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CONFIDENTIAL	PROPRIETARY	TRADE SE	CRET	
High Candiant I	Diaganaman	+ Straam	Vinit	Shaa

STREAM NAM	E: S023	3		1	LOCATIO	N: Bigbon	e, KY		
STATION #: N						Boone	1	PROGRAM: PROJECT:	
INVESTIGATO		JF	1		The second second	30/2016	TIME S	Start:	
Verify Site LAT/	LONG vs	GPS	YES 🗖 NO 🔳	N/A		30/2010	(24br)]	Finish:	·····
	Station		Downs	tream	Reach Ups	tream		COVER:	STREAM
LAT LONG						Fully Exposed (0-25 Partially Exposed (22 Partially Exposed (22 Partially Shaded (50 Fully Shaded (75-10			TYPE: Perennial Ephemeral Intermitten
WEATHER Has there been a scouring rain in the last 14 days? Yes No		Stead Inter Clear Clou	/y rain dy rain mittent showers r/sunny		AL WATERSHI urface Mining eep Mining il Wells and Disposal esidential	Const Comn Indust	ruction nercial rial Crops	 Forest Pasture/Gra Silviculture Urban Rund 	zing
INSTREAM Stream Width Maximum Deptl Reach Length Riffle/Run/I (No. Sampl 2 Riffle 1 P-CHEM	h $\frac{3.5}{1.5}$ Pool Seque led in Reac	ft ft m nce ch) Pool	HYDRA STRUCT Dams Bridge Al Island Waterfalls Other: C	URES outments	STREAM FI Dry Pooled Low High Normal	LOW Domir Tree Domir Tree Domir Tree Domir Tree Domir	ARIAN VEGE iate Type: tes Herbaceo asses Shrubs er of strata hrub Taxa b., Taraxacum	Dom.	CHANNEL LTERATIONS Dredging Channelization]Full Partial) Culvert
	DC			Saturation	pH	(SU)		Calibrated:	
Temp(C)		. (mg/i)_	//		and the second second		Cond	Turb.	
Algae	Sample		IHC Other	Samp	Collection Ve		Lead Co	llector	
Fish				Time: BPI		eine	Lead Co	194.	
Habitat			ate 🗌 Other:	TINC. DIT	<u> </u>		Lead Co		No. No. N
Invertebrates	1m ²	Qual] Other:				Lead Co.	llector:	14 F. 200 P. 46
	20 Jai	b (#Jabs: C	Cobble Si	nags	Veg. Banks	SandM	acrophytes	Other)	
Tissue:	No. of Sa	amples col	lected	Sp:			Lead Co	llector:	
Water Chem			ulk 🗌 Nutrient				Lead Co	llector:	
Duplicate Sam			Pesticides 🗌 O		Uther:				
		St.I.	n an an Alberta Ann an Alberta	Subst	rate Charact	erization			
Substrate Est	t. □ P.C.	Riffle_	40 %		Run_30	6 P	ool_30 %	6 R	each Total
Silt/Clay (<0.00	6 mm)		ALC: A SAME			-41			40
Sand (0.06 - 2	mm)								20
	m)								20
Gravel (2-64 m		T	E CERCENCE (10
	56 mm)				同時 起送的 路外 路			a second and the second second	10
Gravel (2-64 m Cobble (64 – 2: Boulders (>256									5

Dry Dro deep/Impounded Land owner denial

Site not found/Secluded Unsafe

RBP High Gradient Habitat

Habitat	and the second sec	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).	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.	Little or no enlargement of slands or point bars and less han 5% (<20% for low- radient streams) of the bottom affected by sediment						
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.	extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disputed. Instream hat greatly altered or remov					
7.Frequency of Riffles (or bends) · 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;				
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.	surfaces and immediate an zone covered by vegetation, including understory shrubs, or body macrophytes; g or mowing minimal or g or mowing minimal or dent, almost all plants						
10. Riparian Vegetative Zone Width LB O RB O	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

