

Aquatic Resource Assessment for Coal Mining Permits in West Virginia

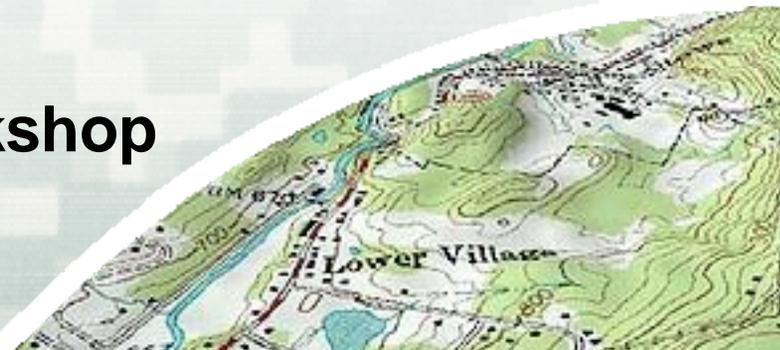
Appalachian Stream Mitigation Workshop

April 11-15, 2011
Lexington, KY

Alison Rogers
Regulatory Project Manager
USACE Huntington District

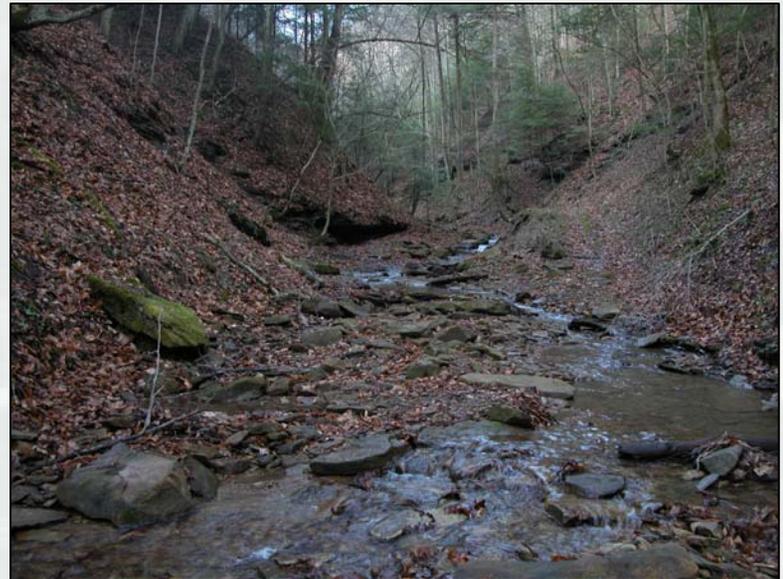


US Army Corps of Engineers
BUILDING STRONG

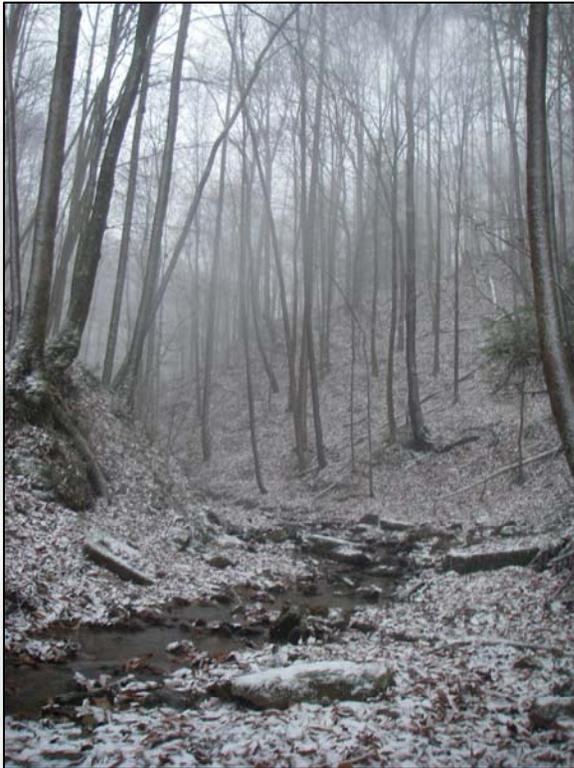


Evolution of Stream Assessment

- West Virginia Stream Condition Index (WVSCI)
 - Implemented in 2000
 - Benthic Macroinvertebrate Based Metric
 - Biotic Community & Water Quality Assessment Measure
- Water Chemistry
- Aquatic Habitat Quality
 - Rapid Bioassessment Procedures (RBP) Habitat Assessment Value (HAV) – Revised and Released in 1999



Evaluation of Earlier Stream Assessment



- Applicable to High & Low Gradient Stream Types
- Rapid Assessment
- Ratio Based Mitigation
- Temporal Losses Captured on a Percent per Year Basis
- Ecological Assessment Variable i.e. Subject to Best Professional Judgment
- No Functional Assessment Methods Available



Litigation Driven Evolution

Expanded Assessment Tools

- Numerous Decisions to Legal Challenges
 - Most Notably Chambers March 2007; Overturned on Appeal February 2009
- Industry/Applicants/Agents
 - Riffle-Pool Assessments
 - Various Studies to Better Understand Stream Function – leaf pack degradation, periphyton colonization, aquatic salamander surveys
- USACE
 - Development of the Interim Functional Assessment Approach (IFAA) – Short Term Assessment Tool (2007)
 - Development of the Hydrogeomorphic Approach (HGM) – Long Term Assessment Tool (2010)



Interim Functional Assessment Approach (IFAA)

- Released June 2007; Implemented August 2007
- Assessment of Stream & Watershed Condition
- Strengths
 - Assesses the Capacity of High Gradient Streams to Perform Four Categories of Functions
 - Hydrology, Biogeochemical, Plant Community, Habitat
 - Rapid Assessment
- Weaknesses
 - Limited Use (High Gradient Streams)
 - Problematic When Proposed Mitigation Targets Low Gradient Streams

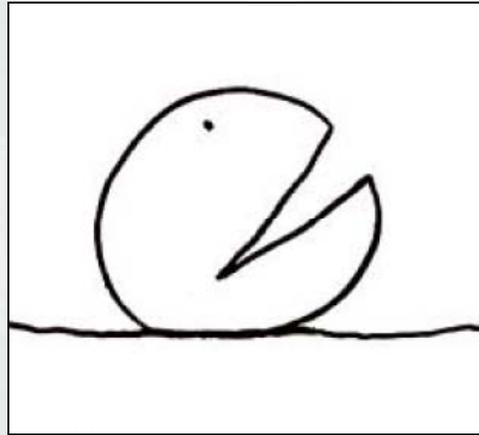


Hydrogeomorphic Approach (HGM)

- Draft Operational Guidebook Released July 2010; Training for Agencies & Potential Applicants November 2010
- Region-Specific Model
- Strengths
 - Incorporates Field Measured Variables to Produce a Functional Capacity Index (FCI) Ranging from 0 to 1.0
 - Assesses the Capacity of High Gradient Streams to Perform Three Categories of Functions
 - Hydrology, Biogeochemical Cycling, Habitat
 - Rapid Assessment
- Weaknesses
 - Limited Use (High Gradient Streams)



The Missing Piece?



A Method to Evaluate High Gradient Stream
Impacts and Proposed Rehabilitation on Low
Gradient Streams...

