y				
S-B21	4	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	4	$ 14,000.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	44	$1,341,000.00	Y		Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	44	$1,752,000.00	Y		Y	Y	Y				
S-H1	10	---	---	---	N	Y	Y	N	N	---	---	---	---
		Open Cut	10	$ 35,000.00	Y	Y	TOY	Y	Y	Y	1.0	TOY	TOY Open Cut
		Bore	50	$1,350,000.00	Y		Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y			Y	Y				
		Tunnel	50	$1,800,000.00	Y			Y	Y				
S-G26	7	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	7	$ 24,500.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	47	$1,345,500.00	Y		Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	47	$1,776,000.00	Y		Y	Y	Y				
S-G27	7	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	7	$ 24,500.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	47	$1,345,500.00	Y		Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	47	$1,776,000.00	Y		Y	Y	Y				
S-G24	6	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	6	$ 21,000.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	46	$1,344,000.00	Y		Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	46	$1,768,000.00	Y		Y	Y	Y				
S-G25	7	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	7	$ 24,500.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	47	$1,345,500.00	Y		Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	47	$1,776,000.00	Y		Y	Y	Y				

Stream ID	Width (ft)	Crossing Option	Footage	Cost	Karst Area	15% or Greater Slopes at WOTUS	Aquatic ETS	Trout	Proximity to Private Wells	Cost Effectiveness		Practicable	Most Practicable Option
										Test (300%)	Ratio		
S-D8	18	---	---	---	N	Y	Y	N	N	---	---	---	---
		Open Cut	18	$ 64,800.00	Y	Y	TOY	Y	Y	Y	1.0	TOY	TOY Open Cut
		Bore	58	$1,362,000.00	Y		Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y			Y	Y				
		Tunnel	58	$1,864,000.00	Y			Y	Y				
S-D9	7	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	7	$ 24,500.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	47	$1,345,500.00	Y	Y	Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	47	$1,776,000.00	Y		Y	Y	Y				
S-D10	8	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	8	$ 28,000.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	48	$1,347,000.00	Y		Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	48	$1,784,000.00	Y		Y	Y	Y				
S-D11	10	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	10	$ 35,000.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	50	$1,350,000.00	Y		Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	50	$1,800,000.00	Y		Y	Y	Y				
S-D12	6	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	6	$ 21,000.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	46	$1,344,000.00	Y		Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	46	$1,768,000.00	Y		Y	Y	Y				
S-MM26	7	---	---	---	N	N	N	N	N	---	---	---	---
		Open Cut	7	$ 24,500.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	47	$1,345,500.00	Y	Y	Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y	Y	Y	Y	Y				
		Tunnel	47	$1,776,000.00	Y	Y	Y	Y	Y				
S-MM26[2]	7	---	---	---	N	N	N	N	N	---	---	---	---
		Open Cut	7	$ 24,500.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	47	$1,345,500.00	Y	Y	Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y	Y	Y	Y	Y				
		Tunnel	47	$1,776,000.00	Y	Y	Y	Y	Y				
S-D13	4	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	4	$ 14,000.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	44	$1,341,000.00	Y		Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	44	$1,752,000.00	Y		Y	Y	Y				

Stream ID	Width (ft)	Crossing Option	Footage	Cost	Karst Area	15% or Greater Slopes at WOTUS	Aquatic ETS	Trout	Proximity to Private Wells	Cost Effectiveness		Practicable	Most Practicable Option
										Test (300%)	Ratio		
S-D17	7	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	7	$ 24,500.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	47	$1,345,500.00	Y		Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	47	$1,776,000.00	Y		Y	Y	Y				
S-D17	7	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	7	$ 24,500.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	47	$1,345,500.00	Y		Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	47	$1,776,000.00	Y		Y	Y	Y				
S-II4	15	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	15	$ 54,000.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	55	$1,357,500.00	Y		Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	55	$1,840,000.00	Y		Y	Y	Y				
S-GH7	9	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	9	$ 31,500.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	49	$1,348,500.00	Y	Y	Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	49	$1,792,000.00	Y		Y	Y	Y				
S-GH1S	4	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	4	$ 14,000.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	44	$1,341,000.00	Y	Y	Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	44	$1,752,000.00	Y		Y	Y	Y				
S-GH14	4	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	4	$ 14,000.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	44	$1,341,000.00	Y	Y	Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	44	$1,752,000.00	Y		Y	Y	Y				
S-GH11	3	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	3	$ 10,500.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	43	$1,339,500.00	Y		Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	43	$1,744,000.00	Y		Y	Y	Y				
S-GH9	4	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	4	$ 14,000.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	44	$1,341,000.00	Y		Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	44	$1,752,000.00	Y		Y	Y	Y				

Stream ID	Width (ft)	Crossing Option	Footage	Cost	Karst Area	15% or Greater Slopes at WOTUS	Aquatic ETS	Trout	Proximity to Private Wells	Cost Effectiveness		Practicable	Most Practicable Option
										Test (300%)	Ratio		
S-RR08	7	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	7	$ 24,500.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	47	$1,345,500.00	Y	Y	Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	47	$1,776,000.00	Y		Y	Y	Y				
S-RR09	9	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	9	$ 31,500.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	49	$1,348,500.00	Y	Y	Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	49	$1,792,000.00	Y		Y	Y	Y				
S-RR11	7	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	7	$ 24,500.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	47	$1,345,500.00	Y		Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	47	$1,776,000.00	Y		Y	Y	Y				
S-IJ1	12	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	12	$ 43,200.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	52	$1,353,000.00	Y		Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	52	$1,816,000.00	Y		Y	Y	Y				
S-IJ2	2.5	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	2.5	$ 8,750.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	42.5	$1,338,750.00	Y		Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	42.5	$1,740,000.00	Y		Y	Y	Y				
S-II6	3	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	3	$ 10,500.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	43	$1,339,500.00	Y		Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	43	$1,744,000.00	Y		Y	Y	Y				
S-IJ3	5	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	5	$ 17,500.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	45	$1,342,500.00	Y	Y	Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	45	$1,760,000.00	Y		Y	Y	Y				
S-GH6	3	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	3	$ 10,500.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	43	$1,339,500.00	Y		Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	43	$1,744,000.00	Y		Y	Y	Y				

Stream ID	Width (ft)	Crossing Option	Footage	Cost	Karst Area	15% or Greater Slopes at WOTUS	Aquatic ETS	Trout	Proximity to Private Wells	Cost Effectiveness		Practicable	Most Practicable Option
										Test (300%)	Ratio		
S-II12	2	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	2	$ 7,000.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	42	$1,338,000.00	Y	Y	Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	42	$1,736,000.00	Y		Y	Y	Y				
S-II11	4	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	4	$ 14,000.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	44	$1,341,000.00	Y	Y	Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	44	$1,752,000.00	Y		Y	Y	Y				
S-II8	2	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	2	$ 7,000.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	42	$1,338,000.00	Y		Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	42	$1,736,000.00	Y		Y	Y	Y				
S-II9	20	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	20	$ 72,000.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	60	$1,365,000.00	Y		Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	60	$1,880,000.00	Y		Y	Y	Y				
S-II7	4	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	4	$ 14,000.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	44	$1,341,000.00	Y	Y	Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	44	$1,752,000.00	Y		Y	Y	Y				
S-IJ4	4	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	4	$ 14,000.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	44	$1,341,000.00	Y		Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	44	$1,752,000.00	Y		Y	Y	Y				
S-KL1	4.5	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	4.5	$ 15,750.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	44.5	$1,341,750.00	Y		Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	44.5	$1,756,000.00	Y		Y	Y	Y				
S-KL2	3.7	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	3.7	$ 12,950.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	43.7	$1,340,550.00	Y		Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	43.7	$1,749,600.00	Y		Y	Y	Y				

Stream ID	Width (ft)	Crossing Option	Footage	Cost	Karst Area	15% or Greater Slopes at WOTUS	Aquatic ETS	Trout	Proximity to Private Wells	Cost Effectiveness		Practicable	Most Practicable Option
										Test (300%)	Ratio		
S-GH2	2	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	2	$ 7,000.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	42	$1,338,000.00	Y		Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	42	$1,736,000.00	Y		Y	Y	Y				
S-GH4	5	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	5	$ 17,500.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	45	$1,342,500.00	Y		Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	45	$1,760,000.00	Y		Y	Y	Y				
S-GH3	6	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	6	$ 21,000.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	46	$1,344,000.00	Y		Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	46	$1,768,000.00	Y		Y	Y	Y				
S-IJ8	1.5	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	1.5	$ 5,250.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	41.5	$1,337,250.00	Y		Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	41.5	$1,732,000.00	Y		Y	Y	Y				
S-IJ10	3	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	3	$ 10,500.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	43	$1,339,500.00	Y		Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	43	$1,744,000.00	Y		Y	Y	Y				
S-CD6	56	---	---	---	N	Y	Y	N	N	---	---	---	---
		Open Cut	56	$ 235,200.00	Y	Y	TOY	Y	Y	Y	1.0	TOY	TOY Open Cut
		Bore	96	$1,419,000.00	Y		Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y			Y	Y				
		Tunnel	96	$2,168,000.00	Y			Y	Y				
S-II2	60	---	---	---	N	Y	Y	N	N	---	---	---	---
		Open Cut	60	$ 252,000.00	Y	Y	TOY	Y	Y	Y	1.0	TOY	TOY Open Cut
		Bore	100	$1,425,000.00	Y		Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y			Y	Y				
		Tunnel	100	$2,200,000.00	Y			Y	Y				
S-E29	8	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	8	$ 28,000.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	48	$1,347,000.00	Y		Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	48	$1,784,000.00	Y		Y	Y	Y				

Stream ID	Width (ft)	Crossing Option	Footage	Cost	Karst Area	15% or Greater Slopes at WOTUS	Aquatic ETS	Trout	Proximity to Private Wells	Cost Effectiveness		Practicable	Most Practicable Option
										Test (300%)	Ratio		
S-E28	12	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	12	$ 43,200.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	52	$1,353,000.00	Y		Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	52	$1,816,000.00	Y		Y	Y	Y				
S-E28	12	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	12	$ 43,200.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	52	$1,353,000.00	Y		Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	52	$1,816,000.00	Y		Y	Y	Y				
S-E28	12	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	12	$ 43,200.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	52	$1,353,000.00	Y		Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	52	$1,816,000.00	Y		Y	Y	Y				
S-EF12	20	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	20	$ 72,000.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	60	$1,365,000.00	Y		Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	60	$1,880,000.00	Y		Y	Y	Y				
S-D23	20	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	20	$ 72,000.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	60	$1,365,000.00	Y		Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	60	$1,880,000.00	Y		Y	Y	Y				
S-C14	50	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	50	$ 210,000.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	90	$1,410,000.00	Y		Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	90	$2,120,000.00	Y		Y	Y	Y				
S-C17	30	---	---	---	N	Y	Y	N	N	---	---	---	---
		Open Cut	30	$ 109,500.00	Y	Y	TOY	Y	Y	Y	1.0	TOY	TOY Open Cut
		Bore	70	$1,380,000.00	Y		Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y			Y	Y				
		Tunnel	70	$1,960,000.00	Y			Y	Y				
S-EF4	11	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	11	$ 39,600.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	51	$1,351,500.00	Y		Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	51	$1,808,000.00	Y		Y	Y	Y				