U A INALIAN IN AN	1E: S025	5			LOCATION: E	Bigbon	e, KY		
STATION #: N		26.3		1. 1. je	and the second se	COUNTY: BOONE PROGRAM: PROJECT:			
INVESTIGAT		JF	1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1		- DATE: 3/30/		The state of the	tart:	
Verify Site LAT	/LONG vs	GPS	YES NO		h the second	2010	(24hr) F	'inish:	
	Station		Downstre		leach Upstrean	1	Fully Expos		STREAM TYPE:
LAT							Partially Ex Partially Sh Fully Shade	aded (50-759	%) DEphemeral
WEATHER Has there been a scouring rain in the last 14 days? Yes No		Stea	vy rain dy rain rmittent showers ur/sunny	Dee Oil Lan	L WATERSHED F face Mining ep Mining Wells Wells d Disposal idential	EATURE Const Comr Indus Row	ruction nercial trial	Forest Pasture Silvicu	/Grazing
	th $\frac{3}{\frac{1}{30}}$ Pool Seque	ft ft m nce :h)	HYDRAUL STRUCTUF Dams Bridge Abutt Island Waterfalls Other:	RES	STREAM FLOW Dry Pooled Low High Normal	Domin Tro Gr Numb Tree/S	ARIAN VEGET nate Type: ees Herbaceou asses Shrubs er of strata Shrub Taxa	ıs Dom.	CHANNEL ALTERATIONS Dredging Channelization (Full Partial)
P-CHEM		Instru	ument Used:			197	Date	Calibrated:	
Temp(°C)	D.C). (mg/ l)_	%Sa	turation	pH(S.U)	Cond	T	urb
		and the second		Sample	Collection Verific	ation			
Algae	Sample:	QualN	AHC Other	1.1	Visual Assessm	ent	Lead Col	lector:	
Fish	BPEF	_		ne: BPEF	Seine		Lead Col		
	the second s							lantan	
			rate Other:				Lead Col		
	[] 1m ² [Qual] Other:	Is V	/eg. Banks San	d M	Lead Col	lector:	
Invertebrates	1m ² [20 Jai	Qual (#Jabs:			/eg. Banks San	dM		lector: _Other	
Habitat Invertebrates Tissue: Water Chem	1m ² 1m ² 20 Jat No. of Sa Acid/.	Qual C b (#Jabs: amples co Alk B	Other: CobbleSnag	Sp: Metals	Low Hg	dM	Lead Col	lector: Other lector:	<u>_)</u>
Invertebrates Fissue: Water Chem	1m ² 20 Jat No. of Sa Acid/. Herbi	Qual C b (#Jabs: amples co Alk B cides C	CobbleSnag IlectedS Ulk [] Nutrients []	Sp: Metals	Low Hg	dM	Lead Col lacrophytes Lead Col	lector: Other lector:	
invertebrates Fissue: Water Chem	1m ² 20 Jat No. of Sa Acid/. Herbi	Qual C b (#Jabs: amples co Alk B cides C	Other: CobbleSnag IlectedS Ulk [] Nutrients [Pesticides [] Orth	Sp: Metals o P 🔲 O	Low Hg		Lead Col lacrophytes Lead Col	lector: Other lector:	
invertebrates Fissue: Water Chem Duplicate San	1m ² 1m ² 20 Jat 20 Jat No. of Sa Acid/. Herbi Herbi Tak	Qual C b (#Jabs: amples co Alk B cides C	Other: CobbleSnag IlectedS Ulk [] Nutrients [Pesticides] Orth	Sp: Metals o P D O Substra	Low Hg	ition	Lead Col lacrophytes Lead Col	lector: Other lector: lector:) Reach Total
Invertebrates Fissue: Water Chem Duplicate San Substrate EEs	inples Take	Qual [b (#Jabs: 1 umples co Alk B cides co en:	Other: CobbleSnag IlectedS Ulk [] Nutrients [Pesticides] Orth	Sp: Metals o P D O Substra	Low Hg ther: ate Characterize	ition	Lead Col lacrophytes Lead Col Lead Col	lector: Other lector: lector:	Reach Total
Invertebrates Fissue: Water Chem Duplicate San Substrate EEs Silt/Clay (<0.0	1m ² 1m ² 20 Jat 10. of Sa Acid/. Herbi Herbi Herbi Herbi Di Acid/. Herbi Herbi Di Acid/. Di Acid/.	Qual [b (#Jabs: 1 umples co Alk B cides co en:	Other: CobbleSnag IlectedS Ulk [] Nutrients [Pesticides] Orth	Sp: Metals o P D O Substra	Low Hg ther: ate Characterize	ition	Lead Col lacrophytes Lead Col Lead Col	lector: Other lector: lector:	
Invertebrates Fissue: Water Chem Duplicate San Substrate EEs Silt/Clay (<0.0 Sand (0.06 – 2	1m ² 1m ² 20 Jat 10. of Sa Acid/. Herbi nples Take stP.C. 6 mm) mm)	Qual [b (#Jabs: 1 umples co Alk B cides co en:	Other: CobbleSnag IlectedS Ulk [] Nutrients [Pesticides] Orth	Sp: Metals o P D O Substra	Low Hg ther: ate Characterize	ition	Lead Col lacrophytes Lead Col Lead Col	lector: Other lector: lector:	50
Invertebrates Fissue:	1m ² 1m ² 20 Jat No. of Sa Acid/. Herbi nples Tak st. [P.C. 6 mm) mm) nm)	Qual [b (#Jabs: 1 umples co Alk B cides co en:	Other: CobbleSnag IlectedS Ulk [] Nutrients [Pesticides] Orth	Sp: Metals o P D O Substra	Low Hg ther: ate Characterize	ition	Lead Col lacrophytes Lead Col Lead Col	lector: Other lector: lector:	50 10
Invertebrates Tissue: Water Chem Duplicate San Substrate EEs Silt/Clay (<0.0 Sand (0.06 - 2 Gravel (2-64 n	1m ² 1m ² 20 Jal No. of Sa Acid/. Herbi nples Tak st. [P.C. 66 mm) mm) nm) 256 mm)	Qual [b (#Jabs: 1 umples co Alk B cides co en:	Other: CobbleSnag IlectedS Ulk [] Nutrients [Pesticides] Orth	Sp: Metals o P D O Substra	Low Hg ther: ate Characterize	ition	Lead Col lacrophytes Lead Col Lead Col	lector: Other lector: lector:	50 10 20

Land owner denial

Site not found/Secluded Unsafe

Dry Dry

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 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.					
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.)	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} 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.				
	tal Score	NOTES/COMMENTS:		a the star product of the				

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CONFIDENTIAL PROPRIETARY TRADE SECRET