Ecological Currency



BUILDING STRONG®

West Virginia Stream & Wetland Valuation Metric (WV SWVM)

- Comprehensive Metric that Generates an Ecological Currency (Debit/Credit)
- Combines Current Assessment Measures including, WVSCI, Water Chemistry, RBP HAV, and HGM
- Benefits
 - Addresses “The Missing Piece” Issue
 - Consistent with Final Rule on Compensatory Mitigation
 - Debit & Credit Inputs Data Driven
 - Captures Temporal Losses as Debits
 - Shift from Ratio-Based Mitigation to Ecological-Based Mitigation



Example #1: Underground Mine

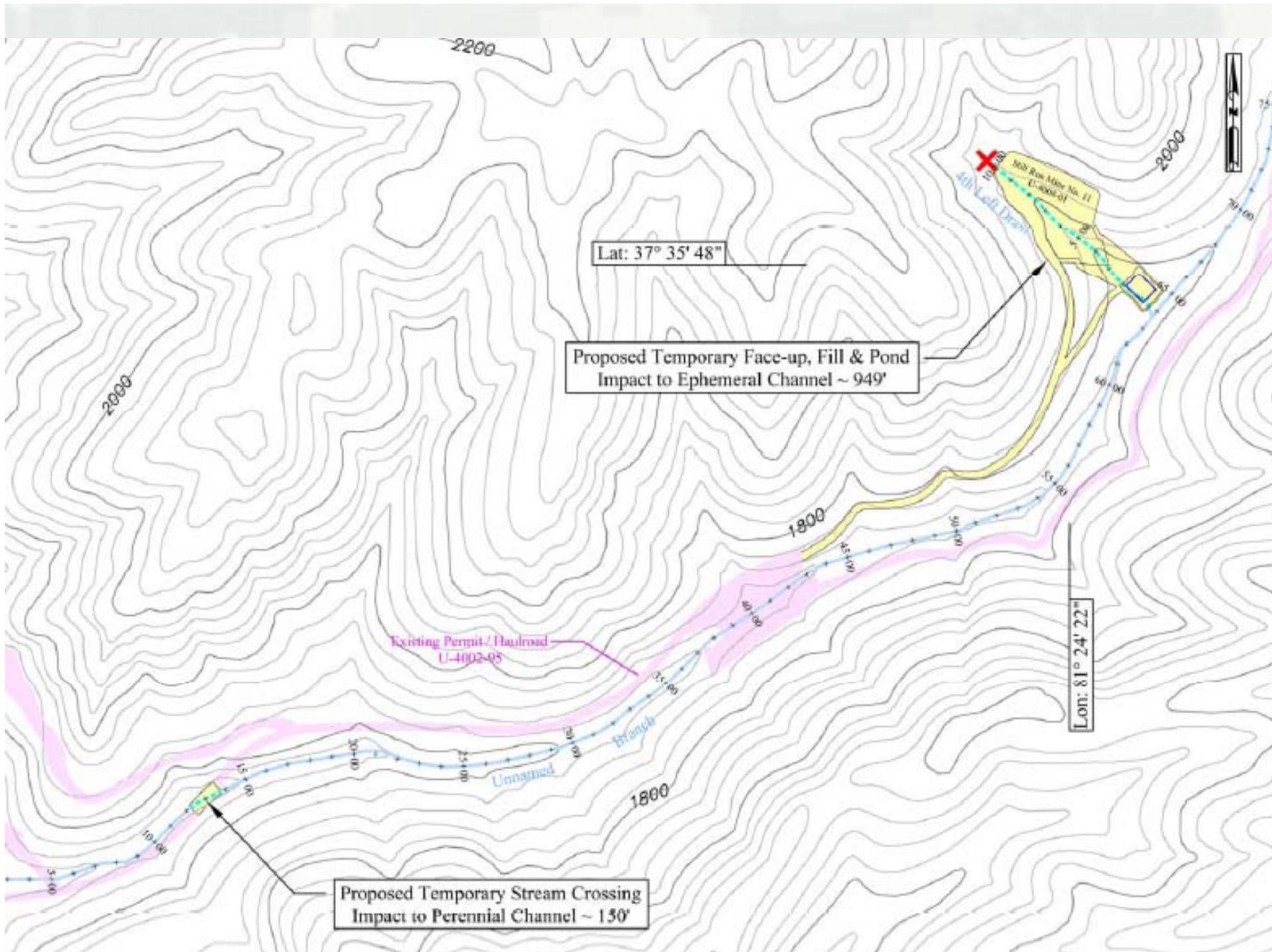
- Entry Types
 - Drift
 - Shaft/Slope
 - Box Cut
- Typical Impacts
 - Excavation to “Daylight” Coal Seam
 - Temporary Storage of Excavated Materials
 - Temporary Sediment and Drainage Control System
 - Access/Haul Road(s)
 - Staging/Operation Area

