Baseline Assessment – Stream Attributes

Reach S-I21 (1) (Pipeline ROW)
Perennial
Spread E
Greenbrier County, West Virginia

Data	Included
Photos	✓
SWVM Form	✓Water quality readings from benthic sampling date
FCI Calculator and HGM Form	N/A – Perennial stream (not shadeable, slope <4%)
RBP Physical Characteristics Form	✓
Water Quality Data	✓
RBP Habitat Form	✓
RBP Benthic Form	✓
Benthic Identification Sheet	✓Sampling date 7/1/2021
Wolman Pebble Count	✓
Reference Reach Software Pebble Count Data	✓
Longitudinal Profile and Cross Sections	✓

Spread E Stream S-I21(1) (Pipeline ROW) Greenbrier County

Photo Type: DS, US View
Location, Orientation, Photographer Initials: Downstream Edge of ROW, Upstream View, MD
Lat: 37.918228 Long: -80.736774

Spread E Stream S-I21(1) (Pipeline ROW) Greenbrier County

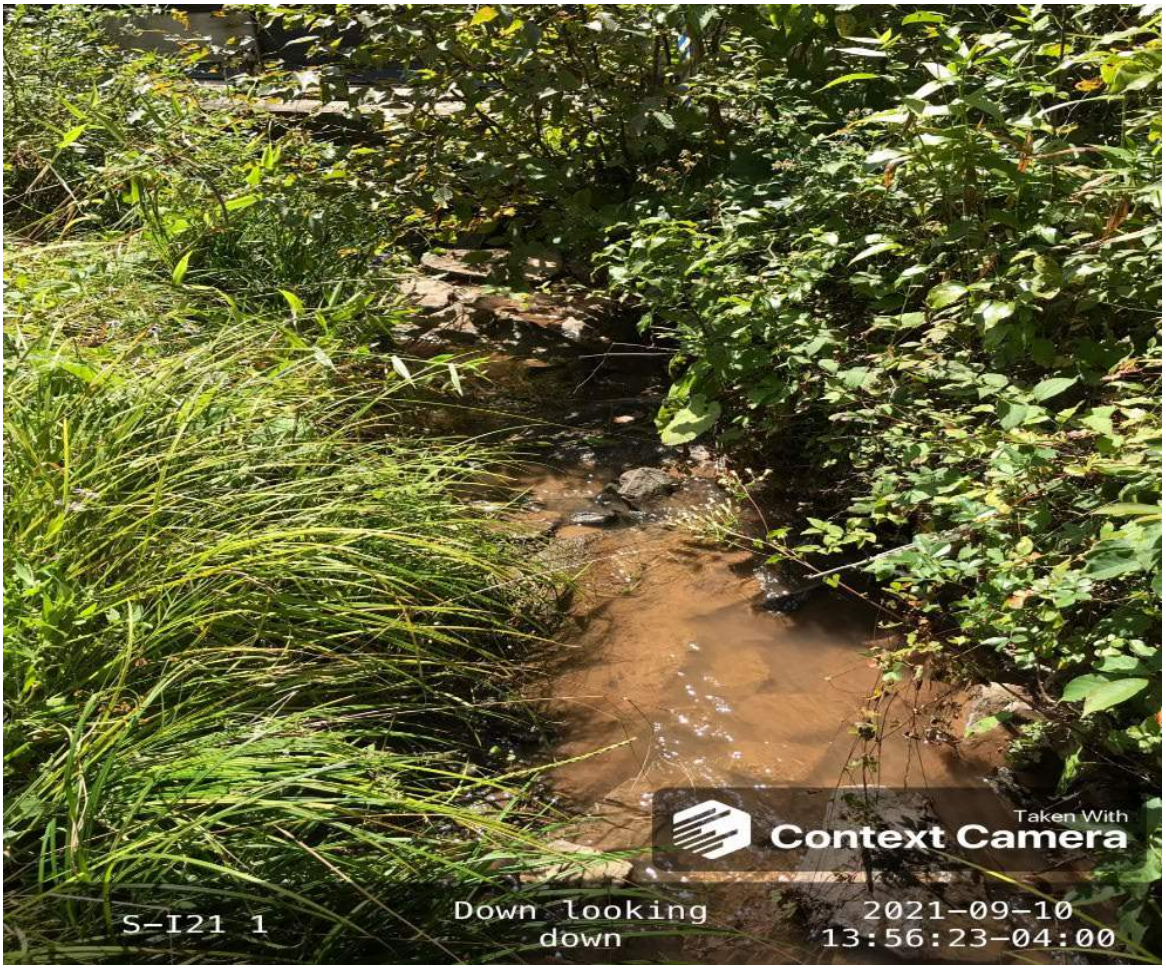


Photo Type: DS, DS View
Location, Orientation, Photographer Initials: Downstream Edge of ROW, Downstream View, MD
Lat: 37.918228 Long: -80.736774

Photo Type: US View at Center
Location, Orientation, Photographer Initials: Center ROW, Upstream View, MD
Lat: 37.918228 Long: -80.736774

