Baseline Assessment – Stream Attributes

Reach S-C3 (Timber Mat Crossing)
Perennial
Spread I
Pittsylvania County, Virginia

Data	Included
Photos	✓
SWVM Form	✓
FCI Calculator and HGM Form	N/A – Perennial stream (not shadeable)
RBP Physical Characteristics Form	✓
Water Quality Data	✓
RBP Habitat Form	✓
RBP Benthic Form	✓
Benthic Identification Sheet	✓
Wolman Pebble Count	✓
RiverMorph Data Sheet	✓
USM Form (Virginia Only)	✓
Longitudinal Profile and Cross Sections	✓

Spread I Stream S-C3 (Timber Mat Crossing) Pittsylvania County

Photo Type: US LB VIEW
Downstream at LOD looking SW upstream standing on the left bank, BH

Photo Type: DS COND
Downstream at LOD looking N downstream, BH

Spread I Stream S-C3 (Timber Mat Crossing) Pittsylvania County

Photo Type: LB CL
On thalweg at pipe centerline looking SE at left streambank, BH

Photo Type: RB CL
On thalweg at pipe centerline looking W at right streambank, BH

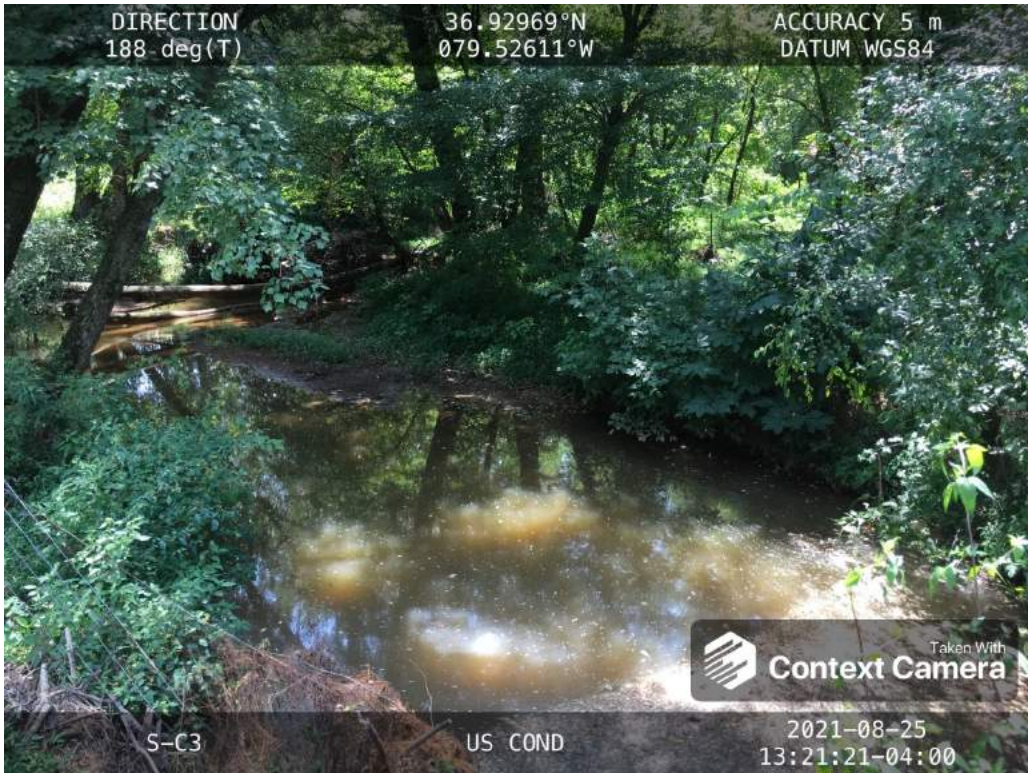


Photo Type: US COND
Upstream at LOD looking S upstream, BH

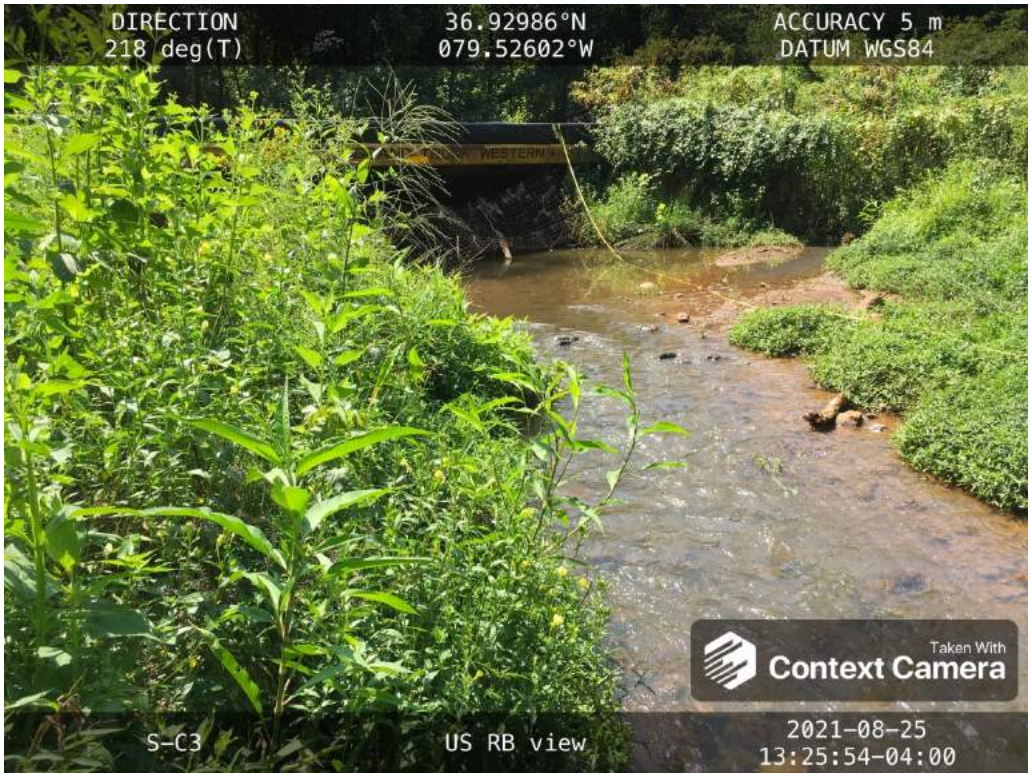


Photo Type: US RB VIEW
Downstream at LOD looking SW upstream standing on the right bank, BH