Stream ID	Width (ft)	Crossing Option	Footage	Cost	Karst Area	15% or Greater Slopes at WOTUS	Aquatic ETS	Trout	Proximity to Private Wells	Cost Effectiveness		Practicable	Most Practicable Option
										Test (300%)	Ratio		
S-EF7	2	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	2	$ 7,000.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	42	$1,338,000.00	Y		Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	42	$1,736,000.00	Y		Y	Y	Y				
S-MM42	2	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	2	$ 7,000.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	42	$1,338,000.00	Y		Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	42	$1,736,000.00	Y		Y	Y	Y				
S-D22	8	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	8	$ 28,000.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	48	$1,347,000.00	Y		Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	48	$1,784,000.00	Y		Y	Y	Y				
S-D18	2	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	2	$ 7,000.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	42	$1,338,000.00	Y		Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	42	$1,736,000.00	Y		Y	Y	Y				
S-RR15	14	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	14	$ 50,400.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	54	$1,356,000.00	Y		Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	54	$1,832,000.00	Y		Y	Y	Y				
S-D20	8	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	8	$ 28,000.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	48	$1,347,000.00	Y		Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	48	$1,784,000.00	Y		Y	Y	Y				
S-KL61	4	---	---	---	N	N	N	N	N	---	---	---	---
		Open Cut	4	$ 14,000.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	44	$1,341,000.00	Y	Y	Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y	Y	Y	Y	Y				
		Tunnel	44	$1,752,000.00	Y	Y	Y	Y	Y				
S-EF48	2	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	2	$ 7,000.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	42	$1,338,000.00	Y		Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	42	$1,736,000.00	Y		Y	Y	Y				

Stream ID	Width (ft)	Crossing Option	Footage	Cost	Karst Area	15% or Greater Slopes at WOTUS	Aquatic ETS	Trout	Proximity to Private Wells	Cost Effectiveness		Practicable	Most Practicable Option
										Test (300%)	Ratio		
S-YZ4	3	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	3	$ 10,500.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	43	$1,339,500.00	Y		Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	43	$1,744,000.00	Y		Y	Y	Y				
S-YZS	4	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	4	$ 14,000.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	44	$1,341,000.00	Y	Y	Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	44	$1,752,000.00	Y		Y	Y	Y				
S-KL41	12	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	12	$ 43,200.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	52	$1,353,000.00	Y		Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	52	$1,816,000.00	Y		Y	Y	Y				
S-KL39	6.5	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	6.5	$ 22,750.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	46.5	$1,344,750.00	Y		Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	46.5	$1,772,000.00	Y		Y	Y	Y				
S-C16	15	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	15	$ 54,000.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	55	$1,357,500.00	Y		Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	55	$1,840,000.00	Y		Y	Y	Y				
S-KL54	10	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	10	$ 35,000.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	50	$1,350,000.00	Y	Y	Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	50	$1,800,000.00	Y		Y	Y	Y				
S-C8	5	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	5	$ 17,500.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	45	$1,342,500.00	Y		Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	45	$1,760,000.00	Y		Y	Y	Y				
S-F4	10	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	10	$ 35,000.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	50	$1,350,000.00	Y	Y	Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	50	$1,800,000.00	Y		Y	Y	Y				

Stream ID	Width (ft)	Crossing Option	Footage	Cost	Karst Area	15% or Greater Slopes at WOTUS	Aquatic ETS	Trout	Proximity to Private Wells	Cost Effectiveness		Practicable	Most Practicable Option
										Test (300%)	Ratio		
S-KL52	1	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	1	$ 3,500.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	41	$1,336,500.00	Y	Y	Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	41	$1,728,000.00	Y		Y	Y	Y				
S-F8	30	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	30	$ 109,500.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	70	$1,380,000.00	Y		Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	70	$1,960,000.00	Y		Y	Y	Y				
S-HH4	9	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	9	$ 31,500.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	49	$1,348,500.00	Y		Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	49	$1,792,000.00	Y		Y	Y	Y				
S-KL51	5.5	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	5.5	$ 19,250.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	45.5	$1,343,250.00	Y		Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	45.5	$1,764,000.00	Y		Y	Y	Y				
S-KL38	7	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	7	$ 24,500.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	47	$1,345,500.00	Y		Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	47	$1,776,000.00	Y		Y	Y	Y				
S-C20	4	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	4	$ 14,000.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	44	$1,341,000.00	Y		Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	44	$1,752,000.00	Y		Y	Y	Y				
S-C19	45	---	---	---	N	Y	Y	N	N	---	---	---	---
		Open Cut	45	$ 189,000.00	Y	Y	TOY	Y	Y	Y	1.0	TOY	TOY Open Cut
		Bore	85	$1,402,500.00	Y		Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y			Y	Y				
		Tunnel	85	$2,080,000.00	Y			Y	Y				
S-KL36	7.5	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	7.5	$ 26,250.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	47.5	$1,346,250.00	Y		Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	47.5	$1,780,000.00	Y		Y	Y	Y				

Stream ID	Width (ft)	Crossing Option	Footage	Cost	Karst Area	15% or Greater Slopes at WOTUS	Aquatic ETS	Trout	Proximity to Private Wells	Cost Effectiveness		Practicable	Most Practicable Option
										Test (300%)	Ratio		
S-F11	90	---	---	---	N	Y	Y	N	N	---	---	---	---
		Open Cut	90	$ 378,000.00	Y	Y	TOY	Y	Y	Y	1.0	TOY	TOY Open Cut
		Bore	130	$1,470,000.00	Y		Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y			Y	Y				
		Tunnel	130	$2,440,000.00	Y			Y	Y				
S-KL35	2.5	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	2.5	$ 8,750.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	42.5	$1,338,750.00	Y		Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	42.5	$1,740,000.00	Y		Y	Y	Y				
S-F9b	15	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	15	$ 54,000.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	55	$1,357,500.00	Y	Y	Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	55	$1,840,000.00	Y		Y	Y	Y				
S-F10	9	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	9	$ 31,500.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	49	$1,348,500.00	Y	Y	Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	49	$1,792,000.00	Y		Y	Y	Y				
S-CD1	3.5	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	3.5	$ 12,250.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	43.5	$1,340,250.00	Y	Y	Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	43.5	$1,748,000.00	Y		Y	Y	Y				
S-F9a	15	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	15	$ 54,000.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	55	$1,357,500.00	Y	Y	Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	55	$1,840,000.00	Y		Y	Y	Y				
S-GG4	5	---	---	---	N	N	N	N	N	---	---	---	---
		Open Cut	5	$ 17,500.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	45	$1,342,500.00	Y	Y	Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y	Y	Y	Y	Y				
		Tunnel	45	$1,760,000.00	Y	Y	Y	Y	Y				
S-A36	4	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	4	$ 14,000.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	44	$1,341,000.00	Y	Y	Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	44	$1,752,000.00	Y		Y	Y	Y				

Stream ID	Width (ft)	Crossing Option	Footage	Cost	Karst Area	15% or Greater Slopes at WOTUS	Aquatic ETS	Trout	Proximity to Private Wells	Cost Effectiveness		Practicable	Most Practicable Option
										Test (300%)	Ratio		
S-A38	9	---	---	---	N	N	N	N	N	---	---	---	---
		Open Cut	9	$ 31,500.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	49	$1,348,500.00	Y	Y	Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y	Y	Y	Y	Y				
		Tunnel	49	$1,792,000.00	Y	Y	Y	Y	Y				
S-A40	5.8	---	---	---	N	N	N	N	N	---	---	---	---
		Open Cut	5.8	$ 20,300.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	45.8	$1,343,700.00	Y	Y	Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y	Y	Y	Y	Y				
		Tunnel	45.8	$1,766,400.00	Y	Y	Y	Y	Y				
S-A41	12	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	12	$ 43,200.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	52	$1,353,000.00	Y	Y	Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	52	$1,816,000.00	Y		Y	Y	Y				
S-GH36	3	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	3	$ 10,500.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	43	$1,339,500.00	Y	Y	Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	43	$1,744,000.00	Y		Y	Y	Y				
S-KL17	5	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	5	$ 17,500.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	45	$1,342,500.00	Y	Y	Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	45	$1,760,000.00	Y		Y	Y	Y				
S-GH37	3	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	3	$ 10,500.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	43	$1,339,500.00	Y	Y	Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	43	$1,744,000.00	Y		Y	Y	Y				
S-GH38	3	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	3	$ 10,500.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	43	$1,339,500.00	Y	Y	Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	43	$1,744,000.00	Y		Y	Y	Y				
S-GH39	4	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	4	$ 14,000.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	44	$1,341,000.00	Y	Y	Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	44	$1,752,000.00	Y		Y	Y	Y				

Stream ID	Width (ft)	Crossing Option	Footage	Cost	Karst Area	15% or Greater Slopes at WOTUS	Aquatic ETS	Trout	Proximity to Private Wells	Cost Effectiveness		Practicable	Most Practicable Option
										Test (300%)	Ratio		
S-GH40	3	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	3	$ 10,500.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	43	$1,339,500.00	Y	Y	Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	43	$1,744,000.00	Y		Y	Y	Y				
S-GH44	6	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	6	$ 21,000.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	46	$1,344,000.00	Y	Y	Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	46	$1,768,000.00	Y		Y	Y	Y				
S-IJ47	2	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	2	$ 7,000.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	42	$1,338,000.00	Y	Y	Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	42	$1,736,000.00	Y		Y	Y	Y				
S-G22	12	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	12	$ 43,200.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	52	$1,353,000.00	Y		Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	52	$1,816,000.00	Y		Y	Y	Y				
S-G23	3	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	3	$ 10,500.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	43	$1,339,500.00	Y		Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	43	$1,744,000.00	Y		Y	Y	Y				
S-G21	3	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	3	$ 10,500.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	43	$1,339,500.00	Y		Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	43	$1,744,000.00	Y		Y	Y	Y				
S-G20	10	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	10	$ 35,000.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	50	$1,350,000.00	Y	Y	Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	50	$1,800,000.00	Y		Y	Y	Y				
S-G18	2	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	2	$ 7,000.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	42	$1,338,000.00	Y	Y	Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	42	$1,736,000.00	Y		Y	Y	Y				

Stream ID	Width (ft)	Crossing Option	Footage	Cost	Karst Area	15% or Greater Slopes at WOTUS	Aquatic ETS	Trout	Proximity to Private Wells	Cost Effectiveness		Practicable	Most Practicable Option
										Test (300%)	Ratio		
S-G17	5	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	5	$ 17,500.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	45	$1,342,500.00	Y	Y	Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	45	$1,760,000.00	Y		Y	Y	Y				
S-E18	7	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	7	$ 24,500.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	47	$1,345,500.00	Y	Y	Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	47	$1,776,000.00	Y		Y	Y	Y				
S-E17	8	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	8	$ 28,000.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	48	$1,347,000.00	Y		Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	48	$1,784,000.00	Y		Y	Y	Y				
S-E14	20	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	20	$ 72,000.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	60	$1,365,000.00	Y	Y	Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	60	$1,880,000.00	Y		Y	Y	Y				
S-H38	12	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	12	$ 43,200.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	52	$1,353,000.00	Y	Y	Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	52	$1,816,000.00	Y		Y	Y	Y				
S-H32	10	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	10	$ 35,000.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	50	$1,350,000.00	Y	Y	Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	50	$1,800,000.00	Y		Y	Y	Y				
S-H37	6	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	6	$ 21,000.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	46	$1,344,000.00	Y		Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	46	$1,768,000.00	Y		Y	Y	Y				
S-H34	3	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	3	$ 10,500.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	43	$1,339,500.00	Y	Y	Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	43	$1,744,000.00	Y		Y	Y	Y				

