APPENDIX A
High Gradient Bioassessment Stream Data Sheets

CONFIDENTIAL PROPRIETARY TRADE SECRET

High Gradient Bioassessment Stream Visit Sheet

STREAM NAME: SKY-		**LOCATION:** BIGBONE,	
STATION #: N/A		**COUNTY:** BOONE	**PROGRAM:** **PROJECT:** G141890.0
INVESTIGATORS: CDK,		**DATE:** 10/15/15	**TIME (24hr)** **Start:** 12:45 **Finish:**
Verify Site LAT/LONG vs GPS ☐YES ☐NO ☒N/A			

	Station	Reach Downstream	Reach Upstream
LAT	38.88495	-	-
LONG	-84.72972	-	-

CANOPY COVER:
☐ Fully Exposed (0-25%)
☒ Partially Exposed (25-50%)
☐ Partially Shaded (50-75%)
☐ Fully Shaded (75-100%)

STREAM TYPE:
☒ Perennial
☐ Ephemeral
☐ Intermittent

WEATHER
Has there been a scouring rain in the last 14 days? ☐ Yes ☒ No

	Now	Past 24 hours
Heavy rain	☐	☐
Steady rain	☐	☐
Intermittent showers	☐	☐
Clear/sunny	☒	☒
Cloudy	☐	☐

LOCAL WATERSHED FEATUREES (Predominant Surrounding Land Use):

☐ Surface Mining	☐ Construction	☐ Forest
☐ Deep Mining	☐ Commercial	☐ Pasture/Grazing
☐ Oil Wells	☐ Industrial	☐ Silviculture
☐ Land Disposal	☐ Row Crops	☐ Urban Runoff/Storm Sewers
☒ Residential		

INSTREAM FEATURES
Stream Width 120 ft
Maximum Depth 73 ft
Reach Length 15.2 m
Riffle/Run/Pool Sequence (No. Sampled in Reach)
0 Riffle 0 Run 1 Pool

HYDRAULIC STRUCTURES
☐ Dams
☒ Bridge Abutments
☐ Island
☐ Waterfalls
☐ Other:

STREAM FLOW
☐ Dry
☐ Pooled
☒ Low
☐ High
☐ Normal

RIPARIAN VEGETATION
Dominate Type:
☒ Trees ☐ Herbaceous
☐ Grasses ☒ Shrubs
Number of strata 2 Dom. Tree/Shrub Taxa
PLATANUS OCCIDENTALIS,
ACER NEGUNDO

CHANNEL ALTERATIONS
☐ Dredging
☒ Channelization (☒ Full ☐ Partial)

P-CHEM Instrument Used: _____ Date Calibrated: _____

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:
Invertebrates	☐ 1m² ☐ 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:
	☐ Herbicides ☐ Pesticides ☐ Ortho P ☐ Other:	

Duplicate Samples Taken:

Substrate Characterization

Substrate ☒Est. ☐P.C.	Riffle 0 %	Run 0 %	Pool 100 %	Reach Total
Silt/Clay (<0.06 mm)				20
Sand (0.06 – 2 mm)				15
Gravel (2-64 mm)				15
Cobble (64 – 256 mm)				35
Boulders (>256 mm)				15
Bedrock				0

NOTES/COMMENTS:

50' REACH

SITE NOT SAMPLED:

☐ Land owner denial ☐ Dry ☐ Too deep/Impounded
☐ Site not found/Secluded ☐ Unsafe
☐ Other (indicate under comments)

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RBP High Gradient Habitat

Habitat Parameter	Condition Category			
	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 Score 12	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 Score 11	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 17	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 Score 17	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 20	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 Score 2	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 3	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 9 / RB 9	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 LB 6 / 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 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.

Total Score 118

NOTES/COMMENTS:

50' REACH

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High Gradient Bioassessment Stream Visit Sheet

STREAM NAME: SKY-		**LOCATION:** BIGBONE,	
STATION #: N/		**COUNTY:** BOONE	**PROGRAM:** **PROJECT:** G141890.0
INVESTIGATORS: CDK,		**DATE:** 10/15/15	**TIME (24hr)** **Start:** 1:30 PM **Finish:**
Verify Site LAT/LONG vs GPS ☐YES ☐NO ☒N/A			

	Station	Reach Downstream	Reach Upstream
LAT	38.8849	-	-
LONG	-84.73619	-	-

CANOPY COVER:
☐ Fully Exposed (0-25%)
☒ Partially Exposed (25-50%)
☐ Partially Shaded (50-75%)
☐ Fully Shaded (75-100%)

STREAM TYPE:
☒ Perennial
☐ Ephemeral
☐ Intermittent

WEATHER
Has there been a scouring rain in the last 14 days? ☐ Yes ☒ No

	Now	Past 24 hours
Heavy rain	☐	☐
Steady rain	☐	☐
Intermittent showers	☐	☐
Clear/sunny	☒	☒
Cloudy	☐	☐

LOCAL WATERSHED FEATURES (Predominant Surrounding Land Use):
☐ Surface Mining ☐ Deep Mining ☐ Oil Wells ☐ Land Disposal ☒ Residential
☐ Construction ☐ Commercial ☐ Industrial ☐ Row Crops
☐ Forest ☐ Pasture/Grazing ☐ Silviculture ☐ Urban Runoff/Storm Sewers

INSTREAM FEATURES
Stream Width 10 ft
Maximum Depth 0.16 ft
Reach Length 15.2 m
Riffle/Run/Pool Sequence (No. Sampled in Reach)
2 Riffle 1 Run 1 Pool