Spread E Stream S-I21(1) (Pipeline ROW) Greenbrier County

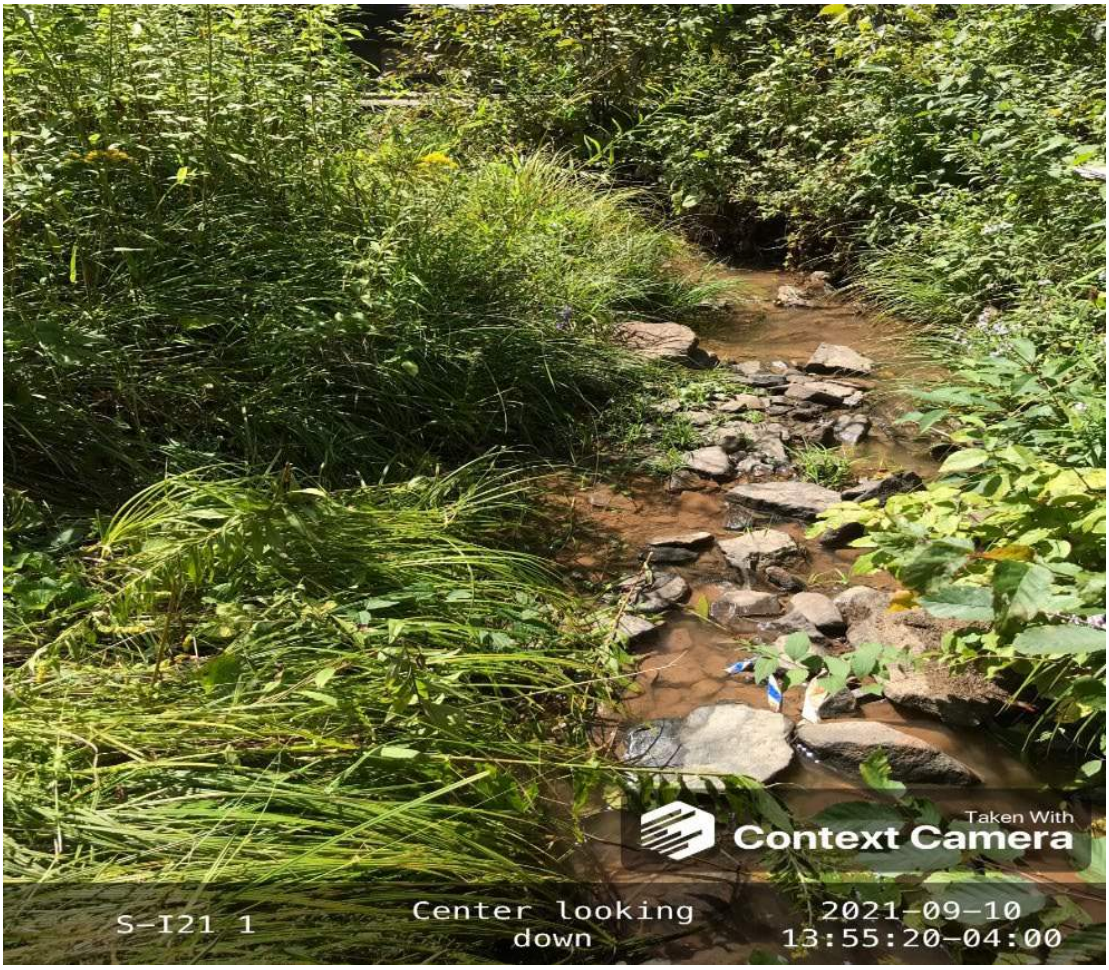


Photo Type: DS View at Center
Location, Orientation, Photographer Initials: ROW Center, Downstream View, MD
Lat: 37.918228 Long: -80.736774

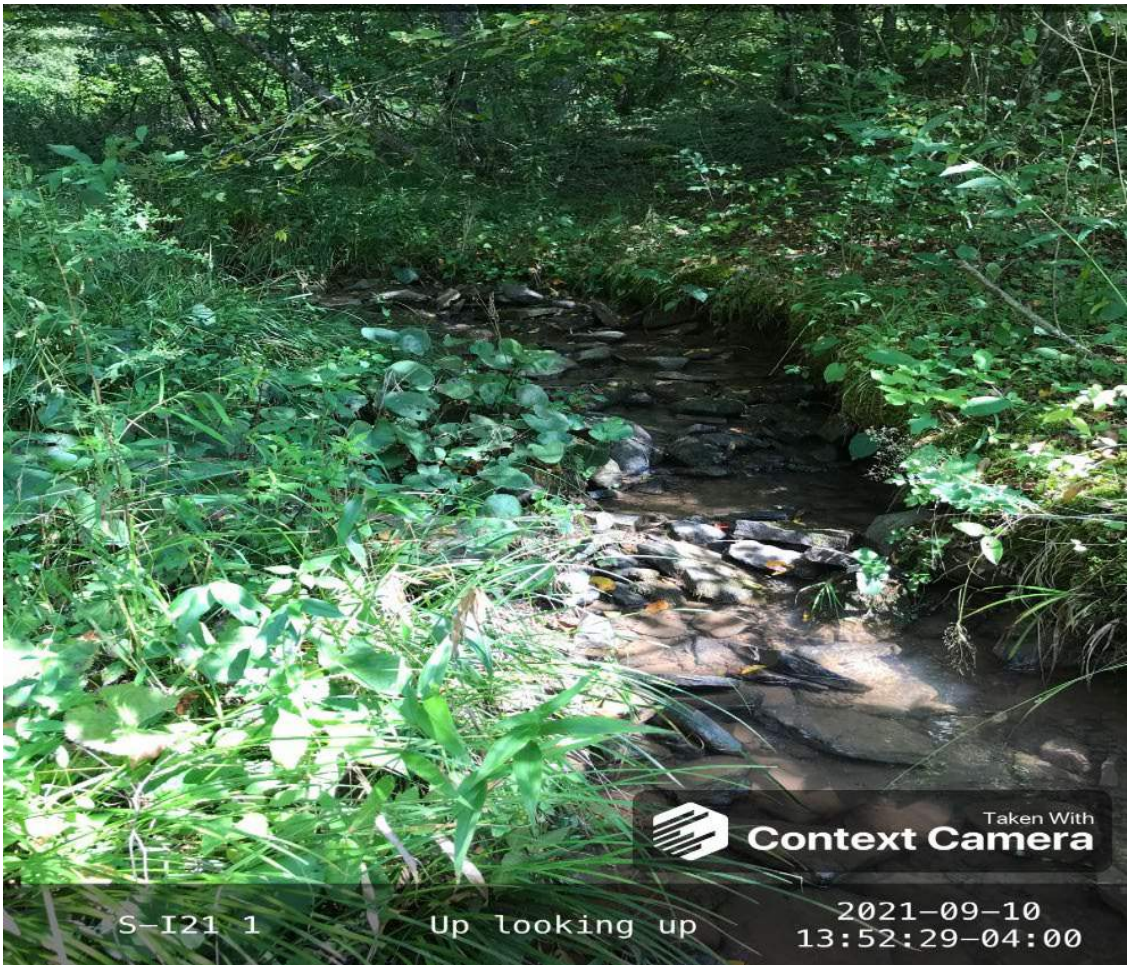


Photo Type: US, US View
Location, Orientation, Photographer Initials: Upstream Edge of ROW, Upstream View, MD
Lat: 37.918228 Long: -80.736774