Stream ID	Width (ft)	Crossing Option	Footage	Cost	Karst Area	15% or Greater Slopes at WOTUS	Aquatic ETS	Trout	Proximity to Private Wells	Cost Effectiveness		Practicable	Most Practicable Option
										Test (300%)	Ratio		
S-H36	3	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	3	$ 10,500.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	43	$1,339,500.00	Y	Y	Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	43	$1,744,000.00	Y		Y	Y	Y				
S-H30	1	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	1	$ 3,500.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	41	$1,336,500.00	Y	Y	Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	41	$1,728,000.00	Y		Y	Y	Y				
S-A18	2.6	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	2.6	$ 9,100.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	42.6	$1,338,900.00	Y	Y	Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	42.6	$1,740,800.00	Y		Y	Y	Y				
S-A19/H26	7	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	7	$ 24,500.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	47	$1,345,500.00	Y		Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	47	$1,776,000.00	Y		Y	Y	Y				
S-A20	7	---	---	---	N	Y	Y	N	N	---	---	---	---
		Open Cut	7	$ 24,500.00	Y	Y	TOY	Y	Y	Y	1.0	TOY	TOY Open Cut
		Bore	47	$1,345,500.00	Y	Y	Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y			Y	Y				
		Tunnel	47	$1,776,000.00	Y			Y	Y				
S-H28	6	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	6	$ 21,000.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	46	$1,344,000.00	Y	Y	Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	46	$1,768,000.00	Y		Y	Y	Y				
S-H27	10	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	10	$ 35,000.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	50	$1,350,000.00	Y	Y	Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	50	$1,800,000.00	Y		Y	Y	Y				
S-A22	8	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	8	$ 28,000.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	48	$1,347,000.00	Y	Y	Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	48	$1,784,000.00	Y		Y	Y	Y				

Stream ID	Width (ft)	Crossing Option	Footage	Cost	Karst Area	15% or Greater Slopes at WOTUS	Aquatic ETS	Trout	Proximity to Private Wells	Cost Effectiveness		Practicable	Most Practicable Option
										Test (300%)	Ratio		
S-MM44	4	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	4	$ 14,000.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	44	$1,341,000.00	Y	Y	Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	44	$1,752,000.00	Y		Y	Y	Y				
S-MM46	3	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	3	$ 10,500.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	43	$1,339,500.00	Y	Y	Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	43	$1,744,000.00	Y		Y	Y	Y				
S-MM45	4	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	4	$ 14,000.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	44	$1,341,000.00	Y	Y	Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	44	$1,752,000.00	Y		Y	Y	Y				
S-MM48	7	---	---	---	N	N	N	N	N	---	---	---	---
		Open Cut	7	$ 24,500.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	47	$1,345,500.00	Y	Y	Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y	Y	Y	Y	Y				
		Tunnel	47	$1,776,000.00	Y	Y	Y	Y	Y				
S-H25	7	---	---	---	N	N	N	N	N	---	---	---	---
		Open Cut	7	$ 24,500.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	47	$1,345,500.00	Y	Y	Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y	Y	Y	Y	Y				
		Tunnel	47	$1,776,000.00	Y	Y	Y	Y	Y				
S-H24	10	---	---	---	N	N	N	N	N	---	---	---	---
		Open Cut	10	$ 35,000.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	50	$1,350,000.00	Y	Y	Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y	Y	Y	Y	Y				
		Tunnel	50	$1,800,000.00	Y	Y	Y	Y	Y				
S-H23	5	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	5	$ 17,500.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	45	$1,342,500.00	Y		Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	45	$1,760,000.00	Y		Y	Y	Y				
S-HH1	5	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	5	$ 17,500.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	45	$1,342,500.00	Y	Y	Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	45	$1,760,000.00	Y		Y	Y	Y				

Stream ID	Width (ft)	Crossing Option	Footage	Cost	Karst Area	15% or Greater Slopes at WOTUS	Aquatic ETS	Trout	Proximity to Private Wells	Cost Effectiveness		Practicable	Most Practicable Option
										Test (300%)	Ratio		
S-A13	8	---	---	---	N	Y	Y	N	N	---	---	---	---
		Open Cut	8	$ 28,000.00	Y	Y	TOY	Y	Y	Y	1.0	TOY	TOY Open Cut
		Bore	48	$1,347,000.00	Y	Y	Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y			Y	Y				
		Tunnel	48	$1,784,000.00	Y			Y	Y				
S-A11	3	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	3	$ 10,500.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	43	$1,339,500.00	Y	Y	Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	43	$1,744,000.00	Y		Y	Y	Y				
S-H17	8	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	8	$ 28,000.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	48	$1,347,000.00	Y	Y	Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	48	$1,784,000.00	Y		Y	Y	Y				
S-A7	6	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	6	$ 21,000.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	46	$1,344,000.00	Y	Y	Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	46	$1,768,000.00	Y		Y	Y	Y				
S-SS8	8	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	8	$ 28,000.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	48	$1,347,000.00	Y	Y	Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	48	$1,784,000.00	Y		Y	Y	Y				
S-CD8	4.5	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	4.5	$ 15,750.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	44.5	$1,341,750.00	Y		Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	44.5	$1,756,000.00	Y		Y	Y	Y				
S-AB8	4	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	4	$ 14,000.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	44	$1,341,000.00	Y	Y	Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	44	$1,752,000.00	Y		Y	Y	Y				
S-DD3	15	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	15	$ 54,000.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	55	$1,357,500.00	Y		Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	55	$1,840,000.00	Y		Y	Y	Y				

Stream ID	Width (ft)	Crossing Option	Footage	Cost	Karst Area	15% or Greater Slopes at WOTUS	Aquatic ETS	Trout	Proximity to Private Wells	Cost Effectiveness		Practicable	Most Practicable Option
										Test (300%)	Ratio		
S-G16	30	---	---	---	N	Y	Y	N	N	---	---	---	---
		Open Cut	30	$ 109,500.00	Y	Y	TOY	Y	Y	Y	1.0	TOY	TOY Open Cut
		Bore	70	$1,380,000.00	Y	Y	Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y			Y	Y				
		Tunnel	70	$1,960,000.00	Y			Y	Y				
S-G15	9	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	9	$ 31,500.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	49	$1,348,500.00	Y	Y	Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	49	$1,792,000.00	Y		Y	Y	Y				
S-G13	8	---	---	---	N	Y	Y	N	N	---	---	---	---
		Open Cut	8	$ 28,000.00	Y	Y	TOY	Y	Y	Y	1.0	TOY	TOY Open Cut
		Bore	48	$1,347,000.00	Y		Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y			Y	Y				
		Tunnel	48	$1,784,000.00	Y			Y	Y				
S-D3	10	---	---	---	N	Y	Y	N	N	---	---	---	---
		Open Cut	10	$ 35,000.00	Y	Y	TOY	Y	Y	Y	1.0	TOY	TOY Open Cut
		Bore	50	$1,350,000.00	Y		Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y			Y	Y				
		Tunnel	50	$1,800,000.00	Y			Y	Y				
S-D4	6	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	6	$ 21,000.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	46	$1,344,000.00	Y		Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	46	$1,768,000.00	Y		Y	Y	Y				
S-D2	18	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	18	$ 64,800.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	58	$1,362,000.00	Y		Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	58	$1,864,000.00	Y		Y	Y	Y				
S-D7	8	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	8	$ 28,000.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	48	$1,347,000.00	Y		Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	48	$1,784,000.00	Y		Y	Y	Y				
S-D1-EPH	10	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	10	$ 35,000.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	50	$1,350,000.00	Y	Y	Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	50	$1,800,000.00	Y		Y	Y	Y				

Stream ID	Width (ft)	Crossing Option	Footage	Cost	Karst Area	15% or Greater Slopes at WOTUS	Aquatic ETS	Trout	Proximity to Private Wells	Cost Effectiveness		Practicable	Most Practicable Option
										Test (300%)	Ratio		
S-D1-INT	10	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	10	$ 35,000.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	50	$1,350,000.00	Y	Y	Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	50	$1,800,000.00	Y		Y	Y	Y				
S-G11	6	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	6	$ 21,000.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	46	$1,344,000.00	Y		Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	46	$1,768,000.00	Y		Y	Y	Y				
S-G9	4	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	4	$ 14,000.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	44	$1,341,000.00	Y		Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	44	$1,752,000.00	Y		Y	Y	Y				
S-G8	4	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	4	$ 14,000.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	44	$1,341,000.00	Y		Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	44	$1,752,000.00	Y		Y	Y	Y				
S-Q15	5	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	5	$ 17,500.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	45	$1,342,500.00	Y		Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	45	$1,760,000.00	Y		Y	Y	Y				
S-A5	8	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	8	$ 28,000.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	48	$1,347,000.00	Y		Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	48	$1,784,000.00	Y		Y	Y	Y				
S-A6	5	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	5	$ 17,500.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	45	$1,342,500.00	Y	Y	Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	45	$1,760,000.00	Y		Y	Y	Y				
S-H11-Braid	2	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	2	$ 7,000.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	42	$1,338,000.00	Y		Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	42	$1,736,000.00	Y		Y	Y	Y				

Stream ID	Width (ft)	Crossing Option	Footage	Cost	Karst Area	15% or Greater Slopes at WOTUS	Aquatic ETS	Trout	Proximity to Private Wells	Cost Effectiveness		Practicable	Most Practicable Option
										Test (300%)	Ratio		
S-H11	3	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	3	$ 10,500.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	43	$1,339,500.00	Y		Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	43	$1,744,000.00	Y		Y	Y	Y				
S-H11	3	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	3	$ 10,500.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	43	$1,339,500.00	Y		Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	43	$1,744,000.00	Y		Y	Y	Y				
S-F2	7	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	7	$ 24,500.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	47	$1,345,500.00	Y	Y	Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	47	$1,776,000.00	Y		Y	Y	Y				
S-C7	20	---	---	---	N	Y	Y	N	N	---	---	---	---
		Open Cut	20	$ 72,000.00	Y	Y	TOY	Y	Y	Y	1.0	TOY	TOY Open Cut
		Bore	60	$1,365,000.00	Y	Y	Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y			Y	Y				
		Tunnel	60	$1,880,000.00	Y			Y	Y				
S-E12	3	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	3	$ 10,500.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	43	$1,339,500.00	Y	Y	Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	43	$1,744,000.00	Y		Y	Y	Y				
S-E11 [1]	100	---	---	---	N	Y	Y	N	N	---	---	---	---
		Open Cut	100	$ 420,000.00	Y	Y	TOY	Y	Y	Y	1.0	TOY	TOY Open Cut
		Bore	140	$1,485,000.00	Y		Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y			Y	Y				
		Tunnel	140	$2,520,000.00	Y			Y	Y				
S-H8	6	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	6	$ 21,000.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	46	$1,344,000.00	Y		Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	46	$1,768,000.00	Y		Y	Y	Y				
S-A4	8	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	8	$ 28,000.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	48	$1,347,000.00	Y	Y	Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	48	$1,784,000.00	Y		Y	Y	Y				

Stream ID	Width (ft)	Crossing Option	Footage	Cost	Karst Area	15% or Greater Slopes at WOTUS	Aquatic ETS	Trout	Proximity to Private Wells	Cost Effectiveness		Practicable	Most Practicable Option
										Test (300%)	Ratio		
S-H7	5	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	5	$ 17,500.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	45	$1,342,500.00	Y	Y	Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	45	$1,760,000.00	Y		Y	Y	Y				
S-C3	18	---	---	---	N	Y	Y	N	N	---	---	---	---
		Open Cut	18	$ 64,800.00	Y	Y	TOY	Y	Y	Y	1.0	TOY	TOY Open Cut
		Bore	58	$1,362,000.00	Y	Y	Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y			Y	Y				
		Tunnel	58	$1,864,000.00	Y			Y	Y				
S-H13	20	---	---	---	N	Y	Y	N	N	---	---	---	---
		Open Cut	20	$ 72,000.00	Y	Y	TOY	Y	Y	Y	1.0	TOY	TOY Open Cut
		Bore	60	$1,365,000.00	Y		Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y			Y	Y				
		Tunnel	60	$1,880,000.00	Y			Y	Y				
S-G4	30	---	---	---	N	N	Y	N	N	---	---	---	---
		Open Cut	30	$ 109,500.00	Y	Y	TOY	Y	Y	Y	1.0	TOY	TOY Open Cut
		Bore	70	$1,380,000.00	Y	Y	Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y	Y		Y	Y				
		Tunnel	70	$1,960,000.00	Y	Y		Y	Y				
S-C4	4	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	4	$ 14,000.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	44	$1,341,000.00	Y		Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	44	$1,752,000.00	Y		Y	Y	Y				
S-G6	6	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	6	$ 21,000.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	46	$1,344,000.00	Y		Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	46	$1,768,000.00	Y		Y	Y	Y				
5-G5	6	---	---	---	N	N	N	N	N	---	---	---	---
		Open Cut	6	$ 21,000.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	46	$1,344,000.00	Y	Y	Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y	Y	Y	Y	Y				
		Tunnel	46	$1,768,000.00	Y	Y	Y	Y	Y				
5-G3	9	---	---	---	N	N	N	N	N	---	---	---	---
		Open Cut	9	$ 31,500.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	49	$1,348,500.00	Y	Y	Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y	Y	Y	Y	Y				
		Tunnel	49	$1,792,000.00	Y	Y	Y	Y	Y				