High Gradient Bioassessment Stream Visit Sheet

CTREAMN	AME: SO28		ingii Giudici		LOCATION:	ALL PROPERTY AND INC.			
STREAM N.				1	COUNTY: BO			PROGRAM	:
	TORS: SM.	JF			VICTOR STATES	S. (10) 44	TIME	PROJECT: Start:	
10 995 M				A	DATE: 3/30	/2016	(24hr)	Start: Finish:	
		1. 19		Re	each		CANO	PY COVER::	STREAM
LAT	Station		Downstre	am	Upstrea	m		posed (0-25%) Exposed (25-5	TYPE:
				441		11/2	Partially	Shaded (50-75 aded (75-100%	%) Ephemeral
LONG WEATHE	D		ALL AND	Tracur	WATERCHER				
Has there be		Past 24 ho Heav	urs 79 rain		. WATERSHED I ace Mining			Forest	
a scouring ra in the last 14			ly rain mittent showers	Deep Oil V	Mining Vells	Comr		Pasture Silvicu	
days?	⊠ [× Clean	r/sunny	Land	Disposal	Row			Runoff/Storm Sewers
THE BUNCHER S	AM FEATUR		dy	Resi	dential	DID	ARIAN VEG	FTATION	
Stream Widt	h <u>10</u>	ft	HYDRAUL	2	STREAM FLOW	Domin	nate Type:		
Maximum D Reach Lengt		ft m	STRUCTUR Dams	ES	Dry Dry	10	ees Herbac asses Shru		CHANNEL ALTERATIONS
Riffle/R	un/Pool Seque		Bridge Abutn	nents	Pooled Low	Numb	er of strata		Dredging Channelization
Action the state	mpled in Reac		Waterfalls		High Normal			1.5.1.1	(DFull Partial)
2 Riffle	1Run1	Pool	Other:Bridge	culvert		Acer	negundo, L	onicera sp.	Bridge
P-CHEM		Instru	ment Used:	10211	1129 (T. 1997) 1	13121	Da	ate Calibrated:	
Temp(°C)	D.C). (mg/l)	%Sat	uration	pH(S.U	J.)	Cond	1	`urb
				Sample (Collection Verifi	cation			
Algae	Sample:	QualM	HC Other		Visual Assessm	nent	Lead (Collector:	
Fish	BPEF	Seine	Other Tim	e: BPEF	Seine		Lead (Collector:	
Habitat		Substra	ate 🔲 Other:			31.5	Lead (Collector:	A STATE OF THE AND
Invertebrate	C. C. Strategies	Qual						Collector:	
T			CobbleSnage		eg. Banks Sa	nd M	and the second second	Other)
Tissue: Water Chem		-	lected S		T Low He			Collector:	
water Chem	ALC: NO DECISION	Country of	Pesticides Ortho		12		Lead	Lonector:	
Duplicate S	amples Tak								
				Substra	te Characteriz	ation			
Substrate	Est. P.C.	Riffle ²		-	tun_25%		ool_50	%	Reach Total
Silt/Clay (<	0.06 mm)								20
Sand (0.06 -	- 2 mm)								20
Gravel (2-64	4 mm)								15
Cobble (64	– 256 mm)								20
Boulders (>	256 mm)								15
Bedrock									10
NOTES	COMMEN	TS:			and the second		I PART		
					ST	E NO	SAMP	LED.	

Land owner denial Dry Too 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 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	Gravel, cobble, and boulder particles are 0-25% surrounded by fine sediment. Layering of cobble provides diversity of niche space.	Gravel, cobble, and boulder particles are 25-50% surrounded by fine sediment.	Gravel, cobble, and boulder particles are 50-75% surrounded by fine sediment.	Gravel, cobble, and boulder particles are more than 75% surrounded by fine sediment.			
Score 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 fire 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 O 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	tal Score	NOTES/COMMENTS:		The second states and s			

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STREAM NAME	S031				LOCATIO	N: Bigbon	e, KY		
STATION #: N//					COUNTY:			PROGRAM: PROJECT:	
INVESTIGATOR	IS: SM, JI	F			136-01-010	/30/16	TIME	Start:	
Verify Site LAT/L	ONG vs G	PS 🗆	YES NO	I/A	DAIL: 3	30/10	(24hr)	Finish:	
	Station		Downst		Reach Upst	ream		OPY COVER:: xposed (0-25%)	STREAM TYPE:
LAT LONG							Partiall	y Exposed (0-23%) y Exposed (25-5 y Shaded (50-75 haded (75-100%	0%) Perennial %) Ephemeral
WEATHED			L	LOCA	L WATERSHE	DEFATIDE	Contract of		
Has there been a scouring rain		Stead Inter Clear	/y rain dy rain mittent showers r/sunny	Dec Oil	face Mining ep Mining	Const Com Indus Row	ruction nercial trial	Forest Pasture Silvicu	/Grazing
INSTREAM I Stream Width Maximum Depth Reach Length Riffle/Run/Po (No. Sample <u>1</u> Riffle <u>1</u>	6 0.5 18 vol Sequence d in Reach	ft ft m 	HYDRAU STRUCTU Dams Bridge Abu Island Waterfalls Other: cult	RES	STREAM FL Dry Pooled Low High Normal	OW Domi Tr Gr Numb Tree/S	nate Type: ees Herba asses Shr er of strata Shrub Taxa	ubs	CHANNEL ALTERATIONS Dredging Channelization (□Full ■Partial) Culverted
P-CHEM	1. 19	Instru	ment Used:				I	Date Calibrated:	
Temp(°C)	D.O.	(mg/l)_	%S	aturation_	pH	(S.U.)	Cond	1	`urb
	Silve a		な特別的に	Sample	Collection Ve	rification			
Algae	Sample:	QualM	IHC Other		Visual Ass	essment	Lead	Collector:	
	BPEF [me: BPEI	s Se	ine	Lead	Collector:	
			ate Other:	<u></u>				Collector:	
					lag Basks	Sand h		Collector:	
	And and a second second		Cobble Sna		eg. Danks	SandIV	lacrophytes_	Other	
			ulk 🗌 Nutrients		Low Hg		11 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	Collector:	
			Pesticides 🗌 Ort						
Duplicate Samp	les Take	n:		Carbota	ate Characte				
Substrate Est.		Riffle	25 %	Party of Contract of Contract	Run ²⁵ %	- T	Pool 50	%	Reach Total
Silt/Clay (<0.06									30
Sand (0.06 – 2 m									20
Gravel (2-64 mm		in the second							20
Cobble (64 – 256									30
Boulders (>256 r	nm)								0
Bedrock	and the								0

Land owner denial Dry Too 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 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 not new fall and not transient).	40-70% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of 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 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 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 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.		
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)	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 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 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 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.		

