High Gradient Bioassessment Stream Visit Sheet

STREAM	NAME:	S014				LOCATION: Bigbone, KY				
STATIO	N #: N/A					COUNTY: Boone			PROGRAM: PROJECT:	
INVEST	IGATORS	S: SM, J	F			DATE 2/20	12016	TIME	Start:	
Verify Sit	te LAT/LO	NG vs G	PS 🗖	YES NO	A	DATE: 3/30	2010	(24hr)	Finish:	
100		Station		Downstree	Rea	ch Unstrear	1	CANO	PY COVER:	STREAM
LAT		Junion		Downstruc		opstreat		Fully Exp	posed (0-25%) Exposed (25-5)	0%) Perennial
LONG		1	1.12					Partially	Shaded (50-75 aded (75-100%	%) Ephemeral ) Intermittent
WEAT.	HER N	low P	ast 24 ho	urs	LOCAL	WATERSHED F	EATURE	ES (Predomin	nant Surroundin	ng Land Use):
a scourin	ng rain		Heav Stead	y rain Iy rain	Deep 1	e Mining Mining		nercial	Pasture	/Grazing
in the las days?	st 14		Inter	mittent showers	Oil We	ells		rial	Silvicu	Iture Runoff/Storm Sewers
Yes	No C		Clou	dy	Reside	ntial		010µ3		Cunoi b Storin Sewers
INST Stream V	FREAM F	EATUR	ES A	HVDRAUL		heres 19	RIP	ARIAN VEG	ETATION	
Maximu	m Depth	0.5	ft	STRUCTUR	ES S	TREAM FLOW	Tre	es Herbac	eous	CHANNEL
Reach Le	ength le/Run/Poo	101	m	Dams Bridge Abutn	nents	Pooled	Numb	asses Shrut er of strata	Dom.	Dredging
(No	o. Sampled	in Reach	1)	Island Waterfalls		High	Tree/S	hrub Taxa		Channelization
<u>1</u> _Ri	iffle <u>1</u> F	Run 1	Pool	Other: Catch b	asin	Normal	Junipen	us virginiana, A	Andropogon sp.	
P-CHEM	1		Instru	ment Used:	1.00	1100		Da	te Calibrated:	New Ches.
Temp(°C	.)	D.O.	. (mg/l)	%Sat	uration	pH(S.U	.)(	Cond	т	urb
			04		Sample Co	ollection Verific	ation	The state		
Algae	Si	ample: [	QualM	HC 🗌 Other	E	Visual Assessm	ent	Lead C	Collector:	
Fish	C	BPEF	Seine	Other Tim	e: BPEF	Seine	24	Lead C	Collector:	
Habitat		] RBP [	Substra	ate 🗌 Other:	1.00		Sec.	Lead C	Collector:	
Inverteb	rates [	] 1m <sup>2</sup>	] Qual	] Other:				Lead C	Collector:	
TPI		20 Jab	(#Jabs: C	CobbleSnags	sVeg	. Banks San	dM	acrophytes	Other	
Tissue:	N Lon L	0. of Sat	nples col	lected S	p:	L on Ug		Lead	Collector:	
water Ci	nem L	J Herbic		Pesticides  Ortho		r.		Leau	onector.	
Duplica	te Sample	es Take	n:				1		19 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	
								No.		
				5	Substrate	Characteriz	ation			
Substrate	e 🔳 Est. 🚺	]P.C.	Riffle <sup>8</sup>	30 %	Ru	n 10 %	P	ool 10	%	Reach Total
Silt/Clay	y (<0.06 m	nm)								50
Sand (0.	06 – 2 mm	n)			9 (17-5) 3 - 5 194					10
Gravel (2	2-64 mm)									25
Cobble (	(64 - 256 )	mm)								10
Boulders	s (>256 m	m)								5
Bedrock		-								0
NOT	ES/COM	IMEN	rs:							

SITE NOT SAMPLED:

Land owner denial Dry

Unsafe

Too deep/Impounded

Site not found/Secluded

## RBP High Gradient Habitat

Habitat	Condition Category											
Parameter	Optimal	Suboptimal	Marginal	Poor								
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0								
1.Epifaunal Substrate/ Available Cover 7 Score	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 <u>not</u> new fall and <u>not</u> 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 new fall, 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.								
2.Embeddedness 10 Score	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.								
3.Velocity/ Depth Regime Score 8	All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast- shallow). (Sow 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).								
4. Sediment Deposition 10 Score	Little or no enlargement of islands or point bars and less than 5% (<20% for low-gradient streams) of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 5-30% (20-50% for low-gradient) of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 30-50% (50-80% for low-gradient) 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% (80% for low-gradient) of the bottom changing frequently; pools almost absent due to substantial sediment deposition.								
5.Channel Flow Status Score 11	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.								
6.Channel Alteration 8 Score	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.								
7.Frequency of Riffles (or bends) 11 Score	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.								
Left/Right Bank	10 9	8 7 6	5 4 3 .	2 1 0								
8.Bank Stability LB 4 RB 4	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.								
9. Vegetative Protection 5 LB RB 5	More than 90% of the stream bank 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 stream bank 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 stream bank 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 stream bank surfaces covered by vegetation; disruption of stream bank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.								
10. Riparian Vegetative Zone Width LB 6 RB 3	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.								

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High Gradient Bioassessment Stream Visit Sheet

STREAM	INAME: SC	15				LOCATION: Bigbone, KY				
STATIO	N#: N/A					COUNTY: Boone		PROGRAM: PROJECT:		
INVEST	IGATORS: S	M, JF				DATE 2/20	12016	TIME	Start:	
Verify Sit	te LAT/LONG	vs GPS	ΠY		4	DATE: 3/30	12010	(24hr)	Finish:	
5.70	Stat	ion	-	Downstree	Rea	ch Unstrear	1	CANOP	Y COVER:	STREAM
LAT	Stat	1011	Т	Downstree		Opsilical		Fully Expo	osed (0-25%) xposed (25-5	0%) Perennial
LONG								Partially S     Fully Shace	haded (50-75 led (75-100%	%) Ephemeral ) Intermittent
WEAT	HER Now	Past 2	24 hour	s	LOCAL	WATERSHED F	EATURE	ES (Predomina	ant Surroundin	ng Land Use):
a scourin	ig rain		Heavy Steady	rain rain	Deep 1	e Mining Mining	Const	ruction nercial	Forest	/Grazing
in the las days?	t 14	ā	Interm	ittent showers	Oilw	ells		rial Trans	Silvicu	lture
Yes   No   Image: Cloudy   Ima							KullofD3tofill Sewers			
INSTREAM FEATURES Stream Width 2 ft HVDPAULIC Dominate Type:										
Maximu	Maximum Depth 1 ft STRUCTURES Dry Trees Herbaceous CHANNEL									
Reach Le	ength	auence	m	Dams Bridge Abutm	ients	Pooled	Numb	asses Shrubs er of strata 3	Dom.	ALTERATIONS Dredging
(No. Sampled in Reach) Island High Tree/Shrub Taxa (Channelization										
<u>1 Riffle 1 Run 1 Pool</u> Other: Culvert Normal Juniperus virginiana, Poa sp.										
P-CHEM		I	nstrum	ent Used:			-	Date	e Calibrated:	
T <b>emp(°</b> C	)	D.O. (m	g/l)	%Satu	uration	pH(S.U	.)	Cond	T	urb
1999 - F		an e			Sample Co	ollection Verific	ation			
Algae	Samp	le: 🗌 Q	ualMH	IC 🗌 Other	E	Visual Assessm	ent	Lead Co	ollector:	
Fish	BF	EF 🗆 S	eine [	Other Time	e: BPEF	Seine		Lead Co	ollector:	
Habitat		BP S	ubstrate	e 🗌 Other:	1.1			Lead Co	ollector:	
Inverteb	rates 11	n <sup>2</sup> 🗌 Qı	ual 🔲 (	Other:				Lead Co	ollector:	
TT:	1 20	Jab (#Ja	abs: Co	bbleSnags	Veg	Banks San	.dM	acrophytes	Other	
Tissue:	No. o	t Sample	s colle	cted S	p:	1		Lead Co	llector:	
water Ci	nem LA	orbicides		sticides $\Box$ Ortho		Low Hg		Lead Co	offector:	
Duplica	te Samples T	aken:								
			T. Star	a di sa			1			
			2	5	Substrate	e Characteriz	ation			
Substrate	e 🛛 Est. 🔲 P.	C. Rit	ffle 35	%	Ru	m <u>35</u> %	P	ool_30	6	Reach Total
Silt/Clay	v (<0.06 mm)									40
Sand (0.	06 – 2 mm)									25
Gravel (2-64 mm) 25							25			
Cobble (	64 – 256 mm	)								10
Boulders (>256 mm)						0				
Bedrock		1.	-			191.27				0
NOT	ES/COMM	ENTS:	10		1					2 SCHOOL CONTRACT

#### SITE NOT SAMPLED:

Land owner denial Dry

Site not found/Secluded Unsafe

Too deep/Impounded

## **RBP** High Gradient Habitat

Habitat	Condition Category											
Parameter	Optimai	Suboptimal	Marginal	Poor								
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0								
1.Epifaunal Substrate/ Available Cover 6 Score	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 <u>not</u> new fall and <u>not</u> 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 new fall, 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.								
2.Embeddedness 3 Score	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.								
3.Velocity/ Depth Regime Score 7	All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast- shallow). (Sow 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).								
4. Sediment Deposition 2 Score	Little or no enlargement of islands or point bars and less than 5% (<20% for low-gradient streams) of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 5-30% (20-50% for low-gradient) of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 30-50% (50-80% for low-gradient) 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% (80% for low-gradient) of the bottom changing frequently; pools almost absent due to substantial sediment deposition.								
5.Channel Flow Status Score 11	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.								
6.Channel Alteration 7 Score	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.								
7.Frequency of Riffles (or bends) 2 Score	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.								
Left/Right Bank	10 9	8 7 6	5 4 3	2 1 0								
8.Bank Stability LB 2 RB 2	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.								
9. Vegetative Protection 4 LB RB 4	More than 90% of the stream bank 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 stream bank 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 stream bank 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 stream bank surfaces covered by vegetation; disruption of stream bank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.								
10. Riparian Vegetative Zone Width LB 2 RB 4	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.								
Tot	al Score	NOTES/COMMENTS:										

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1. 10.001 W. ST. W. LANKER TO P. MART - 101-

High Gradient Bioassessment Stream Visit Sheet

STREAM	INAME: SO	17			LOCATION: Bigbone, KY					
STATIO	N #: N/A				COUNTY: BO	oone		PROGRAM PROJECT:		
INVEST	IGATORS: SM	/I, JF		a - 30	DATE 2/20	12016	TIME	Start:		
Verify Sit	te LAT/LONG	vs GPS	YES NO	Ά	DATE: 3/30	12010	(24hr)	Finish:		
4	Stati	on	Downstre	Rea	Upstrea	m	CANC	DPY COVER:	STREAM	
LAT							Partially	xposed (0-25%)TYPE:y Exposed (25-50%)Perennial		
LONG							Fully SI	naded (75-100%)	) D Intermittent	
WEAT Has there a scourin in the las days?	HER Now e been ag rain at 14	Past 24 ho Hear Stea Inter Clea	ours vy rain dy rain rmittent showers ar/sunny ady	LOCAL Surfac Deep I Oil Wo Land I Reside	WATERSHED I the Mining Mining ells Disposal ential	FEATURE	ES ( <u>Predom</u> ruction nercial trial Crops	inant Surroundii Forest Pasture Silvicu Urban	ng Land Use): e/Grazing liture Runoff/Storm Sewers	
INSTREAM FEATURES         Stream Width       *       ft       HYDRAULIC       STREAM FLOW       RIPARIAN VEGETATION       Ominate Type:         Maximum Depth       2       ft       STRUCTURES       Dams       Dry       Dominate Type:       Trees       Herbaceous       International Constraints       ALTERATIONS         Riffle/Run/Pool Sequence (No. Sampled in Reach)       Bridge Abutments       Island       Low       Tree/Shrub Taxa       Dom.       Dredging         2       Riffle 2       Run 2       Pool       Other: Culvert       Normal       Acer negundo, Erythronium americanum       Image: Channelization										
P-CHEM Temp(°C	I :) I	Instru D.O. (mg/l)_	iment Used:%Sa	turation	pH(S.U	J.)	ECond.	Date Calibrated:	`urb	
				Sample Co	ollection Verific	cation		State No.		
Algae	Sampl	e: 🔲 QualM	IHC 🗌 Other	C C	Visual Assessm	nent	Lead	Collector:	Salar Strength	
Fish	BP	EF 🔲 Seine	Other Tin	ne: BPEF	Seine		Lead	Collector:		
Habitat		BP 🗌 Substr	ate 🗌 Other:				Lead	Collector:		
Inverteb	rates 🗋 1 m	<sup>2</sup> Qual	] Other:				Lead	Collector:		
	20	Jab (#Jabs:	CobbleSnag	sVeg	. Banks Sa	ndM	acrophytes_	Other		
Tissue:	No. of	Samples co	llected S	Sp:	IT		Lead	Collector:		
water Ci	nem ∐Ac		Pesticides C Orth	OP COthe	I LOW FIG		Lead	Conector:		
Duplicat	te Samples Ta	aken:		Substrat	Characteria	vetion				
Substrate		Diffie	50 %	D	m 20 %		Poot 30	0/	Peach Total	
Silt/Clay	v (<0.06 mm)		/0						30	
Sand (0.	06 – 2 mm)								20	
Gravel (2-64 mm) 20								20		
Cobble (	64 – 256 mm)								20	
Boulders	Boulders (>256 mm) 5								5	
Bedrock		-	All a Sheet						5	
NOT	ES/COMME	ENTS:				1.215-53	- Section a	and the state		