Stream ID	Width (ft)	Crossing Option	Footage	Cost	Karst Area	15% or Greater Slopes at WOTUS	Aquatic ETS	Trout	Proximity to Private Wells	Cost Effectiveness		Practicable	Most Practicable Option
										Test (300%)	Ratio		
S-CC16	11	---	---	---	N	N	N	N	N	---	---	---	---
		Open Cut	11	$ 39,600.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	51	$1,351,500.00	Y	Y	Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y	Y	Y	Y	Y				
		Tunnel	51	$1,808,000.00	Y	Y	Y	Y	Y				
S-CC14	8	---	---	---	N	N	N	N	N	---	---	---	---
		Open Cut	8	$ 28,000.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	48	$1,347,000.00	Y	Y	Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y	Y	Y	Y	Y				
		Tunnel	48	$1,784,000.00	Y	Y	Y	Y	Y				
S-CC13	7	---	---	---	N	N	N	N	N	---	---	---	---
		Open Cut	7	$ 24,500.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	47	$1,345,500.00	Y	Y	Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y	Y	Y	Y	Y				
		Tunnel	47	$1,776,000.00	Y	Y	Y	Y	Y				
S-MM8	6	---	---	---	N	N	N	N	N	---	---	---	---
		Open Cut	6	$ 21,000.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	46	$1,344,000.00	Y	Y	Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y	Y	Y	Y	Y				
		Tunnel	46	$1,768,000.00	Y	Y	Y	Y	Y				
S-CC15	6	---	---	---	N	N	N	N	N	---	---	---	---
		Open Cut	6	$ 21,000.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	46	$1,344,000.00	Y	Y	Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y	Y	Y	Y	Y				
		Tunnel	46	$1,768,000.00	Y	Y	Y	Y	Y				
S-CC8	8	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	8	$ 28,000.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	48	$1,347,000.00	Y	Y	Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	48	$1,784,000.00	Y		Y	Y	Y				
S-CC5	12	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	12	$ 43,200.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	52	$1,353,000.00	Y	Y	Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	52	$1,816,000.00	Y		Y	Y	Y				
5-CCS	12	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	12	$ 43,200.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	52	$1,353,000.00	Y	Y	Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	52	$1,816,000.00	Y		Y	Y	Y				

Stream ID	Width (ft)	Crossing Option	Footage	Cost	Karst Area	15% or Greater Slopes at WOTUS	Aquatic ETS	Trout	Proximity to Private Wells	Cost Effectiveness		Practicable	Most Practicable Option
										Test (300%)	Ratio		
S-CC9	5.5	---	---	---	N	N	N	N	N	---	---	---	---
		Open Cut	5.5	$ 19,250.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	45.5	$1,343,250.00	Y	Y	Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y	Y	Y	Y	Y				
		Tunnel	45.5	$1,764,000.00	Y	Y	Y	Y	Y				
S-CC10	9	---	---	---	N	N	N	N	N	---	---	---	---
		Open Cut	9	$ 31,500.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	49	$1,348,500.00	Y	Y	Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y	Y	Y	Y	Y				
		Tunnel	49	$1,792,000.00	Y	Y	Y	Y	Y				
S-MM10	7	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	7	$ 24,500.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	47	$1,345,500.00	Y	Y	Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	47	$1,776,000.00	Y		Y	Y	Y				
S-CC11	8	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	8	$ 28,000.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	48	$1,347,000.00	Y	Y	Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	48	$1,784,000.00	Y		Y	Y	Y				
S-CC1	15	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	15	$ 54,000.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	55	$1,357,500.00	Y	Y	Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	55	$1,840,000.00	Y		Y	Y	Y				
S-CC3	8	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	8	$ 28,000.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	48	$1,347,000.00	Y	Y	Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	48	$1,784,000.00	Y		Y	Y	Y				
S-P5	5	---	---	---	N	N	N	N	N	---	---	---	---
		Open Cut	5	$ 17,500.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	45	$1,342,500.00	Y	Y	Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y	Y	Y	Y	Y				
		Tunnel	45	$1,760,000.00	Y	Y	Y	Y	Y				
S-IJ35-EPH	4	---	---	---	N	N	N	N	N	---	---	---	---
		Open Cut	4	$ 14,000.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	44	$1,341,000.00	Y	Y	Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y	Y	Y	Y	Y				
		Tunnel	44	$1,752,000.00	Y	Y	Y	Y	Y				

Stream ID	Width (ft)	Crossing Option	Footage	Cost	Karst Area	15% or Greater Slopes at WOTUS	Aquatic ETS	Trout	Proximity to Private Wells	Cost Effectiveness		Practicable	Most Practicable Option
										Test (300%)	Ratio		
S-Q4	5	---	---	---	N	N	N	N	N	---	---	---	---
		Open Cut	5	$ 17,500.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	45	$1,342,500.00	Y	Y	Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y	Y	Y	Y	Y				
		Tunnel	45	$1,760,000.00	Y	Y	Y	Y	Y				
S-Q3	25	---	---	---	N	N	N	N	N	---	---	---	---
		Open Cut	25	$ 91,250.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	65	$1,372,500.00	Y	Y	Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y	Y	Y	Y	Y				
		Tunnel	65	$1,920,000.00	Y	Y	Y	Y	Y				
S-Q2	7	---	---	---	N	N	N	N	N	---	---	---	---
		Open Cut	7	$ 24,500.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	47	$1,345,500.00	Y	Y	Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y	Y	Y	Y	Y				
		Tunnel	47	$1,776,000.00	Y	Y	Y	Y	Y				
S-Q1	4	---	---	---	N	N	N	N	N	---	---	---	---
		Open Cut	4	$ 14,000.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	44	$1,341,000.00	Y	Y	Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y	Y	Y	Y	Y				
		Tunnel	44	$1,752,000.00	Y	Y	Y	Y	Y				
S-B6	10	---	---	---	N	N	N	N	N	---	---	---	---
		Open Cut	10	$ 35,000.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	50	$1,350,000.00	Y	Y	Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y	Y	Y	Y	Y				
		Tunnel	50	$1,800,000.00	Y	Y	Y	Y	Y				
S-B8	4	---	---	---	N	N	N	N	N	---	---	---	---
		Open Cut	4	$ 14,000.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	44	$1,341,000.00	Y	Y	Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y	Y	Y	Y	Y				
		Tunnel	44	$1,752,000.00	Y	Y	Y	Y	Y				
S-B9	7	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	7	$ 24,500.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	47	$1,345,500.00	Y	Y	Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	47	$1,776,000.00	Y		Y	Y	Y				
S-DD4	6	---	---	---	N	N	N	N	N	---	---	---	---
		Open Cut	6	$ 21,000.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	46	$1,344,000.00	Y	Y	Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y	Y	Y	Y	Y				
		Tunnel	46	$1,768,000.00	Y	Y	Y	Y	Y				

Stream ID	Width (ft)	Crossing Option	Footage	Cost	Karst Area	15% or Greater Slopes at WOTUS	Aquatic ETS	Trout	Proximity to Private Wells	Cost Effectiveness		Practicable	Most Practicable Option
										Test (300%)	Ratio		
S-DD4	6	---	---	---	N	N	N	N	N	---	---	---	---
		Open Cut	6	$ 21,000.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	46	$1,344,000.00	Y	Y	Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y	Y	Y	Y	Y				
		Tunnel	46	$1,768,000.00	Y	Y	Y	Y	Y				
S-KL27	1	---	---	---	N	N	N	N	N	---	---	---	---
		Open Cut	1	$ 3,500.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	41	$1,336,500.00	Y	Y	Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y	Y	Y	Y	Y				
		Tunnel	41	$1,728,000.00	Y	Y	Y	Y	Y				
S-C1	6	---	---	---	N	N	N	N	N	---	---	---	---
		Open Cut	6	$ 21,000.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	46	$1,344,000.00	Y	Y	Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y	Y	Y	Y	Y				
		Tunnel	46	$1,768,000.00	Y	Y	Y	Y	Y				
S-G2	7	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	7	$ 24,500.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	47	$1,345,500.00	Y	Y	Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	47	$1,776,000.00	Y		Y	Y	Y				
S-B2	5	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	5	$ 17,500.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	45	$1,342,500.00	Y	Y	Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	45	$1,760,000.00	Y		Y	Y	Y				
S-H55	3	---	---	---	N	N	N	N	N	---	---	---	---
		Open Cut	3	$ 10,500.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	43	$1,339,500.00	Y	Y	Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y	Y	Y	Y	Y				
		Tunnel	43	$1,744,000.00	Y	Y	Y	Y	Y				
S-H54	12	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	12	$ 43,200.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	52	$1,353,000.00	Y	Y	Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	52	$1,816,000.00	Y		Y	Y	Y				
S-GG11	8	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	8	$ 28,000.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	48	$1,347,000.00	Y	Y	Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	48	$1,784,000.00	Y		Y	Y	Y				

Stream ID	Width (ft)	Crossing Option	Footage	Cost	Karst Area	15% or Greater Slopes at WOTUS	Aquatic ETS	Trout	Proximity to Private Wells	Cost Effectiveness		Practicable	Most Practicable Option
										Test (300%)	Ratio		
S-H3	6	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	6	$ 21,000.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	46	$1,344,000.00	Y		Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	46	$1,768,000.00	Y		Y	Y	Y				
S-H5	8	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	8	$ 28,000.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	48	$1,347,000.00	Y	Y	Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	48	$1,784,000.00	Y		Y	Y	Y				
S-OO1	5	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	5	$ 17,500.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	45	$1,342,500.00	Y	Y	Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	45	$1,760,000.00	Y		Y	Y	Y				
S-H44	8	---	---	---	Y	N	N	N	N	---	---	---	---
		Open Cut	8	$ 28,000.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	48	$1,347,000.00	Y	Y	Y	Y	Y				
		HDD	1,250	$3,475,000.00		Y	Y	Y	Y				
		Tunnel	48	$1,784,000.00		Y	Y	Y	Y				
S-H42	5	---	---	---	Y	N	N	N	N	---	---	---	---
		Open Cut	5	$ 17,500.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	45	$1,342,500.00	Y	Y	Y	Y	Y				
		HDD	1,250	$3,475,000.00		Y	Y	Y	Y				
		Tunnel	45	$1,760,000.00		Y	Y	Y	Y				
S-OO2	5	---	---	---	N	N	N	N	N	---	---	---	---
		Open Cut	5	$ 17,500.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	45	$1,342,500.00	Y	Y	Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y	Y	Y	Y	Y				
		Tunnel	45	$1,760,000.00	Y	Y	Y	Y	Y				
S-EF26	20	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	20	$ 72,000.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	60	$1,365,000.00	Y	Y	Y	Y	Y				
		HDD	1,250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	60	$1,880,000.00	Y		Y	Y	Y				

[1] The Federal Energy Regulatory Commission (FERC) recommended in its Final Environmental Impact Statement (June 2017) that MVP utilize an HDD for this crossing. The conclusion reached by FERC differs from this Alternatives Analysis because FERC's analysis employed a materiality different technical feasibility standard, rather than a practicability standard. Due to the length of the bore, impacts to S-E11 also would be avoided by the recommended HDD.