HYDRAULIC STRUCTURES
☐ Dams
☒ Bridge Abutments
☐ Island
☐ Waterfalls
☐ Other:

STREAM FLOW
☐ Dry
☐ Pooled
☒ Low
☐ High
☐ Normal

RIPARIAN VEGETATION
Dominate Type:
☒ Trees ☐ Herbaceous
☐ Grasses ☒ Shrubs
Number of strata 2 Dom.
Tree/Shrub Taxa
SALIX NIGRA, PLATANUS

CHANNEL ALTERATIONS
☐ Dredging
☒ Channelization
(☒ Full ☐ Partial)

P-CHEM Instrument Used: _____ Date Calibrated: _____

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:
Invertebrates	☐ 1m² ☐ 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:
	☐ Herbicides ☐ Pesticides ☐ Ortho P ☐ Other:	

Duplicate Samples Taken:

Substrate Characterization

Substrate ☒Est. ☐P.C.	Riffle 70 %	Run 5 %	Pool 25 %	Reach Total
Silt/Clay (<0.06 mm)				10
Sand (0.06 – 2 mm)				5
Gravel (2-64 mm)				10
Cobble (64 – 256 mm)				75
Boulders (>256 mm)				0
Bedrock				0

NOTES/COMMENTS:

50' REACH

SITE NOT SAMPLED:

☐ Land owner denial ☐ Dry ☐ Too deep/Impounded
☐ Site not found/Secluded ☐ Unsafe
☐ Other (indicate under comments)

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RBP High Gradient Habitat

Habitat Parameter	Condition Category			
	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 Score 7	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 Score 13	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 Score 8	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 Score 4	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 4	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 8 / RB 8	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 LB 6 / 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 5 / RB 5	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

88

NOTES/COMMENTS:

50' REACH

CONFIDENTIAL PROPRIETARY TRADE SECRET

High Gradient Bioassessment Stream Visit Sheet

STREAM NAME: SKY-		**LOCATION:** BIGBONE,	
STATION #: N/A		**COUNTY:** BOONE	**PROGRAM:** **PROJECT:** G141890.0
INVESTIGATORS: CDK,		**DATE:** 10/15/15	**TIME (24hr)** **Start:** 2:00 PM **Finish:**
Verify Site LAT/LONG vs GPS ☐YES ☐NO ☒N/A			

	Station	Reach Downstream	Reach Upstream
LAT	38.88831	-	-
LONG	-84.7551	-	-

CANOPY COVER:
☐ Fully Exposed (0-25%)
☒ Partially Exposed (25-50%)
☐ Partially Shaded (50-75%)
☐ Fully Shaded (75-100%)

STREAM TYPE:
☒ Perennial
☐ Ephemeral
☐ Intermittent

WEATHER
Has there been a scouring rain in the last 14 days? ☐ Yes ☒ No

Now	Past 24 hours
☐	☐ Heavy rain
☐	☐ Steady rain
☐	☐ Intermittent showers
☒	☒ Clear/sunny
☐	☐ Cloudy

LOCAL WATERSHED FEATUREES (Predominant Surrounding Land Use):

☐ Surface Mining	☐ Construction	☐ Forest
☐ Deep Mining	☐ Commercial	☒ Pasture/Grazing
☐ Oil Wells	☐ Industrial	☐ Silviculture
☐ Land Disposal	☐ Row Crops	☐ Urban Runoff/Storm Sewers
☒ Residential		

INSTREAM FEATURES
Stream Width 50 ft
Maximum Depth 2 ft
Reach Length 15.2 m
Riffle/Run/Pool Sequence (No. Sampled in Reach)
1 Riffle 0 Run 1 Pool

HYDRAULIC STRUCTURES
☐ Dams
☒ Bridge Abutments
☐ Island
☐ Waterfalls
☐ Other:

STREAM FLOW
☐ Dry
☒ Pooled
☐ Low
☐ High
☐ Normal

RIPARIAN VEGETATION
Dominate Type:
☒ Trees ☐ Herbaceous
☐ Grasses ☒ Shrubs
Number of strata 2 Dom.
Tree/Shrub Taxa
PLATANUS OCCIDENTALIS, LONICERA SP

CHANNEL ALTERATIONS
☐ Dredging
☒ Channelization (☒ Full ☐ Partial)

P-CHEM Instrument Used: _____ Date Calibrated: _____

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:
Invertebrates	☐ 1m² ☐ 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:
	☐ Herbicides ☐ Pesticides ☐ Ortho P ☐ Other:	

Duplicate Samples Taken:

Substrate Characterization

Substrate ☒Est. ☐P.C.	Riffle 75 %	Run 0 %	Pool 25 %	Reach Total
Silt/Clay (<0.06 mm)				20
Sand (0.06 – 2 mm)				10
Gravel (2-64 mm)				20
Cobble (64 – 256 mm)				35
Boulders (>256 mm)				15
Bedrock				0

NOTES/COMMENTS:
50' REACH

SITE NOT SAMPLED:
☐ Land owner denial ☐ Dry ☐ Too deep/Impounded
☐ Site not found/Secluded ☐ Unsafe
☐ Other (indicate under comments)

CONFIDENTIAL PROPRIETARY TRADE SECRET

RBP High Gradient Habitat

Habitat Parameter	Condition Category			
	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 Score 8	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 Score 13	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 13	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 Score 10	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 5	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 Score 3	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 4	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 LB 7 / RB 7	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 6	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

94

NOTES/COMMENTS:

50' REACH

CONFIDENTIAL PROPRIETARY TRADE SECRET

High Gradient Bioassessment Stream Visit Sheet

STREAM NAME: SKY-CDK-010		**LOCATION:** BIGBONE, KY	
STATION #: N/A		**COUNTY:** BOONE	**PROGRAM:** **PROJECT:** G141890.03
INVESTIGATORS: CDK, RFL		**DATE:** 10/15/15	**TIME (24hr)** **Start:** 2:30 PM **Finish:**
Verify Site LAT/LONG vs GPS ☐YES ☐NO ☒N/A			

	Station	Reach Downstream	Reach Upstream
LAT	38.887878	-	-
LONG	-84.756212	-	-

CANOPY COVER:
☐ Fully Exposed (0-25%)
☒ Partially Exposed (25-50%)
☐ Partially Shaded (50-75%)
☐ Fully Shaded (75-100%)

STREAM TYPE:
☒ Perennial
☐ Ephemeral
☐ Intermittent

WEATHER
Has there been a scouring rain in the last 14 days? ☐ Yes ☒ No

	Now	Past 24 hours
Heavy rain	☐	☐
Steady rain	☐	☐
Intermittent showers	☐	☐
Clear/sunny	☒	☒
Cloudy	☐	☐

LOCAL WATERSHED FEATUREES (Predominant Surrounding Land Use):
☐ Surface Mining ☐ Deep Mining ☐ Oil Wells ☐ Land Disposal ☒ Residential
☐ Construction ☐ Commercial ☐ Industrial ☐ Row Crops
☐ Forest ☒ Pasture/Grazing ☐ Silviculture ☐ Urban Runoff/Storm Sewers

INSTREAM FEATURES
Stream Width 10 ft
Maximum Depth 1.5 ft
Reach Length 15.24 m
Riffle/Run/Pool Sequence (No. Sampled in Reach)
0 Riffle 1 Run 1 Pool

HYDRAULIC STRUCTURES
☐ Dams
☒ Bridge Abutments
☐ Island
☐ Waterfalls
☐ Other:

STREAM FLOW
☐ Dry
☐ Pooled
☐ Low
☐ High
☒ Normal

RIPARIAN VEGETATION
Dominate Type:
☐ Trees ☒ Herbaceous
☐ Grasses ☒ Shrubs
Number of strata 2 Dom.
Tree/Shrub Taxa
DIPSACUS SP., JUGLANS

CHANNEL ALTERATIONS
☐ Dredging
☒ Channelization
(☐ Full ☒ Partial)

P-CHEM Instrument Used: _____ Date Calibrated: _____

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:
Invertebrates	☐ 1m² ☐ 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:
	☐ Herbicides ☐ Pesticides ☐ Ortho P ☐ Other:	

Duplicate Samples Taken:

Substrate Characterization

Substrate ☒Est. ☐P.C.	Riffle 0 %	Run 75 %	Pool 15 %	Reach Total
Silt/Clay (<0.06 mm)				30
Sand (0.06 – 2 mm)				30
Gravel (2-64 mm)				30
Cobble (64 – 256 mm)				10
Boulders (>256 mm)				0
Bedrock				0

NOTES/COMMENTS:

50' REACH USED.

SITE NOT SAMPLED:

☐ Land owner denial ☐ Dry ☐ Too deep/Impounded
☐ Site not found/Secluded ☐ Unsafe
☐ Other (indicate under comments)

CONFIDENTIAL PROPRIETARY TRADE SECRET

RBP High Gradient Habitat

Habitat Parameter	Condition Category			
	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 Score 4	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 Score 2	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 2	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 Score 12	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 16	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 Score 7	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 9	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 7 RB 7	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 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.

Total Score

80

NOTES/COMMENTS:

50' REACH USED.

CONFIDENTIAL PROPRIETARY TRADE SECRET

High Gradient Bioassessment Stream Visit Sheet

STREAM NAME: SKY-		**LOCATION:** BIGBONE,	
STATION #: N/A		**COUNTY:** BOONE	**PROGRAM:** **PROJECT:** G141890.0
INVESTIGATORS: CDK,		**DATE:** 10/15/15	**TIME (24hr)** **Start:** 2:30 PM **Finish:**
Verify Site LAT/LONG vs GPS ☐YES ☐NO ☒N/A			

	Station	Reach Downstream	Reach Upstream
LAT	38.88909	-	-
LONG	-84.7489	-	-

CANOPY COVER:
☐ Fully Exposed (0-25%)
☒ Partially Exposed (25-50%)
☐ Partially Shaded (50-75%)
☐ Fully Shaded (75-100%)

STREAM TYPE:
☐ Perennial
☐ Ephemeral
☒ Intermittent

WEATHER
Has there been a scouring rain in the last 14 days? ☐ Yes ☒ No

Now	Past 24 hours
☐	☐ Heavy rain
☐	☐ Steady rain
☐	☐ Intermittent showers
☒	☒ Clear/sunny
☐	☐ Cloudy

LOCAL WATERSHED FEATURES (Predominant Surrounding Land Use):

☐ Surface Mining	☐ Construction	☐ Forest
☐ Deep Mining	☐ Commercial	☐ Pasture/Grazing
☐ Oil Wells	☐ Industrial	☐ Silviculture
☐ Land Disposal	☐ Row Crops	☐ Urban Runoff/Storm Sewers
☒ Residential		

INSTREAM FEATURES
Stream Width 5 ft
Maximum Depth 0 ft
Reach Length 15.2 m

Riffle/Run/Pool Sequence (No. Sampled in Reach)
0 Riffle 0 Run 0 Pool

HYDRAULIC STRUCTURES
☐ Dams
☐ Bridge Abutments
☐ Island
☐ Waterfalls
☒ Other: CULVER

STREAM FLOW
☒ Dry
☐ Pooled
☐ Low
☐ High
☐ Normal

RIPARIAN VEGETATION
Dominate Type:
☒ Trees ☐ Herbaceous
☐ Grasses ☒ Shrubs
Number of strata 2 Dom.
Tree/Shrub Taxa
FRAXINUS AMERICANA, SALIX NIGRA, CUPRESSUS SP., POPULUS SP.