Spread E Stream S-I21(1) (Pipeline ROW) Greenbrier County

Photo Type: US, DS View
Location, Orientation, Photographer Initials: Upstream Edge of ROW, Downstream View, MD
Lat: 37.918228 Long: -80.736774

Photo Type: Riffle, DS View
Location, Orientation, Photographer Initials: Upstream of Riffle, Downstream View, MD
Lat: 37.918228 Long: -80.736774

Spread E Stream S-I21(1) (Pipeline ROW) Greenbrier County

Photo Type: Riffle, US View
Location, Orientation, Photographer Initials: Downstream of Riffle, Upstream View, MD
Lat: 37.918228 Long: -80.736774

Spread E Stream S-I21(1) (Pipeline ROW) Greenbrier County

Photo Type: Pool, DS View
Location, Orientation, Photographer Initials: Upstream of Pool, Downstream View, MD
Lat: 37.918228 Long: -80.736774

Photo Type: Pool, US View
Location, Orientation, Photographer Initials: Downstream of Pool, Upstream View, MD
Lat: 37.918228 Long: -80.736774

USACE FILE NO./ Project Name: (v2.1, Sept 2015)	Mountain Valley Pipeline	IMPACT COORDINATES: (in Decimal Degrees)	Lat.	37.918228	Lon.	-80.736774	WEATHER:	Sunny	DATE:	7/1/2021
IMPACT STREAM/SITE ID AND SITE DESCRIPTION: (watershed size (acreage), unaltered or impairments)	S-I21 (1) Pipeline ROW	MITIGATION STREAM CLASS./SITE ID AND SITE DESCRIPTION: (watershed size (acreage), unaltered or impairments)							Comments:	
STREAM IMPACT LENGTH:	30	FORM OF MITIGATION:	RESTORATION (Levels I-III)	MIT COORDINATES: (in Decimal Degrees)	Lat.		Lon.		PRECIPITATION PAST 48 HRS:		Mitigation Length:	

Column No. 1- Impact Existing Condition (Debit)			
Stream Classification:	Perennial		
Percent Stream Channel Slope			5
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	15
2. Embeddedness	0-20		13
3. Velocity/ Depth Regime	0-20		13
4. Sediment Deposition	0-20		19
5. Channel Flow Status	0-20		10
6. Channel Alteration	0-20		17
7. Frequency of Riffles (or bends)	0-20		16
8. Bank Stability (LB & RB)	0-20		18
9. Vegetative Protection (LB & RB)	0-20		18
10. Riparian Vegetative Zone Width (LB & RB)	0-20		20
Total RBP Score	Suboptimal		159
Sub-Total			0.795
CHEMICAL INDICATOR (Applies to Intermittent and Perennial Streams)			
WVDEP Water Quality Indicators (General)			
Specific Conductivity			
<=99 - 90 points	0-90	0-1	36.6
pH			
6.0-8.0 = 80 points	0-80		6.34
DO			
>5.0 = 30 points	10-30		7.07
Sub-Total			1
BIOLOGICAL INDICATOR (Applies to Intermittent and Perennial Streams)			
WV Stream Condition Index (WVSCI)			
Very Good	0-100	0-1	90.6
Sub-Total			1

PART II - Index and Unit Score		
Index	Linear Feet	Unit Score
0.932	30	27.95

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-I21 (1)	LOCATION Greenbrier County	
STATION # _____ RIVERMILE _____	STREAM CLASS Perennial	
LAT 37.918228 LONG -80.736774	RIVER BASIN None	
STORET #	AGENCY WVDEP	
INVESTIGATORS EG, MD, JD		
FORM COMPLETED BY EG	DATE 09-10-2021 TIME 130	REASON FOR SURVEY Baseline Assessment

WEATHER CONDITIONS

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

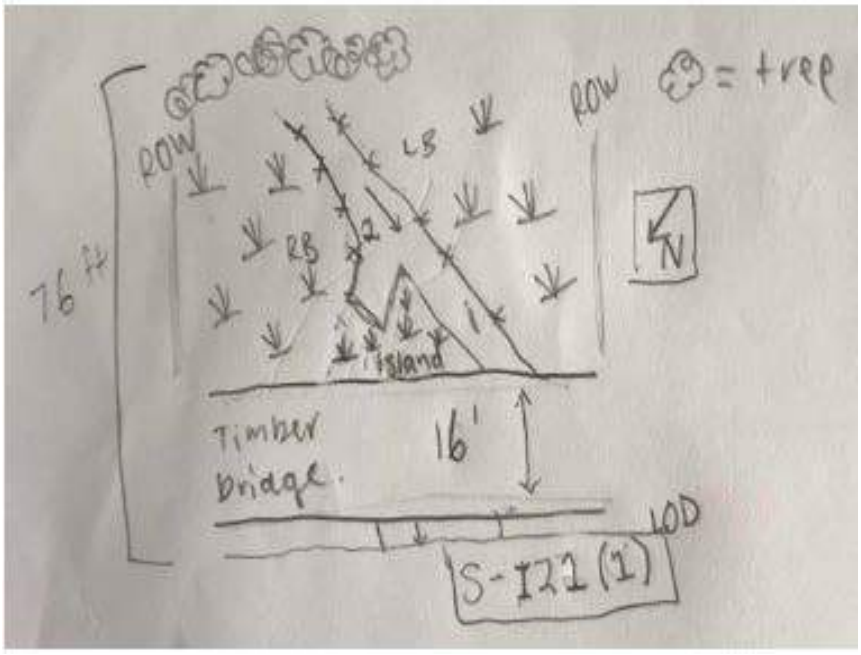
Has there been a heavy rain in the last 7 days? ☑ Yes ☐ No

Air Temperature 17.78 ^{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 N/A 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 Golden ragwort

INSTREAM FEATURES

Estimated Reach Length 23.03 m

Estimated Stream Width 2.58 m

Sampling Reach Area 59.42 m^2

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

Estimated Stream Depth 0.025 m

Surface Velocity (at thalweg) 0.10 m/sec

Canopy Cover
☑ Partly open ☐ Partly shaded ☐ Shaded

High Water Mark 0.45 m

Proportion of Reach Represented by Stream Morphology Types
Riffle 10 % Run 70 %
Pool 20 %