[2] In consultation with the Virginia Department of Historic Resources pursuant to Section 106 of the National Historic Preservation Act, MVP has proposed to utilize a conventional bore to avoid direct impacts to a significant prehistoric resource in the vicinity of S-MM26. Due to the length of the proposed bore, direct impacts to this crossing may not occur if the bore is required to avoid the prehistoric resource and it is completed successfully.

Exhibit 6: Alternatives Analysis Summary (Pipeline Wetland Crossings)

Stream ID	Width (ft)	Crossing Option	Footage	Cost	Karst Area	15% or Greater Slopes at WOTUS	Aquatic ETS	Trout	Proximity to Private Wells	Cost Effectiveness		Practicable	Most Practicable Option
										Test (300%)	Ratio		
W-Z11	21	---	---	---	N	N	N	N	N	---	---	---	---
		Open Cut	21	$ 14,434.60	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	63	$1,368,931.28	Y	Y	Y	Y	Y				
		HDD	1250	$3,475,000.00	Y	Y	Y	Y	Y				
		Tunnel	63	$1,900,966.84	Y	Y	Y	Y	Y				
W-Z3	3	---	---	---	N	N	N	N	N	---	---	---	---
		Open Cut	3	$ 2,395.63	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	47	$1,346,133.49	Y	Y	Y	Y	Y				
		HDD	1250	$3,475,000.00	Y	Y	Y	Y	Y				
		Tunnel	47	$1,779,378.64	Y	Y	Y	Y	Y				
W-CD12	11	---	---	---	Y	Y	N	N	N	---	---	---	---
		Open Cut	11	$ 8,029.81	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	57	$1,361,206.73	Y		Y	Y	Y				
		HDD	1250	$3,475,000.00			Y	Y	Y				
		Tunnel	57	$1,859,769.25			Y	Y	Y				
W-RR1b	11	---	---	---	Y	N	N	N	N	---	---	---	---
		Open Cut	11	$ 7,350.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	59	$1,362,750.00	Y	Y	Y	Y	Y				
		HDD	1250	$3,475,000.00		Y	Y	Y	Y				
		Tunnel	59	$1,868,000.00		Y	Y	Y	Y				
W-IJ46-PEM	20	---	---	---	Y	Y	N	N	N	---	---	---	---
		Open Cut	20	$ 13,869.36	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	70	$1,379,720.06	Y		Y	Y	Y				
		HDD	1250	$3,475,000.00			Y	Y	Y				
		Tunnel	70	$1,958,506.99			Y	Y	Y				
W-NN6	10	---	---	---	N	N	N	N	N	---	---	---	---
		Open Cut	10	$ 7,000.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	62	$1,368,000.00	Y	Y	Y	Y	Y				
		HDD	1250	$3,475,000.00	Y	Y	Y	Y	Y				
		Tunnel	62	$1,896,000.00	Y	Y	Y	Y	Y				
W-PP8	47	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	47	$ 32,900.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	101	$1,426,500.00	Y		Y	Y	Y				
		HDD	1250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	101	$2,208,000.00	Y		Y	Y	Y				

Stream ID	Width (ft)	Crossing Option	Footage	Cost	Karst Area	15% or Greater Slopes at WOTUS	Aquatic ETS	Trout	Proximity to Private Wells	Cost Effectiveness		Practicable	Most Practicable Option
										Test (300%)	Ratio		
W-F9-PFO	43	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	43	$ 30,100.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	99	$1,423,500.00	Y		Y	Y	Y				
		HDD	1250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	99	$2,192,000.00	Y		Y	Y	Y				
W-C12	77	---	---	---	N	N	N	N	N	---	---	---	---
		Open Cut	77	$ 53,900.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	135	$1,477,500.00	Y	Y	Y	Y	Y				
		HDD	1250	$3,475,000.00	Y	Y	Y	Y	Y				
		Tunnel	135	$2,480,000.00	Y	Y	Y	Y	Y				
W-C11	100	---	---	---	N	N	N	N	N	---	---	---	---
		Open Cut	100	$ 70,000.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	160	$1,515,000.00	Y	Y	Y	Y	Y				
		HDD	1250	$3,475,000.00	Y	Y	Y	Y	Y				
		Tunnel	160	$2,680,000.00	Y	Y	Y	Y	Y				
W-C5	26	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	26	$ 18,443.51	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	90	$1,410,521.81	Y		Y	Y	Y				
		HDD	1250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	90	$2,122,782.98	Y		Y	Y	Y				
W-NN8	49	---	---	---	Y	N	N	N	Y	---	---	---	---
		Open Cut	49	$ 34,259.24	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	115	$1,447,412.66	Y	Y	Y	Y	Y				
		HDD	1250	$3,475,000.00		Y	Y	Y					
		Tunnel	115	$2,319,534.21		Y	Y	Y					
W-AB7	9	---	---	---	Y	N	N	N	Y	---	---	---	---
		Open Cut	9	$ 6,468.38	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	77	$1,390,860.80	Y	Y	Y	Y	Y				
		HDD	1250	$3,475,000.00		Y	Y	Y					
		Tunnel	77	$2,017,924.29		Y	Y	Y					
W-CD11	19	---	---	---	Y	Y	N	N	N	---	---	---	---
		Open Cut	19	$ 13,648.15	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	89	$1,409,246.03	Y		Y	Y	Y				
		HDD	1250	$3,475,000.00			Y	Y	Y				
		Tunnel	89	$2,115,978.80			Y	Y	Y				

Stream ID	Width (ft)	Crossing Option	Footage	Cost	Karst Area	15% or Greater Slopes at WOTUS	Aquatic ETS	Trout	Proximity to Private Wells	Cost Effectiveness		Practicable	Most Practicable Option
										Test (300%)	Ratio		
W-EF5-PFO	66	---	---	---	Y	Y	N	N	N	---	---	---	---
		Open Cut	66	$ 46,166.64	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	138	$1,481,928.52	Y		Y	Y	Y				
		HDD	1250	$3,475,000.00			Y	Y	Y				
		Tunnel	138	$2,503,618.75			Y	Y	Y				
W-EF22	48	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	48	$ 33,420.92	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	122	$1,457,616.25	Y		Y	Y	Y				
		HDD	1250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	122	$2,373,953.34	Y		Y	Y	Y				
W-EF21	47	---	---	---	N	N	N	N	Y	---	---	---	---
		Open Cut	47	$ 32,843.92	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	123	$1,459,379.83	Y	Y	Y	Y	Y				
		HDD	1250	$3,475,000.00	Y	Y	Y	Y					
		Tunnel	123	$2,383,359.10	Y	Y	Y	Y					
W-EF19	20	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	20	$ 14,268.12	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	98	$1,422,574.54	Y		Y	Y	Y				
		HDD	1250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	98	$2,187,064.22	Y		Y	Y	Y				
W-IJ93	21	---	---	---	N	N	N	N	N	---	---	---	---
		Open Cut	21	$ 14,700.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	101	$1,426,500.00	Y	Y	Y	Y	Y				
		HDD	1250	$3,475,000.00	Y	Y	Y	Y	Y				
		Tunnel	101	$2,208,000.00	Y	Y	Y	Y	Y				
W-IJ94-PEM	232	---	---	---	N	N	N	N	N	---	---	---	---
		Open Cut	232	$ 162,400.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	314	$1,746,000.00	Y	Y	Y	Y	Y				
		HDD	1250	$3,475,000.00	Y	Y	Y	Y	Y				
		Tunnel	314	$3,912,000.00	Y	Y	Y	Y	Y				
W-IJ94-PSS	51	---	---	---	N	N	N	N	N	---	---	---	---
		Open Cut	51	$ 35,700.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	135	$1,477,500.00	Y	Y	Y	Y	Y				
		HDD	1250	$3,475,000.00	Y	Y	Y	Y	Y				
		Tunnel	135	$2,480,000.00	Y	Y	Y	Y	Y				
W-IJ95-PSS	188	---	---	---	N	N	N	N	N	---	---	---	---
		Open Cut	188	$ 131,600.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	274	$1,686,000.00	Y	Y	Y	Y	Y				
		HDD	1250	$3,475,000.00	Y	Y	Y	Y	Y				
		Tunnel	274	$3,592,000.00	Y	Y	Y	Y	Y				

Stream ID	Width (ft)	Crossing Option	Footage	Cost	Karst Area	15% or Greater Slopes at WOTUS	Aquatic ETS	Trout	Proximity to Private Wells	Cost Effectiveness		Practicable	Most Practicable Option
										Test (300%)	Ratio		
W-IJ102	42	---	---	---	N	N	N	N	N	---	---	---	---
		Open Cut	42	$ 29,400.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	130	$1,470,000.00	Y	Y	Y	Y	Y				
		HDD	1250	$3,475,000.00	Y	Y	Y	Y	Y				
		Tunnel	130	$2,440,000.00	Y	Y	Y	Y	Y				
W-IJ105	14	---	---	---	N	N	N	N	N	---	---	---	---
		Open Cut	14	$ 9,800.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	104	$1,431,000.00	Y	Y	Y	Y	Y				
		HDD	1250	$3,475,000.00	Y	Y	Y	Y	Y				
		Tunnel	104	$2,232,000.00	Y	Y	Y	Y	Y				
W-IJ100	40	---	---	---	N	N	N	N	N	---	---	---	---
		Open Cut	40	$ 28,000.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	132	$1,473,000.00	Y	Y	Y	Y	Y				
		HDD	1250	$3,475,000.00	Y	Y	Y	Y	Y				
		Tunnel	132	$2,456,000.00	Y	Y	Y	Y	Y				
W-IJ101	3	---	---	---	N	N	N	N	N	---	---	---	---
		Open Cut	3	$ 2,100.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	97	$1,420,500.00	Y	Y	Y	Y	Y				
		HDD	1250	$3,475,000.00	Y	Y	Y	Y	Y				
		Tunnel	97	$2,176,000.00	Y	Y	Y	Y	Y				
W-KL17	29	---	---	---	N	Y	N	N	Y	---	---	---	---
		Open Cut	29	$ 20,008.37	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	125	$1,461,875.08	Y		Y	Y	Y				
		HDD	1250	$3,475,000.00	Y		Y	Y					
		Tunnel	125	$2,396,667.08	Y		Y	Y					
W-EF42	10	---	---	---	N	N	N	N	N	---	---	---	---
		Open Cut	10	$ 7,000.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	112	$1,443,000.00	Y	Y	Y	Y	Y				
		HDD	1250	$3,475,000.00	Y	Y	Y	Y	Y				
		Tunnel	112	$2,296,000.00	Y	Y	Y	Y	Y				