Spread I Stream S-C3 (Timber Mat Crossing) Pittsylvania County

Photo Type: DS LB VIEW
Upstream at LOD looking NE downstream standing on left bank, BH

Photo Type: DS RB VIEW
Upstream at LOD looking NW downstream standing on right bank, BH

USACE FILE NO./ Project Name: (v2.1, Sept 2015)	Mountain Valley Pipeline	IMPACT COORDINATES: (in Decimal Degrees)	Lat.	36.929762	Lon.	-79.526109	WEATHER:	Sunny, 10% Cloud Cover	DATE:	8/25/2021
IMPACT STREAM/SITE ID AND SITE DESCRIPTION: (watershed size (acreage), unaltered or impairments)	S-C3/4898.61 ac	MITIGATION STREAM CLASS./SITE ID AND SITE DESCRIPTION: (watershed size (acreage), unaltered or impairments)							Comments:	
STREAM IMPACT LENGTH:	20	FORM OF MITIGATION:	RESTORATION (Levels I-III)	MIT COORDINATES: (in Decimal Degrees)	Lat.		Lon.		PRECIPITATION PAST 48 HRS:	None	Mitigation Length:	

Column No. 1- Impact Existing Condition (Debit)			
Stream Classification:	Perennial		
Percent Stream Channel Slope			1.84
HGM Score (attach data forms):			
			Average
Hydrology			0
Biogeochemical Cycling			
Habitat			
PART I - Physical, Chemical and Biological Indicators			
	Points Scale	Range	Site Score
PHYSICAL INDICATOR (Applies to all streams classifications)			
USEPA RBP (High Gradient Data Sheet)			
1. Epifaunal Substrate/Available Cover	0-20	0-1	18
2. Embeddedness	0-20		16
3. Velocity/ Depth Regime	0-20		14
4. Sediment Deposition	0-20		7
5. Channel Flow Status	0-20		17
6. Channel Alteration	0-20		19
7. Frequency of Riffles (or bends)	0-20		17
8. Bank Stability (LB & RB)	0-20		14
9. Vegetative Protection (LB & RB)	0-20		15
10. Riparian Vegetative Zone Width (LB & RB)	0-20		12
Total RBP Score	Suboptimal		149
Sub-Total			0.745
CHEMICAL INDICATOR (Applies to Intermittent and Perennial Streams)			
WVDEP Water Quality Indicators (General)			
Specific Conductivity			
<=99 - 90 points	0-90	0-1	66.6
pH			
6.0-8.0 = 80 points	0-80		6.88
DO			
<5.0 = 10 points	10-30		4.68
Sub-Total			0.9
BIOLOGICAL INDICATOR (Applies to Intermittent and Perennial Streams)			
WV Stream Condition Index (WVSCI)			
Poor	0-100	0-1	34.8
Sub-Total			0.248

PART II - Index and Unit Score		
Index	Linear Feet	Unit Score
0.631	20	12.62

Column No. 2- Mitigation Existing Condition - Baseline (Credit)			
Stream Classification:			
Percent Stream Channel Slope			
HGM Score (attach data forms):			
			Average
Hydrology			0
Biogeochemical Cycling			
Habitat			
PART I - Physical, Chemical and Biological Indicators			
	Points Scale	Range	Site Score
PHYSICAL INDICATOR (Applies to all streams classifications)			
USEPA RBP (Low Gradient Data Sheet)			
1. Epifaunal Substrate/Available Cover	0-20	0-1	
2. Pool Substrate Characterization	0-20		
3. Pool Variability	0-20		
4. Sediment Deposition	0-20		
5. Channel Flow Status	0-20		
6. Channel Alteration	0-20		
7. Channel Sinuosity	0-20		
8. Bank Stability (LB & RB)	0-20		
9. Vegetative Protection (LB & RB)	0-20		
10. Riparian Vegetative Zone Width (LB & RB)	0-20		
Total RBP Score	Poor		0
Sub-Total			0
CHEMICAL INDICATOR (Applies to Intermittent and Perennial Streams)			
WVDEP Water Quality Indicators (General)			
Specific Conductivity			
	0-90	0-1	
pH			
	5-90		
DO			
	10-30		
Sub-Total			0
BIOLOGICAL INDICATOR (Applies to Intermittent and Perennial Streams)			
WV Stream Condition Index (WVSCI)			
	0-100	0-1	
Sub-Total			0

PART II - Index and Unit Score		
Index	Linear Feet	Unit Score
0	0	0

Column No. 3- Mitigation Projected at Five Years Post Completion (Credit)			
Stream Classification:	0		
Percent Stream Channel Slope			0
HGM Score (attach data forms):			
			Average
Hydrology			0
Biogeochemical Cycling			
Habitat			
PART I - Physical, Chemical and Biological Indicators			
	Points Scale	Range	Site Score
PHYSICAL INDICATOR (Applies to all streams classifications)			
USEPA RBP (High Gradient Data Sheet)			
1. Epifaunal Substrate/Available Cover	0-20	0-1	
2. Embeddedness	0-20		
3. Velocity/ Depth Regime	0-20		
4. Sediment Deposition	0-20		
5. Channel Flow Status	0-20		
6. Channel Alteration	0-20		
7. Frequency of Riffles (or bends)	0-20		
8. Bank Stability (LB & RB)	0-20		
9. Vegetative Protection (LB & RB)	0-20		
10. Riparian Vegetative Zone Width (LB & RB)	0-20		
Total RBP Score	Poor		0
Sub-Total			0
CHEMICAL INDICATOR (Applies to Intermittent and Perennial Streams)			
WVDEP Water Quality Indicators (General)			
Specific Conductivity			
	0-90	0-1	
pH			
	5-90		
DO			
	10-30		
Sub-Total			0
BIOLOGICAL INDICATOR (Applies to Intermittent and Perennial Streams)			
WV Stream Condition Index (WVSCI)			
	0-100	0-1	
Sub-Total			0