SITE NOT SAMPLED:

Land owner denial Dry

Site not found/Secluded Unsafe

Too deep/Impounded

## RBP High Gradient Habitat

Habitat	Condition Category											
Parameter	Optimal	Suboptimal	Marginal	Poor								
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5.Channel Flow Status Score 10	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.								
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7.Frequency of Riffles (or bends) 15 Score	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.								
Left/Right Bank	10 9	8 7 6	5 4 3	2 1 0								
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9. Vegetative Protection 6 LB RB 6	More than 90% of the stream bank 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 stream bank 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 stream bank 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 stream bank surfaces covered by vegetation; disruption of stream bank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.								
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III ALL ALMAN ALL ON A DAMA

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11111 (2) 111 - 184

111.11

High Gradient Bioassessment Stream Visit Sheet

STREAM	MNAME	, S023	3			LOCATION: Bigbone, KY				
STATIO	N #: N/	A				COUNTY: BC	one		PROGRAM: PROJECT:	
INVEST	IGATO	RS: SM,	JF		ŇШ,	DATE. 2/20	10046	TIME	Start:	
Verify Si	te LAT/L	ONG vs	GPS 🗖	YES NO N/A	4	DATE: 3/30	2016	(24hr)	Finish:	
		Station		Downstree	Rea	ach Unstream		CANOI	PY COVER:	STREAM
LAT		Station		Downstrea	im .	Upstreat	<b>D</b>	Fully Exp	bosed (0-25%) Exposed (25-50	TYPE:
LONG								Partially : Fully Sha	Shaded (50-75) ided (75-100%)	%)         Ephemeral           Intermittent
WEAT	HER	Now 1	Past 24 ho	urs	LOCAL	WATERSHED F	EATURE	ES (Predomin	ant Surroundir	ng Land Use):
a scourir	e been ng rain		Heav Stead	/y rain dv rain	Deep	ce Mining Mining		ruction nercial	Forest Pasture	/Grazing
in the last 14								trial	Silvicu	lture
Yes     No     Image: No										
INST	TREAM	FEATU	RES				RIP	ARIAN VEG	ETATION	日本の日本でで表
Maximu	m Depth	1.5	ft	STRUCTUR	ES	STREAM FLOW		es Herbace	eous	CHANNEL
Reach L	ength	18	m	Dams Bridge Abutm	ients	Pooled	I Gr	asses Shrub er of strata	Dom	ALTERATIONS
(Ne	o. Sample	ed in Read	ch)	Island		Low High	Tree/S	hrub Taxa		Channelization
2Ri	iffle 1	_Run _1	Pool	Other: Culv	vert i	Normal Normal	Poa s	p., Taraxacu	m officinale	(UPull Partial) Culvert
P-CHEN	P-CHEM Instrument Used: Date Calibrated:									
Temp(°C	C)	D.C	D. (mg/l)_	%Sati	uration	pH(S.U	.)	Cond	T	urb
					Sample C	Collection Verific	ation			
Algae	1	Sample:	QualM	IHC Other	I	Visual Assessm	ent	Lead C	ollector:	
Fish	11	BPEF	Seine	Other Time	e: BPEF	Seine		Lead C	collector:	
Habitat			Substra	ate 🗋 Other:				Lead C	collector:	
Inverted	rates	20 Ja	b (#Jabs: (	Other: Cobble Snags	Veg	g. Banks Sar	dM	Lead C	Ollector: Other	
Tissue:		No. of Sa	amples col	lected S	p:			Lead C	collector:	
Water C	hem	Acid/	Alk 🔲 Bu	ulk 🔲 Nutrients 🗖 Pesticides 🥅 Ortho	P Othe	] Low Hg er:		Lead C	collector:	
Duplica	te Samp	les Tak	en:			2.01.0				
						2				
				5	Substrat	e Characteriz	ation	12.131 24	7-12-7%	
Substrat	e 🗆 Est.	P.C.	Riffle_4	10 %	R	un_30 %	P	ool 30	%	Reach Total
Silt/Clay	y (<0.06	mm)						AJN -		40
Sand (0.	06 – 2 m	nm)								20
Gravel (	2-64 mn	n)								20
Cobble (	(64 – 25	6 mm)								10
Boulder	s (>256	mm)								5
Bedrock										5
NOT	ES/CO	MMEN	TS:	all the day of		SIT	E NOT	r sampi	LED:	

Land owner denial Dry

Other (indicate under comments)

Site not found/Secluded

\$11/57.11ca

Too deep/Impounded

Unsafe

## RBP High Gradient Habitat

Habitat	Condition Category											
Parameter	Optimal	Suboptimal	Marginal	Poor								
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0								
1.Epifaunal Substrate/ Available Cover 12 Score	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 <u>not</u> new fall and <u>not</u> 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 new fall, 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.								
2.Embeddedness 8 Score	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.								
3.Velocity/ Depth Regime Score 12	All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast- shallow). (Sow 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).								
4. Sediment Deposition 6 Score	Little or no enlargement of islands or point bars and less than 5% (<20% for low-gradient streams) of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 5-30% (20-50% for low-gradient) of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 30-50% (50-80% for low-gradient) 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% (80% for low-gradient) of the bottom changing frequently; pools almost absent due to substantial sediment deposition.								
5.Channel Flow Status Score 10	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.								
6.Channel Alteration 11 Score	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.								
7.Frequency of Riffles (or bends) 12 Score	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.								
Left/Right Bank	10 9	8 7 6	5 4 3	2 1 · 0								
8.Bank Stability LB 6 RB 6	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.								
9. Vegetative Protection 3 LB RB 3	More than 90% of the stream bank 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 stream bank 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 stream bank 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 stream bank surfaces covered by vegetation; disruption of stream bank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.								
10. Riparian Vegetative Zone Width LB 0	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.								

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train in it is a seal

High Gradient Bioassessment Stream Visit Sheet

STREAM	NAME: SO2	5			LOCATION: Bigbone, KY					
STATIO	N#: N/A				COUNTY: B	oone	1	PROGRAM:		
INVEST	GATORS: SM,	JF ·			DATE 2/20	12016	TIME S	Start:		
Verify Site	e LAT/LONG vs	GPS	YES NO N/	A	5/30	2010	(24hr) 1	Finish:		
	Station		Downstre	Rea am	ach Upstrea	m	CANOP	COVER:	STREAM	
LAT						1	Partially Expo	(posed (25-50	(%) Perennial	
LONG		199					Fully Shade	aded (50-75%) ed (75-100%)	(6) Ephemeral	
WEATI Has there a scouring in the last days?	HER Now been grain 14 No EFAM EFATU	Past 24 ho Heav Stead Inter Clear Clou	urs /y rain dy rain mittent showers r/sunny dy	LOCAL Surfac Deep Oil W Land Resid	WATERSHED ) ce Mining Mining /ells Disposal ential	FEATURE	ES ( <u>Predominar</u> ruction nercial trial Crops	ht Surroundin Forest Pasture Silvicul Urban I	g Land Use): (Grazing ture Runoff/Storm Sewers	
Stream W Maximun Reach Le Riffle (No.	$\begin{array}{r} \text{REAM FEATO}\\ \text{/idth} & 3\\ \text{n Depth} & \frac{1}{1}\\ \text{ngth} & 30\\ \text{e/Run/Pool Seque}\\ \text{. Sampled in Read}\\ \text{file} & 0 \qquad \text{Run} & 2 \\ \end{array}$	ft ft m ence ch)	HYDRAUL STRUCTUR Dams Bridge Abutu Island Waterfalls Other:	IC ES nents	STREAM FLOW Dry Pooled Low High Normal	V Domin Domin Tree/S Dij	hate Type: eess Herbaceo asses Shrubs er of strata bhrub Taxa	us Dom. S SP.	CHANNEL ALTERATIONS Dredging Channelization (■Full □Partial)	
P-CHEM		Instru	ment Used:				Date	Calibrated:		
Temp(°C)	) D.C	O. (mg/l)	%Sat	uration	pH(S.U	J.)	Cond	T	urb	
			The second second	Sample C	Collection Verifi	cation	in the second			
Algae	Sample:	QualM	THC Other		Visual Assess	nent	Lead Col	llector:		
Fish Habitat		Substra	te Other Tim	e: BPEF_	Seine		Lead Col	llector:		
Invertebr	ates 1m <sup>2</sup>		] Other:	1-n			Lead Col	llector:		
	20 Ja	b (#Jabs: C	CobbleSnage	sVe	g. BanksSa	ndM	acrophytes	_Other		
Tissue:	No. of Sa	amples col	llected S	p: •		t og ge	Lead Col	llector:		
Water Ch	nem 🔲 Acid/	/Alk 🔲 Bı icides 🗌 I	ulk 🗌 Nutrients 🗌 Pesticides 🗌 Ortho	Metals D	] Low Hg er:		Lead Col	llector:		
Duplicat	e Samples Tak	ien:		Substaat	. Chomotoric					
Substrate	Est. P.C.	Riffle <sup>1</sup>	10 %	R	un <sup>0</sup> %	F	ool 90 %		Reach Total	
Silt/Clay	(<0.06 mm)								50	
Sand (0.0	06 – 2 mm)					-			10	
Gravel (2-64 mm)						1			20	
Cobble (f	54 – 256 mm)								15	
		1							5	
Boulders	(>256 mm)		in the fact							

Land owner denial

Site not found/Secluded

Other (indicate under comments)

Dry Too deep/Impounded

Unsafe

## **RBP** High Gradient Habitat

Habitat	Condition Category										
Parameter	Optimal	Suboptimal	Marginal	Poor							
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0							
1.Epifaunal Substrate/ Available Cover 8 Score	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 <u>not</u> new fall and <u>not</u> 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 new fall, 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.							
2.Embeddedness 6 Score	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.							
3.Velocity/ Depth Regime Score 5	All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast- shallow). (Sow 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).							
4. Sediment Deposition 7 Score	Little or no enlargement of islands or point bars and less than $5\%$ (<20% for low-gradient streams) of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 5-30% (20-50% for low-gradient) of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 30-50% (50-80% for low-gradient) 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% (80% for low-gradient) of the bottom changing frequently; pools almost absent due to substantial sediment deposition.							
5.Channel Flow Status Score 6	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.							
6.Channel Alteration 3 Score	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.							
7.Frequency of Riffles (or bends) 6 Score	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.							
Left/Right Bank	10 9	8 7 6	5 4 3	2 1 0							
8.Bank Stability LB 3 RB 3	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.							
9. Vegetative Protection 8 LB RB 8	More than 90% of the stream bank 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 stream bank 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 stream bank 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 stream bank surfaces covered by vegetation; disruption of stream bank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.							
10. Riparian Vegetative Zone Width LB R <sup>B</sup> 3	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.							
Tot	al Score	NOTES/COMMENTS:									