Stream ID	Width (ft)	Crossing Option	Footage	Cost	Karst Area	15% or Greater Slopes at WOTUS	Aquatic ETS	Trout	Proximity to Private Wells	Cost Effectiveness		Practicable	Most Practicable Option
										Test (300%)	Ratio		
W-AB6-PEM-2	197	---	---	---	N	N	N	N	N	---	---	---	---
		Open Cut	197	$ 137,645.49	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	301	$1,725,954.62	Y	Y	Y	Y	Y				
		HDD	1250	$3,475,000.00	Y	Y	Y	Y	Y				
		Tunnel	301	$3,805,091.32	Y	Y	Y	Y	Y				
W-AB6-PFO-1	23	---	---	---	N	N	N	N	N	---	---	---	---
		Open Cut	23	$ 15,930.65	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	129	$1,468,137.12	Y	Y	Y	Y	Y				
		HDD	1250	$3,475,000.00	Y	Y	Y	Y	Y				
		Tunnel	129	$2,430,064.62	Y	Y	Y	Y	Y				
W-AB6-PEM-1	47	---	---	---	N	N	N	N	N	---	---	---	---
		Open Cut	47	$ 32,952.91	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	155	$1,507,613.39	Y	Y	Y	Y	Y				
		HDD	1250	$3,475,000.00	Y	Y	Y	Y	Y				
		Tunnel	155	$2,640,604.72	Y	Y	Y	Y	Y				
W-AB6-PSS	44	---	---	---	N	N	N	N	N	---	---	---	---
		Open Cut	44	$ 30,870.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	154	$1,506,150.00	Y	Y	Y	Y	Y				
		HDD	1250	$3,475,000.00	Y	Y	Y	Y	Y				
		Tunnel	154	$2,632,800.00	Y	Y	Y	Y	Y				
W-AB5	15	---	---	---	N	N	N	N	N	---	---	---	---
		Open Cut	15	$ 10,500.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	127	$1,465,500.00	Y	Y	Y	Y	Y				
		HDD	1250	$3,475,000.00	Y	Y	Y	Y	Y				
		Tunnel	127	$2,416,000.00	Y	Y	Y	Y	Y				
W-AB3-PEM-2	95	---	---	---	N	N	N	N	N	---	---	---	---
		Open Cut	95	$ 66,727.15	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	209	$1,588,986.75	Y	Y	Y	Y	Y				
		HDD	1250	$3,475,000.00	Y	Y	Y	Y	Y				
		Tunnel	209	$3,074,595.99	Y	Y	Y	Y	Y				
W-EF46	57	---	---	---	N	Y	N	N	Y	---	---	---	---
		Open Cut	57	$ 39,849.40	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	173	$1,534,391.56	Y		Y	Y	Y				
		HDD	1250	$3,475,000.00	Y		Y	Y					
		Tunnel	173	$2,783,421.66	Y		Y	Y					
W-KL48-P5S-1	27	---	---	---	N	N	N	N	N	---	---	---	---
		Open Cut	27	$ 18,900.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	145	$1,492,500.00	Y	Y	Y	Y	Y				
		HDD	1250	$3,475,000.00	Y	Y	Y	Y	Y				
		Tunnel	145	$2,560,000.00	Y	Y	Y	Y	Y				

Stream ID	Width (ft)	Crossing Option	Footage	Cost	Karst Area	15% or Greater Slopes at WOTUS	Aquatic ETS	Trout	Proximity to Private Wells	Cost Effectiveness		Practicable	Most Practicable Option
										Test (300%)	Ratio		
W-KL48-PEM	22	---	---	---	N	N	N	N	N	---	---	---	---
		Open Cut	22	$ 15,400.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	142	$1,488,000.00	Y	Y	Y	Y	Y				
		HDD	1250	$3,475,000.00	Y	Y	Y	Y	Y				
		Tunnel	142	$2,536,000.00	Y	Y	Y	Y	Y				
W-KL48-PSS-2	120	---	---	---	N	N	N	N	N	---	---	---	---
		Open Cut	120	$ 84,000.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	242	$1,638,000.00	Y	Y	Y	Y	Y				
		HDD	1250	$3,475,000.00	Y	Y	Y	Y	Y				
		Tunnel	242	$3,336,000.00	Y	Y	Y	Y	Y				
W-KL50	19	---	---	---	N	N	N	N	N	---	---	---	---
		Open Cut	19	$ 13,300.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	143	$1,489,500.00	Y	Y	Y	Y	Y				
		HDD	1250	$3,475,000.00	Y	Y	Y	Y	Y				
		Tunnel	143	$2,544,000.00	Y	Y	Y	Y	Y				
W-KL49	32	---	---	---	N	N	N	N	N	---	---	---	---
		Open Cut	32	$ 22,400.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	158	$1,512,000.00	Y	Y	Y	Y	Y				
		HDD	1250	$3,475,000.00	Y	Y	Y	Y	Y				
		Tunnel	158	$2,664,000.00	Y	Y	Y	Y	Y				
W-KLS1-PEM	17	---	---	---	N	N	N	N	N	---	---	---	---
		Open Cut	17	$ 11,900.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	145	$1,492,500.00	Y	Y	Y	Y	Y				
		HDD	1250	$3,475,000.00	Y	Y	Y	Y	Y				
		Tunnel	145	$2,560,000.00	Y	Y	Y	Y	Y				
W-KLS1-PSS	31	---	---	---	N	N	N	N	N	---	---	---	---
		Open Cut	31	$ 21,700.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	161	$1,516,500.00	Y	Y	Y	Y	Y				
		HDD	1250	$3,475,000.00	Y	Y	Y	Y	Y				
		Tunnel	161	$2,688,000.00	Y	Y	Y	Y	Y				
W-MN7-PEM	25	---	---	---	N	N	N	N	N	---	---	---	---
		Open Cut	25	$ 17,500.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	157	$1,510,500.00	Y	Y	Y	Y	Y				
		HDD	1250	$3,475,000.00	Y	Y	Y	Y	Y				
		Tunnel	157	$2,656,000.00	Y	Y	Y	Y	Y				
W-EF44	4	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	4	$ 3,056.78	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	138	$1,482,550.25	Y		Y	Y	Y				
		HDD	1250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	138	$2,506,934.67	Y		Y	Y	Y				

Stream ID	Width (ft)	Crossing Option	Footage	Cost	Karst Area	15% or Greater Slopes at WOTUS	Aquatic ETS	Trout	Proximity to Private Wells	Cost Effectiveness		Practicable	Most Practicable Option
										Test (300%)	Ratio		
W-IJ36	253	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	253	$ 177,064.32	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	389	$1,858,423.55	Y		Y	Y	Y				
		HDD	1250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	389	$4,511,592.26	Y		Y	Y	Y				
W-Y2	22	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	22	$ 15,070.68	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	160	$1,514,294.31	Y		Y	Y	Y				
		HDD	1250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	160	$2,676,236.33	Y		Y	Y	Y				
W-KL2	7	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	7	$ 4,900.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	147	$1,495,500.00	Y		Y	Y	Y				
		HDD	1250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	147	$2,576,000.00	Y		Y	Y	Y				
W-B25-PEM-1	103	---	---	---	N	N	N	N	N	---	---	---	---
		Open Cut	103	$ 71,911.91	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	245	$1,642,096.94	Y	Y	Y	Y	Y				
		HDD	1250	$3,475,000.00	Y	Y	Y	Y	Y				
		Tunnel	245	$3,357,850.36	Y	Y	Y	Y	Y				
W-B25-PSS-2	223	---	---	---	N	N	N	N	N	---	---	---	---
		Open Cut	223	$ 156,357.42	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	367	$1,826,051.62	Y	Y	Y	Y	Y				
		HDD	1250	$3,475,000.00	Y	Y	Y	Y	Y				
		Tunnel	367	$4,338,941.98	Y	Y	Y	Y	Y				
W-B24-PSS	92	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	92	$ 64,077.64	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	238	$1,631,309.23	Y		Y	Y	Y				
		HDD	1250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	238	$3,300,315.90	Y		Y	Y	Y				
W-B24-PEM	60	---	---	---	N	N	N	N	N	---	---	---	---
		Open Cut	60	$ 41,744.38	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	208	$1,586,452.25	Y	Y	Y	Y	Y				
		HDD	1250	$3,475,000.00	Y	Y	Y	Y	Y				
		Tunnel	208	$3,061,078.68	Y	Y	Y	Y	Y				
W-ST2-PEM	65	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	65	$ 45,500.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	215	$1,597,500.00	Y		Y	Y	Y				
		HDD	1250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	215	$3,120,000.00	Y		Y	Y	Y				

Stream ID	Width (ft)	Crossing Option	Footage	Cost	Karst Area	15% or Greater Slopes at WOTUS	Aquatic ETS	Trout	Proximity to Private Wells	Cost Effectiveness		Practicable	Most Practicable Option
										Test (300%)	Ratio		
W-EF11	9	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	9	$ 6,300.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	161	$1,516,500.00	Y		Y	Y	Y				
		HDD	1250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	161	$2,688,000.00	Y		Y	Y	Y				
W-D6	8	---	---	---	N	N	N	N	N	---	---	---	---
		Open Cut	8	$ 5,600.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	162	$1,518,000.00	Y	Y	Y	Y	Y				
		HDD	1250	$3,475,000.00	Y	Y	Y	Y	Y				
		Tunnel	162	$2,696,000.00	Y	Y	Y	Y	Y				
W-D7-PEM	49	---	---	---	N	N	N	N	N	---	---	---	---
		Open Cut	49	$ 34,300.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	205	$1,582,500.00	Y	Y	Y	Y	Y				
		HDD	1250	$3,475,000.00	Y	Y	Y	Y	Y				
		Tunnel	205	$3,040,000.00	Y	Y	Y	Y	Y				
W-IJ70-PSS	128	---	---	---	N	N	N	N	N	---	---	---	---
		Open Cut	128	$ 89,600.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	286	$1,704,000.00	Y	Y	Y	Y	Y				
		HDD	1250	$3,475,000.00	Y	Y	Y	Y	Y				
		Tunnel	286	$3,688,000.00	Y	Y	Y	Y	Y				
W-IJ70-PFO-2	52	---	---	---	N	N	N	N	N	---	---	---	---
		Open Cut	52	$ 36,400.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	212	$1,593,000.00	Y	Y	Y	Y	Y				
		HDD	1250	$3,475,000.00	Y	Y	Y	Y	Y				
		Tunnel	212	$3,096,000.00	Y	Y	Y	Y	Y				
W-IJ67	12	---	---	---	N	N	N	N	N	---	---	---	---
		Open Cut	12	$ 8,400.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	174	$1,536,000.00	Y	Y	Y	Y	Y				
		HDD	1250	$3,475,000.00	Y	Y	Y	Y	Y				
		Tunnel	174	$2,792,000.00	Y	Y	Y	Y	Y				
W-IJ71	31	---	---	---	N	N	N	N	N	---	---	---	---
		Open Cut	31	$ 21,700.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	195	$1,567,500.00	Y	Y	Y	Y	Y				
		HDD	1250	$3,475,000.00	Y	Y	Y	Y	Y				
		Tunnel	195	$2,960,000.00	Y	Y	Y	Y	Y				
W-IJ1	27	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	27	$ 19,221.30	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	193	$1,565,188.50	Y		Y	Y	Y				
		HDD	1250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	193	$2,947,672.02	Y		Y	Y	Y				