Channelized ☐ Yes ☑ No

Dam Present ☐ Yes ☑ No

LARGE WOODY DEBRIS

LWD 0 m^2

Density of LWD 0 m^2/km^2 **(LWD/ reach area)**

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 N/A

Portion of the reach with aquatic vegetation 0 %

WATER QUALITY (DS, US)

Temperature D15.4 U14.5 ^{0} C

Specific Conductance D32U28us/cm

Dissolved Oxygen D7.02U8.5mg/L

pH D6.74 U6.87

Turbidity N/A

WQ Instrument Used YSI

Water Odors
☑ Normal/None ☐ Sewage
☐ Petroleum ☐ Chemical
☐ Fishy ☐ Other _____

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 _____

Oils
☑ Absent ☐ Slight ☐ Moderate ☐ Profuse

Deposits
☐ Sludge ☐ Sawdust ☐ Paper fiber ☐ Sand
☐ Relict shells ☑ Other NONE

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)	8
Boulder	> 256 mm (10")	5			
Cobble	64-256 mm (2.5"-10")	60	Muck-Mud	black, very fine organic (FPOM)	0
Gravel	2-64 mm (0.1"-2.5")	20			
Sand	0.06-2mm (gritty)	5	Marl	grey, shell fragments	0
Silt	0.004-0.06 mm	10			
Clay	< 0.004 mm (slick)	0			

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

STREAM NAME S-I21 (1)	LOCATION Greenbrier County	
STATION #_____ RIVERMILE_____	STREAM CLASS Perennial	
LAT 37.918228 LONG -80.736774	RIVER BASIN None	
STORET #	AGENCY WVDEP	
INVESTIGATORS EG, MD, JD		
FORM COMPLETED BY EG	DATE 09-10-2021 TIME 130 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 15	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 13	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 13	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 19	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 10	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

Notes:

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 17	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 16	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 9	Left Bank 10 9	8 7 6	5 4 3	2 1 0
	SCORE 9	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 9	Left Bank 10 9	8 7 6	5 4 3	2 1 0
	SCORE 9	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 10	Left Bank 10 9	8 7 6	5 4 3	2 1 0
	SCORE 10	Right Bank 10 9	8 7 6	5 4 3	2 1 0

Total Score 159 Notes:

BENTHIC MACROINVERTEBRATE FIELD DATA SHEET

STREAM NAME S-I21 (1)	LOCATION Greenbrier County	
STATION #_____ RIVERMILE_____	STREAM CLASS Perennial	
LAT 37.918228 LONG -80.736774	RIVER BASIN None	
STORET #	AGENCY WVDEP	
INVESTIGATORS AK CH		LOT NUMBER
FORM COMPLETED BY AK CH	DATE 7/1/2021 TIME 1300	REASON FOR SURVEY Baseline Assessment

HABITAT TYPES	**Indicate the percentage of each habitat type present** ☑ Cobble 40 % ☐ Snags ____ % ☐ Vegetated Banks ____ % ☑ Sand 20 % ☐ 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	US: Temp: 16.6C SPC: 34.6us/cm DO: 7.41mg/L pH: 6.34 DS: Temp: 17.1C SPC: 36.6us/cm DO: 7.07mg/L pH: 6.34

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						

Insects	Count	Tolerance	TV
Ephemeroptera			75
Ameletidae	1	2	2
Baetidae	1	4	4
Beatiscidae		4	0
Caenidae		5	0
Ephemerellidae	13	3	39
Ephemeridae		5	0
Heptageniidae	17	3	51
Isonychiidae		3	0
Leptophlebiidae	43	4	172
Potamanthidae		5	0
Siphlonuridae		3	0
Tricorythidae		5	0
Plecoptera			87
Capniidae		2	0
Chloroperlidae	4	2	8
Leuctridae	72	2	144
Nemouridae	1	2	2
Peltoperlidae	3	1	3
Perlidae	2	1	2
Perlodidae	5	1	5
Pteronarcyidae		1	0
Taeniopterygidae		2	0
Trichoptera			4
Brachycentridae		2	0
Glossosomatidae		2	0
Helicopsychidae		3	0
Hydropsychidae	1	5	5
Hydroptilidae		3	0
Lepidostomatidae		3	0
Leptoceridae		3	0
Limnephilidae	1	4	4
Molannidae		3	0
Philopotamidae	2	4	8
Phryganeidae		4	0
Polycentropodidae		5	0
Psychomiidae		4	0
Rhyacophilidae		3	0
Uenoidae		2	0
Total Tolerance Value			730

Insects	Count	Tolerance	TV
Odonata			0
Aeshnidae		3	0
Calopterygidae		6	0
Coenagrionidae		7	0
Cordulegastridae		3	0
Gomphidae		5	0
Lestidae		7	0
Libellulidae		7	0
Coleoptera			10
Chrysomelidae		7	0
Dryopidae		5	0
Dytiscidae		6	0
Elmidae	1	4	4
Gyrinidae		5	0
Haliplidae		7	0
Hydrophilidae		7	0
Psephenidae	9	3	27
Ptilodactylidae		5	0
Hemiptera			0
Belostomatidae		8	0
Corixidae		8	0
Gerridae		10	0
Hydrometridae		8	0
Nepidae		8	0
Notonectidae		8	0
Megaloptera			5
Corydalidae	5	3	15
Sialidae		6	0
Diptera			32
Athericidae		3	0
Blephariceridae		2	0
Ceratopogonidae	1	8	8
Chironomidae	16	9	144
Culicidae		10	0
Dixidae	6	6	36
Empididae		7	0
Psychodidae		8	0
Ptychopteridae		8	0
Simuliidae		7	0
Stratiomyidae		10	0
Syrphidae		10	0
Tabanidae	1	7	7
Tipulidae	8	5	40

Non-Insects	Count	Tolerance	TV
Crustacea			0
Asellidae		7	0
Cambaridae		5	0
Gammaridae		5	0
Palaemonidae		5	0
Annelida			0
Hirudinea		10	0
Nematoda		10	0
Nematomorpha		10	0
Oligochaeta		10	0
Turbellaria			0
Turbellaria		7	0
Bivalvia			0
Corbiculidae		6	0
Sphaeriidae		5	0
Unionidae		4	0
Gastropoda			0
Ancylidae		7	0
Hydrobiidae		4	0
Physidae		7	0
Planorbidae		5	0
Pleuroceridae		5	0
Viviparidae		5	0
Miscellaneous			0
Collembola		6	0
Lepidoptera		5	0
Neuroptera		5	0
Hydrachnidae		6	0
Totals	**Total number**		**213**
	Total families		**22**