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High Gradient Bioassessment Stream Visit Sheet

STREAM NAM	E: S033			201	LOCAT	ION: BI	gbon	e, KY			
STATION #: N			21			Y: Boo			PROGRAM		
INVESTIGATO		F		¥1.	1.1		1838	TIME	Start:		4
Verify Site LAT/	LONG vs G	PS 🔲	YES NO	N/A	DATE:	3/31/2	010	(24hr)	Finish:		
	Station	100	Dowr	R Istream	leach U	pstream			OPY COVER:		STREAM
LAT		-							Fully Exposed (0-25%) TYPE: Partially Exposed (25-50%) Perennial Partially Shaded (50-75%) Ephemera		
LONG		16							haded (75-1009		Intermittent
WEATHER Has there been a scouring rain in the last 14 days?	Now Pa	Stead	ry rain ly rain mittent showe r/sunny	rs Oil	face Mining p Mining Wells d Disposal		Constr Comm Indust Row C	ruction nercial rial	hinant Surround Fores Pastu Silvic	t re/Graz sulture	
INSTREAM Stream Width Maximum Depth Reach Length Riffle/Run/F (No. Sampl <u>1</u>	Pool Sequen led in Reach	ft ft m 	HYDR/ STRUC Dams Bridge A Island Waterfal	TURES	STREAM Dry Pooled Low High Normal		Domin Tree Gra Number Tree/S	ate Type: es Herba usses Shr er of strata hrub Taxa	ubs		CHANNEL LTERATIONS Dredging Channelization Full Partial)
P-CHEM	100	Instru	ment Used:	1 MARY				1	Date Calibrated		
Temp(°C)	D.O.	(mg/l)_		%Saturation		pH(S.U.)_		Cond		Turb	
STATE OF THE REAL			The state	Sample	Collection	Verificat	ion				
Algae	Sample:	QualM	HC Other		Visual A	ssessmen	t	Lead	Collector:	6 2	
Fish	BPEF [Seine	Other	Time: BPEF	+	Seine	4 8	Lead	Collector:	1	
Habitat		August and and	ate Other:					Lead	Collector:	-	
Invertebrates			and the second	S. 3. 1.					Collector:		
Tissue:				SnagsV	eg. Banks	Sand_	M		Other		
Water Chem	No. of San	2 • Colored and Color		Sp: nts Metals		the star			Collector:		
Water Chem	TT VERICE SI				ALC: NO.			Louid			
Duplicate Sam	ples Take	n:									
		Die	10 01	Contraction of the second	ate Chara	1		1.50	N		1
Substrate Est		Riffle_4	<u>%</u>		Run 10	_%	P	ool_50	_%	Re	ach Total
Silt/Clay (<0.06	ómm)										40
Sand (0.06 - 2 i	mm)							9.0			10
Gravel (2-64 m	m)										20
Cobble (64 – 25	56 mm)							" "这些"你是"			20
Boulders (>256	mm)										10
Bedrock								S.			0
NOTES/CO	OMMENT	rs:			-				Section 20		

SITE NOT SAMPLED:

Land owner denial Dry Too 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 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) 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 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	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	tal Score	NOTES/COMMENTS:	and the second second second second			

90

15 1 11 11 11 11 11

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Dry Dro deep/Impounded

Unsafe

Land owner denial

Site not found/Secluded

Other (indicate under comments)

CONFIDENTIAL PROPRIETARY TRADE SECRET

High Gradient Bioassessment Stream Visit Sheet

STREAM NA	ME. S037				LOCATION:		1		
STATION #:		10.75			A REAL PROPERTY AND A REAL PROPERTY.	Boone PROGRAM:			
INVESTIGA		JF				212		PROJECT: Start:	1
Verify Site LA	T/LONG vs	GPS 🗖	YES NO N/A	4	DATE: 3/31	/2016	(24hr)	Finish:	
	Station		Downstrea		each Upstrea	n	CANOP Fully Expo	Y COVER:	STREAM TYPE;
LAT				215			Partially E	xposed (25-5	0%) 🔲 Perennial
LONG	"White	147					Fully Shad		
WEATHER Has there bee	INOW I	Past 24 ho			L WATERSHED F				ng Land Use):
a scouring rai in the last 14		Stead	/y rain dy rain	Dee	ace Mining p Mining	Const	nercial	Forest Pasture	/Grazing
days?			mittent showers r/sunny	Oil Oil Lan	Wells d Disposal	Indust		Silvicu	Iture Runoff/Storm Sewers
Yes No		Clou	dy	Resi			BUILDER		
Stream Width		ft	HYDRAUL	and the second se	STREAM FLOW	Domir	ARIAN VEGE ate Type:		
Maximum De Reach Length		ft m	STRUCTUR Dams	ES	Dry Pooled		es Herbaced		CHANNEL ALTERATIONS
	In/Pool Seque		Bridge Abutn	nents	Low		er of strata hrub Taxa	_Dom.	Dredging Channelization
	Waterfalls			High Normal	Tara	xacum o	fficinale	(CFull Partial)	
P-CHEM			ment Used:				Date	calibrated:	
Temp(°C)	D.O. (mg/l)%SaturationpH(S.U.				.)			`urb	
				Sample	Collection Verific	ation		CT TO A CAR	
Algae	Sample:	QualM	IHC 🗌 Other		Visual Assessm	ent	Lead Co	ollector:	
Fish	BPEF	Seine	Other Tim	e: BPEF	Seine		Lead Co	ollector:	
Habitat			ate 🗌 Other:	1			Lead Co		
Invertebrates	5-L-1 (19)	Qual (#Jabs: (v	eg. Banks Sa	nd M	Lead Co acrophytes	ollector: Other	1
Tissue:		imples col			• <u>6</u>		Lead Co		
Water Chem	Acid/	Alk 🗌 Bi	ulk 🗌 Nutrients 🗌	Metals	Low Hg		Lead Co	ollector:	
			Pesticides 🗌 Ortho	P 🗌 Ot	her:				
Duplicate S	amples Tak	en:							
	Walt .	345 N (APR LES				Section Constant	the state of the
				_	te Characteriz	South and the second			
Substrate		Riffle 5	<u>50 %</u>	1	Run <u>²⁵</u> %	P	ool_259	6	Reach Total
Silt/Clay (<0).06 mm)					1			80
Sand (0.06 -	2 mm)	Angenetic						7440 S 1975	5
Gravel (2-64 mm)							10		
Cobble (64 – 256 mm)								5	
Boulders (>2	256 mm)								0
Bedrock									0
NOTES/	COMMEN	TS:		New York			1777 - 1995 - I	UP OF STATES	
					SIT	E NOT	SAMPL	ED:	