PART II - Index and Unit Score		
Index	Linear Feet	Unit Score
0	0	0

Column No. 4- Mitigation Projected at Ten Years Post Completion (Credit)			
Stream Classification:	0		
Percent Stream Channel Slope			0
HGM Score (attach data forms):			
			Average
Hydrology			0
Biogeochemical Cycling			
Habitat			
PART I - Physical, Chemical and Biological Indicators			
	Points Scale	Range	Site Score
PHYSICAL INDICATOR (Applies to all streams classifications)			
USEPA RBP (High Gradient Data Sheet)			
1. Epifaunal Substrate/Available Cover	0-20	0-1	
2. Embeddedness	0-20		
3. Velocity/ Depth Regime	0-20		
4. Sediment Deposition	0-20		
5. Channel Flow Status	0-20		
6. Channel Alteration	0-20		
7. Frequency of Riffles (or bends)	0-20		
8. Bank Stability (LB & RB)	0-20		
9. Vegetative Protection (LB & RB)	0-20		
10. Riparian Vegetative Zone Width (LB & RB)	0-20		
Total RBP Score	Poor		0
Sub-Total			0
CHEMICAL INDICATOR (Applies to Intermittent and Perennial Streams)			
WVDEP Water Quality Indicators (General)			
Specific Conductivity			
	0-90	0-1	
pH			
	5-90		
DO			
	10-30		
Sub-Total			0
BIOLOGICAL INDICATOR (Applies to Intermittent and Perennial Streams)			
WV Stream Condition Index (WVSCI)			
	0-100	0-1	
Sub-Total			0

PART II - Index and Unit Score		
Index	Linear Feet	Unit Score
0	0	0

Column No. 5- Mitigation Projected at Maturity (Credit)			
Stream Classification:	0		
Percent Stream Channel Slope			0
HGM Score (attach data forms):			
			Average
Hydrology			0
Biogeochemical Cycling			
Habitat			
PART I - Physical, Chemical and Biological Indicators			
	Points Scale	Range	Site Score
PHYSICAL INDICATOR (Applies to all streams classifications)			
USEPA RBP (High Gradient Data Sheet)			
1. Epifaunal Substrate/Available Cover	0-20	0-1	
2. Embeddedness	0-20		
3. Velocity/ Depth Regime	0-20		
4. Sediment Deposition	0-20		
5. Channel Flow Status	0-20		
6. Channel Alteration	0-20		
7. Frequency of Riffles (or bends)	0-20		
8. Bank Stability (LB & RB)	0-20		
9. Vegetative Protection (LB & RB)	0-20		
10. Riparian Vegetative Zone Width (LB & RB)	0-20		
Total RBP Score	Poor		0
Sub-Total			0
CHEMICAL INDICATOR (Applies to Intermittent and Perennial Streams)			
WVDEP Water Quality Indicators (General)			
Specific Conductivity			
	0-90	0-1	
pH			
	5-90		
DO			
	10-30		
Sub-Total			0
BIOLOGICAL INDICATOR (Applies to Intermittent and Perennial Streams)			
WV Stream Condition Index (WVSCI)			
	0-100	0-1	
Sub-Total			0

PART II - Index and Unit Score		
Index	Linear Feet	Unit Score
0	0	0

PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET (FRONT)

STREAM NAME S-C3	LOCATION Pittsylvania County, Spread I	
STATION # _____ RIVERMILE 289.85	STREAM CLASS Perennial	
LAT 36.929762 LONG -79.526109	RIVER BASIN Banister	
STORET #	AGENCY VADEQ	
INVESTIGATORS CB, BH		
FORM COMPLETED BY BH	DATE 8/25/21 TIME 12:50	REASON FOR SURVEY Baseline Assessment

WEATHER CONDITIONS

Now		Past 24 hours
	storm (heavy rain)	
	rain (steady rain)	
	showers (intermittent)	
10 %	%cloud cover	____ %
☑	clear/sunny	☑

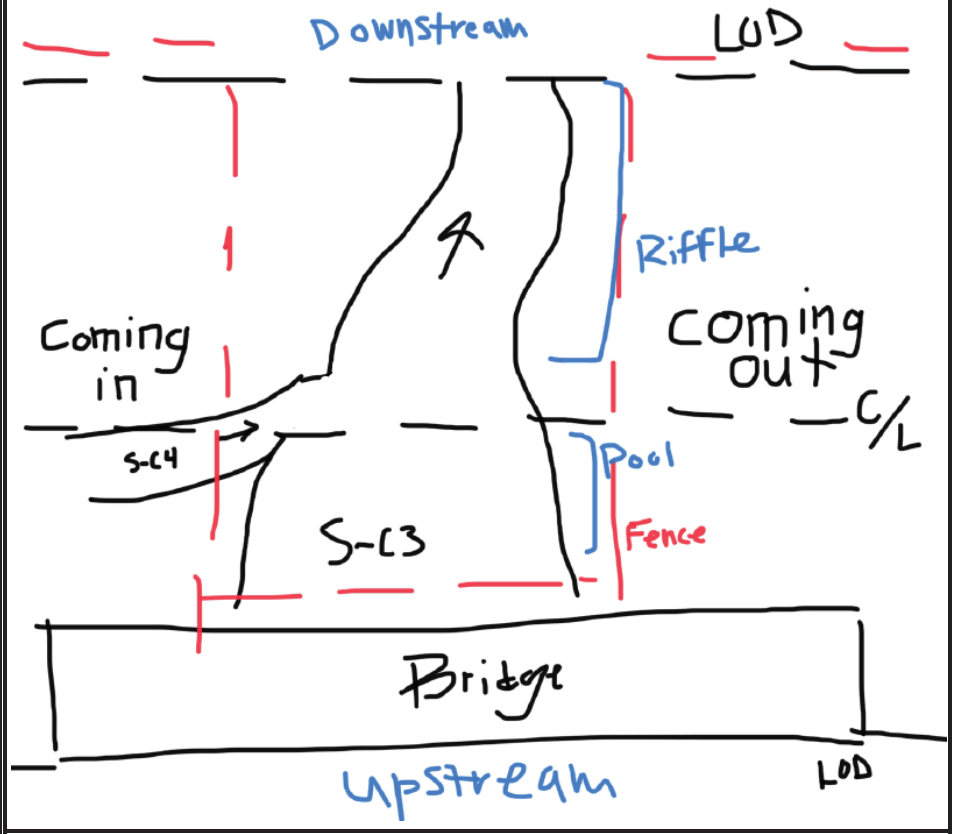
Has there been a heavy rain in the last 7 days? ☑ Yes ☐ No