SITE ID:	S-I21(1)

7/1/2021

Metric calculations

WVSCI Metric Scores		
Total Taxa	22	100.0
EPT Taxa	14	100.0
% EPT Abundance	77.9	87.3
% Chironomidae	7.5	94.1
Hilsenhoff Biotic Index (HBI)	3.43	88.9
% 2 Dominant Taxa	54.0	73.4
WV Stream Condition Index		**90.6**

Additional metrics	
Ephemeroptera Taxa	5
Plecoptera Taxa	6
Trichoptera Taxa	3
Long-lived Taxa	10
Odonata Taxa	0
Diptera Taxa	5
COET Taxa	10
% Sensitive	62.9
% Tolerant	8.5
% Clingers	80.8
% Net-spinners	1.4

West Virginia Stream Condition Index (WVSCI)

Gerritson, J., J. Burton, and M.T. Barbour. 2000. A stream condition index for West Virginia wadeable streams. Tetra Tech, Inc. Owing Mills, MD.

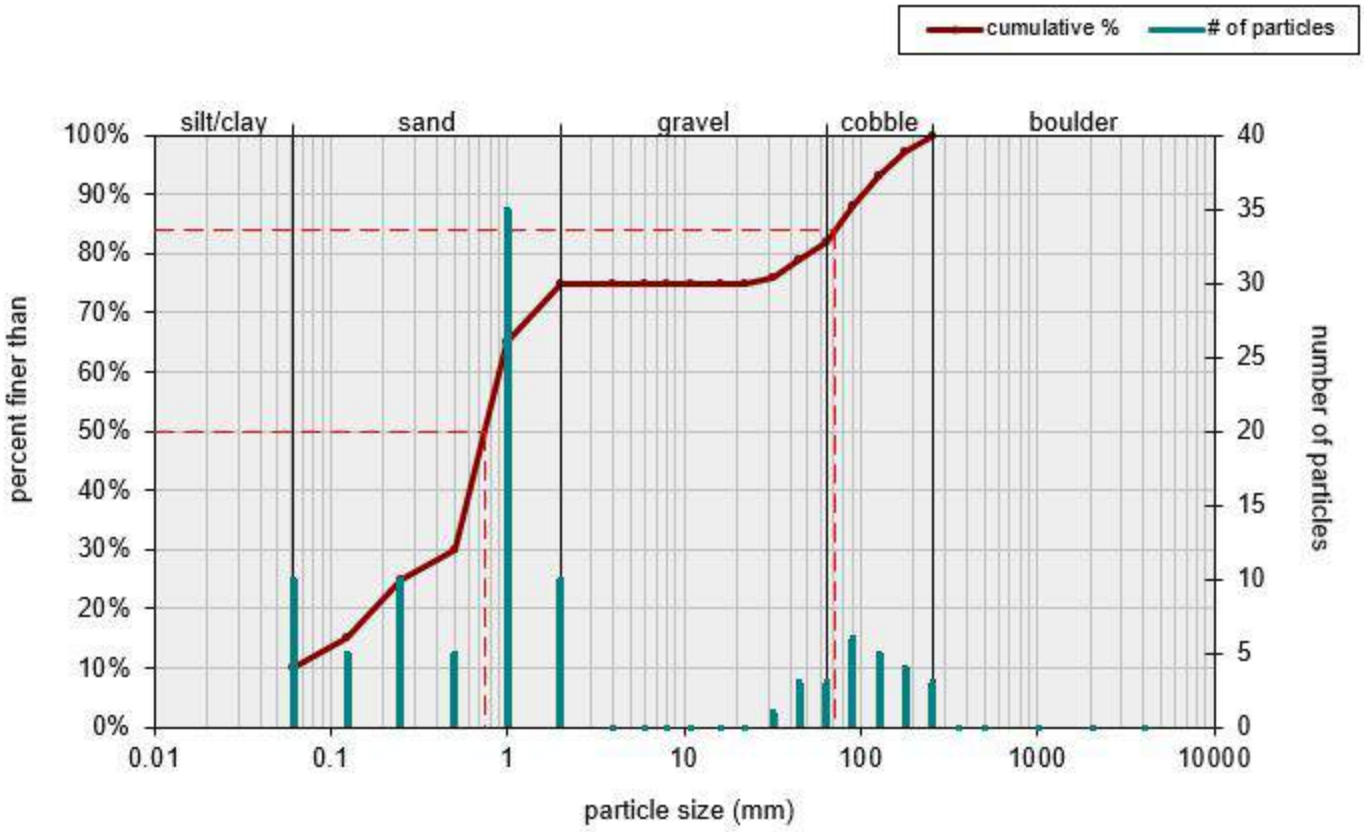
Spreadsheet uses updated Best Standard Values [BSV] for each metric per WVSCI Addenda dated March 23, 2010

WOLMAN PEBBLE COUNT FORM

County: Greenbrier
Stream ID: S-I21 (1)
Stream Name: UNT to Boggs Creek (1)
HUC Code:
Basin:
Survey Date: 9/10/2021
Surveyors: EG, JD, MD
Impact Reach: 23.03 m
Type: Bankfull Channel

PEBBLE COUNT							
Inches	PARTICLE	Millimeters		Particle Count	**Total #**	**Item %**	**% Cum**
	Silt/Clay	< .062	S/C		10	10.00	10.00
	Very Fine	.062-.125	SAND		5	5.00	15.00
	Fine	.125-.25			10	10.00	25.00
	Medium	.25-.5			5	5.00	30.00
	Coarse	.50-1.0			35	35.00	65.00
.04-.08	Very Coarse	1.0-2			10	10.00	75.00
.08 -.16	Very Fine	2 -4	GRAVEL		0	0.00	75.00
.16 - .22	Fine	4 -5.7			0	0.00	75.00
.22 - .31	Fine	5.7 - 8			0	0.00	75.00
.31 - .44	Medium	8 -11.3			0	0.00	75.00
.44 - .63	Medium	11.3 - 16			0	0.00	75.00
.63 - .89	Coarse	16 -22.6			0	0.00	75.00
.89 - 1.26	Coarse	22.6 - 32			1	1.00	76.00
1.26 - 1.77	Vry Coarse	32 - 45			3	3.00	79.00
1.77 -2.5	Vry Coarse	45 - 64			3	3.00	82.00
2.5 - 3.5	Small	64 - 90	COBBLE		6	6.00	88.00
3.5 - 5.0	Small	90 - 128			5	5.00	93.00
5.0 - 7.1	Large	128 - 180			4	4.00	97.00
7.1 - 10.1	Large	180 - 256			3	3.00	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:						