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in francisco comi-

High Gradient Bioassessment Stream Visit Sheet

STREAM NA	ME: S028	3			LOCATION:	Bigbon	e, KY			
STATION #:	N/A				COUNTY: BO	one	VAL 1	PROGRAM		
INVESTIGA	TORS: SM,	JF	- A MARINE		DATE 2/20	10046	TIME	Start:		
Verify Site LA	T/LONG vs	GPS 🗖	YES NO N/A	1	DATE: 3/30	12010	(24hr)	Finish:		
	Station		Downstree	Rea	ich Linstreau	n	CANOP	Y COVER:	COVER:: STREAM	
LAT	Station		Downstrea		Opstream		Fully Expo	xposed (0-25%)	0%) TYPE:	
LONG	19-19-18-18-18-18-18-18-18-18-18-18-18-18-18-						Partially S Fully Shad	haded (50-75) led (75-100%)	%) Ephemeral ) Intermittent	
WEATHEF Has there bee a scouring rai in the last 14 days? Yes No INSTRE. Stream Width	Now F Now F N 0 0 N 0 0 N 0 N 0 N 0 N 0 N 0	Past 24 ho Heav Stead Inten Clean Clou <b>RES</b>	urs ry rain ly rain mittent showers r/sunny dy HYDRAULI	LOCAL Surfac Deep J Oil W Land J Reside	VATERSHED FEATUREES (Predominant Surrounding Land U         a Mining       Construction         dining       Commercial         disposal       Industrial         bisposal       Row Crops         ntial       RIPARIAN VEGETATION			ng Land Use): //Grazing lture Runoff/Storm Sewers		
Maximum De Reach Length Riffle/Ru (No. Sau 2 Riffle	rpth 3 18 m/Pool Sequen mpled in Reac 1 Run 1	ft m nce h) Pool	STRUCTUR Dams Bridge Abutm Island Waterfalls Other:Bridge	ents	STREAM FLOW Dry Pooled Low High Normal	Tree/S	Herbaced asses Herbaced asses Shrubs er of strata 2 hrub Taxa hegundo, Lot	Dom. Dom. Docera sp.	CHANNEL ALTERATIONS Dredging Channelization (Full Partial) Bridge	
P-CHEM Instrument Used: Date Calibrated:										
Temp(°C)	D.C	). (mg/l)	%Satu	ration	pH(S.U	.)	Cond	T	urb	
Employee		The second		Sample C	ollection Verific	ation				
Algae	Sample:	QualM	HC Other	[	Visual Assessm	ent	Lead Co	llector:		
Fish	BPEF	Seine	Other Time	e: BPEF	Seine		Lead Co	ollector:		
Habitat Invertebrates			Ate U Other:				Lead Co	llector:		
Invertebrates		) (#Jabs: C	Cobble Snags	Veg	g. BanksSar	idM	acrophytes	Other		
Tissue:	No. of Sa	mples col	lected Sp	<b>)</b> :			Lead Co	ollector:		
Water Chem	Acid/	Alk 🗍 Bu	alk 🗌 Nutrients 🗍 Pesticides 🗍 Ortho	P Othe	] Low Hg		Lead Co	llector:		
Duplicate S	amples Tako	en:								
		1.342	5	Substrat	e Characteriz	ation	a net og	C. C. C. M	And and the	
Substrate	Est. P.C.	Riffle <sup>2</sup>	25_%	R	un_25%	P	ool_509	0	Reach Total	
Silt/Clay (<0	).06 mm)						240 500	11-	20	
Sand (0.06 -	2 mm)		Marine						20	
Gravel (2-64	mm)		1 solition	in a second					15	
Cobble (64 -	- 256 mm)			125.2		1			20	
Boulders (>2	256 mm)	Ser.			A				15	
Bedrock				3.1.2.					10	
NOTES/	COMMEN	TS:		he stat	ST	E NO	C SAMPI	ED:		

Land owner denial Dry Too deep/Impounded

Unsafe

Site not found/Secluded

## **RBP** High Gradient Habitat

Habitat	Condition Category										
Parameter	Optimal	Suboptimal	Marginal	Poor							
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0							
1.Epifaunal Substrate/ Available Cover 8 Score	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 <u>not</u> new fall and <u>not</u> 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 new fall, 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.							
2.Embeddedness 7 Score	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.							
3.Velocity/ Depth Regime Score 15	All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast- shallow). (Sow 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).							
4. Sediment Deposition 8 Score	Little or no enlargement of islands or point bars and less than $5\%$ (<20% for low-gradient streams) of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 5-30% (20-50% for low-gradient) of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 30-50% (50-80% for low-gradient) 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% (80% for low-gradient) of the bottom changing frequently; pools almost absent due to substantial sediment deposition.							
5.Channel Flow Status Score 13	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.							
6.Channel Alteration 13 Score	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.							
7.Frequency of Riffles (or bends) 13 Score	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.							
Left/Right Bank	10 9	8 7 6	5 4 3	2 1 0							
8.Bank Stability LB 2 RB 5	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.							
9. Vegetative Protection 3 LB RB 5	More than 90% of the stream bank 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 stream bank 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 stream bank 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 stream bank surfaces covered by vegetation; disruption of stream bank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.							
10. Riparian Vegetative Zone Width LB 0 RB 10	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.							
Tot	al Score	NOTES/COMMENTS:									

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High Gradient Bioassessment Stream Visit Sheet

STREAM	NAME: SO	31			LOCATION: Bigbone, KY				
STATIO	N#: N/A				COUNTY: BC	one		PROGRAM: PROJECT:	
INVEST	IGATORS: SM	A, JF			DATE 2/20/16		TIME Start:		
Verify Sit	te LAT/LONG	vs GPS	YES NO	4	DATE: 3/30/10 (24hr)			Finish:	
12 110	Stati		Downstro	Rea	the CANOPY COVER:: S			STREAM	
LAT	Statu	<u>u</u>	Downstre		Partially Expo			osed (0-25%) Exposed (25-50	TYPE:     0%)   Perennial
LONG		111		1			Fully Shad	ied (75-100%)	(6) Ephemeral Intermittent
WEAT Has there a scourin in the las	HER Now been x Ig rain the second sec	Past 24 ho	urs /y rain dy rain	LOCAL V Surface	WATERSHED F e Mining Mining		ES (Predomina ruction nercial	ant Surroundin	g Land Use): /Grazing
days?		Clear	r/sunny dy	Land D Reside	Disposal ntial	Row	Crops	Urban F	Runoff/Storm Sewers
INST Stream V Maximuu Reach Le Riffl (No <u>1</u> Ri	Image: Constraint of the second se	URES ft ft muence each) 1 Pool	HYDRAULI STRUCTUR Dams Bridge Abutn Island Waterfalls Other: culve	IC ES nents	TREAM FLOW Dry Pooled · Low High Normal	RIP Domin Tr Gr Numb Tree/S Dipsa	ARIAN VEGE nate Type: ees Herbace asses Shrubs er of strata 2 shrub Taxa acus sp., Poa	TATION ous s Dom. a pratensis	CHANNEL ALTERATIONS Dredging Channelization (]Full [Partial) Culverted
P-CHEM		Instru	ment Used:		, all the		Dat	e Calibrated:	
Temp(°C	;) C	D.O. (mg/l)_	%Sat	uration	pH(S.U	.)(	Cond	Ti	urb
		ABUST		Sample Co	llection Verific	ation			1. A
Algae	Sample	e: 🔲 QualM	HC 🗌 Other		Visual Assessm	ent	Lead Co	ollector:	
Fish	BPE	EF 🔲 Seine	Other Tim	e: BPEF	Seine	AL IN	Lead Co	ollector:	
Habitat	🗌 RB	P 🗌 Substra	ate 🗌 Other:	1992		(	Lead Co	ollector:	A Starting
Inverteb	rates 🗌 1 m	<sup>2</sup> Qual	] Other:				Lead Co	ollector:	
	20	Jab (#Jabs: C	CobbleSnage	S Veg.	Banks San	dN	lacrophytes	Other	
Tissue:	No. of	Samples col	lected S	p:		-	Lead Co	ollector:	
Water Cl	hem ∐Aci	id/Alk 🛄 Bi rhicides 🗍 I	alk [] Nutrients [ Posticides [] Ortho	B C Other	Low Hg		Lead Co	ollector:	
Duplicat	te Samples Ta	aken:							
				Substrate	Characteriza	ation			
Substrate	EEst. P.C	Riffle_2	25 %	Ru	n_25%	F	ool 50	/0	Reach Total
Silt/Clay	r (<0.06 mm)								30
Sand (0.0	06 – 2 mm)	3							20
Gravel (2	2-64 mm)								20
Cobble (	64 – 256 mm)								30
Boulders (>256 mm)							0		
Bedrock									0
NOT	ES/COMME	ENTS:							

SITE NOT SAMPLED:

Land owner denial Dry

Site not found/Secluded Unsafe

Too deep/Impounded

### RBP High Gradient Habitat

Parameter SCORE         Optimal         Subortinal         Marginal         Poor           SCORE         20         19         18         17         16         13         14         13         10         9         8         7         6         5         4         3         2         1           Substrate/ Substrate/ Cover         Creater than 70% or substrata favorable for eprimanal favorable	Habitat	at Condition Category								
SORE     20     19     18     17     16     15     14     12     11     10     9     8     7     6     5     4     3     2       1.Epfnamal Substrate/ Analatie     forenter than 0% of substrate forwards     forwards     forwards <th>Parameter</th> <th>Optimal</th> <th>Suboptimal</th> <th>Marginal</th> <th>Poor</th>	Parameter	Optimal	Suboptimal	Marginal	Poor					
Lip Bytemunal Available Cover         Greater than 70% of substrate incombine for optimulant colonization and fish cover, substrate of all colonization other stable habitat and at potential (i.e., logs/mag that and stage to all ow fill colonization potential (i.e., logs/mag that sate to all ow fill colonization potential (i.e., logs/mag that substrate in the form drev fall, but not yet prepared for massion). (i.e., logs/mag that substrate in the form drev fall, but not yet prepared for surrounded by fine sediment.         20.40% mix of stable habitat is obvious; substrate in the form drev fall, but not yet prepared for for massion). (i.e., logs/mag that surrounded by fine sediment.         Converting for wet, cobble, and boulder particles are 0.573%.         Gravet, cobble, and bouder particles are 0.573%.         Gravet, cobbl	SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0					
2.2.Embeddedness       Gravel, cobble, and boulder particles are 0.25%       Gravel, cobble, and boulder particles are 0.25%       Gravel, cobble, and boulder particles are 0.25%       Gravel, cobble, and boulder particles are 0.57%       Gravel, cobble, and boulder pa	1.Epifaunal Substrate/ Available Cover 5 Score	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 <u>not</u> new fall and <u>not</u> 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 new fall, 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.					
3. Velocity/ Depth Regime score       All four velocity/depth regimes pressi (150w-dept, slow-shallow, fast-deep, fast- shallow), (200 wis < 0.3 m/s, deep is > 0.5 m.)       Dominated by 1 velocity/ depth regime (usually slow deep).         A. Sectiment Deposition       Little or no enlargement of islands or point burs and less than 5% (-20% for low- gradient stream) of the footnom affected by sediment deposition in poils.       Moderate deposition of new gradient stream) of the footnom affected by sediment deposition.       Moderate deposition of new gradient stream) of the footnom affected by sediment deposition in poils.       Moderate deposition of poils (80% for low-gradient) of the bottom affected by sediment deposition in poils.         8 core 8 core 7       Water reaches base of both low to famel substrate is exposed.       Water fills >75% of the available channel; arc2 for dage absent or minimal amount of channel substrate is exposed.       Water fills >75% of the available channel; arc2 for dage absent or minimal stream with normal pattern.       Water fills >75% of the available channel; arc2 for dage absent or minimal stream with ormal pattern.       Some channel; arc1 more absent or minimal amount of channel substrate is channel; arc1 more of past channel; arc1 m	2.Embeddedness 6 Score	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.					
4. Sediment DepositionLittle or no enlargement of islands or point bar and less aradient streams) of the totom affected by sediment deposition.Some new increase in bar formation, mostly from gravel, of the bottom affected, sediment deposition in pools.Moderate deposition of new gravel, sand or fine sediment of da an new bar; 30-50% (the bottom affected, sight deposition of pools.Heavy deposits of fine material, increased bar to do and new bar; 30-50% (the bottom affected, sight deposition in pools.Heavy deposits of fine material, increased bar to do and new bar; 30-50% (the bottom affected, sediment deposition of pools.Heavy deposits of fine material, increased bar to bottom changing frequent pools.Score8Water reaches base of both norwer 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 >75% of the available channel, or <25% of channel substrate is exposed.Water fills >75% of the available channel, or <25% of channel substrate is exposed.Water fills >75% of the available channel, or <25% of the substrate is exposed.Banks shored with gabion cereative, embankments or both banks, and 40 to 80% of disrupted. Instruem habita graver than patz 20 yr.) may be resent, but recent thannelization is not present.Channelization is not present. some channelization is not present. thannelization is not present. thannelization is not present.Channelization is not present. thannelization is not present. thanneliza	3.Velocity/ Depth Regime Score 8	All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast- shallow). (Sow 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).					
S.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 >75% of the available channel, or <25% of channel substrate is exposed.       Very little water in channe available channel, and/or riffle substrates are mostly exposed.         3       Channelization or dredging absent or minimal, stream with normal pattern.       Some channelization present, usually in areas of bridge absent or minimal, stream with normal pattern.       Some channelization present, usually in areas of bridge absent or minimal, stream with normal pattern.       Channelization is areas of bridge absent or minimal, stream with normal pattern.       Some channelization present, usually in areas of bridge absent or minimal, stream with normal pattern.       Some channelization present, usually in areas of bridge absent or minimal, stream with of the stream stop resent.       Channelization may be extensive, embankments or shoring structures present of the stream reach channelized and disrupted.       Banks shored with gabion creach channelized in disrupted.       Banks shored with gabion creach channelized in disrupted.       Banks shored with gabion creach channelized in disrupted.       Banks shore of with stream reach channelized in disrupted.       Banks shore of miles with of the stream of the stream is between 15 to 25.       Banks stable,	4. Sediment Deposition 8 Score	Little or no enlargement of islands or point bars and less than 5% ( $<20\%$ for low- gradient streams) of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 5-30% (20-50% for low-gradient) of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 30-50% (50-80% for low-gradient) 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% (80% for low-gradient) of the bottom changing frequently; pools almost absent due to substantial sediment deposition.					
6.Channel AlterationChannelization or dredging absent or minimal; stream with normal pattern.Some channelization present, usually in areas of bridge abutments; cvidence of pattern persent, but recent channelization is not present.Channelization may be extensive; embankments or shoring structures present on bot banks; and 40 to 80% of the annelization sis not present.Banks shored with gabion cement; over 80% of the stream reach channelized a disrupted.Banks shored with gabion cement; over 80% of the stream neah to 80% of the stream habita; disrupted.Banks shored with gabion cement; over 80% of the stream neah to 80% of the stream sis persent.3Occurrence of riffles relatively width of the stream Occurrence of riffles infrequent; distance between riffles divided by the width of the stream is between 7 to 15Cocasional riffle or bend; bottom contours provide some habitat; distance between riffles divided by the width of the stream is between 7 to 15Generally all flat water or shallow riffles; poor habita divided by the width of the stream is between 7 to 155Score087654321Left/Right Bank109876543218.Bank Stability BBBanks stable; evidence of erosion or bank failure absent 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 reosion potential onwowody macrophytes; vegetation, including trees,	5.Channel Flow Status Score 7	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.					
7. Frequency of RifflesOccurrence of riffles relatively frequent; ratio of distance between riffles divided by width of the stream '5'.1 (generally 5 to 7); variety of habitat is key. In streams where riffles are continuous, placement of boulders or other arge, 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 7 to 15.Generally all flat water or shallow riffles; poor habita distance between riffles divided by the width of the stream is between 15 to 25.554321Left/Right Bank109876543218.Bank Stability RB6Banks stable; evidence of erosion or bank failure absent or minimal, little potential for minimal, little potential for mainiar zone covered by native vegetation, including rest, understory shrubs, or native vegetation, including rest, understory shrubs, or mawoody macrophytes; vegetative disruption through grazing or mowody macrophytes; vegetation disruption of stream or moving minimal, or entan one-half of the potential loany great extent; wegetation, bilt on any great extent; ration or covered by native vegetation, including rest, understory shrubs, or notwoody macrophytes; vegetation disruption of tream one noorphytes; vegetation disruption of the notential land stuble of the potential land stuble.50-70% of the stream bank surfaces covered by vegetation, disruption of stream bank vegetation is 'n inguing for the s	6.Channel Alteration 3 Score	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.					
Left/Right Bank109876543218.Bank Stability LBBanks 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 are "raw" areas frequent along of bank in reach has areas of erosion; high erosion potential during floods.Unstable; many eroded are "raw" areas frequent along of bank in reach has areas of erosion; high erosion potential during floods.Unstable; many eroded are "raw" areas frequent along obvious bank sloughing; 6 100% of bank has erosion scars.9. Vegetative Protection 4 LBMore than 90% of the stream bank surfaces and immediate riparian zone covered by native vegetation, including treas, understory shrubs, or nonwoody macrophytes; vegetative disruption through RB70-90% of the stream bank surfaces covered by native vegetation; disruption of closely cropped vegetation common; less than one-half of the potential lot any great extent; more than one-half of the potential lot any great extent; more than one-half of the potential to any great extent; more than one-half of the potential lot any lot stubbleLess than 50% of the stream bank surfaces covered by vegetation has been reacting in potential lot any great extent; more than one-half of the potential lot any great extent;50-70% of the stream bank surfaces covered by vegetation; disruption of stream bank vegetation has been e	7.Frequency of Riffles (or bends) 5 Score	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.					
8.Bank Stability       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 or bank in reach has areas of erosion, high erosion potential during floods.       Unstable; many eroded are "raw" areas frequent along straight sections and bends obvious bank sloughing; 6         9. Vegetative Protection       More than 90% of the stream bank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through erating or mowing minimal or       70-90% of the stream bank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption or-balf of nore than one-balf of potential to any great extent; more than one-balf of the potential to any great extent;       50-70% of the stream bank surfaces covered by vegetation; disruption of stream bank vegetation is 'n igh; vegetation has been igh; vegetation has been	Left/Right Bank	10 9	8 7 6	5 4 3	2 1 0					
9. Vegetative Protection       More than 90% of the stream bank surfaces and immediate riparian zone covered by native vegetation, including LB       70-90% of the stream bank surfaces covered by native vegetation, but one class of plants is not well-represented; vegetative disruption through grazing or mowing minimal or       70-90% of the stream bank 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;       50-70% of the stream bank surfaces covered by vegetation, disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of removed to 5 centimeters of high; vegetation has been removed to 5 centimeters of high; vegetation is	8.Bank Stability LB 4 RB 6	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.					
4 not evident; almost all plants allowed to grow naturally. potential plant stubble height remaining. less in average stubble height remaining.	9. Vegetative Protection 4 LB RB 4	More than 90% of the stream bank 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 stream bank 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 stream bank 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 stream bank surfaces covered by vegetation; disruption of stream bank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.					
10. Riparian Vegetative Zone Width       Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear- uinpacted 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 6-12 meters; human activities have impacted zone a great deal.       Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.       Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.       Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.       Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.       Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.       Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.       Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.       Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.       Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	10. Riparian Vegetative Zone Width LB RB 1	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.					