Air Temperature 32 ^{0} C

Other _____

SITE LOCATION/MAP

Draw a map of the site and indicate the areas sampled (or attach a photograph)



STREAM CHARACTERIZATION

Stream Subsystem
☑ Perennial ☐ Intermittent ☐ Tidal

Stream Type
☐ Coldwater ☑ Warmwater

Stream Origin
☐ Glacial
☐ Non-glacial montane
☐ Swamp and bog
☐ Spring-fed
☐ Mixture of origins
☑ Other _____

Catchment Area 19.83 km^2

PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET (BACK)

WATERSHED FEATURES

Predominant Surrounding Landuse
☐ Forest ☐ Commercial
☑ Field/Pasture ☐ Industrial
☐ Agricultural ☐ Other _____
☐ Residential

Local Watershed NPS Pollution
☐ No evidence ☑ Some potential sources
☐ Obvious sources

Local Watershed Erosion
☐ None ☑ Moderate ☐ Heavy

RIPARIAN VEGETATION (18 meter buffer)

Indicate the dominant type and record the dominant species present
☐ Trees ☐ Shrubs ☑ Grasses ☐ Herbaceous

Dominant species present Unknown

INSTREAM FEATURES

Estimated Reach Length 15.24 m

Estimated Stream Width 4.87 m

Sampling Reach Area 74.21 m^2

Area in km^2 (m^2x1000) N/A km^2

Estimated Stream Depth 0.45 m

Surface Velocity (at thalweg) _____ m/sec

Canopy Cover
☑ Partly open ☐ Partly shaded ☐ Shaded

High Water Mark 0.55 m

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

Channelized ☐ Yes ☑ No

Dam Present ☐ Yes ☑ No

LARGE WOODY DEBRIS

LWD 3.5 m^2

Density of LWD N/A m^2/km^2 **(LWD/ reach area)** N/A

AQUATIC VEGETATION

Indicate the dominant type and record the dominant species present
☑ Rooted emergent ☑ Rooted submergent ☐ Rooted floating ☐ Free floating
☐ Floating Algae ☑ Attached Algae

Dominant species present _____

Portion of the reach with aquatic vegetation 90 %

WATER QUALITY

Temperature 26.1/26.2 ^{0} C

Specific Conductance 66.6 D 66.7 U ms/cm

Dissolved Oxygen 4.68 D 4.92 U mg/L

pH 6.88 D 7.02 U su

Turbidity N/A

WQ Instrument Used YSI

Water Odors
☐ Normal/None ☐ Sewage
☐ Petroleum ☐ Chemical
☐ Fishy ☑ Other Cows access stream

Water Surface Oils
☐ Slick ☑ Sheen ☐ Globs Flecks
☐ None ☐ Other _____

Turbidity (if not measured)
☐ Clear ☐ Slightly turbid ☑ Turbid
☐ Opaque ☐ Stained ☐ Other _____

SEDIMENT/ SUBSTRATE

Odors
☐ Normal ☐ Sewage ☐ Petroleum
☐ Chemical ☐ Anaerobic ☐ None
☑ Other Cows have access to sream

Oils
☑ Absent ☐ Slight ☐ Moderate ☐ Profuse

Deposits
☐ Sludge ☐ Sawdust ☐ Paper fiber ☑ Sand
☐ Relict shells ☐ Other _____

Looking at stones which are not deeply embedded, are the undersides black in color?
☑ Yes ☐ No

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		0	Detritus	sticks, wood, coarse plant materials (CPOM)	10
Boulder	> 256 mm (10")	0			
Cobble	64-256 mm (2.5"-10")	30	Muck-Mud	black, very fine organic (FPOM)	0
Gravel	2-64 mm (0.1"-2.5")	57			
Sand	0.06-2mm (gritty)	13	Marl	grey, shell fragments	0
Silt	0.004-0.06 mm	0			
Clay	< 0.004 mm (slick)	0			

HABITAT ASSESSMENT FIELD DATA SHEET - HG - USE ON ALL STREAMS (FRONT)

STREAM NAME S-C3	LOCATION Pittsylvania County, Spread I	
STATION # _____ RIVERMILE 289.85	STREAM CLASS Perennial	
LAT 36.929762 LONG -79.526109	RIVER BASIN Banister	
STORET #	AGENCY VADEQ	
INVESTIGATORS CB, BH		
FORM COMPLETED BY BH	DATE 8/25/21 TIME 12:50 AM PM	REASON FOR SURVEY Baseline Assessment

	Habitat Parameter	Condition Category			
		Optimal	Suboptimal	Marginal	Poor
Parameters to be evaluated in sampling reach	**1. Epifaunal Substrate/ Available Cover**	Greater than 70% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	40-70% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
	SCORE 18	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
	2. Embeddedness	Gravel, cobble, and boulder particles are 0-25% surrounded by fine sediment. Layering of cobble provides diversity of niche space.	Gravel, cobble, and boulder particles are 25-50% surrounded by fine sediment.	Gravel, cobble, and boulder particles are 50-75% surrounded by fine sediment.	Gravel, cobble, and boulder particles are more than 75% surrounded by fine sediment.
	SCORE 16	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
	3. Velocity/Depth Regime	All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow). (Slow is < 0.3 m/s, deep is > 0.5 m.)	Only 3 of the 4 regimes present (if fast-shallow is missing, score lower than if missing other regimes).	Only 2 of the 4 habitat regimes present (if fast-shallow or slow-shallow are missing, score low).	Dominated by 1 velocity/ depth regime (usually slow-deep).
	SCORE 14	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
	4. Sediment Deposition	Little or no enlargement of islands or point bars and less than 5% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 5-30% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 30-50% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 50% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
	SCORE 7	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
	5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
	SCORE 17	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

HABITAT ASSESSMENT FIELD DATA SHEET—HIGH GRADIENT STREAMS (BACK)