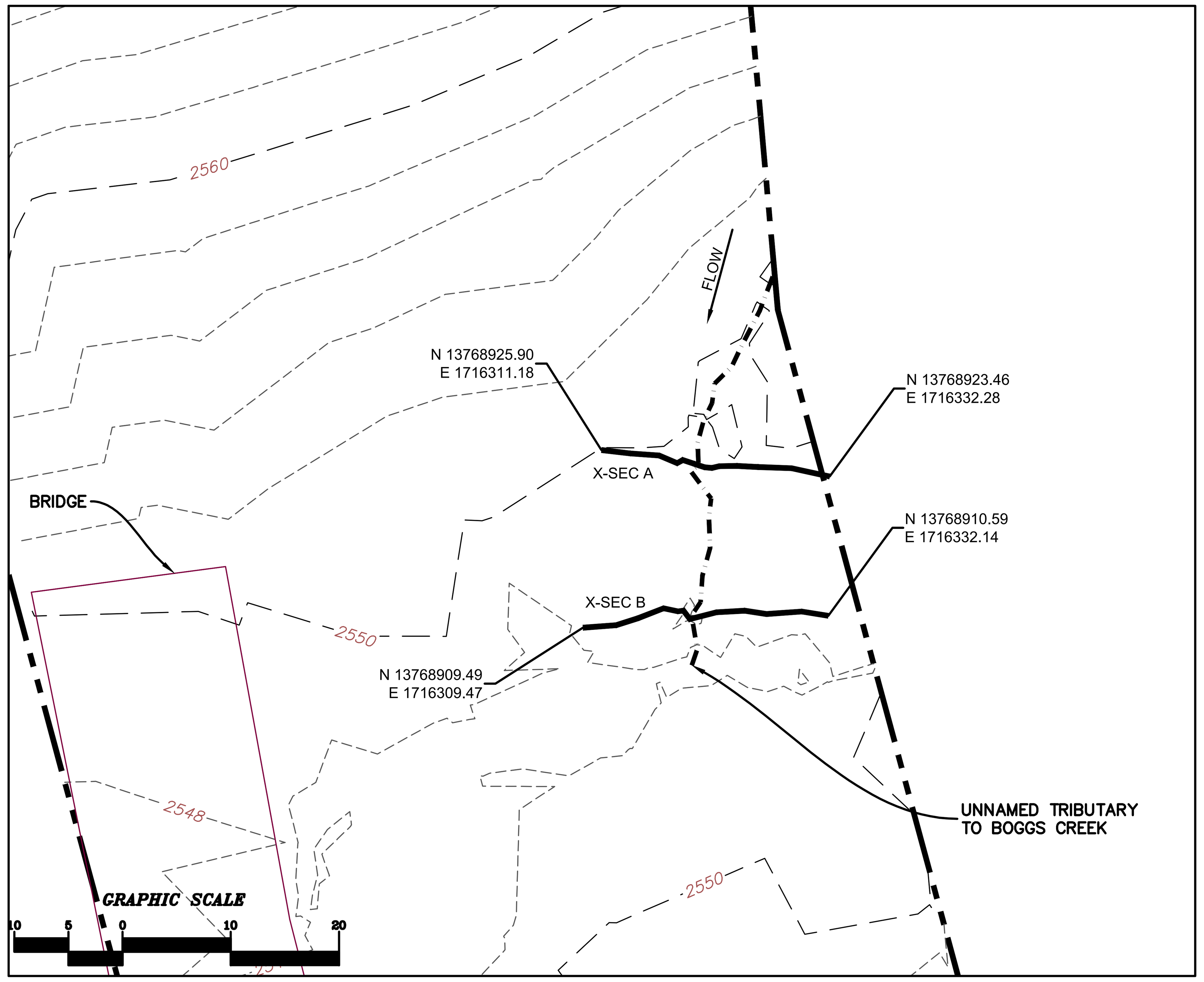
Bankfull Channel Pebble Count, S-I21 (1)