Stream ID	Width (ft)	Crossing Option	Footage	Cost	Karst Area	15% or Greater Slopes at WOTUS	Aquatic ETS	Trout	Proximity to Private Wells	Cost Effectiveness		Practicable	Most Practicable Option
										Test (300%)	Ratio		
W-IJ2-PSS	3	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	3	$ 2,206.84	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	171	$1,531,728.94	Y		Y	Y	Y				
		HDD	1250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	171	$2,769,221.02	Y		Y	Y	Y				
W-IJ2-PEM	11	---	---	---	N	N	N	N	N	---	---	---	---
		Open Cut	11	$ 7,632.28	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	181	$1,546,354.89	Y	Y	Y	Y	Y				
		HDD	1250	$3,475,000.00	Y	Y	Y	Y	Y				
		Tunnel	181	$2,847,226.09	Y	Y	Y	Y	Y				
W-GH2	24	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	24	$ 16,884.62	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	196	$1,569,181.33	Y		Y	Y	Y				
		HDD	1250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	196	$2,968,967.11	Y		Y	Y	Y				
W-II8	13	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	13	$ 9,344.81	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	187	$1,556,024.59	Y		Y	Y	Y				
		HDD	1250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	187	$2,898,797.81	Y		Y	Y	Y				
W-IJ6	7	---	---	---	N	N	N	N	N	---	---	---	---
		Open Cut	7	$ 5,024.37	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	183	$1,549,766.51	Y	Y	Y	Y	Y				
		HDD	1250	$3,475,000.00	Y	Y	Y	Y	Y				
		Tunnel	183	$2,865,421.38	Y	Y	Y	Y	Y				
W-E7	8	---	---	---	N	N	N	N	N	---	---	---	---
		Open Cut	8	$ 5,813.02	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	186	$1,554,456.48	Y	Y	Y	Y	Y				
		HDD	1250	$3,475,000.00	Y	Y	Y	Y	Y				
		Tunnel	186	$2,890,434.53	Y	Y	Y	Y	Y				
W-E8	65	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	65	$ 45,627.51	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	245	$1,642,773.24	Y		Y	Y	Y				
		HDD	1250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	245	$3,361,457.28	Y		Y	Y	Y				
W-EF51	23	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	23	$ 16,100.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	205	$1,582,500.00	Y		Y	Y	Y				
		HDD	1250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	205	$3,040,000.00	Y		Y	Y	Y				

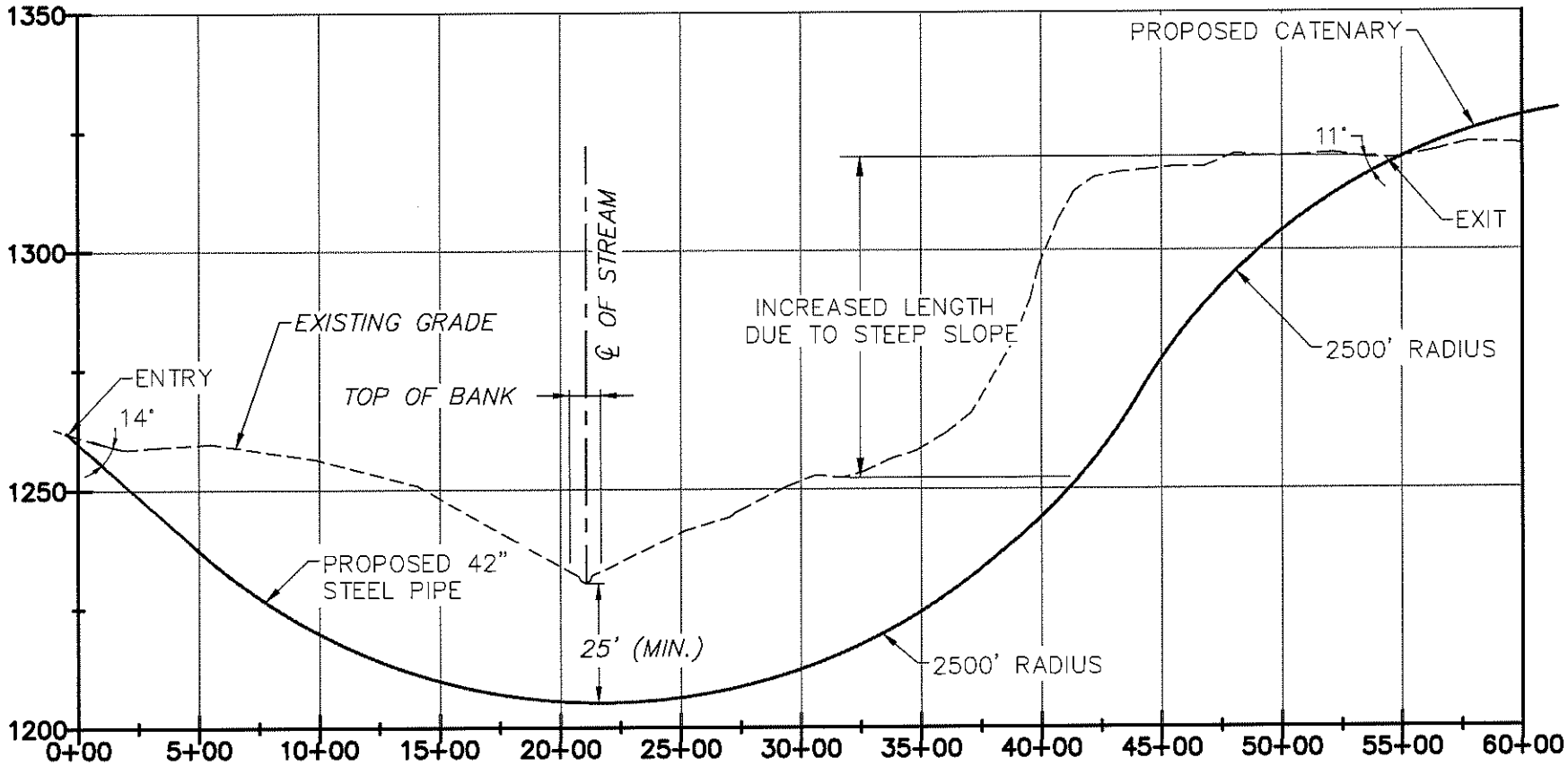
Stream ID	Width (ft)	Crossing Option	Footage	Cost	Karst Area	15% or Greater Slopes at WOTUS	Aquatic ETS	Trout	Proximity to Private Wells	Cost Effectiveness		Practicable	Most Practicable Option
										Test (300%)	Ratio		
W-KL43b	6	---	---	---	N	N	N	N	N	---	---	---	---
		Open Cut	6	$ 4,200.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	190	$1,560,000.00	Y	Y	Y	Y	Y				
		HDD	1250	$3,475,000.00	Y	Y	Y	Y	Y				
		Tunnel	190	$2,920,000.00	Y	Y	Y	Y	Y				
W-CD6	75	---	---	---	N	N	N	N	N	---	---	---	---
		Open Cut	75	$ 52,585.92	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	261	$1,666,684.10	Y	Y	Y	Y	Y				
		HDD	1250	$3,475,000.00	Y	Y	Y	Y	Y				
		Tunnel	261	$3,488,981.89	Y	Y	Y	Y	Y				
W-CD5	66	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	66	$ 46,528.87	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	254	$1,656,704.71	Y		Y	Y	Y				
		HDD	1250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	254	$3,435,758.46	Y		Y	Y	Y				
W-EF48	16	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	16	$ 10,895.42	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	206	$1,583,347.34	Y		Y	Y	Y				
		HDD	1250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	206	$3,044,519.13	Y		Y	Y	Y				
W-CD1	69	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	69	$ 48,572.18	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	261	$1,667,083.25	Y		Y	Y	Y				
		HDD	1250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	261	$3,491,110.66	Y		Y	Y	Y				
W-DD1	24	---	---	---	N	N	N	N	N	---	---	---	---
		Open Cut	24	$ 16,814.39	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	218	$1,602,030.83	Y	Y	Y	Y	Y				
		HDD	1250	$3,475,000.00	Y	Y	Y	Y	Y				
		Tunnel	218	$3,144,164.42	Y	Y	Y	Y	Y				
W-A12-PFO	24	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	24	$ 16,800.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	220	$1,605,000.00	Y		Y	Y	Y				
		HDD	1250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	220	$3,160,000.00	Y		Y	Y	Y				
W-GH16	173	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	173	$ 121,225.86	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	371	$1,831,769.70	Y		Y	Y	Y				
		HDD	1250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	371	$4,369,438.42	Y		Y	Y	Y				

Stream ID	Width (ft)	Crossing Option	Footage	Cost	Karst Area	15% or Greater Slopes at WOTUS	Aquatic ETS	Trout	Proximity to Private Wells	Cost Effectiveness		Practicable	Most Practicable Option
										Test (300%)	Ratio		
W-H17	84	---	---	---	N	N	N	N	N	---	---	---	---
		Open Cut	84	$ 58,689.63	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	284	$1,700,763.48	Y	Y	Y	Y	Y				
		HDD	1250	$3,475,000.00	Y	Y	Y	Y	Y				
		Tunnel	284	$3,670,738.58	Y	Y	Y	Y	Y				
W-H11	40	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	40	$ 27,943.89	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	242	$1,637,879.76	Y		Y	Y	Y				
		HDD	1250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	242	$3,335,358.73	Y		Y	Y	Y				
W-H16	53	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	53	$ 37,100.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	257	$1,660,500.00	Y		Y	Y	Y				
		HDD	1250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	257	$3,456,000.00	Y		Y	Y	Y				
W-H14	23	---	---	---	N	N	N	N	N	---	---	---	---
		Open Cut	23	$ 16,100.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	229	$1,618,500.00	Y	Y	Y	Y	Y				
		HDD	1250	$3,475,000.00	Y	Y	Y	Y	Y				
		Tunnel	229	$3,232,000.00	Y	Y	Y	Y	Y				
W-A8	33	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	33	$ 23,100.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	241	$1,636,500.00	Y		Y	Y	Y				
		HDD	1250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	241	$3,328,000.00	Y		Y	Y	Y				
W-H15	1	---	---	---	N	N	N	N	N	---	---	---	---
		Open Cut	1	$ 700.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	211	$1,591,500.00	Y	Y	Y	Y	Y				
		HDD	1250	$3,475,000.00	Y	Y	Y	Y	Y				
		Tunnel	211	$3,088,000.00	Y	Y	Y	Y	Y				
W-H9	4	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	4	$ 3,144.22	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	216	$1,599,737.61	Y		Y	Y	Y				
		HDD	1250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	216	$3,131,933.94	Y		Y	Y	Y				
W-H6	20	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	20	$ 14,000.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	234	$1,626,000.00	Y		Y	Y	Y				
		HDD	1250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	234	$3,272,000.00	Y		Y	Y	Y				

Stream ID	Width (ft)	Crossing Option	Footage	Cost	Karst Area	15% or Greater Slopes at WOTUS	Aquatic ETS	Trout	Proximity to Private Wells	Cost Effectiveness		Practicable	Most Practicable Option
										Test (300%)	Ratio		
W-D3	2	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	2	$ 1,331.06	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	218	$1,601,852.27	Y		Y	Y	Y				
		HDD	1250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	218	$3,143,212.08	Y		Y	Y	Y				
W-MM17	4	---	---	---	N	N	N	N	N	---	---	---	---
		Open Cut	4	$ 3,032.95	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	222	$1,608,499.17	Y	Y	Y	Y	Y				
		HDD	1250	$3,475,000.00	Y	Y	Y	Y	Y				
		Tunnel	222	$3,178,662.24	Y	Y	Y	Y	Y				
W-B5	14	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	14	$ 9,800.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	234	$1,626,000.00	Y		Y	Y	Y				
		HDD	1250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	234	$3,272,000.00	Y		Y	Y	Y				
W-B4-PSS	23	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	23	$ 16,100.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	245	$1,642,500.00	Y		Y	Y	Y				
		HDD	1250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	245	$3,360,000.00	Y		Y	Y	Y				
W-A4#	27	---	---	---	N	N	N	N	N	---	---	---	---
		Open Cut	27	$ 18,900.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	251	$1,651,500.00	Y	Y	Y	Y	Y				
		HDD	1250	$3,475,000.00	Y	Y	Y	Y	Y				
		Tunnel	251	$3,408,000.00	Y	Y	Y	Y	Y				
W-C1	42	---	---	---	N	N	N	N	N	---	---	---	---
		Open Cut	42	$ 29,400.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	268	$1,677,000.00	Y	Y	Y	Y	Y				
		HDD	1250	$3,475,000.00	Y	Y	Y	Y	Y				
		Tunnel	268	$3,544,000.00	Y	Y	Y	Y	Y				
W-H5	121	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	121	$ 84,676.37	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	349	$1,798,449.35	Y		Y	Y	Y				
		HDD	1250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	349	$4,191,729.89	Y		Y	Y	Y				
W-B3	11	---	---	---	N	N	N	N	N	---	---	---	---
		Open Cut	11	$ 7,700.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	241	$1,636,500.00	Y	Y	Y	Y	Y				
		HDD	1250	$3,475,000.00	Y	Y	Y	Y	Y				
		Tunnel	241	$3,328,000.00	Y	Y	Y	Y	Y				