	Habitat Parameter	Condition Category			
		Optimal	**Suboptimal**	**Marginal**	**Poor**
Parameters to be evaluated broader than sampling reach	**6. Channel Alteration**	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
	SCORE 19	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
	7. Frequency of Riffles (or bends)	Occurrence of riffles relatively frequent; ratio of distance between riffles divided by width of the stream <7:1 (generally 5 to 7); variety of habitat is key. In streams where riffles are continuous, placement of boulders or other large, natural obstruction is important.	Occurrence of riffles infrequent; distance between riffles divided by the width of the stream is between 7 to 15.	Occasional riffle or bend; bottom contours provide some habitat; distance between riffles divided by the width of the stream is between 15 to 25.	Generally all flat water or shallow riffles; poor habitat; distance between riffles divided by the width of the stream is a ratio of >25.
	SCORE 17	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
	8. Bank Stability (score each bank) Note: determine left or right side by facing downstream.	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
	SCORE 8	Left Bank 10 9	8 7 6	5 4 3	2 1 0
	SCORE 6	Right Bank 10 9	8 7 6	5 4 3	2 1 0
	9. Vegetative Protection (score each bank)	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
	SCORE 7	Left Bank 10 9	8 7 6	5 4 3	2 1 0
	SCORE 8	Right Bank 10 9	8 7 6	5 4 3	2 1 0
	10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.
	SCORE 8	Left Bank 10 9	8 7 6	5 4 3	2 1 0
	SCORE 4	Right Bank 10 9	8 7 6	5 4 3	2 1 0

Total Score 149

BENTHIC MACROINVERTEBRATE FIELD DATA SHEET

STREAM NAME S-C3	LOCATION Pittsylvania County	
STATION #_____ RIVERMILE_____	STREAM CLASS Perennial	
LAT 36.929762 LONG -79.526109	RIVER BASIN Upper Roanoke	
STORET #	AGENCY VADEQ	
INVESTIGATORS ES, NF		LOT NUMBER
FORM COMPLETED BY NF	DATE 09/08/21 TIME 1:30pm	REASON FOR SURVEY Baseline Assessment

HABITAT TYPES	**Indicate the percentage of each habitat type present** ☑ Cobble 80 % ☐ Snags_____% ☑ Vegetated Banks 20 % ☐ Sand_____% ☐ Submerged Macrophytes_____% ☐ Other ( )_____%
SAMPLE COLLECTION	**Gear used** ☐ D-frame ☑ kick-net ☐ Other _____ **How were the samples collected?** ☑ wading ☐ from bank ☐ from boat **Indicate the number of jabs/kicks taken in each habitat type.** ☑ Cobble 4 ☐ Snags_____ ☐ Vegetated Banks_____ ☐ Sand_____ ☐ Submerged Macrophytes_____ ☐ Other ( )_____
GENERAL COMMENTS	4 kicks in riffle habitat

QUALITATIVE LISTING OF AQUATIC BIOTA
Indicate estimated abundance: 0 = Absent/Not Observed, 1 = Rare, 2 = Common, 3= Abundant, 4 = Dominant

Periphyton	0	1	2	3	4	Slimes	0	1	2	3	4
Filamentous Algae	0	1	2	3	4	Macroinvertebrates	0	1	2	3	4
Macrophytes	0	1	2	3	4	Fish	0	1	2	3	4

FIELD OBSERVATIONS OF MACROBENTHOS
Indicate estimated abundance: 0 = Absent/Not Observed, 1 = Rare (1-3 organisms), 2 = Common (3-9 organisms), 3= Abundant (>10 organisms), 4 = Dominant (>50 organisms)

Porifera	0	1	2	3	4	Anisoptera	0	1	2	3	4	Chironomidae	0	1	2	3	4
Hydrozoa	0	1	2	3	4	Zygoptera	0	1	2	3	4	Ephemeroptera	0	1	2	3	4
Platyhelminthes	0	1	2	3	4	Hemiptera	0	1	2	3	4	Trichoptera	0	1	2	3	4
Turbellaria	0	1	2	3	4	Coleoptera	0	1	2	3	4	Other	0	1	2	3	4
Hirudinea	0	1	2	3	4	Lepidoptera	0	1	2	3	4						
Oligochaeta	0	1	2	3	4	Sialidae	0	1	2	3	4						
Isopoda	0	1	2	3	4	Corydalidae	0	1	2	3	4						
Amphipoda	0	1	2	3	4	Tipulidae	0	1	2	3	4						
Decapoda	0	1	2	3	4	Empididae	0	1	2	3	4						
Gastropoda	0	1	2	3	4	Simuliidae	0	1	2	3	4						
Bivalvia	0	1	2	3	4	Tabinidae	0	1	2	3	4						
						Culcidae	0	1	2	3	4						

Mountain Valley Pipeline
Data are not adjusted for subsampling

EcoANALYSTS, INC.
LIFE IN WATER

		Sample ID	S-C3
		Collection Date	09-08-2021
ORDER	**GENUS/SPECIES**		**COUNT**
Trichoptera	Cheumatopsyche sp.		15
Trichoptera	Hydropsyche sp.		19
Diptera-Chironomidae	Chironomus sp.		1
Diptera-Chironomidae	Cricotopus sp.		15
Diptera-Chironomidae	Cryptochironomus sp.		1
Diptera-Chironomidae	Dicrotendipes sp.		1
Diptera-Chironomidae	Glyptotendipes sp.		22
Diptera-Chironomidae	Microtendipes sp.		5
Diptera-Chironomidae	Nanocladius sp.		1
Diptera-Chironomidae	Polypedilum sp.		11
Diptera-Chironomidae	Rheocricotopus sp.		1
Diptera-Chironomidae	Rheotanytarsus sp.		6
Diptera-Chironomidae	Tanytarsus sp.		4
Diptera-Chironomidae	Thienemanniella sp.		1
Diptera-Chironomidae	Thienemannimyia gr. sp.		12
Diptera-Chironomidae	Xenochironomus xenolabis		1
Annelida	Enchytraeidae		2
Annelida	Naididae		3
Annelida	tubificoid Naididae w/o cap setae		65
Gastropoda	Physa sp.		1
Other Organisms	Turbellaria		28
		TOTAL	**215**