Size (mm)	
D16	0.13
D35	0.55
D50	0.74
D65	1
D84	72
D95	150

Size Distribution	
mean	3.1
dispersion	51.5
skewness	0.37

Type	
silt/clay	10%
sand	65%
gravel	7%
cobble	18%
boulder	0%



S–I21–1

NORTH

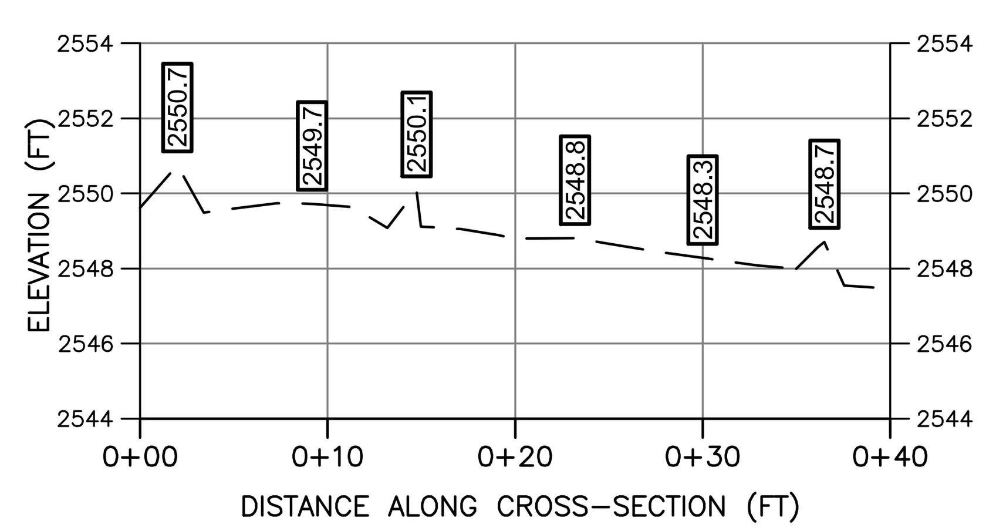
LEGEND

- STUDY AREA (EASEMENT)
- EXISTING SURVEY–LOCATED THALWEG
- 1176.87 + EXISTING SURVEYED GROUND SHOT ELEVATION

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 REAL TIME DGPS. FIELD LOCATIONS WERE COMPLETED ON SEPTEMBER 10, 2021.
2. EASEMENT LINES SHOWN ON PLAN VIEW WERE PROVIDED BY MOUNTAIN VALLEY PIPELINE.
3. SURVEY POINTS FOR CROSS SECTIONS AND THALWEG PROFILES COLLECTED IN 2021 HAVE BEEN USED IN COMBINATION WITH SURVEY POINTS COLLECTED PREVIOUSLY IN 2020 IN ORDER TO GENERATE THE PRE-CROSSING SURFACE SHOWN IN PLAN. DUE TO NATURAL EROSIONAL STREAM PROCESSES THAT CAN OCCUR OVER TIME, MINOR ADJUSTMENTS TO THE PROFILE ALIGNMENTS MAY HAVE BEEN REQUIRED IN ORDER TO GENERATE A CLEAN PRE-CROSSING SURFACE.
4. ALL SECTION VIEWS SHOWN LEFT TO RIGHT FACING DOWNSTREAM.
5. POST-CROSSING SURVEY INFORMATION SHOWN IN RED. DATA PENDING.
6. POST-CROSSING SURVEY POINTS FOR CROSS SECTIONS AND THALWEG ARE PROJECTED ONTO PRE-CROSSING SECTION AND PROFILE VIEWS FOR COMPARISON.