**Total Score** 

#### **OTES/COMMENTS**

. 1. с. и с. и с. Р. 10. сто. он и основать стальности

62

 $\mathbf{H} \mathbf{x} = \mathbf{Y} \left( \mathbf{H} \mathbf{Y} \left( \mathbf{x} \right) + \mathbf{H} \mathbf{H} \left( - \mathbf{Y} \mathbf{H} \right) \right) = \mathbf{Y} \left( - \mathbf{H} \mathbf{Y} \right) \left( \mathbf{H} \right) \left( \mathbf{H} \right) \left( \mathbf{H} \right)$ 

Too deep/Impounded

Unsafe

Land owner denial Dry

Other (indicate under comments)

Site not found/Secluded

#### CONFIDENTIAL PROPRIETARY TRADE SECRET

High Gradient Bioassessment Stream Visit Sheet

STREAM	ANAME	.S033	3			LOCATION	Bigbon	e, KY	Sea that	
STATIO	N.4. N/A	4				COUNTY, BO	oone	P	ROGRAM:	
INVEST	IGATOR	s. SM,	JF		-	COUNTY: -		TIME S	ROJECT:	
Verify Sit	te LAT/LO	ONG vs (	GPS C	YES NO	A	DATE: 3/31	/2016	(24hr) H	inish:	
11		Station		Donumetro	Rea	ch		CANOPY	COVER::	STREAM
LAT		Station		Downstre	am	Opstrea		Fully Expos	ed (0-25%)	(%) Perennial
LONG								Partially Sh	aded (50-75% d (75-100%)	b) Ephemeral Intermittent
WEAT Has there a scouring in the last	HER been g rain t 14	Now P	Past 24 ho Heaven Stea	ours vy rain dy rain	LOCAL V Surface Deep N	WATERSHED I e Mining Mining		ES ( <u>Predominar</u> ruction nercial	t Surrounding	<u>: Land Use):</u> Grazing
days?	No		× Clea	r/sunny idy	Land I	oisposal Cisposal Intial	ure unoff/Storm Sewers			
INST Stream W Maximur Reach Le Riffl (No <u>1</u>	<b>REAM I</b> Vidth m Depth ength e/Run/Poo Sampleo ffle 1	FEATUR 6 3 9 ol Sequer 1 in React Run 2	tes ft ft m nce h) Pool	HYDRAUL STRUCTUR Dams Bridge Abutr Island Waterfalls Other: Cult	IC ES nents	TREAM FLOW Dry Pooled Low High Normal	RIP. Domin Tru Gr Numb Tree/S Acer ne	ARIAN VEGET nate Type: ces Herbaceon asses Herbaceon asses Shrubs er of strata hrub Taxa gundo, Taraxacu	TATION us Dom. m officinale	CHANNEL ALTERATIONS Dredging Channelization (Full Partial)
P-CHEM	[		Instru	iment Used:		Childes-Ph		Date	Calibrated:	
Temp(°C	)	D.O	. (mg/l)_	%Sat	uration	pH(S.U	J.)	Cond	Tu	rb
201					Sample Co	ollection Verifi	cation	5.10 2.2		
Algae	5	Sample: [	Qual	fHC 🗌 Other	an sei a t	Visual Assessn	nent	Lead Col	lector:	
Fish		BPEF	Seine	Other Tim	e: BPEF	Seine		Lead Col	lector:	
Habitat		RBP [	Substr	ate 🗌 Other:			1	Lead Col	lector:	
Invertebr	nates [	] 1m² [ ] 20 Jab	J Qual L (#Jabs: (	] Other: Cobble Snag:	sVeg	. Banks Sa	ndM	Lead Col acrophytes	lector: _ Other	<u>ر</u>
Tissue:	1	No. of Sa	mples col	llected S	p:		20.20	Lead Col	lector:	C. Kaller and
Water Ch	hem [	Acid//	Alk 🔲 B	ulk 🔲 Nutrients 🗋 Pesticides 🔲 Ortho	Metals	Low Hg r:		Lead Col	lector:	
Duplicat	te Sampl	les Tako	en:							
					Substrate	e Characteriz	ation		山民が出	
Substrate	Est.	P.C.	Riffle	40 %	Ru	in 10 %	P	ool 50 %	1.3 1.41	Reach Total
Silt/Clay	(<0.0 <b>6 i</b>	nm)								40
Sand (0.0	06 – 2 m	m)				N. Maine		1907 - Sta		10
Gravel (2	2-64 mm	)		1. 1. 1. 1.				1 <sup>4</sup>	B. a.i.	20
Cobble (	64 – 256	mm)				7.9	al a	a sur		20
Boulders	(>256 n	nm)					1. 16.			10
Bedrock									1.123	0
NOT	ES/CON	MMEN	TS:			SIT	E NO	C SAMPL	ED:	

### RBP High Gradient Habitat

Habitat	Condition Category											
Parameter	Optimal	Suboptimal	Marginal	Poor								
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0								
1.Epifaunal Substrate/ Available Cover 12 Score	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 <u>not</u> new fall and <u>not</u> 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 new fall, 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.								
2.Embeddedness 10 Score	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.								
3.Velocity/ Depth Regime Score 9	All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast- shallow). (Sow 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).								
4. Sediment Deposition 10 Score	Little or no enlargement of islands or point bars and less than 5% (<20% for low-gradient streams) of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 5-30% (20-50% for low-gradient) of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 30-50% (50-80% for low-gradient) 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% (80% for low-gradient) of the bottom changing frequently; pools almost absent due to substantial sediment deposition.								
5.Channel Flow Status Score 8	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.								
6.Channel Alteration 4 Score	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.								
7.Frequency of Riffles (or bends) 13 Score	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.	of riffles relatively io of distance les divided by stream <7:1 to 7); variety of y. In streams s are continuous, f boulders or other u obstruction is										
Left/Right Bank	10 9	8 7. 6	5 4 3	2 1 0								
8.Bank Stability LB 5 RB 5	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.								
9. Vegetative Protection 5 LB RB 5	More than 90% of the stream bank 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 stream bank 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 stream bank 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 stream bank surfaces covered by vegetation; disruption of stream bank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.								
10. Riparian Vegetative Zone Width LB 2 RB 2	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.								
Tot	al Score	NOTES/COMMENTS.	The second s									

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90

821. 81. 11. 81. 85. 85. 81. 11. 1. FF

High Gradient Bioassessment Stream Visit Sheet

STREAM	NAME	S037	7			LOCATION: Bigbone, KY				
STATION	#. N//	4		C. S.S.		COUNTY, BO	oone	1	ROGRAM	
INVESTI	GATOR	S: SM,	JF			DATE: 2/24	10040	TIME S	start:	
Verify Site	LAT/L	ONG vs	GPS C	YES NO	A	DATE: 3/3	12016	(24hr) 1	inish:	
14		Station		Downstre	Rea am	ich Unstreat	m	CANOPY	COVER:	STREAM
LAT	in Se	<u>Canton</u>						Partially Expo	sed (0-25%) sposed (25-5)	0%) Derennial
LONG								Partially Sh	aded (50-75) ed (75-100%)	%) Ephemeral ) Intermittent
WEATH Has there a scouring in the last	IER been rain 14	Now 1	Past 24 ho Hea Stea	ours vy rain dy rain rmittent showers		WATERSHED I ce Mining Mining ells		ES ( <u>Predominal</u> ruction nercial	The Surrounding of Silvien	ng Land Use): /Grazing
days?	No			ur/sunny udy	Land I	Disposal ential	Row	Crops	Urban 1	Runoff/Storm Sewers
INSTI Stream W Maximum Reach Ler Riffle (No. 1Riff	REAM I idth Depth ngth /Run/Po Sampleo	FEATUR 3 1 18 ol Seque d in Reac Run 1	RES ft ft m nce ch) Pool	HYDRAUL STRUCTUR Dams Bridge Abutn Island Waterfalls Other: Cu	IC ES nents	STREAM FLOW Dry Pooled Low High Normal	RIP Domin Tr Gr Numb Tree/S	ARIAN VEGE" hate Type: ees Herbaceo asses Shrubs er of strata Shrub Taxa AXACUM OF	TATION us Dom. ficinale	CHANNEL ALTERATIONS Dredging Channelization (Full Partial)
Р-СНЕМ		1.11	Instru	iment Used:	a colent	251-4-2	91.512	Date	Calibrated:	
Temp(°C)	ast!	D.C	). (mg/l)_	%Sat	uration	pH(S.U	J.)	Cond	T	urb
			N HICK		Sample Co	ollection Verific	cation	S. Salar		
Algae	1	Sample:	Qual	IHC 🗌 Other	C	Visual Assessm	ent	Lead Col	lector:	
Fish		BPEF	Seine	Other Tim	e: BPEF	Seine		Lead Col	lector:	
Habitat		RBP	Subst	ate Other:				Lead Col	lector:	
Invertebra	ites	1m <sup>-</sup> [	UQual L b (#Jabs:	] Other: Cobble Snag:	sVeg	. BanksSa	ndM	Lead Col lacrophytes	lector: Other	
Tissue:	1	No. of Sa	mples co	llected S	p:		1.00	Lead Col	lector:	
Water Ch	em	Acid/.	Alk 🗌 B	ulk 🔲 Nutrients 🗌 Pesticides 🗖 Ortho	Metals	Low Hg		Lead Col	lector:	
Duplicate	e Samp	les Tak	en:					R.		
					Substrate	e Characteriz	ation		14.18	
Substrate	Est.	P.C.	Riffle	50_%	Ru	1m_25%	F	ool_25%		Reach Total
Silt/Clay	(<0.06 1	nm)								80
Sand (0.0	6 – 2 m	m)				and the s				5
Gravel (2-	-64 mm	)	an Îl secon							10
Cobble (6	4 - 256	mm)								5
Boulders	(>256 n	nm)							1	0
Bedrock										0
NOTE	ES/COM	MMEN	TS:			SIT	'E NO'	C SAMPL	ED:	