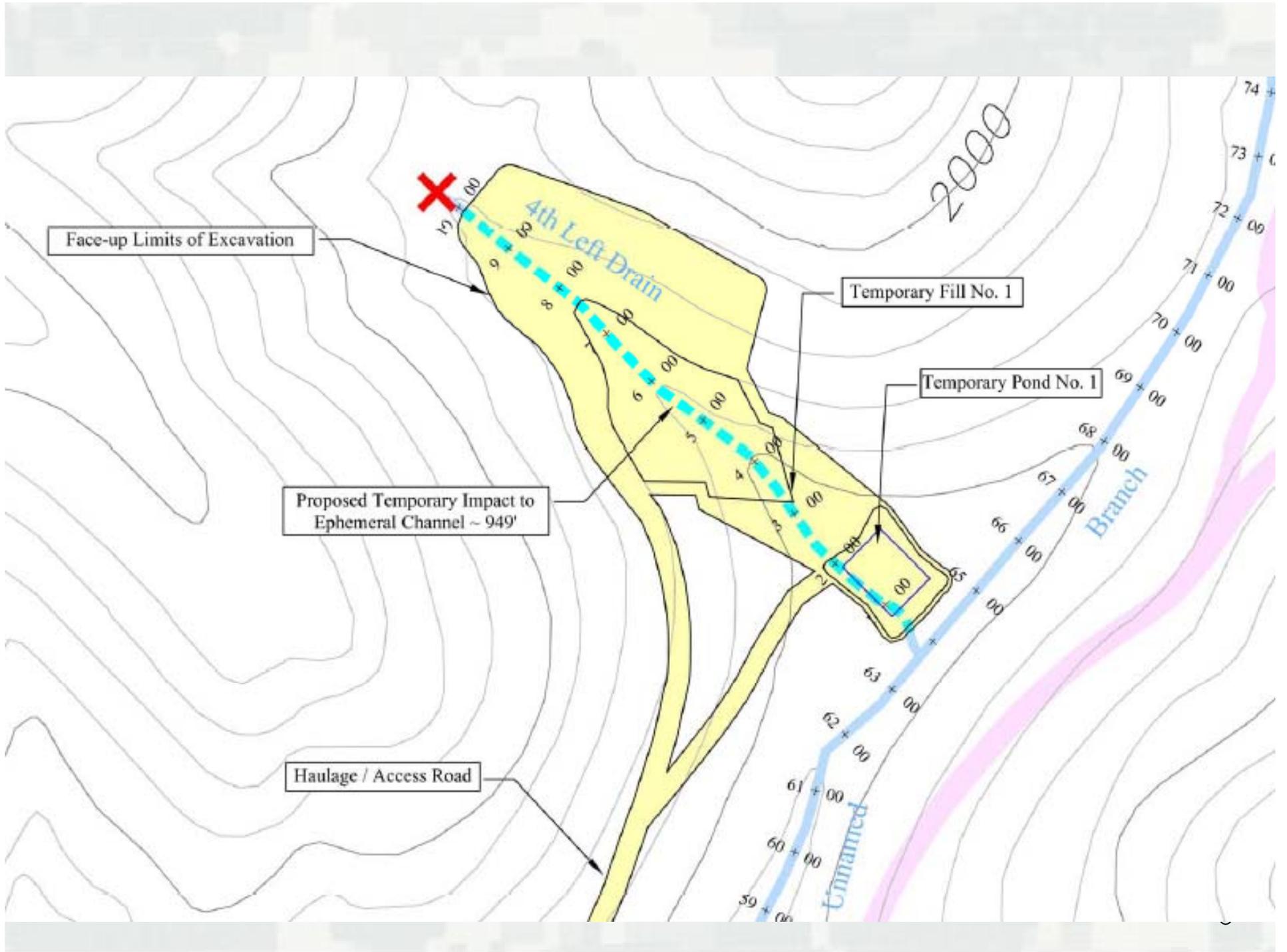


Review of PCN Under Terms and Conditions of NWP 50

- Proposed Underground Mine located in Wyoming County, West Virginia
- Drift Entry – Face-Up Excavation Required
- Activities Requiring Discharge into Waters of the U.S. (Ephemeral and Perennial Waters)
 - Face-Up Excavation (Ephemeral Waters)
 - Construction of Temporary Excess Material Storage Site (Ephemeral Waters)
 - Installation of Temporary Sediment and Drainage Control System (Ephemeral Waters)
 - Reinstallation of a Haul Road Crossing (Perennial Water)







Stream Impact Evaluation

- Impacts (Temporary):
 - 949 feet ephemeral channel
 - 150 feet of perennial channel
- Ephemeral Channel Characteristics:
 - WVSCI & Water Chemistry: Dry, not collected
 - HAV Scores (range): 104 to 123
 - HGM FCI (Avg FCI = 0.86):
 - Hydrology = 0.86
 - Biogeochemical Cycling = 0.94
 - Habitat = 0.78
 - WV SWVM Debits: 1,167.1 (8 yr temporal loss)



USACE FILE NO./Project Name:	SBH Run No.11		IMPACT COORDINATES: (in Decimal Degree)	Lat.	37.595765	Lon.	81.40537	WEATHER:	Sunny, 50F	DATE:	February 28, 2011	
STREAM CLASSIFICATION:	Ephemeral	IMPACT STREAM/SITE ID AND SITE DESCRIPTION: (% stream slope, watershed size (acres), unaltered or impairments)		Channel Slope 5-38%, 49 ac Watershed, Un-impaired Forestland			MITIGATION STREAM CLASS./SITE ID AND SITE DESCRIPTION: (% stream slope, watershed size (acres), unaltered or impairments)		Channel Slope 5-38%, 49 ac Watershed, Un-impaired Forestland			
STREAM IMPACT LENGTH:	949	FORM OF MITIGATION:	Permittee Responsible-On-site	MIT COORDINATES: (in Decimal Degree)	Lat.	37.595765	Lon.	81.40537	PRECIPITATION PAST 48 HRS:	0	Mitigation Length:	949

Column No. 1- Impact Existing Condition (Debit)			
HOM Score (attach data forms):		Average	
Hydrology	0.85		
Biogeochemical Cycling	0.34	0.85333333	
Habitat	0.77		
PART I - Physical, Chemical and Biological Indicators			
	Points	Range	Site Score
PHYSICAL INDICATOR (Applies to all streams classifications)			
USEPA RBP (High Gradient Data Sheet)			
1. Epifaunal Substrate/Available Cover	0-20		0
2. Embeddedness	0-20		12
3. Velocity/ Depth Regime	0-20		0
4. Sediment Deposition	0-20		11
5. Channel Flow Status	0-20	0-1	0
6. Channel Alteration	0-20		18
7. Frequency of Riffles (or bends)	0-20		0
8. Bank Stability (LB & RB)	0-20		17
9. Vegetative Protection (LB & RB)	0-20		14
10. Riparian Vegetative Zone Width (LB & RB)	0-20		18
Total RBP Score		Marginal	90
Sub-Total			0.45
CHEMICAL INDICATOR (Applies to Intermittent and Perennial Streams)			
WVDEP Water Quality Indicators (General)			
Specific Conductivity			
<=99 = 80 points	0-80		70.91
pH			
6.0-8.0 = 80 points	0-80	0-1	7.1
DO			
>5.0 = 30 points	10-30		5
Sub-Total			1
BIOLOGICAL INDICATOR (Applies to Intermittent and Perennial Streams)			
WV Stream Condition Index (WVSCI)			
Grey Zone	0-100	0-1	61.1
Sub-Total			0.611

Column No. 2- Mitigation Existing Condition - Baseline (Credit)			
HOM Score (attach data forms):		Average	
Hydrology			
Biogeochemical Cycling		0	
Habitat			
PART I - Physical, Chemical and Biological Indicators			
	Points	Range	Site Score
PHYSICAL INDICATOR (Applies to all streams classifications)			
USEPA RBP (High Gradient Data Sheet)			
1. Epifaunal Substrate/Available Cover	0-20		
2. Embeddedness	0-20		
3. Velocity/ Depth Regime	0-20		
4. Sediment Deposition	0-20		
5. Channel Flow Status	0-20	0-1	
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			
<=99 = 80 points	0-80		
pH			
6.0-8.0 = 80 points	0-80	0-1	
DO			
>5.0 = 30 points	10-30		
Sub-Total			0
BIOLOGICAL INDICATOR (Applies to Intermittent and Perennial Streams)			
WV Stream Condition Index (WVSCI)			
Grey Zone	0-100	0-1	
Sub-Total			0

Column No. 3- Mitigation Projected at Five Years Post Completion (Credit)			
HOM Score (attach data forms):		Average	
Hydrology	0.7		
Biogeochemical Cycling	0.62	0.58666667	
Habitat	0.44		
PART I - Physical, Chemical and Biological Indicators			
	Points	Range	Site Score
PHYSICAL INDICATOR (Applies to all streams classifications)			
USEPA RBP (High Gradient Data Sheet)			
1. Epifaunal Substrate/Available Cover	0-20		0
2. Embeddedness	0-20		13
3. Velocity/ Depth Regime	0-20		0
4. Sediment Deposition	0-20		12
5. Channel Flow Status	0-20	0-1	0
6. Channel Alteration	0-20		12
7. Frequency of Riffles (or bends)	0-20		0
8. Bank Stability (LB & RB)	0-20		16
9. Vegetative Protection (LB & RB)	0-20		12
10. Riparian Vegetative Zone Width (LB & RB)	0-20		20
Total RBP Score		Marginal	85
Sub-Total			0.425
CHEMICAL INDICATOR (Applies to Intermittent and Perennial Streams)			
WVDEP Water Quality Indicators (General)			
Specific Conductivity			
<=99 = 80 points	0-80		70
pH			
6.0-8.0 = 80 points	0-80	0-1	7
DO			
>5.0 = 30 points	10-30		5
Sub-Total			0.55
BIOLOGICAL INDICATOR (Applies to Intermittent and Perennial Streams)			
WV Stream Condition Index (WVSCI)			
Grey Zone	0-100	0-1	61
Sub-Total			0.61