marine management

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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 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 for bends)	Occurrence of riffles relatively frequent; ratio of distance between riffles divided by width of the stream <7:1 (generally 5 to 7); variety of habitat is key. In streams where riffles are continuous, placement of boulders or other large, natural obstruction is important.	Occurrence of riffles infrequent; distance between riffles divided by the width of the stream is between 7 to 15.	Occasional riffle or bend; bottom contours provide some habitat; distance between riffles divided by the width of the stream is between 15 to 25.	Generally all flat water or shallow riffles; poor habitat; distance between riffles divided by the width of the stream is a ratio of >25.
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 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.

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CONFIDENTIAL PROPRIETARY TRADE SECRET High Gradient Bioassessment Stream Visit Sheet

STREAM NAM	. S039				LOCATION:	1				
STATION #: N/A					COUNTY: BOONE PROGRAM: PROJECT:					
INVESTIGATO		IF					TIME	Start:		
			YES NO N/A	4	DATE: 3/3	1/2016	(24hr)	Finish:		
15. 19	Station		Downstrea	Re	ach Upstrea	10		OPY COVE		STREAM
LAT	otation						Partial	Exposed (0-2 ly Exposed (ly Shaded (5	25-50%) 0-75%)	TYPE: Perennial Ephemeral
LONG							a national state	Shaded (75-1	30 (B)	Intermittent
WEATHER Has there been a scouring rain in the last 14 days? Yes No		Stead	ry rain ly rain mittent showers r/sunny	Deep	/ells Disposal	Con	struction nmercial Istrial	☐ Fo ☐ Pa ☐ Si	orest sture/Gra lviculture	zing
INSTREAM Stream Width Maximum Depth Reach Length Riffle/Run/P (No. Sampl <u>1</u> Riffle <u>1</u>	$\frac{\frac{3}{1.5}}{18}$ fool Sequered in React	ft ft m nce h)	HYDRAULI STRUCTUR Dams Bridge Abutm Island Waterfalls Other: Culv	ES nents	STREAM FLO Dry Pooled Low High Normal		PARIAN VE ninate Type: Trees Herb Grasses Shuber of strata /Shrub Taxa	aceous rubs	A	CHANNEL LTERATIONS Dredging Channelization [Full]Partial)
P-CHEM		Instru	ment Used:			1.00		Date Calibra	ted:	
Temp(°C)	D.O	. (mg/l)	%Satu	uration	pH(S.	U.)	Cond	l	Turb	
				Sample C	collection Verif	ication				
Algae	Sample:	QualM	HC Other		Visual Assess	ment	Lead	d Collector:	1. 1988	
Fish	BPEF	and and and		e: BPEF	Sein	e	Lead	d Collector:	ad the second	
Habitat			ate 🗌 Other:					d Collector:		
Invertebrates] Other: Cobble Snags	V	- Dealer C	and		d Collector:		
Tissue:	No. of Sa						Macrophytes	Other		
Water Chem			ik 🗌 Nutrients 🗌		Low Hg			d Collector:		1000 C
	State of the second	and a large	Pesticides 🔲 Ortho	EXCLUSION AND						
Duplicate Sam	ples Take	en:								
				T	e Characteri	zation				
Substrate Est	dy at a sign of the	Riffle_1	0 %	R	un_10%		Pool 80	_%	Re	ach Total
Silt/Clay (<0.06	mm)									80
Sand (0.06 - 2 r	nm)									10
Gravel (2-64 mm)										5
Cobble (64 – 256 mm) 5						5				
Boulders (>256	mm)			a de la composition de la comp						
Bedrock		No.				1.2	STAN S			
NOTES/CC	MMEN	TS:		19-19-51	a alexandra		the spectrum of	a Santa in	inge se	n else estats

SITE NOT SAMPLED:

□ Land owner denial □ Dry □Too deep/Impounded

Site not found/Secluded Unsafe

RBP High	Gradient	Habitat
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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.
.Embeddedness	Gravel, cobble, and boulder	E REAL PROPERTY AND		
6 Score	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) 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 O	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.

 $\label{eq:constraint} \begin{array}{c} \mu (t) \\ \mu (t) & \mu (t) \\ \mu$

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TANKIN THE TREAM AND A COMPANY

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CONFIDENTIAL PROPRIETARY TRADE SECRET