Dry Dry

Land owner denial

Site not found/Secluded Unsafe

Too deep/Impounded

## RBP High Gradient Habitat

Havitat	Condition Category									
Parameter	Optimal	Suboptimal	Marginal	Poor						
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0						
1.Epifaunai Substrate/ Available Cover 5 Score	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 <u>not</u> new fall and <u>not</u> 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 new fall, 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.						
2.Embeddedness 5 Score	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.						
3.Velocity/ Depth Regime Score 10	All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast- shallow). (Sow 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).						
4. Sediment Deposition 4 Score	Little or no enlargement of islands or point bars and less than $5\%$ (<20% for low-gradient streams) of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 5-30% (20-50% for low-gradient) of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 30-50% (50-80% for low-gradient) 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% (80% for low-gradient) of the bottom changing frequently; pools almost absent due to substantial sediment deposition.						
5.Channel Flow Status Score 11	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.						
6.Channel Alteration 9 Score	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.						
7.Frequency of Riffles (or bends) 6 Score	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.						
Left/Right Bank	10 9	8 7 6	5 4 . 3	2 1 0						
8.Bank Stability LB 4 RB 4	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.						
9. Vegetative Protection 2 LB RB 2	More than 90% of the stream bank 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 stream bank 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 stream bank 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 stream bank surfaces covered by vegetation; disruption of stream bank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.						
10. Riparian Vegetative Zone Width LB RB 1	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.						

**Total Score** 

64

**NOTES/COMMENTS:** 

High Gradient Bioassessment Stream Visit Sheet

STREAM	NAME: SO39	9	8		LOCATION: Walton, KY					
STATIO	N#: N/A	a series			COUNTY: BO	one		PROGRAM: PROJECT:		
INVEST	IGATORS: SM,	JF	in the state		DATE 2/24	12016	TIME	Start:		
Verify Sit	te LAT/LONG vs	GPS	YES INO N/A	۱	DATE: 3/31	12010	(24hr)	Finish:		
1.	Station		Downstree	Re	ach CAl			PY COVER:	STREAM	
LAT	Surrou		Johnstein			Partia			TYPE:     50%)   Perennial     5%)   Ephemeral	
LONG							L Fully Sh	aded (75-100%	6) Intermittent	
WEAT Has there a scourin in the las days?	HER Now H been       grain       t 14     No	Past 24 hou Heavy Steady Intern Clear/ Cloud	irs y rain y rain nittent showers /sunny ly	LOCAI Surfa Deep Oil V Land Resid	WATERSHED F ace Mining Mining Vells Disposal dential	EATURE Const Comm Indus Row	ES ( <u>Predomi</u> ruction nercial trial Crops	nant Surroundi Forest Pastur Silvice Urban	ing Land Use): t re/Grazing ulture y Runoff/Storm Sewers	
INST Stream V Maximuu Reach Le Riffl (No 1 Ri	REAM FEATUR       Vidth     3       m Depth     15       ength     18       le/Run/Pool Seque     5       o. Sampled in Reac       ffle     1       Run     3	RES ft ft ft m nce ch)	HYDRAULI STRUCTUR Dams Bridge Abutn Island Waterfalls Other: Culv	rerts	STREAM FLOW Dry Pooled Low High Normal	RIP. Domin Tro Gr Numb Tree/S	ARIAN VEC nate Type: ces Herbac asses Shru er of strata shrub Taxa	ETATION ceous bs Dom.	CHANNEL ALTERATIONS Dredging Channelization (Full Partial)	
P-CHEM		Instrum	nent Used:	And suff	and the second second		D	ate Calibrated:	10.00 TT 362444	
Temp(°C	) D.C	). ( <b>mg</b> /l)	%Sati	aration	pH(S.U	.)	Cond	Cart and	Turb	
and the second				Sample (	Collection Verific	ation				
Algae	Sample:		HC 🗌 Other		Visual Assessm	ent	Lead	Collector:		
Fish	BPEF	Seine [	Other Tim	e: BPEF	Seine	S 1.4.	Lead	Collector:		
Habitat	🗌 RBP	Substra	te 🔲 Other:				Lead	Collector:		
Inverteb	rates 1m <sup>2</sup>	Qual	Other:				Lead	Collector:		
1.	20 Jal	b (#Jabs: C	obble Snags	Ve	eg. Banks Sar	IdM	acrophytes	Other		
Tissue:	No. of Sa	amples coll	ectédS	p:			Lead	Collector:		
Water Cl	hem Acid/	Alk 🗌 Bu	Ik 🗌 Nutrients 🗌	Metals [	Low Hg		Lead	Collector:		
Durlias	Herbi	cides [] P	esticides 🗌 Ortho	PUOt	ier:	-31 -11		1		
Dupnca	te Samples Tak	en:						where a star		
			and Malania	Substra	te Characteriz	ation	U. Sum		A CALLER .	
Substrate	e Est. P.C.	Riffle 1	0_%	R	tun 10 %	F	ool 80	_%	Reach Total	
Silt/Clay	r (<0.06 mm)								80	
Sand (0.	06 – 2 mm)	San Lenna S						10		
Gravel (2-64 mm)									5	
Cobble (	64 – 256 mm)			1	a de la la com				5	
Boulders (>256 mm)										
Bedrock		the second								
NOT	ES/COMMEN	TS:				DA VLAN Sin Ang	ACCOUNT OF A			

## SITE NOT SAMPLED:

Land owner denial Dry

Site not found/Secluded Unsafe

Too deep/Impounded

## RBP High Gradient Habitat

Habitat	Condition Category										
Parameter	Optimal	Suboptimal	Marginal	Poor							
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0							
1.Epifaunal Substrate/ Available Cover 6 Score	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 <u>not</u> new fall and <u>not</u> 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 new fall, 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.							
2.Embeddedness 6 Score	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.							
3.Velocity/ Depth Regime Score 7	All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast- shallow). (Sow 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).							
4. Sediment Deposition 9 Score	Little or no enlargement of islands or point bars and less than $5\%$ (<20% for low-gradient streams) of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 5-30% (20-50% for low-gradient) of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 30-50% (50-80% for low-gradient) 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% (80% for low-gradient) of the bottom changing frequently; pools almost absent due to substantial sediment deposition.							
5.Channel Flow Status Score 11	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.							
6.Channel Alteration 8 Score	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.							
7.Frequency of Riffles (or bends) 11 Score	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.							
Left/Right Bank	10 9	8 7 6	5 4 3	2 1 0							
8.Bank Stability LB 6 RB 6	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.							
9. Vegetative Protection 6 LB RB 6	More than 90% of the stream bank 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 stream bank 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 stream bank 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 stream bank surfaces covered by vegetation; disruption of stream bank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.							
10. Riparian Vegetative Zone Width LB R <sup>B</sup> 2	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.							
the second se	the second s			the second s							

**Total Score** 

**NOTES/COMMENTS:** 

84

High Gradient Bioassessment Stream Visit Sheet

STREAM	NAME: SO4	4			LOCATION: Bigbone, KY				
STATIO	N#: N/A				COUNTY: BC	one	PROGRAM: PROJECT:		
INVEST	IGATORS: SM,	JF			DATE. A /4 /	2016	TIME	Start:	
Verify Sit	te LAT/LONG vs	GPS	YES NO N/A	4	DAIE: 4/ 1/	2010	(24hr)	Finish:	and the second second
T	Station		Downstree	Read	CANOPY CO		COVER:	STREAM	
LAT	Julio		Downstre		Fully Exposed     Partially Exposed			sed (0-25%) xposed (25-50	TYPE: Perennial
LONG					a di san	1	Partially SI	haded (50-75% ed (75-100%)	6) Ephemeral
WEAT Has there a scourin in the las days?	HER Now been grain t 14 No ×	Past 24 hou Heavy Stead Intern Clear	irs y rain y rain nittent showers /sunny ly	LOCAL V Surface Deep N Oil We Land D Resider	VATERSHED F 2 Mining Aining 11s Disposal ntial	EATURE Const Comm Indust Row (	ES (Predomina ruction nercial trial Crops	nt Surroundin Forest Pasture Silvicul	<u>g Land Use):</u> /Grazing ture Runoff/Storm Sewers
INST Stream V Maximur Reach Le Riffl (No <u>3</u> Riff	FREAM FEATU       Vidth     3       m Depth     1       ength     31       le/Run/Pool Seque       b. Sampled in Rea       ffle     1       Run     2	RES     ft     ft     m   ence ch) Pool	HYDRAULI STRUCTUR Dams Bridge Abutn Island Waterfalls Other: Culv	IC S ES C nents C	T <b>REAM FLOW</b> ] Dry ] Pooled ] Low ] High ] Normal	RIP. Domin Tre Gr Numb Tree/S	ARIAN VEGE hate Type: hese Herbaceo asses Shrubs er of strata <u>2</u> hrub Taxa hrub Taxa	TATION PUS _ Dom. es, Acer rubrum	CHANNEL ALTERATIONS Dredging Channelization (DFull Partial) Culverted
P-CHEM		Instrur	ment Used:			20,27,2	Date	Calibrated:	OF THE REPORT OF
Temp(°C	.) D.(	0. ( <b>mg</b> /l)	%Sat	uration	pH(S.U	.)(	Cond	Ti	urb
	ALL REPORT	STA ST		Sample Co	llection Verific	ation			
Algae	Sample:		HC 🗌 Other	E	Visual Assessm	ent	Lead Co	llector:	
Fish	BPEF	Seine [	Other Tim	e: BPEF	Seine		Lead Co	llector:	
Habitat	RBP	Substra	te 🗌 Other:				Lead Co	llector:	
Invertebr	rates 1m <sup>2</sup>	Qual	Other:				Lead Co	llector:	
	🗌 20 Ja	b (#Jabs: C	obbleSnags	Veg.	Banks San	dM	acrophytes	_ Other	
Tissue:	No. of S	amples coll	ected S	p:	12. j.	-ix	Lead Co	llector:	
Water Cl	hem Acid	/Alk 📙 Bu	lk [] Nutrients [	Metals	Low Hg		Lead Co	llector:	
Duplicat	te Samples Tak	(en:						r	
			5	Substrate	Characteriz	ation	Tressin	and second	
Substrate	Est. P.C.	Riffle 4	0 %	Ru	n <u>20</u> %	P	ool 40 %	6	Reach Total
Silt/Clay	v (<0.06 mm)	國的的							60
Sand (0.0	06 – 2 mm)								20
Gravel (2-64 mm)									10
Cobble (	64 – 256 mm)				<u>1 a 1 40</u>				10
Boulders	s (>256 mm)	1 13							0
Bedrock	a la la la la		Spatian .	- Courses				15 to 1964	0
NOT	ES/COMMEN	NTS:							

SITE NOT SAMPLED:

Land owner denial Dry

Site not found/Secluded Unsafe

Too deep/Impounded

### RBP High Gradient Habitat

Habitat	Condition Category										
Parameter	Optimal	Suboptimal	Marginal	Poor							
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0							
1.Epifaunal Substrate/ Available Cover 10 Score	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 <u>not</u> new fall and <u>not</u> 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 new fall, 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.							
2.Embeddedness 10 Score	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.							
3.Velocity/ Depth Regime Score 11	All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast- shallow). (Sow 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).							
4. Sediment Deposition 7 Score	Little or no enlargement of islands or point bars and less than 5% (<20% for low-gradient streams) of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 5-30% (20-50% for low-gradient) of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 30-50% (50-80% for low-gradient) 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% (80% for low-gradient) of the bottom changing frequently; pools almost absent due to substantial sediment deposition.							
5.Channel Flow Status Score 13	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.							
6.Channel Alteration 10 Score	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.							
7.Frequency of Riffles (or bends) 10 Score	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.							
Left/Right Bank	10 9	8 7 6	5 4 3	2 1 0							
8.Bank Stability LB 4 RB 4	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.							
9. Vegetative Protection 8 LB RB 8	More than 90% of the stream bank 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 stream bank 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 stream bank 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 stream bank surfaces covered by vegetation; disruption of stream bank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.							
10. Riparian Vegetative Zone Width LB 3 RB 3	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.							
Tot	al Score	<b>NOTES/COMMENTS:</b>									