Mountain Valley Pipeline
WV SCI Metrics

EcoANALYSTS, INC.
LIFE IN WATER

Sample ID	S-C3
Collection Date	09-08-2021
WVSCI Metric Values	
Total taxa	6
EPT taxa	1
% EPT	15.8
% Chironomidae	38.1
% 2 Dominant	69.8
HBI	6.78
WVSCI Metric Scores	
Total taxa	28.6
EPT taxa	7.7
% EPT	17.2
% Chironomidae	62.5
% 2 Dominant	47.2
HBI	45.3
WVSCI Metric Scores	
Total taxa	28.6
EPT taxa	7.7
% EPT	17.2
% Chironomidae	62.5
% 2 Dominant	47.2
HBI	45.3
WVSCI Total Score	**34.8**

WVSCI Thresholds
Unimpaired = > 68.00
Gray Zone = 60.61 to 68.00
Impaired = <60.61

WOLMAN PEBBLE COUNT FORM

County: Pittslyvania
Stream Name: Harpen Creek
HUC Code: 03010101
Survey Date: 8/25/2021
Surveyors: Tt CB BH
Type: Representative

Stream ID: S-C3
Basin: Upper Roanoke

PEBBLE COUNT							
Inches	PARTICLE	Millimeters		Particle Count	**Total #**	**Item %**	**% Cum**
	Silt/Clay	< .062	S/C		0	0.00	0.00
	Very Fine	.062-.125	SAND		0	0.00	0.00
	Fine	.125-.25			1	1.00	1.00
	Medium	.25-.5			0	0.00	1.00
	Coarse	.50-1.0			2	2.00	3.00
.04-.08	Very Coarse	1.0-2			10	10.00	13.00
.08 -.16	Very Fine	2 -4	GRAVEL		19	19.00	32.00
.16 - .22	Fine	4 -5.7			5	5.00	37.00
.22 - .31	Fine	5.7 - 8			3	3.00	40.00
.31 - .44	Medium	8 -11.3			2	2.00	42.00
.44 - .63	Medium	11.3 - 16			7	7.00	49.00
.63 - .89	Coarse	16 -22.6			5	5.00	54.00
.89 - 1.26	Coarse	22.6 - 32			7	7.00	61.00
1.26 - 1.77	Vry Coarse	32 - 45			3	3.00	64.00
1.77 -2.5	Vry Coarse	45 - 64			6	6.00	70.00
2.5 - 3.5	Small	64 - 90	COBBLE		13	13.00	83.00
3.5 - 5.0	Small	90 - 128			9	9.00	92.00
5.0 - 7.1	Large	128 - 180			8	8.00	100.00
7.1 - 10.1	Large	180 - 256			0	0.00	100.00
10.1 - 14.3	Small	256 - 362	BOULDER		0	0.00	100.00
14.3 - 20	Small	362 - 512			0	0.00	100.00
20 - 40	Medium	512 - 1024			0	0.00	100.00
40 - 80	Large	1024 -2048			0	0.00	100.00
80 - 160	Vry Large	2048 -4096			0	0.00	100.00
	Bedrock		BDRK		0	0.00	100.00
				Totals:	100		
	Total Tally:						

RIVERMORPH PARTICLE SUMMARY

River Name: Harpen Creek
Reach Name: S-C3
Sample Name: Representative
Survey Date: 08/25/2021

Size (mm)	TOT #	ITEM %	CUM %
0 - 0.062	0	0.00	0.00
0.062 - 0.125	0	0.00	0.00
0.125 - 0.25	1	1.00	1.00
0.25 - 0.50	0	0.00	1.00
0.50 - 1.0	2	2.00	3.00
1.0 - 2.0	10	10.00	13.00
2.0 - 4.0	19	19.00	32.00
4.0 - 5.7	5	5.00	37.00
5.7 - 8.0	3	3.00	40.00
8.0 - 11.3	2	2.00	42.00
11.3 - 16.0	7	7.00	49.00
16.0 - 22.6	5	5.00	54.00
22.6 - 32.0	7	7.00	61.00
32 - 45	3	3.00	64.00
45 - 64	6	6.00	70.00
64 - 90	13	13.00	83.00
90 - 128	9	9.00	92.00
128 - 180	8	8.00	100.00
180 - 256	0	0.00	100.00
256 - 362	0	0.00	100.00
362 - 512	0	0.00	100.00
512 - 1024	0	0.00	100.00
1024 - 2048	0	0.00	100.00
Bedrock	0	0.00	100.00

D16 (mm)	2.32
D35 (mm)	5.02
D50 (mm)	17.32
D84 (mm)	94.22
D95 (mm)	147.5
D100 (mm)	180
Silt/Clay (%)	0
Sand (%)	13
Gravel (%)	57
Cobble (%)	30
Boulder (%)	0
Bedrock (%)	0

Total Particles = 100.

Stream Assessment Form (Form 1)

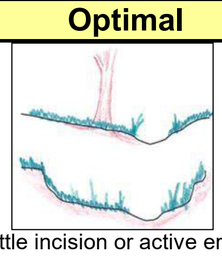
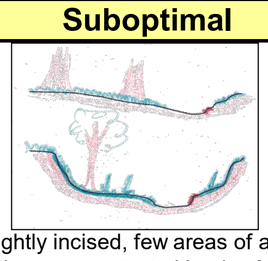
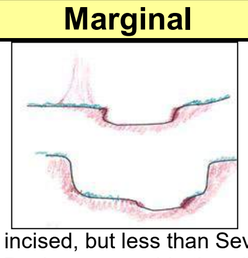
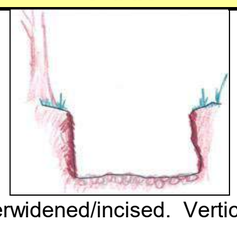
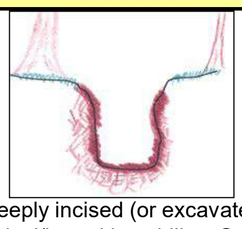
Unified Stream Methodology for use in Virginia

For use in wadeable channels classified as intermittent or perennial, Assessment is limited to areas within the temporary ROW.