STREAM NAME: SO4	4			LOCATION:	Bigbon	e, KY		
STATION #: N/A				COUNTY: BO		I	PROGRAM: PROJECT:	
INVESTIGATORS: SM	, JF		e - ur	DATE: 4/1/		and the M	Start:	
Verify Site LAT/LONG v	s GPS	YES NO N/A		L	2010	(24hr)	Finish:	
Statio	D	Downstrea		ach Upstrea	n	CANOPY	COVER:	STREAM TYPE:
LAT LONG						Partially Expo	aded (25-50)	%)Perennial%)Ephemeral
WEATHED	D 011		LOCAL	WATERSHED F	FATURE		all the second	124、公司的部分第一次
WEATHER Now Has there been a scouring rain in the last 14 days? Yes No	Stead	y rain y rain nittent showers /sunny	Deep Oil V	ice Mining Mining Vells Disposal	Const	ruction nercial trial	Forest Pasture	Grazing
INSTREAM FEATU Stream Width 3 Maximum Depth 1 Reach Length 31 Riffle/Run/Pool Sequ (No. Sampled in Rea 3 Riffle 1 Run 2	ft ft m nence ach)	HYDRAULI STRUCTUR Dams Bridge Abutn Island Waterfalls Other: Culv	ES nents	STREAM FLOW Dry Pooled Low High Normal	Domin Tra Numb Tree/S	ARIAN VEGET nate Type: res Herbaceo asses Shrubs er of strata 2 hrub Taxa	us Dom.	CHANNEL ALTERATIONS Dredging Channelization (DFull Partial) Culverted
P-CHEM	Instru	ment Used:			1.5	Date	Calibrated:	
Temp(°C) D	.O. (mg /l)	%Sati	uration	pH(S.U	.)	Cond	Ti	urb
			Sample (Collection Verific	ation			
		HC Other		Visual Assessm	ent	Lead Col	llector:	
			e: BPEF	Seine		Lead Col		
		te Other:	E-1.75			Lead Col		
			s Ve	g. Banks Sar	d M		_Other)
the state of the s		ected S	The second second			Lead Col		Salaria A.
		esticides 🗌 Ortho				Lead Col	llector:	
Duplicate Samples Ta	and the second sec							
			Substra	te Characteriz	ation			
Substrate Est. P.C.	Riffle_4			un_20%		ool_40%		Reach Total
Silt/Clay (<0.06 mm)								60
Sand (0.06 – 2 mm)								20
Gravel (2-64 mm)								10
Cobble (64 – 256 mm)							10	
Boulders (>256 mm)								0
Bedrock								0
NOTES/COMME	NTS:	A CARLES AND	Names					

Dry Land owner denial

Too deep/Impounded

Site not found/Secluded Unsafe

RBP	High	Gradient	Habitat

Habitat		Condition	Category			
Parameter	Optimal	Suboptimal	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 not new fall and not transient).	40-70% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of 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.		
.Embeddedness	Gravel, cobble, and boulder					
Score 10	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) 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 LA 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	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.		
3						

111 ACT (C. 1. 2014) 4140 (ACT) (ACT) (ACT)

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High Gradient Bioassessment Stream Visit Sheet