CHANNEL ALTERATIONS
☐ Dredging
☒ Channelization (☐ Full ☒ Partial)

P-CHEM Instrument Used: _____ Date Calibrated: _____

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:
Invertebrates	☐ 1m² ☐ 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:
	☐ Herbicides ☐ Pesticides ☐ Ortho P ☐ Other:	

Duplicate Samples Taken:

Substrate Characterization

Substrate ☒ Est. ☐ P.C.	Riffle 0 %	Run 0 %	Pool 0 %	Reach Total
Silt/Clay (<0.06 mm)				30
Sand (0.06 – 2 mm)				25
Gravel (2-64 mm)				30
Cobble (64 – 256 mm)				15
Boulders (>256 mm)				0
Bedrock				0

NOTES/COMMENTS:

50' REACH

SITE NOT SAMPLED:

☐ Land owner denial ☐ Dry ☐ Too deep/Impounded
☐ Site not found/Secluded ☐ Unsafe
☐ Other (indicate under comments)

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RBP High Gradient Habitat

Habitat Parameter	Condition Category			
	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 Score 6	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 Score 12	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 N/A	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 Score 13	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 N/A	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 Score 7	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 7	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 7 / RB 7	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 LB 5 / 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 5	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

80

NOTES/COMMENTS:

50' REACH

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High Gradient Bioassessment Stream Visit Sheet

STREAM NAME: SKY-		**LOCATION:** BIGBONE,	
STATION #: N/A		**COUNTY:** BOONE	**PROGRAM:** **PROJECT:** G141890.0
INVESTIGATORS: CDK,		**DATE:** 10/15/15	**TIME (24hr)** **Start:** 3:30 PM **Finish:**
Verify Site LAT/LONG vs GPS ☐YES ☐NO ☒N/A			

	Station	Reach Downstream	Reach Upstream
LAT	38.87939	-	-
LONG	-84.70139	-	-

CANOPY COVER:
☒ Fully Exposed (0-25%)
☐ Partially Exposed (25-50%)
☐ Partially Shaded (50-75%)
☐ Fully Shaded (75-100%)

STREAM TYPE:
☒ Perennial
☐ Ephemeral
☐ Intermittent

WEATHER
Has there been a scouring rain in the last 14 days? ☐ Yes ☒ No

Now	Past 24 hours
☐	☐ Heavy rain
☐	☐ Steady rain
☐	☐ Intermittent showers
☒	☒ Clear/sunny
☐	☐ Cloudy

LOCAL WATERSHED FEATURES (Predominant Surrounding Land Use):

☐ Surface Mining	☐ Construction	☐ Forest
☐ Deep Mining	☐ Commercial	☐ Pasture/Grazing
☐ Oil Wells	☐ Industrial	☐ Silviculture
☐ Land Disposal	☐ Row Crops	☐ Urban Runoff/Storm Sewers
☒ Residential		

INSTREAM FEATURES
Stream Width 9 ft
Maximum Depth 0.33 ft
Reach Length 15.2 m
Riffle/Run/Pool Sequence (No. Sampled in Reach)
2 Riffle 1 Run 0 Pool

HYDRAULIC STRUCTURES
☐ Dams
☐ Bridge Abutments
☐ Island
☐ Waterfalls
☒ Other: CULVER

STREAM FLOW
☐ Dry
☐ Pooled
☒ Low
☐ High
☐ Normal

RIPARIAN VEGETATION
Dominate Type:
☐ Trees ☒ Herbaceous
☐ Grasses ☒ Shrubs
Number of strata 2 Dom. Tree/Shrub Taxa
SALIX NIGRA, SOLIDAGO CANADENSIS, DIPSACUS

CHANNEL ALTERATIONS
☐ Dredging
☒ Channelization (☐ Full ☒ Partial)

P-CHEM Instrument Used: _____ Date Calibrated: _____

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:
Invertebrates	☐ 1m² ☐ 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:
	☐ Herbicides ☐ Pesticides ☐ Ortho P ☐ Other:	

Duplicate Samples Taken:

Substrate Characterization

Substrate ☒Est. ☐P.C.	Riffle 75 %	Run 25 %	Pool 0 %	Reach Total
Silt/Clay (<0.06 mm)				25
Sand (0.06 – 2 mm)				15
Gravel (2-64 mm)				20
Cobble (64 – 256 mm)				35
Boulders (>256 mm)				0
Bedrock				0

NOTES/COMMENTS:
50' REACH

SITE NOT SAMPLED:
☐ Land owner denial ☐ Dry ☐ Too deep/Impounded
☐ Site not found/Secluded ☐ Unsafe
☐ Other (indicate under comments)

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RBP High Gradient Habitat

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
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2.Embeddedness Score 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.
3.Velocity/ Depth Regime Score 6	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 Score 14	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 9	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 Score 9	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 10	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 8 / RB 8	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 LB 4 / 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 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.