 $(0) \quad (0, -1) \quad (1, 3) \quad (1, 3) \quad (1, 3) \quad (1, 1, 2) \quad (1, 3) \quad$ 

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High Gradient Bioassessment Stream Visit Sheet

STATION #: IVA     PROCRAM:       STATION #: IVA     COUNTY: BOONE     PROCRAM:       INVESTIGATORS: SM. JF     DATE: 4/1/2016     TIME Start:       INVESTIGATORS: SM. JF     DATE: 4/1/2016     TIME Start:       COUNTY: Boone     PROCRAM:       Station     Date: 4/1/2016     TIME Start:       COUNTY: Boone     PROCRAM:       Station     Downstream     Uptote State (5:10%)       Downstream     Diverse Colspan="2">State Mains       LOCAL WATERSHED FEATURES (Predominant Surrounding Land Use):       WATE: AVIATION Description       Description       Description       OU Water State Colspan="2">Structure: State Colspan="2">Structure: State Colspan="2">Structure: State Colspan="2">Structure: State Colspan="2">Structure: State Colspan="2">Structure: State Colspan="2"       Normal     Description: State Colspan="2"       POSTECT: DOWNES       The AM FLOU       Normal Description: State Colspan="2"       Description: State Colspan="2"       The AM FLOU       POSTECONSTECTOR       PO	STREAM	ANAME	S04	6			LOCATION:	Bigbo	ne, KY			
NUMERICATORS: SM. JF       DATE: 4/1/2016       TIME       DATE: 4/1/2016         Verify Site LAT/LONG vs GPS       VSS       NO       NA       TITE: 4/1/2016       TIME       Surt:         Verify Site LAT/LONG vs GPS       Downstream       Upstream       CANOPY COVER:       STREAM         LAT       Downstream       Upstream       CANOPY COVER:       TTPE:         LAT       Downstream       Upstream       CANOPY COVER:       TTPE:         LONG       Weat THER       Now       Past 24 hours:       Stream (14)       Stream (14)       Stream (14)       Depending       Downstream       Depending       Downstream       Depending       Downstream       Depending       Downstream       Depending       Downstream       Depending       Downstream	STATIO	N #. N//	A				COUNTY. BO	oone	ļ	ROGRAM		
Verify Site LAT/LONG vs GPS     YES     NO     NA     C4hr     Pitable:       Station     Downstream     Upstream     CANOPY COVER:     STREAM       LAT     Downstream     Upstream     CANOPY COVER:     Detection       WEATHER     Now     Past 24 hours     Downstream     Streade (30-75%)     Detection       WEATHER     Now     Past 24 hours     DOCAL WATERSHED FEATURES     Detection     Detection       WEATHER     Now     Past 24 hours     DOCAL WATERSHED FEATURES     Detection     Detection       WEATHER     Now     Past 24 hours     DOCAL WATERSHED FEATURES     Detection     Detection       WEATHER     Now     Past 24 hours     DOCAL WATERSHED FEATURES     Detection     Detection       Weather     Diffection     Streade Wining     Docation     Docation     Detection       Brows     Clearing     Streade Wining     Docation     Docation     Diffection       Riffle 1     Run     Pool     Streade Wining     Date Calibrated     Doc       PCHEM     Instrument Used:     Date Calibrated     Doc     Dredging       Poold     Date Calibrated     Diffection     Diffection       Alge     Sample Collection Verification     Lead Collector:       Fish	INVEST	IGATOR	S: SM,	JF	MAGE BALL				TIME S	TIME Start:		
CLNOPY COVER:         STREAM         LAT       Fully Explored (0.25%)       STREAM         LONG       STREAM       STREAM <th co<="" td=""><td>Verify Sit</td><td>te LAT/L</td><td>ONG vs</td><td>GPS</td><td>YES NO</td><td>A</td><td>DATE: <b>4</b>/1/</td><td>2016</td><td>(24hr)</td><td>Finish:</td><td></td></th>	<td>Verify Sit</td> <td>te LAT/L</td> <td>ONG vs</td> <td>GPS</td> <td>YES NO</td> <td>A</td> <td>DATE: <b>4</b>/1/</td> <td>2016</td> <td>(24hr)</td> <td>Finish:</td> <td></td>	Verify Sit	te LAT/L	ONG vs	GPS	YES NO	A	DATE: <b>4</b> /1/	2016	(24hr)	Finish:	
LAT     Differentiation     Differentiation       LAT     Putrally Exposed (2:50%)     Pertnally Exposed (2:50%)     Pertnally Exposed (2:50%)       LONG     Pertnally Exposed (2:50%)     Pertnally Exposed (2:50%)     Pertnally Exposed (2:50%)       WEATHER     Heavy rain     Dep Mining     Construction     Partnally Shaded (75:10%)       Intermittent showers     Dep Mining     Construction     Partnally Shaded (75:10%)       Yesill No     Cloudy     State Mining     Construction       Intermittent showers     Dep Mining     Construction     Partnally Shaded (75:10%)       Yesill No     Cloudy     State Mining     Construction       Waternamy     Cloudy     State Mining     Construction       Bridge Advancents     Dow     State Mining     Dominated Type       Maximum Dept     Trees     HYDRAULIC     State Advancents       Stream With     25     Trees     Bridge Advancents       Maximum Dept     3ndge Advancents     Direct Mining     Dominated Type       0     Riffe/RunPool Sequence     Dote:     Dree Mining     Dote Mining       0     Riffe/RunPool Sequence     Dote:     Date Alibrated:     Dree Mining       0     Riffe/RunPool Sequence     Dote:     Date Alibrated:     Dote Alibrated:       1			Station		Downstre	Rea	CANOPY COVER:: STE				STREAM	
LONG       Partially Shaded (75-107%)       Ephemener         WEATHER       Now       Past 24 hours       Extractions       Entermittee         Has there been as acounting aim       Heavy rain       Dec Mining       Construction       Entermittee         acounting aim       Entermitteet tolowers       Dec Mining       Construction       Entermitteet tolowers         Weils       Dec Mining       Construction       Entermitteet tolowers       Entermitteet tolowers         Weils       Dec Mining       Construction       Entermitteet tolowers       Entermitteet tolowers         Wainum Dept       Time       Dems       STREAM FLOW       Dominate Type         Reach Length       Time       Bridge Abutments       Dow       Stream Width       ClanNEL         Acr ragando       Stream Width       Take       Stream Width       ClanNEL       Acr ragando, Festuce sp., Rose sp.       CHANNEL         Mainum Dept       Do, (m/l)       Y68aturation       pH(SUL)       Cond       Turb       Acr ragando, Festuce sp., Rose sp.       CHANNEL         Alge       Sample Collection Verification       Sample Collector       Ead Collector       Ead Collector         Field       BPEPE       Seine       Lead Collector       Ead Collector	LAT	125	Station	X 3/	Downstre		Fully Exposed (0-25%)     Partially Exposed (25-50%)				0%) Perennial	
WEATHER       Now       Past 24 hours       DCAL WATERSHED FEATUREES (Predominant Surrounding Land Use).         Has there been as counting rain in the last 14       Heavy rain intermittent slowers       Doe Mining intermittent slowers       Commercial intermittent slowers       Poststee/Grazing         Yes No       Decomposition       Residential       Commercial intermittent slowers       Poststee/Grazing         Yes No       Differ Status       STREAM FLOW       STREAM FLOW       Differ Status       Differ Status       Differ Status       CHANNEL         Stream Width       Tres       HYDRAULIC       STREAM FLOW       Differ Status       Differ Statu	LONG				en e				Partially SI	aded (50-75) ed (75-100%	%) Ephemeral ) Intermittent	
Instruction       Image: Construction       Construction       Porest         Sourcing and Intermittent showers       Intermittent showers <td< td=""><td>WEAT</td><td>HER</td><td>Now</td><td>Past 24 ho</td><td>ours</td><td>LOCAL</td><td>WATERSHED H</td><td>EATURE</td><td>ES (Predomina</td><td>nt Surroundi</td><td>ng Land Use):</td></td<>	WEAT	HER	Now	Past 24 ho	ours	LOCAL	WATERSHED H	EATURE	ES (Predomina	nt Surroundi	ng Land Use):	
in the last 14       Intermittent showers       Oil Wells       Bildustrial       Bildust	a scourin	ig rain		× Hea Stea	vy rain dy rain	Deep I	e Mining Mining	Const	ruction nercial	Forest Pasture	/Grazing	
Yes       No       Cloudy       <	in the las days?	it 14			mittent showers	OilW	ells		trial	Silvicu	lture	
RIFREAM FEATURES Maximum Depth       RIFARIAN VEGETATION Dames         STREAM FLOW Dry Pooled (No. Sampled in Reach)       Bridge Abutments Bridge Abutments         0       Riffle farm       Pool       STREAM FLOW Dry Pooled Low Waterfails       STREAM FLOW Dry Pooled Low High Normal       Dimestigation Stresses       CHANNEL ALTERATIONS Number of strata 3_ Dom. TreeShirub Taxa       CHANNEL ALTERATIONS Number of strata 3_ Dom. TreeShirub Taxa         0       Riffle 1_Run 1_Pool       Other:	Yes	No			ıdy	Reside	ential		crops	L Orban	Runon/Storm Sewers	
Maximum Deph       in       ft	INST Stream V	<b>FREAM</b> I	FEATU	RES	HVDPAUL			RIP	ARIAN VEGE	TATION		
Reach Length       m       Dams       Dams       Dooled	Maximu	m Depth	1	ft	STRUCTUR	ES S	STREAM FLOW	Tr	ees Herbaceo	us	CHANNEL	
(No. Sampled in Reach)          Island          Tree/Shrub Taxa          Channelization         0       Riffle 1       Run 1       Pool       Pool       Pool       Acer negundo, Festura sp., Rosa sp.          Channelization         PCHEM       Instrument Used:	Reach Le	ength le/Run/Po	ol Seque	m	Dams Bridge Abutn	nents	Pooled	Numb	er of strata 3	Dom.	Dredging	
0       Riffe 1       Run 1       Pool       Other:       Normal       Acer negundo, Festuca sp., Rosa sp.       Cat. and P.	(No	. Sample	d in Read	ch)	U Island		High	Tree/S	Shrub Taxa		Channelization	
P-CHEM Instrument Used: Date Calibrated: Temp(°C)D.O. (mg/l)%SaturationPH(S.U.)CondTurb Sample Collection Verification Algae Sample: QualMHCOtherVisual Assessment Lead Collector: Fish BPEFSeineOtherVisual Assessment Lead Collector: Fish BPEFSeineOtherLead Collector: Lacd Collector:Lead Collector: 20 Jab (#Jabs: CobbleSngsVeg. BanksSandMacrophytesOther) Fissue: No. of Samples collectedSp:Lead Collector: Water ChemAcid/Alk  Bulk  Nutrients  Metals  Low HgLead Collector: Herbicides  Pesticides  Othor P  Other: Duplicate Samples Taken: Substrate Characterization Substrate [Est. ]P.C. Riffle 35 % Run 5 % Pool 60 % Reach Total Silt/Clay (<0.06 mm) 15 Gravel (2-64 mm) 20 Cobble (64 - 256 mm) 0 Bedrock 0	<u>0</u> Ri	ffle 1	Run 1	Pool	Other:	0	Normal	Acer ne	gundo, Festuca s	sp., Rosa sp.		
Temp(°C)	P-CHEM	1		Instru	iment Used:		12 Marine D		Date	Calibrated:		
Sample Collection Verification         Algae       Sample:       QualMHC       Other       Visual Assessment       Lead Collector:         Fish       BPEF       Seine       Other       Time: BPEF       Seine       Lead Collector:         Habitat       RBP       Substrate       Other:       Lead Collector:       Lead Collector:         Invertebrates       Im <sup>2</sup> Qual       Other:       Lead Collector:       Lead Collector:         20 Jab (#Jabs: Cobble       Snags       Veg. Banks       Sand       Macrophytes       Other       Other         Fissue:       No. of Samples collected       Sp:       Lead Collector:       Veg. Banks       Sand       Macrophytes       Other       Other         Duplicate Samples       Dath (#Jabs: Cobble       Snags       Veg. Banks       Sand       Macrophytes       Other       Outer         Duplicate Samples Taken:       Substrate Characterization       Substrate       Substrate       Stop       Reach Total         Substrate       Def.       Notifies       Stop       Sol       Sol       Sol         Substrate       Def.       Notifies       Sol       Sol       Sol       Sol       Sol         Substrate       Def.	Temp(°C	;)	D.C	D. ( <b>m</b> g/l)_	%Sat	uration	pH(S.U	J.)	Cond	т	`urb	
Algae       Sample:       QualMHC       Other       I visual Assessment       Lead Collector:         Fish       BPEF       Seine       Other       Time:       BPEF       Seine       Lead Collector:         Habitat       RBP       Substrate       Other:       Lead Collector:       Lead Collector:         Invertebrates       Im <sup>2</sup> Qual       Other:       Lead Collector:       Dual Collector:         20 Jab (#Jabs: Cobble       Snags       Veg. Banks       Sand       Macrophytes       Other       Other         Tissue:       No. of Samples collected       Sp:       Lead Collector:       Water Chem       Acid/Alk       Bulk       Nutrients       Metals       Low Hg       Lead Collector:         Herbicides       Pesticides       Ortho P       Other:       Duplicate Samples Taken:       Duplicate Samples Taken:         Substrate       Est.       P.C.       Riffle 35       %       Run 5       %       Pool 60       %       Reach Total         Substrate       Est.       P.C.       Riffle 35       %       Run 5       %       Pool 60       %       Reach Total         Substrate       Est.       P.C.       Riffle 35       %       Run 5       %       Pool 60<			1.33			Sample Co	ollection Verific	cation			ER STUDIES SALT	
Fish       BPEF       Seine       Lead Collector:         Habitat       RBP       Substrate       Other:       Lead Collector:         Invertebrates       Im <sup>2</sup> Qual       Other:       Lead Collector:         20 Jab (#Jabs: Cobble       Snags       Veg. Banks       Sand       Macrophytes       Other	Algae		Sample:	Qual Qual N	1HC Other		Visual Assessm	nent	Lead Co	llector:		
Habitat RBP Substrate Other: Lead Collector:   Invertebrates Im² Qual Other: Lead Collector:   20 Jab (#Jabs: Cobble SnagsVegSandsSandMacrophytesOther)   Tissue: No. of Samples collectedSp: Lead Collector:   Water Chem Acid/Alk Bulk Nutrients Metals Low Hg Lead Collector:   Water Chem Acid/Alk Bulk Nutrients Metals Low Hg Lead Collector:   Water Chem   Acid/Alk Bulk Nutrients Metals Low Hg Lead Collector:   Water Chem   Acid/Alk Bulk Nutrients Metals Low Hg Lead Collector:   Water Chem   Acid/Alk Bulk Nutrients Metals Low Hg Lead Collector:   Duplicate Samples Taken:   Substrate Descindent 60 % Reach Total   Substrate Est. P.C. Riffle 35 % Run 5 % Pool 60 % Reach Total   Silt/Clay (<0.06 mm)	Fish		BPEF	Seine	Other Tim	e: BPEF	Seine		Lead Co	llector:		
Invertebrates       1m² Qual Other:       Lead Collector:         20 Jab (#Jabs: Cobble       SnagsVeg. BanksSandMacrophytesOther	Habitat			Substr	ate Other:			2.10	Lead Co	lector:	17 A.M.	
Tissue:       No. of Samples collected Sp:       Lead Collector:         Water Chem      Acid/AlkBulkNutrientsMetalsLow Hg       Lead Collector:        HerbicidesPesticidesOrtho POther:       Lead Collector:         Duplicate Samples Taken:	Invertebi	rates	1m² [ 20 Jai	_] Qual [ b (#Jabs: (	J Other: Cobble Snage	sVeg	. Banks Sa	ndM	Lead Col acrophytes	llector: Other		
Water Chem Acid/Alk Bulk Nutrients Metals Low Hg Lead Collector:   Herbicides Pesticides Otho Other: Duplicate Samples Taken:     Substrate Est. P.C. Riffle 8   Substrate Est. P.C. Riffle 8   Substrate Est. P.C. Riffle 50   Sand (0.06 - 2 mm) 15 50   Saravel (2-64 mm) 20   Cobble (64 - 256 mm) 15   Boulders (>256 mm) 0   Sedrock 0	Tissue:	J	No. of Sa	amples co	llected S	p:		Part 1	Lead Col	lector:		
Herbicides       Pesticides       Other:         Substrate Characterization         Substrate       Est.       P.C.       Riffle 35 %       Run 5 %       Pool 80 %       Reach Total         Silt/Clay (<0.06 mm)	Water Cl	hem	Acid/	Alk 🗋 B	ulk 🗌 Nutrients 🗌	] Metals 🔲	Low Hg	San Mar	Lead Co	ilector:		
Substrate Characterization           Substrate [_Est. ]P.C.         Riffle 35 %         Run 5 %         Pool 60 %         Reach Total           Silt/Clay (<0.06 mm)	Dunlicat	te Samn	Herbi	icides []	Pesticides 🗌 Ortho	P Othe	er:					
Substrate Characterization           Substrate [Est. ]P.C.         Riffle 35 %         Run 5 %         Pool 60 %         Reach Total           Silt/Clay (<0.06 mm)	Dupnea	e oamp	IC3 I AK									
Substrate [Est.]P.C.         Riffle 35 %         Run 5 %         Pool 60 %         Reach Total           Silt/Clay (<0.06 mm)	2012 - E			102 C 1		Substrat	. Characteriz	ation				
Silt/Clay (<0.06 mm)	Substrate	E Est.	P.C.	Riffle	35 %	Ru	in <u>5</u> %	F	ool_60 %		Reach Total	
Sand (0.06 - 2 mm)       15         Gravel (2-64 mm)       20         Cobble (64 - 256 mm)       15         Boulders (>256 mm)       0         Bedrock       0         NOTES/COMMENTS:	Silt/Clay	(<0.06 1	mm)								50	
Gravel (2-64 mm)       20         Cobble (64 - 256 mm)       15         Boulders (>256 mm)       0         Bedrock       0         NOTES/COMMENTS:       ————————————————————————————————————	Sand (0.0	06 – 2 m	m)								15	
Cobble (64 - 256 mm)         15           Boulders (>256 mm)         0           Bedrock         0           NOTES/COMMENTS:	Gravel (2-64 mm)								20			
Boulders (>256 mm) 0 Bedrock 0 NOTES/COMMENTS:	Cobble (64 – 256 mm)									15		
Bedrock O NOTES/COMMENTS:	Boulders (>256 mm)									0		
NOTES/COMMENTS:	Bedrock										0	
	NOT	ES/CO	MMEN	TS:	Mar and Market	Hun Berry	34	1201012400		State S III		