STATION #: N/A COUNTY: BOONE PROGRAM: PROJECT: INVESTIGATORS: SM, JF DATE: 4/1/2016 TIME (24hr) Start: (24hr) Verify Site LAT/LONG vs GPS YES DOWN/A TIME (24hr) Start: (24hr) Station Downstream Upstream LAT Downstream Upstream Partially Exposed (25-50%) Pere (25-50%)	STREAM NAME: SO46					LOCATIO	LOCATION: Bigbone, KY					
INVESTIGATORS: SM, JF DATE: 4/1/2016 TIME Start: (24hr) Verify Site LAT/LONG vs GPS LYES INO IN/A CANOPY COVER: STR Station Downstream CANOPY COVER: STR LAT CANOPY COVER: STR LAT CANOPY COVER: STR WEATHER Now Past 24 hours LOCAL WATERSHED FEATURES (predominant Surrounding Lad Use): Batter Grazing Clear/sumy Clear/sumy <th colsp<="" td=""><td colspan="5"></td><td>the second se</td><td>and the second second second</td><td></td><td></td><td></td><td></td></th>	<td colspan="5"></td> <td>the second se</td> <td>and the second second second</td> <td></td> <td></td> <td></td> <td></td>						the second se	and the second second second				
Verify Site LAT/LONG vs GPS YES NO Image: Carbon of the second of			IF	10.15	1 Buch	13.1.1.2		TIME			5 - 5	
Station Downstream Upstream CANOPTOVE AC LAT Partially Exposed (2-55%) Pression WEATHER Now Past 24 hours Partially Exposed (2-55%) Persion WEATHER Now Past 24 hours DOCAL WATERSHED FATUREES (Predominant Surrounding Land Use). a scouring run Deep Mining Commercial Bready run in the last 14 Intermittent showers Deep Mining Commercial Bready run days? Cloudy Pression Construction Bready run Bready run Maximum Dept 1 ft Stready run Bready run <td colspan="4">Verify Site LAT/LONG vs GPS YES NO</td> <td>DATE: 4/</td> <td>1/2016</td> <td>(24hr)</td> <td>Finish:</td> <td></td> <td></td>	Verify Site LAT/LONG vs GPS YES NO				DATE: 4/	1/2016	(24hr)	Finish:				
LAT Imply Exposed (2-25%) Imply Exposed (2-5%) LONG Partially Exposed (25-5%) Eph WEATHER Now Partially Exposed (25-5%) Eph Has there been ascuring min Stady rain Surface Mining Construction Pertially Exposed (25-5%) Eph ascuring min Stady rain Surface Mining Construction Pertially Exposed (25-5%) Env Intermittent showers Bitady rain Surface Mining Construction Pertially Exposed (25-5%) Env Intermittent showers Bitady rain Bitady rain Def Mining Construction Pertially Exposed (25-5%) Env Intermittent showers Bitady rain Bitady rain Pertially Exposed (25-5%) Env Env Intermittent showers Bitady rain Bitady rain Pole Construction Pole Intermittent showers Bitady rain Bitady rain Bitady rain Pole Construction Charker Now reach Lengh Bitady rain Pole STREAM FLOW Dom minte Type: Pole Charker Charker Charker Charker Charker Charker <t< td=""><td></td><td>Station</td><td></td><td>Downstr</td><td></td><td></td><td>eam</td><td></td><td></td><td></td><td>STREAM</td></t<>		Station		Downstr			eam				STREAM	
WEATHER Has there been a scouring rule dys? Now Exedy rule dys? Past 24 hours Heavy rule dys? LOCAL WATERSHED FEATURES (Predominant Surrounding Land Use). Bas bers 14 dys? Bready rule dys? Construction dys? Porest diadustrial dustrial dys? Porest diadustrial dustrial Residential Construction dys? Porest diadustrial Row Crops Porest diadustrial dustrial Row Crops Porest diadustrial dustrial Row Crops INSTREAM FEATURES (No Sampled in Reach) 0 ft diadustrial du		Junion						Partially Partially	y Exposed (25- y Shaded (50-7	50%)	TYPE: Perennial Ephemeral Intermitten	
Stream Width 25 ft Maximum Depth 1 ft 1 ft 1 ft Maximum Depth 1 ft ft 1 ft ft ft ft Maximum Depth 1 ft ft ft Name Bridge Abutments Bridge Abutments Bridge Abutments Bridge Abutments Bisland Waterfalls Other: Date Calibrated: Tree/Shrub Taxa Acer negundo, Festuca ap., Rosa sp. P-CHEM Instrument Used:	WEATHER Has there been a scouring rain in the last 14 days?		Heav Stead	ry rain ly rain mittent showers r/sunny	Dee Oil Lan	face Mining p Mining Wells d Disposal	Const	ruction nercial trial	Fores	t re/Grazing culture		
Temp(°C) D.O. (mg/l) %Saturation pH(S.U.) Cond Turb. 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 Im² Qual Other: Lead Collector: Lead Collector: Issue: No. of Samples collected Sp: Lead Collector: Staturation Macrophytes Other Other Tissue: No. of Samples collected Sp: Lead Collector: Staturation Staturation Staturation Water Chem Acid/Alk Bulk Nutrients Metals Low Hg Lead Collector: Staturation Substrate Est. P.C. Riffle 35 % Run 5 % Pool 60 % Reach Tota Silt/Clay (<0.06 mm)	Stream Width Maximum Depth Reach Length Riffle/Run/Po (No. Sample 0Riffle 1	2.5 1 18 2001 Sequented in React	ft ft ft m nice h)	STRUCTU Dams Bridge Abu Island Waterfalls Other:	RES	Dry Pooled Low High	Domin Domin Tree/S	nate Type: ees Herba asses Shr er of strata hrub Taxa ngundo, Festu	ceous ubs 3 Dom. ica sp., Rosa sp	ALTE Dred Char (DFull	RATIONS ging melization	
Sample Collection Verification Algae Sample: QualMHC Other I visual Assessment Lead Collector: Fish BPEF Seine Lead Collector: Lead Collector: Habitat RBP Substrate Other: Lead Collector: Invertebrates Im² Qual Other: Lead Collector: 20 Jab (#Jabs: Cobble Snags Veg. Banks Sand Macrophytes Other										2		
Algae Sample: QualMHC Other Visual Assessment Lead Collector: Fish BPEF Seine Other: Lead Collector: Habitat RBP Substrate Other: Lead Collector: Invertebrates 1m ² Qual Other: Lead Collector: 20 Jab (#Jabs: Cobble	Temp(°C)	D.O	. (mg/l)	%Sa	aturation	pH(S.U.)	Cond.	er Real training	Turb.		
Fish BPEF Seine Lead Collector: Habitat RBP Substrate Other: Lead Collector: Invertebrates Im ² Qual Other: Lead Collector: 20 Jab (#Jabs: Cobble Snags Veg. Banks Sand Macrophytes Other) Tissue: No. of Samples collected Sp: Lead Collector:)) Water Chem Acid/Alk Bulk Nutrients Metals Low Hg Lead Collector: Upplicate Samples Taken: Substrate Characterization Substrate Characterization 50 Substrate Est. P.C. Riffle 35 % Run 5 % Pool 60 % Reach Tots Silt/Clay (<0.06 mm)		ni ber			Sample	and the second second			1.202.11-3	1.00		
Habitat RBP Substrate Other: Lead Collector: Invertebrates Im² Qual Other: Lead Collector: 20 Jab (#Jabs: CobbleSnagsVeg. BanksSandMacrophytesOther) Tissue: No. of Samples collectedSp: Lead Collector: Water Chem Acid/Alk Bulk Nutrients Metals Low Hg Lead Collector: Herbicides Pesticides Ortho P Other: Duplicate Samples Taken: Substrate Characterization Substrate Est. P.C. Riffle 35 % Run 5 % Pool 60 % Reach Tota 50 Sand (0.06 - 2 mm) 15 20 Gravel (2-64 mm) 20 20					11.1.2	U Visual Asse	ssment	Lead	Collector:		1.1.1.1	
Invertebrates 1 m² Qual Other: Lead Collector: 20 Jab (#Jabs: CobbleSnagsVeg. BanksSandMacrophytesOther) Other) 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: Duplicate Samples Taken: Bustrate Characterization Substrate Substrate P.C. Riffle 35 % Run 5 % Pool 60 % Reach Tota Silt/Clay (<0.06 mm)					me: BPEF	Sei	ine					
20 Jab (#Jabs: CobbleSnagsVeg. BanksSandMacrophytesOther					10 44 M							
Tissue: No. of Samples collected Sp: Lead Collector: Water Chem A cid/Alk Bulk Nutrients Metals Low Hg Lead Collector: Herbicides Pesticides Ortho P Other: Lead Collector: Duplicate Samples Taken: Substrate Characterization Run 5 Pool 60 Reach Tota Substrate Est. P.C. Riffle 35 Run 5 Pool 60 Reach Tota Silt/Clay (<0.06 mm) Image: Classical science in the science		The second second	111111111	A DECK OF LEAST								
Water Chem Acid/Alk Bulk Nutrients Metals Low Hg Lead Collector: Herbicides Pesticides Ortho P Other: Other: Duplicate Samples Taken: Substrate Characterization Substrate Est. P.C. Riffle 35 % Run 5 % Pool 60 % Reach Tota Silt/Clay (<0.06 mm)		and the second statements			-	eg. Banks	SandM			<u> </u>		
Herbicides Pesticides Ortho P Other: Duplicate Samples Taken: Substrate Characterization Substrate Est. P.C. Riffle 35 % Run 5 % Pool 60 % Reach Total Silt/Clay (<0.06 mm)											1 minut	
Duplicate Samples Taken: Substrate Characterization Substrate [Est.]P.C. Riffle 35 % Run 5 % Pool 60 % Reach Tota Silt/Clay (<0.06 mm)						and the first of the second		Lead	Collector:			
Substrate Characterization Substrate [Est.]P.C. Riffle 35 % Run 5 % Pool 60 % Reach Tota Silt/Clay (<0.06 mm)				Pesticides [] Ort	ho P 🗋 Ot	ther:					1.1.1.6	
Substrate Est. P.C. Riffle 35 % Run 5 % Pool 60 % Reach Tota Silt/Clay (<0.06 mm) 50 <th>Dupneate Samp</th> <th></th>	Dupneate Samp											
Silt/Clay (<0.06 mm)								Cherry R.				
Sand (0.06 - 2 mm) 15 Gravel (2-64 mm) 20	Substrate Est.	□P.C.	Riffle_3	<u>5 %</u>		Run <u>5</u> %	P	001 60	_%	Reach	Total	
Gravel (2-64 mm) 20	Silt/Clay (<0.06	mm)								5	0	
	Sand (0.06 – 2 m	nm)								1:	5	
Cobble (64 – 256 mm) 15	Gravel (2-64 mm	n)								20	0	
	Cobble (64 – 256 mm)			- 11-11-11-11-11-11-11-11-11-11-11-11-11		14		1:	5			
Boulders (>256 mm) 0	Boulders (>256 r	mm)								0		
Bedrock O	Bedrock		認及	生态制度	1 日月				製品計画	0		