Total Score

91

NOTES/COMMENTS:

50' REACH

CONFIDENTIAL PROPRIETARY TRADE SECRET

High Gradient Bioassessment Stream Visit Sheet

STREAM NAME: SKY- | **LOCATION:** BIGBONE,

STATION #: N/A | **COUNTY:** BOONE | **PROGRAM:** / **PROJECT:** G141890.0

INVESTIGATORS: CDK, | **DATE:** 10/15/15 | **TIME (24hr)** Start: 4:15 PM Finish:

Verify Site LAT/LONG vs GPS ☐YES ☐NO ☒N/A

	Station	Reach Downstream	Reach Upstream
LAT	38.89736 °	-	-
LONG	-84.66256 °	-	-

CANOPY COVER:
- ☒ Fully Exposed (0-25%)
- ☐ Partially Exposed (25-50%)
- ☐ Partially Shaded (50-75%)
- ☐ Fully Shaded (75-100%)

STREAM TYPE:
- ☒ Perennial
- ☐ Ephemeral
- ☐ Intermittent

WEATHER — Has there been a scouring rain in the last 14 days? ☐ Yes ☒ No

	Now	Past 24 hours
Heavy rain	☐	☐
Steady rain	☐	☐
Intermittent showers	☐	☐
Clear/sunny	☒	☒
Cloudy	☐	☐

LOCAL WATERSHED FEATURES (Predominant Surrounding Land Use):
- ☐ Surface Mining
- ☐ Deep Mining
- ☐ Oil Wells
- ☐ Land Disposal
- ☒ Residential
- ☐ Construction
- ☐ Commercial
- ☐ Industrial
- ☐ Row Crops
- ☐ Forest
- ☒ Pasture/Grazing
- ☐ Silviculture
- ☐ Urban Runoff/Storm Sewers

INSTREAM FEATURES
Stream Width 14 ft
Maximum Depth 2 ft
Reach Length 15.2 m

Riffle/Run/Pool Sequence (No. Sampled in Reach)
2 Riffle 1 Run 1 Pool

HYDRAULIC STRUCTURES
- ☐ Dams
- ☒ Bridge Abutments
- ☐ Island
- ☐ Waterfalls
- ☐ Other:

STREAM FLOW
- ☐ Dry
- ☐ Pooled
- ☒ Low
- ☐ High
- ☐ Normal

RIPARIAN VEGETATION
Dominate Type:
☒ Trees ☐ Herbaceous
☒ Grasses ☐ Shrubs
Number of strata 2 Dom. Tree/Shrub Taxa
PLATANUS OCCIDENTALIS,
POA SP

CHANNEL ALTERATIONS
- ☐ Dredging
- ☒ Channelization (☐ Full ☒ Partial)

P-CHEM Instrument Used: _____ Date Calibrated: _____

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:
Invertebrates	☐ 1m² ☐ 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:
	☐ Herbicides ☐ Pesticides ☐ Ortho P ☐ Other:	

Duplicate Samples Taken:

Substrate Characterization

Substrate ☒ Est. ☐ P.C.	Riffle 15 %	Run 50 %	Pool 35 %	Reach Total
Silt/Clay (<0.06 mm)				
Sand (0.06 – 2 mm)				2
Gravel (2-64 mm)				
Cobble (64 – 256 mm)				
Boulders (>256 mm)				10
Bedrock				

NOTES/COMMENTS:

50' REACH

SITE NOT SAMPLED:
- ☐ Land owner denial ☐ Dry ☐ Too deep/Impounded
- ☐ Site not found/Secluded ☐ Unsafe
- ☐ Other (indicate under comments)

CONFIDENTIAL PROPRIETARY TRADE SECRET

RBP High Gradient Habitat

Habitat Parameter	Condition Category: 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 Score 6	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 Score 14	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 13	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 Score 15	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 16	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 Score 5	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 7	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 7 / RB 7	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 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.

Total Score

104

NOTES/COMMENTS:

50' REACH

CONFIDENTIAL PROPRIETARY TRADE SECRET

High Gradient Bioassessment Stream Visit Sheet

STREAM NAME: SKY- | **LOCATION:** BIGBONE,

STATION #: N/A | **COUNTY:** BOONE | **PROGRAM:** / **PROJECT:** G141890.0

INVESTIGATORS: CDK, | **DATE:** 10/16/15 | **TIME (24hr)** Start: 8:50 AM Finish:

Verify Site LAT/LONG vs GPS ☐YES ☐NO ☒N/A

	Station	Reach Downstream	Reach Upstream
LAT	38.88882 °	-	-
LONG	-84.68538 °	-	-

CANOPY COVER:
- ☒ Fully Exposed (0-25%)
- ☐ Partially Exposed (25-50%)
- ☐ Partially Shaded (50-75%)
- ☐ Fully Shaded (75-100%)

STREAM TYPE:
- ☒ Perennial
- ☐ Ephemeral
- ☐ Intermittent

WEATHER — Has there been a scouring rain in the last 14 days? ☐ Yes ☒ No

	Now	Past 24 hours
Heavy rain	☐	☐
Steady rain	☐	☐
Intermittent showers	☐	☐
Clear/sunny	☒	☒
Cloudy	☐	☐

LOCAL WATERSHED FEATUREES (Predominant Surrounding Land Use):
- ☐ Surface Mining
- ☐ Deep Mining
- ☐ Oil Wells
- ☐ Land Disposal
- ☐ Residential
- ☐ Construction
- ☐ Commercial
- ☐ Industrial
- ☐ Row Crops
- ☐ Forest
- ☒ Pasture/Grazing
- ☐ Silviculture
- ☐ Urban Runoff/Storm Sewers