S–I21–1 BASELINE THALWEG PROFILE



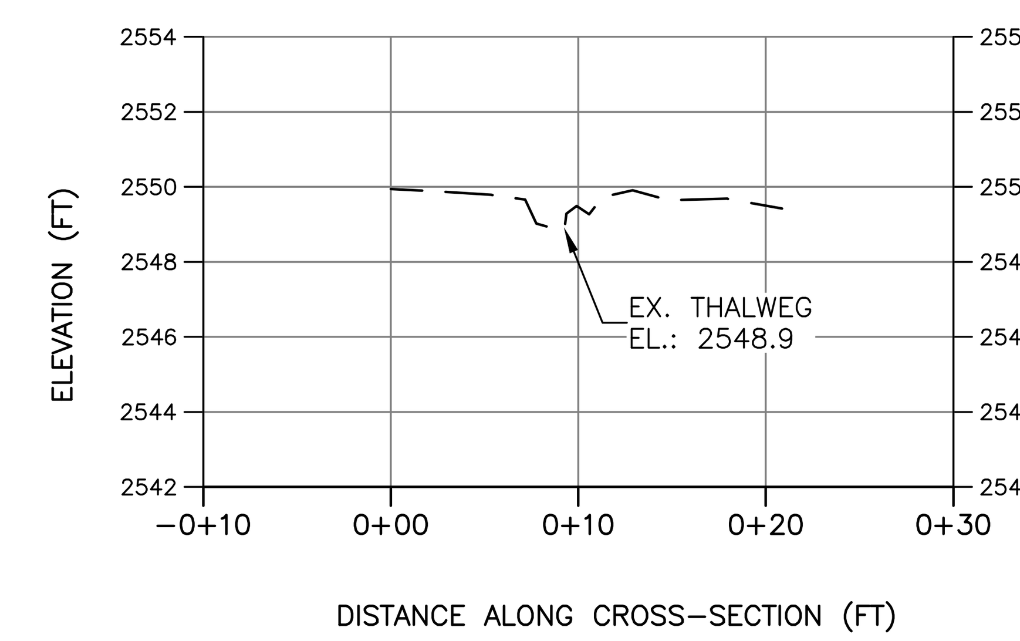
PROFILE LEGEND

EXISTING STREAM PROFILE INVERT ALONG THALWEG

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

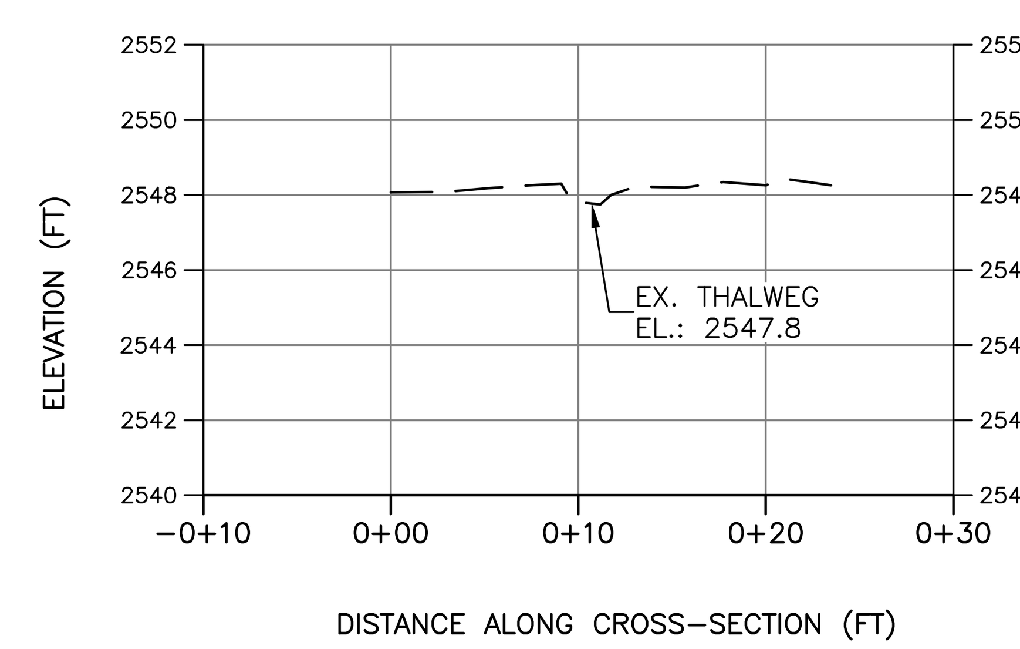
S–I21–1 BASELINE CROSS–SECTION A

POOL



S–I21–1 BASELINE CROSS–SECTION B

RIFFLE



CROSS SECTION LEGEND

EXISTING GRADE

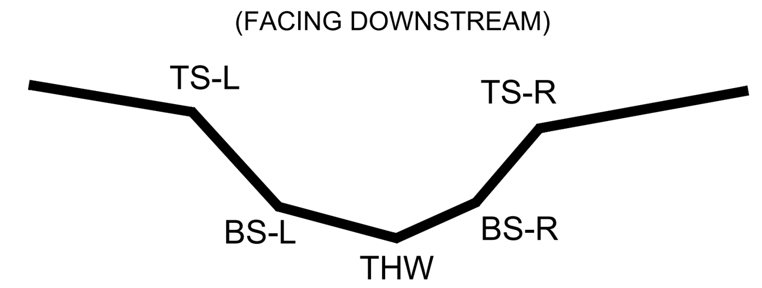
CROSS SECTION SCALE: H: 1"=10' V: 1"=5'

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

AS-BUILT TABLE: S-I21-1 CROSS SECTION B					
	PRE-CROSSING			AS-BUILT	
PT. LOC.	NORTHING	EASTING	ELEV	VERT. DIFF.	HORZ. DIFF.
TS-L	13768911.13	1716317.636	2548.28		
BS-L	13768911.03	1716318.491	2548.09		
THW	13768910.34	1716319.566	2547.83		
BS-R	13768910.72	1716321.084	2548.10		
TS-R	13768910.91	1716321.847	2548.22		

TYPICAL 5-POINT CROSS-SECTION

(FACING DOWNSTREAM)



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

PRE-CROSSING PHOTOS

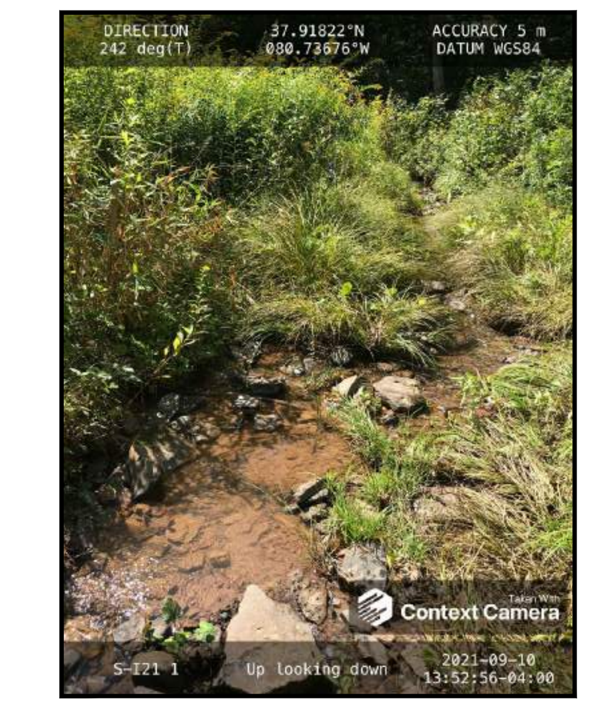


PHOTO TAKEN LOOKING DOWNSTREAM FROM UPSTREAM IMPACT LIMITS

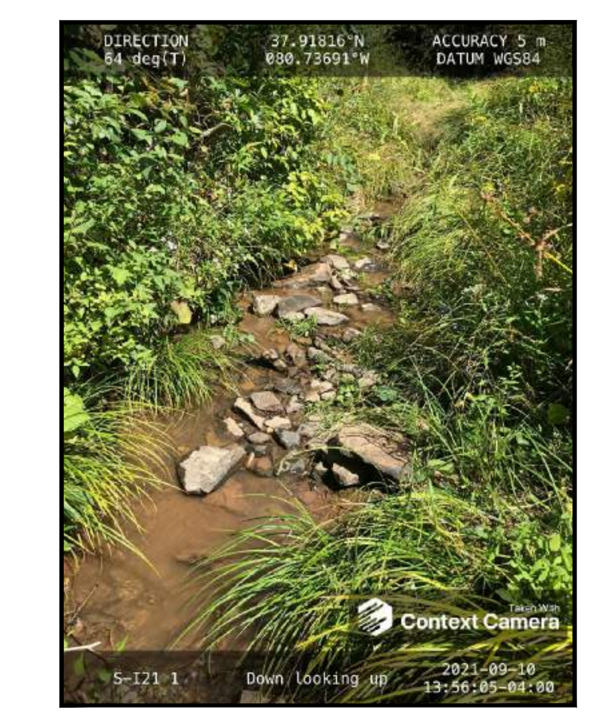


PHOTO TAKEN LOOKING UPSTREAM FROM DOWNSTREAM IMPACT LIMITS

POST-CROSSING PHOTOS

PENDING CROSSING

PHOTO TAKEN LOOKING DOWNSTREAM FROM UPSTREAM IMPACT LIMITS

PENDING CROSSING

PHOTO TAKEN LOOKING UPSTREAM FROM DOWNSTREAM IMPACT LIMITS

PRE-CROSSING

PRELIMINARY

CAD File No.
MRS Drawn
GH Checked
DW Approved
NOTED Scale:
SEPT. 2021 Date:
112IC07157 Project No.

TETRA TECH, INC.
661 ANDERSEN DRIVE FOSTER PLAZA 7
PITTSBURGH, PA 15220
TEL: (412) 921-7090 FAX: (412) 921-4040
E-Mail Address: WWW.TETRATECH.COM

TETRA TECH
www.tetratech.com

Client
MOUNTAIN VALLEY PIPELINE, LLC
2200 ENERGY DRIVE, 2ND FLOOR
CANONSBURG, PA 15317

Title
PROFILE AND CROSS–SECTIONS
BASELINE SURVEY
CROSSING S–I21–1 – UNNAMED TRIB. TO
BOGGS CREEK (MP 149.93)
GREENBRIER COUNTY, WV

1
Drawing No.