Column No. 4- Mitigation Projected at Ten Years Post Completion (Credit)			
HOM Score (attach data forms):		Average	
Hydrology	0.73		
Biogeochemical Cycling	0.64	0.62666667	
Habitat	0.51		
PART I - Physical, Chemical and Biological Indicators			
	Points	Range	Site Score
PHYSICAL INDICATOR (Applies to all streams classifications)			
USEPA RBP (High Gradient Data Sheet)			
1. Epifaunal Substrate/Available Cover	0-20		0
2. Embeddedness	0-20		16
3. Velocity/ Depth Regime	0-20		0
4. Sediment Deposition	0-20		16
5. Channel Flow Status	0-20	0-1	0
6. Channel Alteration	0-20		15
7. Frequency of Riffles (or bends)	0-20		0
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		Marginal	101
Sub-Total			0.505
CHEMICAL INDICATOR (Applies to Intermittent and Perennial Streams)			
WVDEP Water Quality Indicators (General)			
Specific Conductivity			
<=99 = 80 points	0-80		70
pH			
6.0-8.0 = 80 points	0-80	0-1	7
DO			
>5.0 = 30 points	10-30		5
Sub-Total			1
BIOLOGICAL INDICATOR (Applies to Intermittent and Perennial Streams)			
WV Stream Condition Index (WVSCI)			
Grey Zone	0-100	0-1	65
Sub-Total			0.65

Column No. 5- Mitigation Projected At Maturity (Credit)			
HOM Score (attach data forms):		Average	
Hydrology	0.81		
Biogeochemical Cycling	0.91	0.81666667	
Habitat	0.73		
PART I - Physical, Chemical and Biological Indicators			
	Points	Range	Site Score
PHYSICAL INDICATOR (Applies to all streams classifications)			
USEPA RBP (High Gradient Data Sheet)			
1. Epifaunal Substrate/Available Cover	0-20		0
2. Embeddedness	0-20		16
3. Velocity/ Depth Regime	0-20		0
4. Sediment Deposition	0-20		18
5. Channel Flow Status	0-20	0-1	0
6. Channel Alteration	0-20		15
7. Frequency of Riffles (or bends)	0-20		0
8. Bank Stability (LB & RB)	0-20		18
9. Vegetative Protection (LB & RB)	0-20		20
10. Riparian Vegetative Zone Width (LB & RB)	0-20		20
Total RBP Score		Marginal	109
Sub-Total			0.545
CHEMICAL INDICATOR (Applies to Intermittent and Perennial Streams)			
WVDEP Water Quality Indicators (General)			
Specific Conductivity			
<=99 = 80 points	0-80		70
pH			
6.0-8.0 = 80 points	0-80	0-1	7
DO			
>5.0 = 30 points	10-30		5
Sub-Total			1
BIOLOGICAL INDICATOR (Applies to Intermittent and Perennial Streams)			
WV Stream Condition Index (WVSCI)			
Good	0-100	0-1	68
Sub-Total			0.68

PART II - Index and Unit Score		
Index	Linear Feet	Unit Score
0.770166667	949	730.888167

PART II - Index and Unit Score		
Index	Linear Feet	Unit Score
0	949	0

PART II - Index and Unit Score		
Index	Linear Feet	Unit Score
0.5575	949	529.0675

PART II - Index and Unit Score		
Index	Linear Feet	Unit Score
0.6725	949	638.2025

PART II - Index and Unit Score		
Index	Linear Feet	Unit Score
0.779166667	949	739.42917



BUILDING STRONG®

PART III - Impact Factors (See instruction page to insert default values for MITIGATION BANKING and ILF)			
Temporal Loss-Construction		Long-term Protection	
<i>*Note: Reflects duration of aquatic functional loss between the time of an impact (debit) and completion of compensatory mitigation (credit).</i>		<i>*Note: Period between completion of compensatory mitigation measures and the time required for maturity, as it relates to function (i.e. maturity of tree stratum to provide organic matter and detritus within riparian stream or wetland buffer corridor).</i>	
Years	8	% Add. Mitigation and Monitoring Period	Long-Term Protection (Years)
Sub-Total	0.18484	0 + 5/10 Year Monitoring	101
Temporal Loss-Maturity		Sub-Total	0
% Add. Mitigation	Temporal Loss-Maturity (Years)	PART IV - Index to Unit Score Conversion	
30%	30	Final Index Score (Debit)	Linear Feet
Sub-Total	0.2748	1.229806667	949
		Unit Score (Debit)	ILF Costs (Offsetting Debit Units)
		1167.086527	\$933,669.22

PART V- Comparison of Unit Scores and Projected Balance									
Final Unit Score (Debit) [No Net Loss Value]	1167.086527	Mitigation Existing Condition - Baseline (Credit)	0	Mitigation Projected at Five Years Post Completion (Credit)	529.0675	Mitigation Projected at Ten Years Post Completion (Credit)	638.2025	Mitigation Projected At Maturity (Credit)	739.4291667
FINAL PROJECTED NET BALANCE					529.0675		638.2025		739.4291667

Part VI - Mitigation Considerations (Incentives)			
Extent of Stream Restoration <i>*Note1: Reference the Instructional handout to determine the correct Restoration Levels (below) for your project</i> <i>*Note2: Place an "X" in the appropriate category (only select one).</i>		Extended Upland Buffer Zone <i>*Note1: Reference Instructional handout for the definitions of the Buffer Zone Mitigation Extents and Types (below)</i> <i>*Note2: Enter the buffer width for each channel side (Left Bank and Right Bank)</i> <i>*Note3: Select the appropriate mitigation type</i>	
Level I Restoration		Buffer Width	Left Bank
Level II Restoration		50	Preservation and Re-vegetation
Level III Restoration		51-150	Preservation
		Buffer Width	Right Bank
		50	Preservation and Re-vegetation
		51-150	Preservation
		Average Buffer Width/Side	50

Site	Impact Unit Yield (Debit)	Mitigation Unit Yield (Credit)
4th LD Unnamed Branch	1167.086527	998.229375



BUILDING STRONG®

Stream Impact Evaluation

- Perennial Channel Characteristics:
 - WVSCI: 70.1 (Good Range)
 - Water Chemistry: 340 $\mu\text{s}/\text{cm}$ conductivity; all parameters within acceptable ranges
 - HAV Scores (range): 134
 - HGM FCI: Perennial Stream – not applicable
 - WV SWVM Debits: 173.1 (8 year temporal loss)



USACE FILE NO./Project Name:	Still Run No.11	IMPACT COORDINATES: (In Decimal Degrees)	Lat.	37.589155	Lon.	81.41905	WEATHER:	Sunny	DATE:	February 28, 2011
------------------------------	-----------------	--	------	-----------	------	----------	----------	-------	-------	-------------------

STREAM CLASSIFICATION:	Perennial	IMPACT STREAM/SITE ID AND SITE DESCRIPTION: (% stream slope, watershed size (acres), unaltered or impairments)	Channel Slope 2-4%, 684 ac Watershed, Un-Impaired Forestland	MITIGATION STREAM CLASS/SITE ID AND SITE DESCRIPTION: (% stream slope, watershed size (acres), unaltered or impairments)	Channel Slope 2-4%, 684 ac Watershed, Un-Impaired Forestland
------------------------	-----------	--	--	--	--

STREAM IMPACT LENGTH:	150	FORM OF MITIGATION:	Permittee Responsible-Onsite	MIT COORDINATES: (In Decimal Degrees)	Lat.	37.589155	Lon.	81.41905	PRECIPITATION PAST 48 HRS:	0	Mitigation Length:	150
-----------------------	-----	---------------------	------------------------------	---------------------------------------	------	-----------	------	----------	----------------------------	---	--------------------	-----