Land owner denial

Dry Dro deep/Impounded

Site not found/Secluded Unsafe

## RBP High Gradient Habitat

Habitat	Condition Category										
Parameter	Optimal	Suboptimal	Marginal	Poor							
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0							
1.Epifaunal Substrate/ Available Cover 12 Score	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 <u>not</u> new fall and <u>not</u> 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 new fall, 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.							
2.Embeddedness 8 Score	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.							
3.Velocity/ Depth Regime Score 10	All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast- shallow). (Sow 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).							
4. Sediment Deposition 10 Score	Little or no enlargement of islands or point bars and less than 5% (<20% for low-gradient streams) of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 5-30% (20-50% for low-gradient) of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 30,-50% (50-80% for low-gradient) 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% (80% for low-gradient) of the bottom changing frequently; pools almost absent due to substantial sediment deposition.							
5.Channel Flow Status Score 10	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.							
6.Channel Alteration 15 Score	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.							
7.Frequency of Riffles (or bends) 16 Score	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.							
Left/Right Bank	10 9	8 7 6	5 4 3	2.10							
8.Bank Stability LB 6 RB 6	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.							
9. Vegetative Protection 8 LB RB 8	More than 90% of the stream bank 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 stream bank 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 stream bank 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 stream bank surfaces covered by vegetation; disruption of stream bank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.							
10. Riparian Vegetative Zone Width LB 2 RB 2	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.							
Tot	al Score	NOTES/COMMENTS-									

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Appendix C Pond/Open Water Datasheets

## ch2m:

		P	OND DATA	SHEET					
Feature ID: P001			ASSOCIAT S031	Associated Features: S031					
SURVEY TYPE: waterbo	dy								
Date: 3/31/16	CLIENT/PI MILEPOST	NAME: Duke	e/ Walton to	Big Bone					
INVESTIGATORS: S. Miloski and	J. Fr	eer	ROUTE: pipeline	ROUTE: pipeline centerline					
STATE/COUNTY: KY/ Boone			IS THIS A MAPPED NWI FEATURE?: Yes						
		WATE	RBODY CHAI	RACTERISTICS					
WATERBODY TYPE:		pond							
AVG. DEPTH:	77	>3 feet							
AVG. WIDTH (WATER SURFACE):		150 feet							
APPROXIMATE SIZE:		150X400 feet							
		Qu.	alitative A	TTRIBUTES					
Average Water Appearance: clear									
PRIMARY SUBSTRATE (IF OBSERVED): Silt									
POTENTIAL HABITAT FOR:		fish, waterfow	/1						
SURROUNDING LAND USE:	10 10	residential/pasture							
		a proper set of the se	100 March 1						
Wetland Fringe (If pres	ent):	n/a few willow t	rees lining t	ne pona					

# Appendix E GAI Wetland and Stream Delineation Report

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## Wetland Delineation and Stream Identification Report

Duke Energy Walton to Big Bone Pipeline Project Boone County, Kentucky

GAI Project Number: G141890.03 Duke Project: GD70.S587.69100.R2190 November 2015



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## Wetland Delineation and Stream Identification Report

Duke Energy Walton to Big Bone Pipeline Project Boone County, Kentucky

GAI Project Number: G141890.03 Duke Project: GD70.S587.69100.R2190

November 2015

Prepared for: Duke Energy 1000 East Main Street Plainfield, Indiana 46168

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~ helle

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## **1.0 Introduction**

Duke Energy is proposing to construct the Walton to Big Bone Pipeline Project (Project), located in Boone County, Kentucky (KY) (Figure 1). The proposed Project involves the construction of approximately 10.25 miles of eight-inch diameter pipeline and a 0.75-mile pipeline section also eight inches in diameter, as well as a 100-foot by 100-foot metering/valve station.

GAI Consultants, Inc. (GAI), on behalf of Duke Energy, conducted wetland delineations and stream investigations of the Project study areas in October 2015. GAI identified approximate boundaries of waterbodies and wetlands located within a 20-foot wide corridor centered on the existing centerline within road right-of-way (ROW) only. One non-road adjacent section of the provided alignment was not reviewed due to access restrictions. This report describes the methods and results of the environmental field survey within the Project study areas.

## 2.0 Methods

Wetland delineations were conducted in accordance with the 1987 United States Army Corps of Engineers (USACE) *Corps of Engineers Wetlands Delineation Manual* (Environmental Laboratory, 1987) and the *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Eastern Mountains and Piedmont Region* (Version 2.0) (USACE, 2012). Wetlands were classified using the *Classification of Wetlands and Deepwater Habitats of the United States* (Cowardin et al., 1979). Classification of the indicator status of vegetation is based on *The National Wetland Plant List:* 2014 Update of Wetland Ratings (Lichvar, et al. 2014).

The Study Area was investigated for the presence of streams and wetlands. Each field-identified jurisdictional perennial and intermittent drainage was evaluated using the KY Site Characterization and High Gradient Habitat Assessment procedure as outlined in the *Standard Methods for Assessing Biological Integrity of Surface Waters in Kentucky* (KY Division of Water [KDOW], 2008) and in the *Methods for Assessing Habitat in Wadeable Waters* (KDOW, 2011). Both of these procedure revisions apply to the stream assessments in this region of Kentucky, and both utilize the same assessment form and criteria, with only minor differences. The completed High Gradient Bioassessment Stream Data Sheets are included in Appendix A.

The growing season in the Project area is generally between March and December in Boone County, KY (United States Department of Agriculture, Natural Resource Conservation [USDA-NRCS], 2014). Field observations were supplemented with an intensive review of United States Fish and Wildlife Service (USFWS) National Wetlands Inventory (NWI) mapping, USDA-NRCS soils mapping, historical aerial photography (Google Earth), and local landscape topography/morphology to provide a determination of wetlands present within the study area. Professional judgment was used to determine whether hydrophytic vegetation and hydric soils existed within the identified wetlands if on-site data was ambiguous.

Each wetland and waterbody feature (if identified) was given a unique map designation and each boundary flag location was recorded using a Trimble GEO XH model global positioning system mapping grade unit with the capability of sub-meter accuracy. Judgmental upland and wetland soil test pits were taken within the study corridor at the discretion of the delineator to confirm the presence or absence of wetlands in areas with exhibiting wetland indicators. If identified, wetland boundaries and stream centerlines were mapped. Streams with a top-of-bank width of greater than 10 feet had a left and right top-of-bank mapped.

## 3.0 Regulatory Discussion

#### 3.1 Waters of the United States

"Waters of the U.S." are within the jurisdiction of the USACE under the Clean Water Act (CWA). "Waters of the U.S." is a broad term, which includes waters that are used or could be used for interstate commerce. This includes wetlands, ponds, lakes, territorial seas, rivers, tributary streams including any definable intermittent waterways, and some ditches below the ordinary high water mark (OHWM). Also included are manmade waterbodies such as quarries and ponds, which are no longer actively being mined or constructed and are connected to other "waters". Wetlands, mudflats, vegetated shallows, riffle and pool complexes, coral reefs, sanctuaries, and refuges are all considered special aquatic sites which involve more rigorous regulatory permitting requirements. A specific, detailed definition of "Waters of the U.S." can be found in the Federal Register (33 CFR 328.3).