Project #	Project Name (Applicant)	Locality	Cowardin Class.	HUC	Date	SAR #	Impact Length	Impact Factor
22865.06	Mountain Valley Pipeline (Mountain Valley Pipeline, LLC)	Pittslyvania	R3	03010101	8/25/21	S-C3	20	1

Name(s) of Evaluator(s)	Stream Name and Information	SAR Length
CB, BH	Harpen Creek	85

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 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% 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- banks. Vegetative protection present on 20-40% of banks, and is insufficient to prevent erosion. 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 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. than 80% of stream bed is covered by deposition, contributing to instability. Multiple thread channels and/or subterranean flow.	CI
Scores	3	2.4	2	1.6	1	2.40
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>>
Riparian Buffers	Tree stratum (dbh > 3 inches) present, with > 60% tree canopy cover. 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% to 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	
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>	70%	30%					100%
	Score >	0.5	0.75					
Left Bank	% Riparian Area>	40%	60%					100%
	Score >	0.5	0.75					

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

Rt Bank CI >	0.58	CI
Lt Bank CI >	0.65	0.61

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	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.	Stream Gradient	CI
Scores	1.5	1.2	0.9	0.5	High / Low	1.50

Stream Impact Assessment Form Page 2

Project #	Project Name (Applicant)	Locality	Cowardin Class.	HUC	Date	SAR #	Impact Length	Impact Factor
22865.06	Mountain Valley Pipeline (Mountain Valley Pipeline, LLC)	Pittslyvania	R3	03010101	8/25/21	S-C3	20	1

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

	Conditional Category						NOTES>>	
	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.		CI
Scores	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) >>	**1.12**

RCI= (Sum of all CI's)/5, except if stream is ephemeral RCI = (Riparian CI/2)

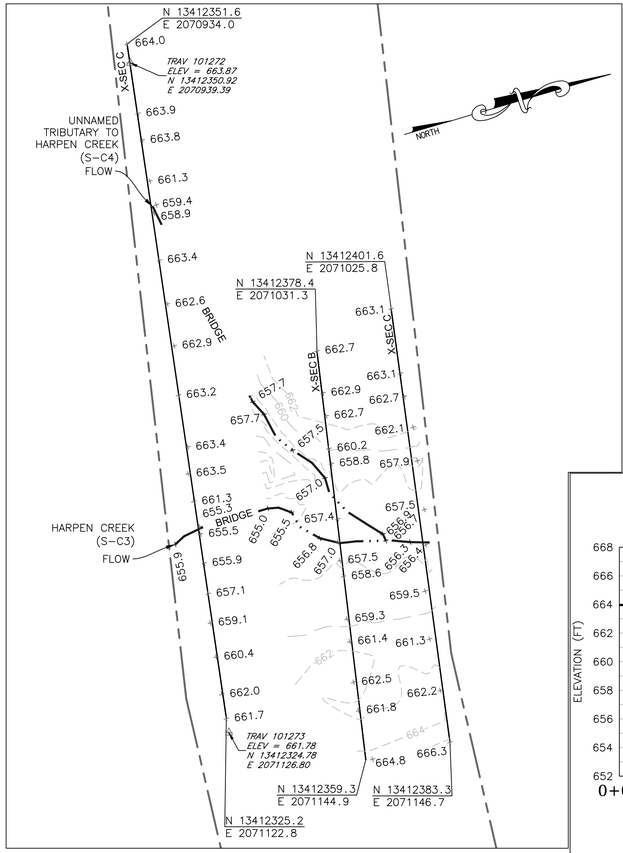
COMPENSATION REQUIREMENT (CR) >>	**22**

CR = RCI X L_I X IF

INSERT PHOTOS:

DESCRIBE PROPOSED IMPACT:

PROVIDED UNDER SEPARATE COVER

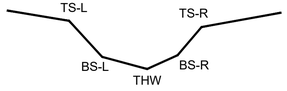


GRAPHIC SCALE

20 0 10 20 40 80

(IN FEET)
1 inch = 20 ft.

TYPICAL 5-POINT CROSS-SECTION



TS: TOP OF SLOPE
BS: BOTTOM OF SLOPE
THW: THALWEG (INVERT)

CL STAKEOUT POINTS: S-C3 & S-C4 CROSS SECTION B (PIPE CL)

	PRE-CROSSING			POST-CROSSING	
PT. LOC.	NORTHING	EASTING	ELEV	VERT. DIFF.	HORZ. DIFF.
TS-L	13412375.75	2071049.51	662.66	----	----
BS-L	13412373.41	2071062.69	658.77	----	----
TS-L	13412372.99	2071067.59	658.47	----	----
THW	13412371.82	2071070.30	656.64	----	----
BS	13412371.33	2071074.15	657.28	----	----
TS	13412370.24	2071080.15	657.59	----	----
BS	13412369.52	2071081.73	657.43	----	----
THW	13412369.03	2071084.26	656.96	----	----
BS-R	13412368.06	2071089.36	657.50	----	----
TS-R	13412367.75	2071093.92	658.65	----	----
BS-R	13412365.36	2071104.88	659.31	----	----
TS-R	13412362.57	2071117.66	662.51	----	----

LEGEND

- STUDY AREA (EASEMENT)
- EXISTING SURVEY-LOCATED THALWEG
- EW — EXISTING SURVEY-LOCATED EDGE OF WATER (AS NECESSARY)
- EXISTING CONTOUR LINE (MAJOR)
- EXISTING CONTOUR LINE (MINOR)
- 660.5 + EXISTING SURVEYED GROUND SHOT ELEVATION
- BENCHMARK POINT (WSSI)

SURVEY NOTES:

1. This map has been oriented to NAD 1983 UTM ZONE 17N, and vertically to The North American Vertical Datum of 1988 (NAVD 88), using a Real Time Network (RTN) GPS. Field locations were completed on September 7, 2018.

2. Monumentation, including traverse stations and fly points, shown on this drawing should be used to orient any future boundary, topographic, or location survey.