Column No. 1- Impact Existing Condition (Debit)			
HCM Score (attach data forms):	Average		
Hydrology			0
Biogeochemical Cycling			0
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		11
2. Embeddiness	0-20		13
3. Velocity/ Depth Regime	0-20		8
4. Sediment Deposition	0-20		8
5. Channel Flow Status	0-20		5
6. Channel Alteration	0-20	D-1	13
7. Frequency of Riffles (or bends)	0-20		12
8. Bank Stability (LB & RB)	0-20		12
9. Vegetative Protection (LB & RB)	0-20		8
10. Riparian Vegetative Zone Width (LB & RB)	0-20		102
Total RBP Score	Marginal		0.51
Sub-Total			0.51
CHEMICAL INDICATOR (Applies to Intermittent and Perennial Streams)			
WVDEP Water Quality Indicators (General)			
Specific Conductivity			
300-399 - 70 points	0-80		340
pH			
6.0-8.0 = 80 points	0-80	D-1	6.7
DO			
	10-30		5
Sub-Total			0.9
BIOLOGICAL INDICATOR (Applies to Intermittent and Perennial Streams)			
WV Stream Condition Index (WVSCI)			
Good	0-100	D-1	70.1
Sub-Total			0.701

Column No. 2- Mitigation Existing Condition - Baseline (Credit)			
HCM Score (attach data forms):	Average		
Hydrology			0
Biogeochemical Cycling			0
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		
2. Embeddiness	0-20		
3. Velocity/ Depth Regime	0-20		
4. Sediment Deposition	0-20		
5. Channel Flow Status	0-20		
6. Channel Alteration	0-20	D-1	
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			
300-399 - 70 points	0-80		
pH			
6.0-8.0 = 80 points	0-80	D-1	
DO			
	10-30		
Sub-Total			0
BIOLOGICAL INDICATOR (Applies to Intermittent and Perennial Streams)			
WV Stream Condition Index (WVSCI)			
Good	0-100	D-1	
Sub-Total			0

Column No. 3- Mitigation Projected at Five Years Post Completion (Credit)			
HCM Score (attach data forms):	Average		
Hydrology			0
Biogeochemical Cycling			0
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		13
2. Embeddiness	0-20		15
3. Velocity/ Depth Regime	0-20		13
4. Sediment Deposition	0-20		13
5. Channel Flow Status	0-20		8
6. Channel Alteration	0-20	D-1	10
7. Frequency of Riffles (or bends)	0-20		13
8. Bank Stability (LB & RB)	0-20		12
9. Vegetative Protection (LB & RB)	0-20		12
10. Riparian Vegetative Zone Width (LB & RB)	0-20		15
Total RBP Score	Suboptimal		0.635
Sub-Total			0.635
CHEMICAL INDICATOR (Applies to Intermittent and Perennial Streams)			
WVDEP Water Quality Indicators (General)			
Specific Conductivity			
300-399 - 70 points	0-80		340
pH			
6.0-8.0 = 80 points	0-80	D-1	6.7
DO			
	10-30		5
Sub-Total			0.55
BIOLOGICAL INDICATOR (Applies to Intermittent and Perennial Streams)			
WV Stream Condition Index (WVSCI)			
Good	0-100	D-1	70
Sub-Total			0.7

Column No. 4- Mitigation Projected at Ten Years Post Completion (Credit)			
HCM Score (attach data forms):	Average		
Hydrology			0
Biogeochemical Cycling			0
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		16
2. Embeddiness	0-20		16
3. Velocity/ Depth Regime	0-20		15
4. Sediment Deposition	0-20		16
5. Channel Flow Status	0-20		11
6. Channel Alteration	0-20	D-1	15
7. Frequency of Riffles (or bends)	0-20		15
8. Bank Stability (LB & RB)	0-20		16
9. Vegetative Protection (LB & RB)	0-20		15
10. Riparian Vegetative Zone Width (LB & RB)	0-20		18
Total RBP Score	Suboptimal		0.77
Sub-Total			0.77
CHEMICAL INDICATOR (Applies to Intermittent and Perennial Streams)			
WVDEP Water Quality Indicators (General)			
Specific Conductivity			
300-399 - 70 points	0-80		340
pH			
6.0-8.0 = 80 points	0-80	D-1	6.7
DO			
	10-30		5
Sub-Total			0.9
BIOLOGICAL INDICATOR (Applies to Intermittent and Perennial Streams)			
WV Stream Condition Index (WVSCI)			
Good	0-100	D-1	72
Sub-Total			0.72

Column No. 6- Mitigation Projected At Maturity (Credit)			
HCM Score (attach data forms):	Average		
Hydrology			0
Biogeochemical Cycling			0
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		16
2. Embeddiness	0-20		16
3. Velocity/ Depth Regime	0-20		15
4. Sediment Deposition	0-20		16
5. Channel Flow Status	0-20		11
6. Channel Alteration	0-20	D-1	16
7. Frequency of Riffles (or bends)	0-20		15
8. Bank Stability (LB & RB)	0-20		16
9. Vegetative Protection (LB & RB)	0-20		20
10. Riparian Vegetative Zone Width (LB & RB)	0-20		20
Total RBP Score	Suboptimal		0.815
Sub-Total			0.815
CHEMICAL INDICATOR (Applies to Intermittent and Perennial Streams)			
WVDEP Water Quality Indicators (General)			
Specific Conductivity			
300-399 - 70 points	0-80		340
pH			
6.0-8.0 = 80 points	0-80	D-1	6.7
DO			
	10-30		5
Sub-Total			0.9
BIOLOGICAL INDICATOR (Applies to Intermittent and Perennial Streams)			
WV Stream Condition Index (WVSCI)			
Good	0-100	D-1	74
Sub-Total			0.74

PART II - Index and Unit Score		
Index	Linear Feet	Unit Score
0.70366667	150	105.55

PART II - Index and Unit Score		
Index	Linear Feet	Unit Score
0	150	0

PART II - Index and Unit Score		
Index	Linear Feet	Unit Score
0.62833333	150	94.25

PART II - Index and Unit Score		
Index	Linear Feet	Unit Score
0.79666667	150	119.5

PART II - Index and Unit Score		
Index	Linear Feet	Unit Score
0.81833333	150	122.75



BUILDING STRONG®

PART III - Impact Factors
(See instruction page to insert default values for MITIGATION BANKING and ILF)

Temporal Loss-Construction	
<i>*Note: Reflects duration of aquatic functional loss between the time of an impact (debit) and completion of compensatory mitigation (credit).</i>	
Years	8
Sub-Total	0.16888
Temporal Loss-Maturity	
<i>*Note: Period between completion of compensatory mitigation measures and the time required for maturity, as it relates to function (i.e. maturity of tree stratum to provide organic matter and detritus within riparian stream or wetland buffer corridor).</i>	
% Add. Mitigation	Temporal Loss-Maturity (Years)
30%	30
Sub-Total	0.281466667

Long-term Protection	
% Add. Mitigation and Monitoring Period	Long-Term Protection (Years)
0 + 5/10 Year Monitoring	101
Sub-Total	0

PART IV - Index to Unit Score Conversion			
Final Index Score (Debit)	Linear Feet	Unit Score (Debit)	ILF Costs (Offsetting Debit Units)
1.154013333	150	1/3.102	\$138,481.60

PART V - Comparison of Unit Scores and Projected Balance

Final Unit Score (Debit) [No Net Loss Value]	173.102	Mitigation Existing Condition - Baseline (Credit)	0	Mitigation Projected at Five Years Post Completion (Credit)	94.25	Mitigation Projected at Ten Years Post Completion (Credit)	119.5	Mitigation Projected At Maturity (Credit)	122.75
FINAL PROJECTED NET BALANCE					94.25		119.5		122.75