INSTREAM FEATURES
Stream Width 12 ft
Maximum Depth 0.83 ft
Reach Length 15.2 m

Riffle/Run/Pool Sequence (No. Sampled in Reach)
0 Riffle 1 Run 1 Pool

HYDRAULIC STRUCTURES
- ☐ Dams
- ☒ Bridge Abutments
- ☐ Island
- ☐ Waterfalls
- ☐ Other:

STREAM FLOW
- ☐ Dry
- ☒ Pooled
- ☐ Low
- ☐ High
- ☐ Normal

RIPARIAN VEGETATION
Dominate Type:
☐ Trees ☒ Herbaceous
☐ Grasses ☐ Shrubs
Number of strata 1 Dom.
Tree/Shrub Taxa
PERSICARIA
LONGISETA

CHANNEL ALTERATIONS
- ☐ Dredging
- ☒ Channelization (☐ Full ☒ Partial)

P-CHEM Instrument Used: _____ Date Calibrated: _____

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:
Invertebrates	☐ 1m² ☐ 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:
	☐ Herbicides ☐ Pesticides ☐ Ortho P ☐ Other:	

Duplicate Samples Taken:

Substrate Characterization

Substrate ☒ Est. ☐ P.C.	Riffle 0 %	Run 30 %	Pool 70 %	Reach Total
Silt/Clay (<0.06 mm)				60
Sand (0.06 – 2 mm)				5
Gravel (2-64 mm)				10
Cobble (64 – 256 mm)				15
Boulders (>256 mm)				10
Bedrock				0

NOTES/COMMENTS:

50' REACH

SITE NOT SAMPLED:
- ☐ Land owner denial ☐ Dry ☐ Too deep/Impounded
- ☐ Site not found/Secluded ☐ Unsafe
- ☐ Other (indicate under comments)

CONFIDENTIAL PROPRIETARY TRADE SECRET

RBP High Gradient Habitat

Habitat Parameter	Condition Category: 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 Score 6	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 Score 11	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 Score 5	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 Score 5	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 5	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 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 LB 2 / 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 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.					

Total Score

65

NOTES/COMMENTS:

50' REACH USED. HEAVY GRAZING WITHIN

CONFIDENTIAL PROPRIETARY TRADE SECRET

High Gradient Bioassessment Stream Visit Sheet

STREAM NAME: SKY- | **LOCATION:** BIGBONE,

STATION #: N/A | **COUNTY:** BOONE | **PROGRAM:** / **PROJECT:** G141890.0

INVESTIGATORS: CDK, | **DATE:** 10/16/15 | **TIME (24hr)** Start: 9:30 AM Finish:

Verify Site LAT/LONG vs GPS ☐YES ☐NO ☒N/A

	Station	Reach Downstream	Reach Upstream
LAT	38.89908	-	-
LONG	-84.6531	-	-

CANOPY COVER:
- ☒ Fully Exposed (0-25%)
- ☐ Partially Exposed (25-50%)
- ☐ Partially Shaded (50-75%)
- ☐ Fully Shaded (75-100%)

STREAM TYPE:
- ☒ Perennial
- ☐ Ephemeral
- ☐ Intermittent

WEATHER — Has there been a scouring rain in the last 14 days? ☐ Yes ☒ No

Now	Past 24 hours
☐	☐ Heavy rain
☐	☐ Steady rain
☐	☐ Intermittent showers
☒	☒ Clear/sunny
☐	☐ Cloudy

LOCAL WATERSHED FEATURES (Predominant Surrounding Land Use):
- ☐ Surface Mining
- ☐ Deep Mining
- ☐ Oil Wells
- ☐ Land Disposal
- ☒ Residential
- ☐ Construction
- ☐ Commercial
- ☐ Industrial
- ☐ Row Crops
- ☐ Forest
- ☒ Pasture/Grazing
- ☐ Silviculture
- ☐ Urban Runoff/Storm Sewers

INSTREAM FEATURES
Stream Width 30 ft
Maximum Depth 0.5 ft
Reach Length 15.2 m

Riffle/Run/Pool Sequence (No. Sampled in Reach)
0 Riffle 1 Run 1 Pool

HYDRAULIC STRUCTURES
- ☐ Dams
- ☒ Bridge Abutments
- ☐ Island
- ☐ Waterfalls
- ☐ Other:

STREAM FLOW
- ☐ Dry
- ☐ Pooled
- ☐ Low
- ☐ High
- ☐ Normal

RIPARIAN VEGETATION
Dominate Type:
☐ Trees ☒ Herbaceous
☐ Grasses ☐ Shrubs
Number of strata 1 Dom. Tree/Shrub Taxa
SETARIA PUMILA, TARAXICUM OFFICIANALE

CHANNEL ALTERATIONS
- ☐ Dredging
- ☒ Channelization (☒ Full ☐ Partial)

P-CHEM Instrument Used: _____ Date Calibrated: _____

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:
Invertebrates	☐ 1m² ☐ 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:
	☐ Herbicides ☐ Pesticides ☐ Ortho P ☐ Other:	

Duplicate Samples Taken:

Substrate Characterization

Substrate ☒ Est. ☐ P.C.	Riffle 65 %	Run 25 %	Pool 10 %	Reach Total
Silt/Clay (<0.06 mm)				20
Sand (0.06 – 2 mm)				10
Gravel (2-64 mm)				25
Cobble (64 – 256 mm)				35
Boulders (>256 mm)				10
Bedrock				0

NOTES/COMMENTS:

50' REACH

SITE NOT SAMPLED:
- ☐ Land owner denial ☐ Dry ☐ Too deep/Impounded
- ☐ Site not found/Secluded ☐ Unsafe
- ☐ Other (indicate under comments)

CONFIDENTIAL PROPRIETARY TRADE SECRET

RBP High Gradient Habitat

Habitat Parameter	Condition Category: 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 Score 5	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 Score 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.
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 Score 6	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 9	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 Score 3	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 12	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 8 / RB 8	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 4 / 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.