On January 9, 2001 the U.S. Supreme Court issued a decision, Solid Waste Agency of Northern Cook County (SWANCC) v. U.S. Army Corps of Engineers (No. 99-1178). The decision reduces the regulation of isolated wetlands under Section 404 of the CWA, which assigns the USACE authority to issue permits for the discharge of dredge or fill material into "Waters of the U.S." Prior to the SWANCC decision, the USACE had adopted a regulatory definition of "Waters of the U.S." that afforded federal protection for almost all of the nation's wetlands. The Supreme Court decision interpreted that the USACE's jurisdiction is restricted to navigable waters, their tributaries, and wetlands that are adjacent to these navigable waterways and tributaries. The decision leaves the majority of "isolated" wetlands unregulated by the CWA. Therefore, most wetlands that are not adjacent to, or contiguous with, any other "Waters of the U.S." via a surface drain such as a swale, ditch, or stream are considered isolated and thus no longer jurisdictional by the USACE.

On June 19, 2006, the U.S. Supreme Court issued decisions in regards to John A. Rapanos v. United States (No. 04-1034) and June Carabell v. United States (04-1384), et al. The plurality decision created two 'tests' for determining CWA jurisdiction: the permanent flow of water test (set out by Justice Scalia) and the "significant nexus" test (set out by Justice Kennedy). On June 5, 2007 the USACE and Environmental Protection Agency issued joint guidance on how to interpret and apply the Court's ruling. According to this guidance, the USACE will assert jurisdiction over traditionally navigable waters (TNWs), adjacent wetlands, and non-navigable tributaries of TNWs that have "relatively permanent" flow, and wetlands that border these waters, regardless of whether or not they are separated by roads, berms, and similar barriers. In addition, the USACE will use a case-by-case "significant nexus" analysis to determine whether waters and their adjacent wetlands are jurisdictional. A "significant nexus" can be found where waters, including adjacent wetlands, alter the physical, biological, or chemical integrity of the traditionally navigable water based on consideration of several factors.

#### 3.2 Waters of the State

"Waters of the State" are within the jurisdiction of the KY Department for Environmental Protection, KDOW. They are generally defined as surface and underground waterbodies, which extend through or exist wholly in the State, which includes, but is not limited to, streams and both isolated and non-isolated wetlands. Private ponds, or any pond, reservoir, or facility built for reduction of pollutants prior to discharge are not included in this definition. In addition to "Waters of the U.S.", the KDOW also regulates and issues permits for isolated wetland impacts. The State relies on the USACE decision regarding wetland determinations and delineations including whether or not a wetland is isolated or non-isolated.

To evaluate potential streams within the Study Area, GAI first reviewed existing United States Geological Survey (USGS) topographic maps, aerial photography, National Hydrography Dataset stream data, and site contour data, prior to the extensive field reconnaissance that was performed in October 2015.

The completed High Gradient Bioassessment Stream Data Sheets for each stream channel are provided in Appendix A. These forms were completed for perennial and intermittent streams only. A 50 foot survey reach was utilized as the survey could be viewed from road ROW. The mapped location of each jurisdictional channel is shown on Figure 2. Additionally, The Kentucky Administrative Regulation (KAR) 401 KAR 10:026 Designation of Uses of Surface Waters database was searched to potentially identify any of the Study Area's streams as special use waters. The KAR states that "waters that are not specifically listed...are designated for the use of warm water aquatic habitat:"

Regulatory activities under the CWA (1972) and amendments of 1977 provide authority for states to issue water quality standards for all waters of the United States including upstream to the highest reaches of tributary streams. In addition, the CWA amendments require knowledge of the potential fish or biological community that can be supported in a stream or river, including upstream headwaters. The High Gradient Bioassessment Stream Data Sheet content is designed to evaluate the quality of in-stream and riparian habitat based on specific features. The availability of quality habitat directly influences the biological integrity of a stream reach. Information obtained from the habitat assessment can generally be used to supplement biological and physiochemical data collected where necessary when determining the overall health of the stream reach and the stream-use designation. Biological and physiochemical sampling was not completed.

Two different habitat assessment field data sheets are used in the Kentucky stream assessment procedure. For streams where riffles should naturally be present (e.g. most stream reaches of the Central Appalachian, Western Allegheny, Southwestern Appalachian and Interior Plateau ecoregions would qualify), the high-gradient habitat assessment field data sheet should be used. In low-gradient streams where rocky riffles are not naturally present (e.g. most stream reaches in the Mississippi Valley Plain and the Interior River Lowland ecoregions would qualify), the low-gradient habitat assessment field data sheet should be used. The high gradient was determined to be the most suitable for the Study Area, which is located within the Outer Bluegrass Ecoregion.

The visually-based habitat evaluation consists of ten parameters that characterize in- stream habitat, channel morphology, bank stability, and riparian vegetation for each sampling location. For each parameter, the investigator determines which of the following conditions exist at the sampling reach: Optimal, Suboptimal, Marginal or Poor and assigns a parameter score within the condition category chosen above as follows: Optimal (20-16), Suboptimal (15-11), Marginal (10-6) or Poor (5-0). The investigator then totals all parameter ratings to obtain a final habitat ranking. Completed High Gradient Bioassessment Stream Data Sheets for the streams delineated during the field survey are provided in Appendix A.

### 4.0 Results

USGS mapping (USGS 1984, 1987, 1992) indicates that the western portion of the Project area (approximately from the Project's western terminus to the Intersection of Beaver Road and United States Routes 127 and 42) is comprised of a dissected landscape of steep hillsides and the Big Bone Creek stream valley. The eastern portion of the Project area is flatter, consisting of low, rolling hills. Land use consists primarily of a rural landscape of forests, farms, and residential areas.

The Project study area is found within the following watersheds:

- Big Bone Creek (Hydrologic Unit Code [HUC] 050902031003); and
- Mud Lick Creek (050902031001).

The USFWS's NWI was reviewed for potential wetland locations. These maps identify potential wetlands on-site. The NWI maps were prepared from high altitude photography and in most cases were not field verified. As a result wetlands are sometimes erroneously identified, missed, or misidentified within this data set. The presence of an NWI wetland does not necessarily constitute the presence of a wetland meeting USACE criteria. The NWI map of the area (Figure 1) identified one feature (Freshwater Pond) crossed by the study area. The NWI classification crossed by the study area is PUBHh (Palustrine/Unconsolidated Bottom/Permanently Flooded/Diked/Impounded).

Twenty seven streams and no wetlands were identified within the study area (Figure 2).

Streams designated for special protection in Kentucky are known as "Special Waters" (Cold Water Aquatic Habitat, Exceptional Waters, Reference Reach Waters, Outstanding State Resource Waters, Outstanding National Resource Waters, State Wild Rivers, and Federal Wild and Scenic Rivers). One stream, Big Bone Creek (SKY-CDK-006) is designated as an Outstanding State Resource Water. There were no USACE Section 10 Waters listed as navigable.

In support of field findings, identified waterbodies are summarized in Table 1. Color photographs of each feature accompany the table. High Gradient Bioassessment Stream Data Sheets were completed during this investigation and are included as Appendix A. Additional data was recorded for all stream features including top of bank (TOB) width and depth and width and depth at OHWM. Additionally, the substrate characteristics and adjacent riparian buffer vegetation were documented for each stream feature on the recorded field sheets. Descriptions of the soils found within the study area are presented in Appendix B.

#### 5.0 Conclusions

Wetland delineations and stream investigations of Duke Energy's Walton to Big Bone Pipeline Project study areas were conducted in October 2015 within a 20-foot wide corridor centered on the existing centerline. Twenty seven streams and no wetlands were identified within the study area. The results of the field study are provided in this report.

All statements in this document pertaining to the jurisdictional status of streams and wetlands with regard to USACE and state regulations represent the opinion of GAI and are based on present USACE guidance. The jurisdictional status of these features may be confirmed a USACE Jurisdictional Determination and/or by state agencies.

### 6.0 References

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TABLE 1Waterbodies IdentifiedWithin the Project Study Area

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#### CONFIDENTIAL PROPRIETARY TRADE SECRET

Feature Designation <sup>1</sup>	Latitude <sup>2</sup>	Longitude <sup>2</sup>	Name	Туре	OHWM Width (ft)	OHWM Depth (ft)	TOB Width (ft)	TOB Depth (ft)	Length Within Study Area <sup>3</sup> (ft)	Kentucky or Federal Special Listing <sup>1</sup>	Open Ended
SKY-CDK-001	38.88303	-84.71081	UNT to Big Bone Creek	Ephemeral	2	0.5	3	1	0.17	No	Y
SKY-CDK-002	38.882929	-84.710698	UNT to Big Bone Creek	Ephemeral	1.5	0.33	2	1.5	N/A	No	Y
SKY-CDK-003	38.883549	-84.712842	UNT to Big Bone Creek	Ephemeral	3	0.25	3	1.5	102.24	No	Y
SKY-CDK-004	38.883609	-84.71288	UNT to Big Bone Creek	Ephemeral	3	0.33	3	1.5	14.93	No	Y
SKY-CDK-005	38.884475	-84.716338	UNT to Big Bone Creek	Epherneral	4	0.83	5	2.5	N/A	No	Y
SKY-CDK-006	38.884952	-84.729726	Big Bone Creek	Perennial	50	8	120	25	21.22	Yes - OSRW <sup>5</sup>	Y
SKY-CDK-007	38.88496	-84.736193	UNT to Big Bone Creek	Perennial	8	2.5	10	3	11.23	No	Y
SKY-CDK-008	38.888311	-84.75515	Gum Branch	Perennial	20	10	50	15	20.92	No	Y
SKY-CDK-009	38.88786	-84.756352	UNT to Gum Branch	Ephemeral	2	0.33	3	2	79.42	No	Y
SKY-CDK-010	38.887878	-84.756212	UNT to Gum Branch	Perennial	8	2	10	6	7.16	No	Y
SKY-CDK-011	38.889099	-84.74891	UNT to Big Bone Creek	Intermittent	4	0.5	5	1.5	N/A	No	Y
SKY-CDK-012	38.879394	-84.701392	Beaver Branch	Perennial	7	0.25	9	3	7.75	No	Y
SKY-CDK-013	38.897369	-84.662568	UNT to Mud Lick Creek	Perennial	13	4	14	6	N/A	No	Y
SKY-CDK-014	38.893747	-84.673277	UNT to Mud Lick Creek	Perennial	4	1.16	5	2.5	N/A	No	Y
SKY-CDK-015	38.879982	-84.697841	UNT to Beaver Branch	Ephemeral	4	0.25	5	2	N/A	No	Y
SKY-CDK-016	38.888829	-84.685389	UNT to Mud Lick Creek	Perennial	11	2	12	2.5	17.47	No	Y
SKY-CDK-017	38.899087	-84.65313	Mud Lick Creek	Perennial	10	5	30	7	27.74	No	Y
SKY-CDK-018	38.898322	-84.650852	UNT to Mud Lick Creek	Perennial	25	5	30	6	22.83	No	Y
SKY-CDK-019	38.906064	-84.642176	UNT to Mud Lick Creek	Ephemeral	3	0.33	4	1.5	10.12	No	Y
SKY-CDK-020	38.895195	-84.648059	UNT to Mud Lick Creek	Perennial	9	1.16	12	5	13.43	No	Y
SKY-CDK-021	38.891331	-84.643072	UNT to Mud Lick Creek	Ephemeral	3	0.33	4	1.5	21.12	No	Y
SKY-CDK-022	38.889844	-84.640177	UNT to Mud Lick Creek	Perennial	12	0.41	14	1.5	12.20	No	Y
SKY-CDK-023	38.887761	-84.632876	UNT to Mud Lick Creek	Ephemeral	3	0.25	4	. 1	18.61	No	Y
SKY-CDK-024	38.889555	-84.626828	UNT to Mud Lick Creek	Intermittent	6	0.33	8	2	12.90	No	Y
SKY-CDK-025	38.88976	-84.62581	UNT to Mud Lick Creek	Ephemeral	6	0.25	7	1.5	6.54	No	Y
SKY-CDK-026	38.890126	-84.624155	UNT to Mud Lick Creek	Perennial	6	0.41	7	2	21.28	No	Y
SKY-CDK-027	38.890165	-84.623638	UNT to Mud Lick Creek	Intermittent	5	0.41	10	4	6.75638.8	No	Y
Total Stream within Study Area (feet)							456.04				

## Table 1. Waterbodies Identified within the Project Study Area

Notes:

<sup>1</sup> GAI map designation.

<sup>2</sup> Decimal degrees; Coordinates provided in NAD 83.

<sup>3</sup> Extent of stream or open water within study area. Stream or open water may extend beyond these limits if noted as open ended. "N/A" in this column signifies that the stream is located outside of the study corridor and therefore, has no delineated length within the 20' study corridor.

4 KDOW Wild Rivers List for Kentucky. Kentucky Register 401 KAR 4:100. Accessed October 2015.

5 KDOW Outstanding State Resource Waters (OSRW) as shown on the KDOW Kentucky Watershed Viewer accessible at: http://eppcgis.ky.gov/flexviewers/watershed/. Accessed October 2015.

# WATERBODY PHOTOGRAPHS