Part VI - Mitigation Considerations (Incentives)

Extent of Stream Restoration	
<i>*Note1: Reference the Instructional handout to determine the correct Restoration Levels (below) for your project</i>	
<i>*Note2: Place an "X" in the appropriate category (only select one).</i>	
Level I Restoration	
Level II Restoration	
Level III Restoration	X

Extended Upland Buffer Zone		
<i>*Note1: Reference Instructional handout for the definitions of the Buffer Zone Mitigation Extents and Types (below)</i>		
<i>*Note2: Enter the buffer width for each channel side (Left Bank and Right Bank)</i>		
<i>*Note3: Select the appropriate mitigation type</i>		
Buffer Width	Left Bank	
50	0-50	Preservation and Re-vegetation
	51-150	Preservation
Buffer Width	Right Bank	
50	0-50	Preservation and Re-vegetation
	51-150	Preservation
Average Buffer Width/Side	50	

Site	Impact Unit Yield (Debit)	Mitigation Unit Yield (Credit)
Unnamed Branch	173.102	227.0875



Stream Mitigation Evaluation

- WV SWVM Credits:
 - Re-establishment of 949 feet of Ephemeral Channel after 8 years with NCD Techniques
 - Generates 998.2 Credits
 - Outstanding Debit Balance of 168.9
 - Applicant Proposes Rehabilitation of a 550-foot degraded reach of Unnamed Branch:
 - Offset Temporal Loss
 - Priority 3 Restoration Proposed
 - Level 3 Restoration Incentive
 - 116.7 Credits
 - Outstanding Debit Balance: 52.2



USACE FILE NO./Project Name:	Still Run No.11	IMPACT COORDINATES: (In Decimal Degrees)	Lat.	37.595765	Lon.	81.40537	WEATHER:	Sunny	DATE:	February 28, 2011		
STREAM CLASSIFICATION:	Perennial	IMPACT STREAM/SITE ID AND SITE DESCRIPTION: (% stream slope, watershed size (acres), unaltered or impairments)	Channel Slope 2-4%, 684 ac Watershed, Un-Impaired Forestland			MITIGATION STREAM CLASS./SITE ID AND SITE DESCRIPTION: (% stream slope, watershed size (acres), unaltered or impairments)	Channel Slope 2-4%, 684 ac Watershed, Un-Impaired Forestland					
STREAM IMPACT LENGTH:	0	FORM OF MITIGATION:	Permittee Responsible-Onsite	MIT COORDINATES: (In Decimal Degrees)	Lat.	37.588921	Lon.	81.419489	PRECIPITATION PAST 48 HRS:	0	Mitigation Length:	550

Column No. 1- Impact Existing Condition (Debit)			
HGM Score (attach data forms):	Average		
Hydrology			0
Biogeochemical Cycling			0
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		11
2. Embeddiness	0-20		13
3. Velocity/ Depth Regime	0-20		8
4. Sediment Deposition	0-20		8
5. Channel Flow Status	0-20	0-1	5
6. Channel Alteration	0-20	0-1	13
7. Frequency of Riffles (or bends)	0-20		12
8. Bank Stability (LB & RB)	0-20		12
9. Vegetative Protection (LB & RB)	0-20		12
10. Riparian Vegetative Zone Width (LB & RB)	0-20		8
Total RBP Score		Poor	102
Sub-Total			0
CHEMICAL INDICATOR (Applies to Intermittent and Perennial Streams)			
WVDEP Water Quality Indicators (General)			
Specific Conductivity	0-40		340
pH	5-9	0-1	6.7
DO	5-8	0-1	5
Sub-Total			0.9
BIOLOGICAL INDICATOR (Applies to Intermittent and Perennial Streams)			
WV Stream Condition Index (WVSCI)			
Good	0-100	0-1	70.1
Sub-Total			0

Column No. 2- Mitigation Existing Condition - Baseline (Credit)			
HGM Score (attach data forms):	Average		
Hydrology			0
Biogeochemical Cycling			0
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		11
2. Embeddiness	0-20		13
3. Velocity/ Depth Regime	0-20		8
4. Sediment Deposition	0-20		8
5. Channel Flow Status	0-20	0-1	5
6. Channel Alteration	0-20	0-1	13
7. Frequency of Riffles (or bends)	0-20		12
8. Bank Stability (LB & RB)	0-20		12
9. Vegetative Protection (LB & RB)	0-20		12
10. Riparian Vegetative Zone Width (LB & RB)	0-20		8
Total RBP Score		Marginal	102
Sub-Total			0.51
CHEMICAL INDICATOR (Applies to Intermittent and Perennial Streams)			
WVDEP Water Quality Indicators (General)			
Specific Conductivity	0-40		340
pH	5-9	0-1	6.7
DO	5-8	0-1	5
Sub-Total			0.9
BIOLOGICAL INDICATOR (Applies to Intermittent and Perennial Streams)			
WV Stream Condition Index (WVSCI)			
Good	0-100	0-1	70.1
Sub-Total			0.701

Column No. 3- Mitigation Projected at Five Years Post Completion (Credit)			
HGM Score (attach data forms):	Average		
Hydrology			0
Biogeochemical Cycling			0
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		13
2. Embeddiness	0-20		15
3. Velocity/ Depth Regime	0-20		13
4. Sediment Deposition	0-20		13
5. Channel Flow Status	0-20	0-1	8
6. Channel Alteration	0-20	0-1	13
7. Frequency of Riffles (or bends)	0-20		12
8. Bank Stability (LB & RB)	0-20		12
9. Vegetative Protection (LB & RB)	0-20		12
10. Riparian Vegetative Zone Width (LB & RB)	0-20		15
Total RBP Score		Suboptimal	117
Sub-Total			0.585
CHEMICAL INDICATOR (Applies to Intermittent and Perennial Streams)			
WVDEP Water Quality Indicators (General)			
Specific Conductivity	0-40		340
pH	5-9	0-1	6.7
DO	5-8	0-1	5
Sub-Total			0.9
BIOLOGICAL INDICATOR (Applies to Intermittent and Perennial Streams)			
WV Stream Condition Index (WVSCI)			
Good	0-100	0-1	70
Sub-Total			0.7

Column No. 4- Mitigation Projected at Ten Years Post Completion (Credit)			
HGM Score (attach data forms):	Average		
Hydrology			0
Biogeochemical Cycling			0
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		16
2. Embeddiness	0-20		16
3. Velocity/ Depth Regime	0-20		15
4. Sediment Deposition	0-20		16
5. Channel Flow Status	0-20	0-1	11
6. Channel Alteration	0-20	0-1	15
7. Frequency of Riffles (or bends)	0-20		15
8. Bank Stability (LB & RB)	0-20		16
9. Vegetative Protection (LB & RB)	0-20		16
10. Riparian Vegetative Zone Width (LB & RB)	0-20		19
Total RBP Score		Suboptimal	154
Sub-Total			0.77
CHEMICAL INDICATOR (Applies to Intermittent and Perennial Streams)			
WVDEP Water Quality Indicators (General)			
Specific Conductivity	0-40		340
pH	5-9	0-1	6.7
DO	5-8	0-1	5
Sub-Total			0.9
BIOLOGICAL INDICATOR (Applies to Intermittent and Perennial Streams)			
WV Stream Condition Index (WVSCI)			
Good	0-100	0-1	72
Sub-Total			0.72