Total Score

83

NOTES/COMMENTS:

50' REACH USED.

CONFIDENTIAL PROPRIETARY TRADE SECRET

High Gradient Bioassessment Stream Visit Sheet

STREAM NAME: SKY- **LOCATION:** BIGBONE,

STATION #: N/A **COUNTY:** BOONE **PROGRAM:/PROJECT:** G141890.0

INVESTIGATORS: CDK, **DATE:** 10/16/15 **TIME (24hr)** Start: 10:00 Finish:

Verify Site LAT/LONG vs GPS ☐YES ☐NO ☒N/A

	Station	Reach Downstream	Reach Upstream
LAT	38.89832	-	-
LONG	-84.65085	-	-

CANOPY COVER:
☒ Fully Exposed (0-25%)
☐ Partially Exposed (25-50%)
☐ Partially Shaded (50-75%)
☐ Fully Shaded (75-100%)

STREAM TYPE:
☒ Perennial
☐ Ephemeral
☐ Intermittent

WEATHER

Has there been a scouring rain in the last 14 days? ☐ Yes ☒ No	Now	Past 24 hours
	☐	☐ Heavy rain
	☐	☐ Steady rain
	☐	☐ Intermittent showers
	☒	☒ Clear/sunny
	☐	☐ Cloudy

LOCAL WATERSHED FEATURES (Predominant Surrounding Land Use):
☐ Surface Mining ☐ Deep Mining ☐ Oil Wells ☐ Land Disposal ☒ Residential
☐ Construction ☒ Commercial ☐ Industrial ☐ Row Crops
☐ Forest ☐ Pasture/Grazing ☐ Silviculture ☐ Urban Runoff/Storm Sewers

INSTREAM FEATURES
Stream Width 30 ft
Maximum Depth 1 ft
Reach Length 15.2 m
Riffle/Run/Pool Sequence (No. Sampled in Reach)
0 Riffle 1 Run 1 Pool

HYDRAULIC STRUCTURES
☐ Dams ☒ Bridge Abutments ☐ Island ☐ Waterfalls ☐ Other:

STREAM FLOW
☐ Dry ☒ Pooled ☐ Low ☐ High ☐ Normal

RIPARIAN VEGETATION
Dominate Type:
☒ Trees ☒ Herbaceous ☐ Grasses ☐ Shrubs
Number of strata 2 Dom. Tree/Shrub Taxa
PLATANUS OCCIDENTALIS, SOLIDAGO CANADENSIS, GLEDITSIA TRIACANTHOS

CHANNEL ALTERATIONS
☐ Dredging
☒ Channelization (☒ Full ☐ Partial)

P-CHEM Instrument Used: _____ Date Calibrated: _____

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:
Invertebrates	☐ 1m² ☐ 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:
	☐ Herbicides ☐ Pesticides ☐ Ortho P ☐ Other:	

Duplicate Samples Taken:

Substrate Characterization

Substrate ☒ Est. ☐ P.C.	Riffle 0 %	Run 15 %	Pool 85 %	Reach Total
Silt/Clay (<0.06 mm)				15
Sand (0.06 – 2 mm)				10
Gravel (2-64 mm)				5
Cobble (64 – 256 mm)				35
Boulders (>256 mm)				0
Bedrock				35

NOTES/COMMENTS:

50' REACH

SITE NOT SAMPLED:

☐ Land owner denial ☐ Dry ☐ Too deep/Impounded
☐ Site not found/Secluded ☐ Unsafe
☐ Other (indicate under comments)

CONFIDENTIAL PROPRIETARY TRADE SECRET

RBP High Gradient Habitat

Habitat Parameter	Condition Category: 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 Score 6	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 Score 16	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 4	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 Score 16	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 16	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 Score 4	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 3	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 LB 4 / 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 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.

Total Score

83

NOTES/COMMENTS:

50' REACH USED.

CONFIDENTIAL PROPRIETARY TRADE SECRET

High Gradient Bioassessment Stream Visit Sheet

STREAM NAME: SKY- | **LOCATION:** BIGBONE,

STATION #: N/A | **COUNTY:** BOONE | **PROGRAM:** / **PROJECT:** G141890.0

INVESTIGATORS: CDK, | **DATE:** 10/16/15 | **TIME (24hr)** Start: 10:25 Finish:

Verify Site LAT/LONG vs GPS ☐YES ☐NO ☒N/A

	Station	Reach Downstream	Reach Upstream
LAT	38.89519	-	-
LONG	-84.64805	-	-

CANOPY COVER:
- ☒ Fully Exposed (0-25%)
- ☐ Partially Exposed (25-50%)
- ☐ Partially Shaded (50-75%)
- ☐ Fully Shaded (75-100%)

STREAM TYPE:
- ☒ Perennial
- ☐ Ephemeral
- ☐ Intermittent

WEATHER — Has there been a scouring rain in the last 14 days? ☐ Yes ☒ No

	Now	Past 24 hours
	☐	☐ Heavy rain
	☐	☐ Steady rain
	☐	☐ Intermittent showers
	☒	☒ Clear/sunny
	☐	☐ Cloudy