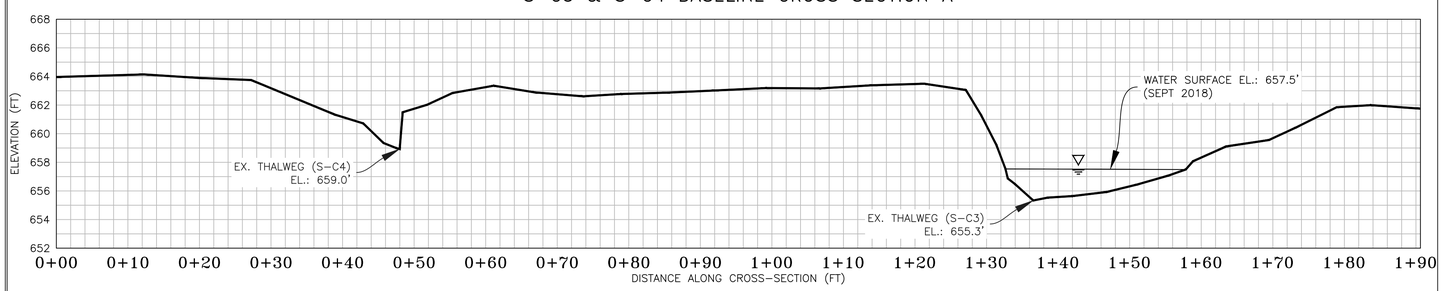
3. Easement lines shown on plan view were provided by Mountain Valley Pipeline (MVP).

4. WSSI Contour Interval = 2.0'. Contours within the channel were interpolated using stream channel breaklines (i.e. top of slopes, toe of slopes, thalweg) and cross-sectional points. Contours outside the channel were interpolated using cross-sectional spot shots.

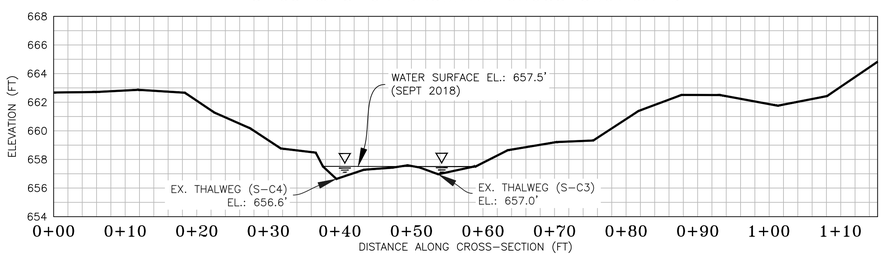
5. All section views shown are left to right facing downstream.

6. Cross-section B shot at location of pipe centerline (based on best professional judgement).

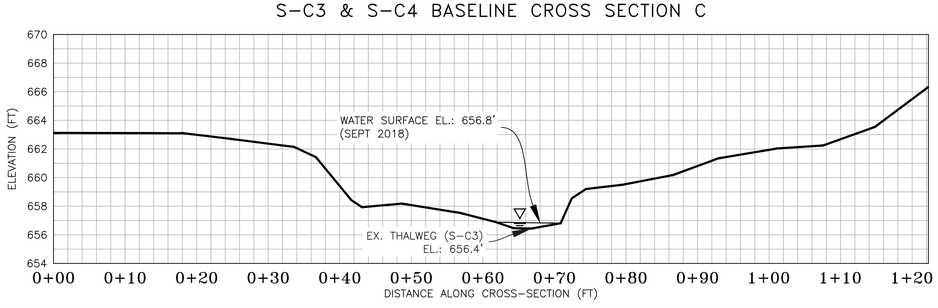
S-C3 & S-C4 BASELINE CROSS SECTION A



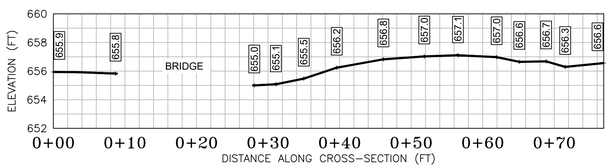
S-C3 & S-C4 BASELINE CROSS SECTION B



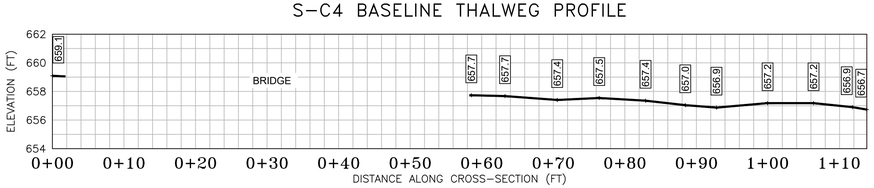
S-C3 & S-C4 BASELINE CROSS SECTION C



S-C3 BASELINE THALWEG PROFILE



S-C4 BASELINE THALWEG PROFILE



PROFILE LEGEND

EXISTING STREAM PROFILE
INVERT ALONG THALWEG

PROFILE
SCALE: H: 1"=10'
V: 1"=5'

CROSS SECTION
SCALE: H: 1"=10'
V: 1"=5'

CROSS SECTION LEGEND
EXISTING GRADE

NOTE: ALL SECTION VIEWS SHOWN LEFT TO RIGHT FACING DOWNSTREAM.

PRE-CROSSING PHOTOS

PHOTO TAKEN LOOKING DOWNSTREAM
ALONG LEFT BANK OF S-C3 ON 04/16/2018

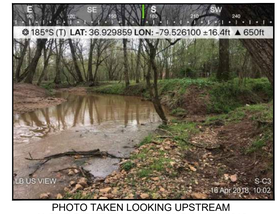


PHOTO TAKEN LOOKING UPSTREAM
ALONG RIGHT BANK OF S-C3 ON 04/16/2018

PHOTO TAKEN LOOKING DOWNSTREAM
ALONG S-C4 ON 04/16/2018

PHOTO TAKEN LOOKING UPSTREAM
ALONG S-C4 ON 04/16/2018

POST-CROSSING PHOTOS

PENDING CROSSING

PHOTO TAKEN LOOKING

PENDING CROSSING

PHOTO TAKEN LOOKING

PENDING CROSSING

PHOTO TAKEN LOOKING

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www.wetlands.com

Profile and Cross-Sections Baseline Survey

Prepared For: MVP

Crossing S-C3 & S-C4 - Harpen Creek (MP 289.6)

Pittsylvania County, Virginia

REVISIONS

No.	Date	Description	Rev. By	App. By

SCALE: AS NOTED

DATE: September, 2021

Horizontal Datum: NAD 1983 UTM ZONE 17N

Vertical Datum: NAVD 88

Boundary and Topo Source:
MVP
WSSI 2' C.I. Topo

Design	Draft	Approved
EJC	SIH	PFS

Sheet #
1 of 1

Computer File Name:
L:\Survey\22600s\22680\22665.03\Spread 1 Work Dwgs
22665_03 S-1 MP 279-291 Sheets_2.dwg