SITE NOT SAMPLED:

Dry Dro deep/Impounded Land owner denial

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 standin 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) 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 8 L.B 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	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:		STATISTICS STATIST			

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and in

Appendix C Pond/Open Water Datasheets

ch2m:

		P	OND DATA	SHEET	
FEATURE ID: P001			ASSOCIAT S031	ED FEATURES:	
SURVEY TYPE: waterb	ody				
Date: 3/31/16	CLIENT/I MILEPOS	PROJECT NAME: ST: Duke	/ Walton to	Big Bone	
INVESTIGATORS: S. Miloski and	d J. F	reer	ROUTE: pipeline	centerline	
STATE/COUNTY: KY/ Boone				Is this a Mapped NWI Feature?: Yes	
		WATE	RBODY CHAI	RACTERISTICS	
WATERBODY TYPE:		pond			
AVG. DEPTH:	and and a	>3 feet			
AVG. WIDTH (WATER SURFACE): 150 feet		150 feet			
Approximate size:	1 3	150X400 fee	et		
		Qu	ALITATIVE A	TTRIBUTES	
AVERAGE WATER APPEA	RANCE:	clear	1.1.2.1		
PRIMARY SUBSTRATE (IF OBSERVED):	•	silt			
POTENTIAL HABITAT FOR	t:	fish, waterfow	1		
SURROUNDING LAND US	E:				
WETLAND FRINGE (IF PRESENT): n/a few willow trees lining the pond					
	and an		Сомме	NTS	

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Appendix D Wetlands, Streams, and Ponds Photo Documentation



Photograph 1: Upstream view of stream S001



Photograph 2: Downstream view of stream S002



Photograph 3: Upstream view of stream S003

Photograph 4: Downstream view of stream S004



Photograph 5: Upstream view of stream S005



Photograph 6: Upstream view of stream S006



Photograph 7: Upstream view of stream S007

Photograph 8: Upstream view of stream S008

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Photograph 9: Downstream view of stream S009



Photograph 10: Downstream view of stream S010



Photograph 11: Downstream view of stream S011

Photograph 12: Upstream view of stream S012

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Photograph 13: Upstream view of stream S013

Photograph 14: Upstream view of stream S016



Photograph 15: Downstream view of stream S017

Photograph 16: Downstream view of stream S018

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Photograph 17: Downstream view of stream S019



Photograph 18: Upstream view of stream S020



Photograph 19: Upstream view of stream S021

Photograph 20: Upstream view of stream S022



Photograph 21: Downstream view of stream S023



Photograph 22: Upstream view of stream S024



Photograph 23: Upstream view of stream S025

Photograph 24: Upstream view of stream S026

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Photograph 25: Upstream view of stream S027



Photograph 26: Upstream view of stream S028



Photograph 27: Downstream view of stream S029

Photograph 28: Downstream view of stream \$030



Photograph 29: Downstream view of stream S031



Photograph 30: Downstream view of stream S032



Photograph 31: Upstream view of stream S033

Photograph 32: Upstream view of stream S034



Photograph 33: Upstream view of stream S035.



Photograph 34: Upstream view of stream S036



Photograph 35: Downstream view of stream S037

Photograph 36: Downstream view of stream S038

Photograph 37: Downstream view of stream S040



Photograph 38: Upstream view of stream SO41



Photograph 39: Downstream view of stream S042



Photograph 40: Upstream view of stream S043

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Photograph 41: Upstream view of stream SO44



Photograph 42: Upstream view of stream S045



Photograph 43: Upstream view of stream SO46



Photograph 1: Palustrine Emergent (PEM) wetland W004.



Photograph 2: Palustrine Emergent (PEM) wetland W005.



Photograph 3: Palustrine Emergent (PEM) wetland W006.



Photograph 4: Palustrine Emergent (PEM) wetland W007.



Photograph 5: Palustrine Emergent (PEM) wetland W008.



Photograph 6: Palustrine Scrub Shrub (PSS) wetland W009.



Photograph 7: Palustrine Emergent (PEM) wetland W010.



Photograph 8: Palustrine Emergent (PEM) wetland W011.



Photograph 8: Palustrine Emergent (PEM) wetland W013.

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

Prepared by: GAI Consultants, Inc. Indianapolis Office 6420 Castleway West Drive Indianapolis, Indiana 46250

Author:

~ helle

Marc Walters, MPA, CPESC Environmental Manager