Column No. 5- Mitigation Projected at Maturity (Credit)			
HGM Score (attach data forms):	Average		
Hydrology			0
Biogeochemical Cycling			0
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		15
2. Embeddiness	0-20		16
3. Velocity/ Depth Regime	0-20		15
4. Sediment Deposition	0-20		16
5. Channel Flow Status	0-20	0-1	11
6. Channel Alteration	0-20	0-1	16
7. Frequency of Riffles (or bends)	0-20		15
8. Bank Stability (LB & RB)	0-20		16
9. Vegetative Protection (LB & RB)	0-20		20
10. Riparian Vegetative Zone Width (LB & RB)	0-20		20
Total RBP Score		Suboptimal	163
Sub-Total			0.815
CHEMICAL INDICATOR (Applies to Intermittent and Perennial Streams)			
WVDEP Water Quality Indicators (General)			
Specific Conductivity	0-40		340
pH	5-9	0-1	6.7
DO	5-8	0-1	5
Sub-Total			0.9
BIOLOGICAL INDICATOR (Applies to Intermittent and Perennial Streams)			
WV Stream Condition Index (WVSCI)			
Good	0-100	0-1	74
Sub-Total			0.74

PART II - Index and Unit Score		
Index	Linear Feet	Unit Score
0.325	0	0

PART II - Index and Unit Score		
Index	Linear Feet	Unit Score
0.70366667	550	387.01667

PART II - Index and Unit Score		
Index	Linear Feet	Unit Score
0.728333333	550	400.58333

PART II - Index and Unit Score		
Index	Linear Feet	Unit Score
0.79666667	550	438.16667

PART II - Index and Unit Score		
Index	Linear Feet	Unit Score
0.818333333	550	450.8333



BUILDING STRONG®

PART III - Impact Factors
(See instruction page to insert default values for MITIGATION BANKING and ILF)

Temporal Loss-Construction	
<i>*Note: Reflects duration of aquatic functional loss between the time of an impact (debit) and completion of compensatory mitigation (credit).</i>	
Years	1
Sub-Total	0

Temporal Loss-Maturity	
<i>*Note: Period between completion of compensatory mitigation measures and the time required for maturity, as it relates to function (i.e. maturity of tree stratum to provide organic matter and detritus within riparian stream or wetland buffer corridor).</i>	
% Add. Mitigation	Temporal Loss-Maturity (Years)
30%	30
Sub-Total	0.13

Long-term Protection	
% Add. Mitigation and Monitoring Period	Long-Term Protection (Years)
0 + 5/10 Year Monitoring	101
Sub-Total	0

PART IV - Index to Unit Score Conversion			
Final Index Score (Debit)	Linear Feet	Unit Score (Debit)	ILF Costs (Offsetting Debit Units)
0.455	0	0	\$0.00

PART V - Comparison of Unit Scores and Projected Balance

Final Unit Score (Debit) [No Net Loss Value]	0	Mitigation Existing Condition - Baseline (Credit)	387.0166667	Mitigation Projected at Five Years Post Completion (Credit)	400.5833333	Mitigation Projected at Ten Years Post Completion (Credit)	438.1666667	Mitigation Projected At Maturity (Credit)	450.0833333
FINAL PROJECTED NET BALANCE					13.5666667		51.15		63.0666667

Part VI - Mitigation Considerations (Incentives)

Extent of Stream Restoration	
<i>*Note1: Reference the Instructional handout to determine the correct Restoration Levels (below) for your project</i>	
<i>*Note2: Place an "X" in the appropriate category (only select one).</i>	
Level I Restoration	
Level II Restoration	
Level III Restoration	X

Extended Upland Buffer Zone		
<i>*Note¹: Reference Instructional handout for the definitions of the Buffer Zone Mitigation Extents and Types (below)</i>		
<i>*Note²: Enter the buffer width for each channel side (Left Bank and Right Bank)</i>		
<i>*Note³: Select the appropriate mitigation type</i>		
Buffer Width	Left Bank	
50	0-50	Preservation and Re-vegetation
	51-150	Preservation
Buffer Width	Right Bank	
50	0-50	Preservation and Re-vegetation
	51-150	Preservation
Average Buffer Width/Side	50	

Site	Impact Unit Yield (Debit)	Mitigation Unit Yield (Credit)
Unnamed Branch	0	116.6733333



Stream Mitigation Evaluation

- Rehabilitation of Haul Road Crossing on Unnamed Branch (150 feet)
 - 173.1 Debits
 - Rehabilitation Generates 227.1 Credits
 - Outstanding Credit Balance: 54
 - Generated by Proposed Ecological Lift
 - Offsets the 52.2 Debit Deficit Generated by Temporal Loss of Ephemeral Channel During Mine Operation

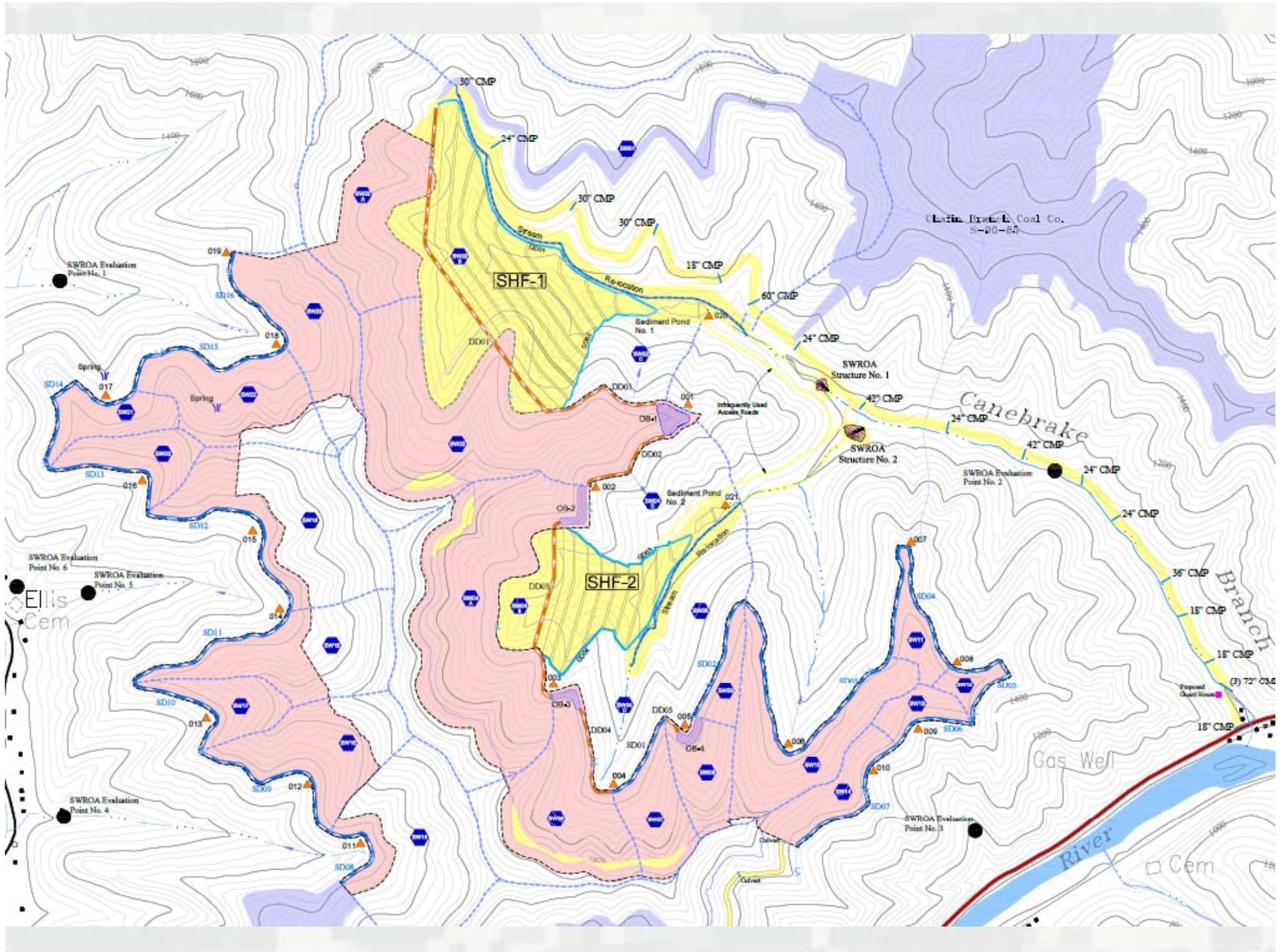
Impact/ Mitigation	Debit	Credit
Temporary Fill/Ephemeral Stream	1,167.1	998.2
Re-establishment		
Stream Rehabilitation	---	116.7
Temporary Crossing/Stream Rehabilitation	173.1	227.1
Total	1340.2	1342