Stream ID	Width (ft)	Crossing Option	Footage	Cost	Karst Area	15% or Greater Slopes at WOTUS	Aquatic ETS	Trout	Proximity to Private Wells	Cost Effectiveness		Practicable	Most Practicable Option
										Test (300%)	Ratio		
W-CC2-PEM	37	---	---	---	N	N	N	N	N	---	---	---	---
		Open Cut	37	$ 25,900.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	269	$1,678,500.00	Y	Y	Y	Y	Y				
		HDD	1250	$3,475,000.00	Y	Y	Y	Y	Y				
		Tunnel	269	$3,552,000.00	Y	Y	Y	Y	Y				
W-MM5	16	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	16	$ 11,046.73	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	250	$1,649,671.55	Y		Y	Y	Y				
		HDD	1250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	250	$3,398,248.29	Y		Y	Y	Y				
W-MM9	1	---	---	---	N	N	N	N	N	---	---	---	---
		Open Cut	1	$ 702.93	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	237	$1,630,506.28	Y	Y	Y	Y	Y				
		HDD	1250	$3,475,000.00	Y	Y	Y	Y	Y				
		Tunnel	237	$3,296,033.52	Y	Y	Y	Y	Y				
W-MM8-PEM	84	---	---	---	N	N	N	N	N	---	---	---	---
		Open Cut	84	$ 58,803.42	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	322	$1,758,007.32	Y	Y	Y	Y	Y				
		HDD	1250	$3,475,000.00	Y	Y	Y	Y	Y				
		Tunnel	322	$3,976,039.06	Y	Y	Y	Y	Y				
W-MM8-PFO	57	---	---	---	N	N	N	N	N	---	---	---	---
		Open Cut	57	$ 39,900.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	297	$1,720,500.00	Y	Y	Y	Y	Y				
		HDD	1250	$3,475,000.00	Y	Y	Y	Y	Y				
		Tunnel	297	$3,776,000.00	Y	Y	Y	Y	Y				
W-Q2	260	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	260	$ 181,988.55	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	502	$2,027,975.47	Y		Y	Y	Y				
		HDD	1250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	502	$5,415,869.17	Y		Y	Y	Y				
W-Q1	4	---	---	---	N	N	N	N	N	---	---	---	---
		Open Cut	4	$ 2,806.67	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	248	$1,647,014.29	Y	Y	Y	Y	Y				
		HDD	1250	$3,475,000.00	Y	Y	Y	Y	Y				
		Tunnel	248	$3,384,076.23	Y	Y	Y	Y	Y				
W-G2	72	---	---	---	N	N	N	N	N	---	---	---	---
		Open Cut	72	$ 50,460.25	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	318	$1,752,129.12	Y	Y	Y	Y	Y				
		HDD	1250	$3,475,000.00	Y	Y	Y	Y	Y				
		Tunnel	318	$3,944,688.62	Y	Y	Y	Y	Y				

Stream ID	Width (ft)	Crossing Option	Footage	Cost	Karst Area	15% or Greater Slopes at WOTUS	Aquatic ETS	Trout	Proximity to Private Wells	Cost Effectiveness		Practicable	Most Practicable Option
										Test (300%)	Ratio		
W-H1	54	---	---	---	N	N	N	N	N	---	---	---	---
		Open Cut	54	$ 37,800.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	302	$1,728,000.00	Y	Y	Y	Y	Y				
		HDD	1250	$3,475,000.00	Y	Y	Y	Y	Y				
		Tunnel	302	$3,816,000.00	Y	Y	Y	Y	Y				
W-EF6	121	---	---	---	N	N	N	N	N	---	---	---	---
		Open Cut	121	$ 84,741.16	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	371	$1,831,588.20	Y	Y	Y	Y	Y				
		HDD	1250	$3,475,000.00	Y	Y	Y	Y	Y				
		Tunnel	371	$4,368,470.41	Y	Y	Y	Y	Y				
W-H2	560	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	560	$ 391,778.32	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	812	$2,492,524.96	Y		Y	Y	Y				
		HDD	1250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	812	$7,893,466.46	Y		Y	Y	Y				
W-IJ21	24	---	---	---	N	N	N	N	N	---	---	---	---
		Open Cut	24	$ 16,800.00	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	278	$1,692,000.00	Y	Y	Y	Y	Y				
		HDD	1250	$3,475,000.00	Y	Y	Y	Y	Y				
		Tunnel	278	$3,624,000.00	Y	Y	Y	Y	Y				
W-H3	28	---	---	---	N	N	N	N	N	---	---	---	---
		Open Cut	28	$ 19,752.79	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	284	$1,701,327.42	Y	Y	Y	Y	Y				
		HDD	1250	$3,475,000.00	Y	Y	Y	Y	Y				
		Tunnel	284	$3,673,746.22	Y	Y	Y	Y	Y				
W-MM3	33	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	33	$ 23,072.75	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	291	$1,711,441.61	Y		Y	Y	Y				
		HDD	1250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	291	$3,727,688.58	Y		Y	Y	Y				
W-IJ22-PEM	229	---	---	---	N	N	N	N	N	---	---	---	---
		Open Cut	229	$ 160,513.98	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	489	$2,008,958.54	Y	Y	Y	Y	Y				
		HDD	1250	$3,475,000.00	Y	Y	Y	Y	Y				
		Tunnel	489	$5,314,445.52	Y	Y	Y	Y	Y				
W-IJ22-PFO	8	---	---	---	N	Y	N	N	N	---	---	---	---
		Open Cut	8	$ 5,718.07	Y	Y	Y	Y	Y	Y	1.0	TRUE	Open Cut
		Bore	270	$1,680,253.01	Y		Y	Y	Y				
		HDD	1250	$3,475,000.00	Y		Y	Y	Y				
		Tunnel	270	$3,561,349.39	Y		Y	Y	Y				



Mountain Valley PIPELINE

STEEP SLOPE EFFECT ON BORE LENGTH

MOUNTAIN VALLEY PIPELINE PROJECT – LEDPA EVALUATION
EXHIBIT A

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

TETRA TECH

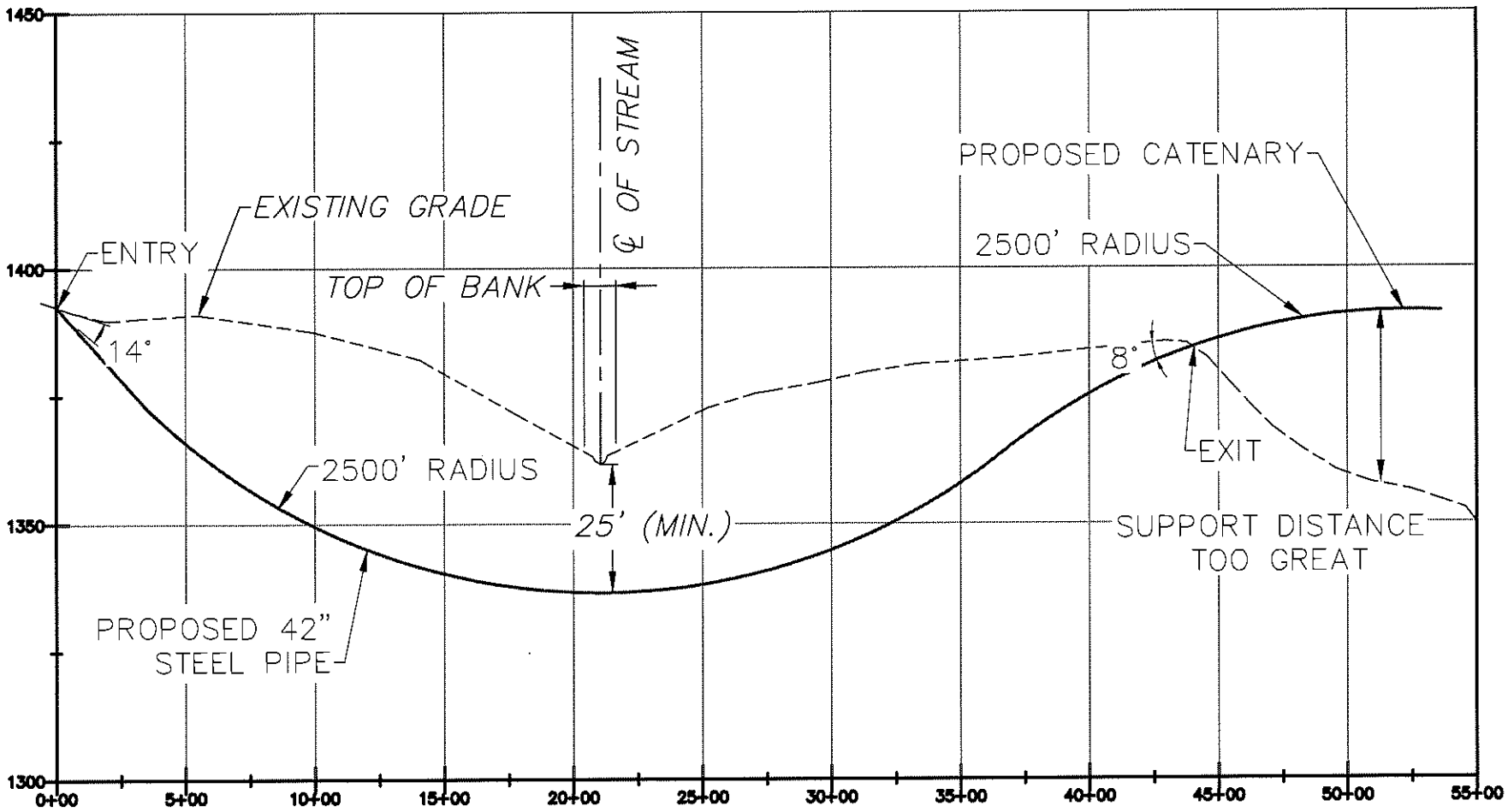
661 ANDERSEN DRIVE
FOSTER PLAZA 7
PITTSBURGH, PA 15220

REVISIONS:

MO.	DATE	DWN.	CHKD.	APPD.	DESCRIPTION

DRAWN BY: NF
CHECKED BY: DZ
APPROVED BY: RE
DATE: 01/19/2017
SCALE: NOT TO SCALE
A REVISION
SHT. NO. OF

P:\Projects (After 8-23-13)\2015 Projects\EQT\MVP - LEDPA Evaluation 112IC0757\Engineering\Civil Environmental\Exhibits\DWG\CATENARY.dwg PLT NICK FLANDERS 2/17/2017 9:34:36 AM



Mountain Valley

STEEP SLOPE EFFECT ON PULLBACK CATENARY HEIGHT

MOUNTAIN VALLEY PIPELINE PROJECT – LEDPA EVALUATION

EXHIBIT B

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

TETRA TECH

661 ANDERSEN DRIVE
FOSTER PLAZA 7
PITTSBURGH, PA 15220

DRAWN BY:	NF
CHECKED BY:	DZ
APPROVED BY:	RE
DATE:	01/19/2017
SCALE:	NOT TO SCALE
SHT. NO.	OF

REVISIONS

NO. | DATE | DWN. | CHKD. | APPD. | DESCRIPTION

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