Example #2: Surface Mine

- Mining Methods
 - Full Extraction Area
 - Highwall/Contour
 - Combinations of Above Methods
- Typical Impacts
 - Permanent Excess Overburden Storage (Valley Fills)
 - Mine-Through of Streams
 - Temporary Sediment and Drainage Control System
 - Access/Haul Road(s)





Preliminary Stream Impact Evaluation

Impact Type	Perennial Impacts (feet)	Intermittent Impacts (feet)	Ephemeral Impacts (feet)
Valley Fill (Permanent)	1,505.0	6,262.0	3,251.0
Mine-Through (Permanent)	---	655.6	359.8
Sediment & Drainage Control (Temporary)	1,497.0	79.0	150.0
Stream Relocation (Temporary)	191.0	453.0	---
Total	3,193.0	7,449.6	3,760.8

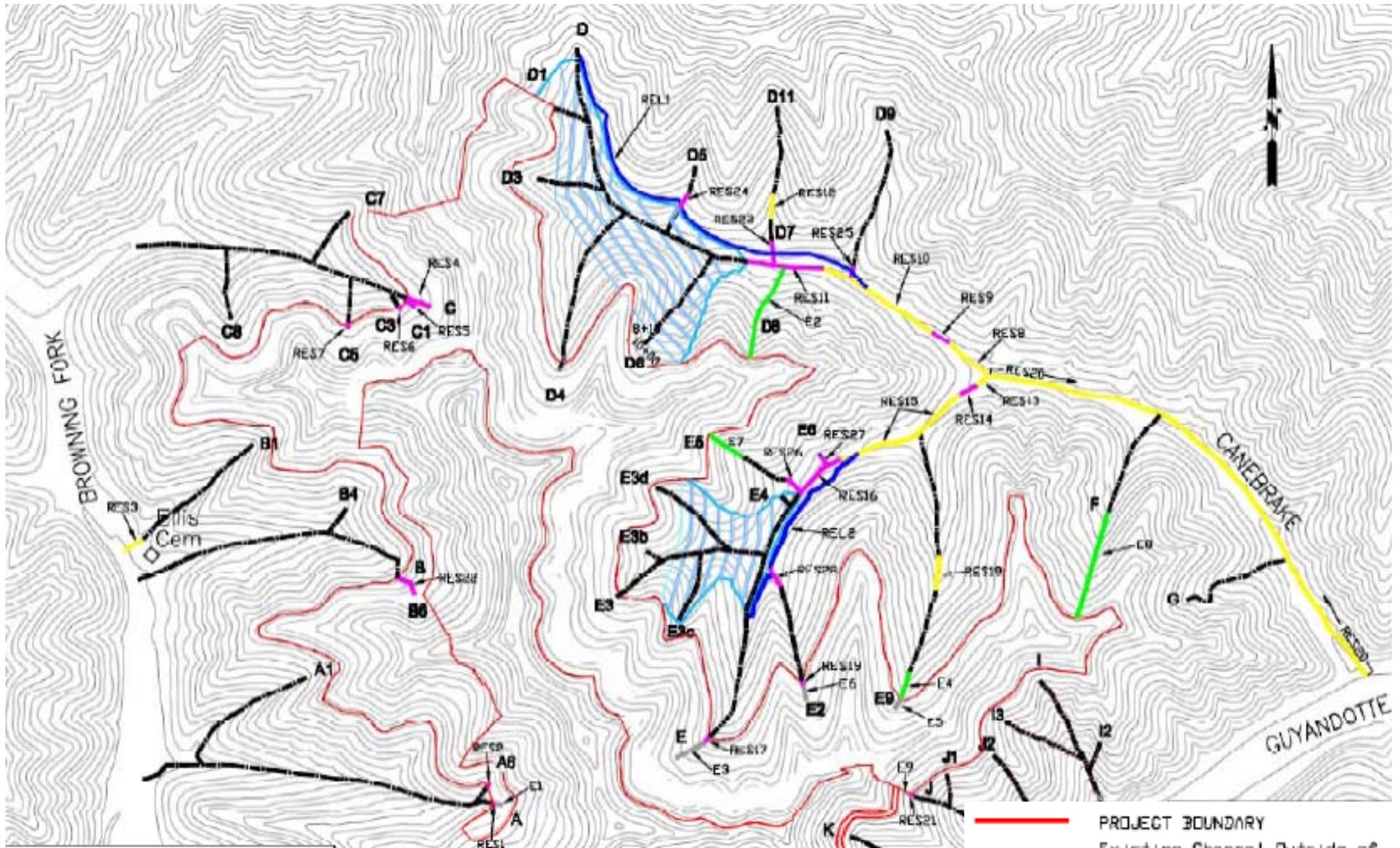
- Perennial, Intermittent, & Ephemeral Stream Impacts (Temporary & Permanent)
- WVSCI: 72.11 to 74.89
- Water Chemistry: Elevated Conductivity, Sulfates, Dissolved Solids, & Alkalinity
- HAV: 87 to 164



Preliminary Stream Mitigation Evaluation

- Mitigation Goal:
 - Establish, re-establish, and rehabilitate channels within the impacted watersheds to offset unavoidable losses to jurisdictional streams
- HGM Data: Field Work Conducted Prior to July 2010 Release
- WV SWVM: Applicant to Submit Information in Version 2.0

Mitigation Type	Length (feet)
Stream Establishment (Mine Reclamation)	2,914.0
Stream Establishment (Stream Relocations)	5,294.0
Stream Re-establishment (Mine Reclamation)	3,239.4
Stream Re-establishment & Rehabilitation within the Browning Fork & Canebrake Branch Watersheds	9,206.0
Total	20,653.4



- PROJECT BOUNDARY
- Existing Channel Outside of Proposed Mitigation Areas
- Insite Stream Relocation
- Insite Stream Establishment
- Insite Stream Restoration
- Offsite Stream Establishment
- Offsite Stream Restoration

Summary

- WVSCI, Water Chemistry & RBP HAV
 - Characterize Stream Quality
- IFAA & HGM
 - Provide Functional Assessment Methodologies for High Gradient Streams
- WV SWVM
 - Combines Above Parameters
 - Quantifies Permanent & Temporal Loss
 - Quantifies Ecological Lift
 - Generates Ecological Currency



Questions?



BUILDING STRONG®