LOCAL WATERSHED FEATURES (Predominant Surrounding Land Use):
- ☐ Surface Mining
- ☐ Deep Mining
- ☐ Oil Wells
- ☐ Land Disposal
- ☒ Residential
- ☐ Construction
- ☐ Commercial
- ☐ Industrial
- ☐ Row Crops
- ☐ Forest
- ☐ Pasture/Grazing
- ☐ Silviculture
- ☐ Urban Runoff/Storm Sewers

INSTREAM FEATURES
Stream Width 12 ft
Maximum Depth 0.5 ft
Reach Length 15.2 m
Riffle/Run/Pool Sequence (No. Sampled in Reach)
1 Riffle 1 Run 1 Pool

HYDRAULIC STRUCTURES
- ☐ Dams
- ☒ Bridge Abutments
- ☐ Island
- ☐ Waterfalls
- ☐ Other:

STREAM FLOW
- ☐ Dry
- ☐ Pooled
- ☐ Low
- ☐ High
- ☐ Normal

RIPARIAN VEGETATION
Dominate Type:
☒ Trees ☐ Herbaceous ☐ Grasses ☐ Shrubs
Number of strata 1 Dom. Tree/Shrub Taxa
FRAXINUS AMERICANA

CHANNEL ALTERATIONS
- ☐ Dredging
- ☒ Channelization (☒ Full ☐ Partial)

P-CHEM Instrument Used: _____ Date Calibrated: _____

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:
Invertebrates	☐ 1m² ☐ 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:
	☐ Herbicides ☐ Pesticides ☐ Ortho P ☐ Other:	

Duplicate Samples Taken:

Substrate Characterization

Substrate ☒Est. ☐P.C.	Riffle 25 %	Run 50 %	Pool 15 %	Reach Total
Silt/Clay (<0.06 mm)				
Sand (0.06 – 2 mm)				10
Gravel (2-64 mm)				
Cobble (64 – 256 mm)				
Boulders (>256 mm)				15
Bedrock				

NOTES/COMMENTS:

50' REACH

SITE NOT SAMPLED:
- ☐ Land owner denial ☐ Dry ☐ Too deep/Impounded
- ☐ Site not found/Secluded ☐ Unsafe
- ☐ Other (indicate under comments)

CONFIDENTIAL PROPRIETARY TRADE SECRET

RBP High Gradient Habitat

Habitat Parameter	Condition Category			
	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 Score 9	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 Score 12	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 Score 12	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 9	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 Score 6	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 10	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 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 LB 4 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 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.

Total Score

89

NOTES/COMMENTS:

50' REACH USED.

CONFIDENTIAL PROPRIETARY TRADE SECRET

High Gradient Bioassessment Stream Visit Sheet

STREAM NAME: SKY- **LOCATION:** BIGBONE,

STATION #: N/A **COUNTY:** BOONE **PROGRAM:/PROJECT:** G141890.0

INVESTIGATORS: CDK, **DATE:** 10/16/15 **TIME (24hr)** Start: 11:00 Finish:

Verify Site LAT/LONG vs GPS ☐YES ☐NO ☒N/A

	Station	Reach Downstream	Reach Upstream
LAT	38.88984	-	-
LONG	-84.64017	-	-

CANOPY COVER:
☒ Fully Exposed (0-25%)
☐ Partially Exposed (25-50%)
☐ Partially Shaded (50-75%)
☐ Fully Shaded (75-100%)

STREAM TYPE:
☒ Perennial
☐ Ephemeral
☐ Intermittent

WEATHER
Has there been a scouring rain in the last 14 days? ☐ Yes ☒ No

Now	Past 24 hours
☐	☐ Heavy rain
☐	☐ Steady rain
☐	☐ Intermittent showers
☒	☒ Clear/sunny
☐	☐ Cloudy

LOCAL WATERSHED FEATURES (Predominant Surrounding Land Use):
☐ Surface Mining ☐ Deep Mining ☐ Oil Wells ☐ Land Disposal ☒ Residential
☐ Construction ☐ Commercial ☐ Industrial ☒ Row Crops
☐ Forest ☐ Pasture/Grazing ☐ Silviculture ☐ Urban Runoff/Storm Sewers

INSTREAM FEATURES
Stream Width 14 ft
Maximum Depth 0.16 ft
Reach Length 15.2 m
Riffle/Run/Pool Sequence (No. Sampled in Reach)
0 Riffle 1 Run 1 Pool

HYDRAULIC STRUCTURES
☐ Dams ☐ Bridge Abutments ☐ Island ☐ Waterfalls ☒ Other: CULVER

STREAM FLOW
☐ Dry ☐ Pooled ☒ Low ☐ High ☐ Normal

RIPARIAN VEGETATION
Dominate Type:
☐ Trees ☒ Herbaceous
☐ Grasses ☒ Shrubs
Number of strata 2 Dom. Tree/Shrub Taxa TYPHA LATIFOLIA, SALIX NIGRA, SOLIDAGO CANADENSIS

CHANNEL ALTERATIONS
☐ Dredging
☒ Channelization (☐ Full ☒ Partial)

P-CHEM Instrument Used: _____ Date Calibrated: _____

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:
Invertebrates	☐ 1m² ☐ 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:
	☐ Herbicides ☐ Pesticides ☐ Ortho P ☐ Other:	

Duplicate Samples Taken:

Substrate Characterization

Substrate ☒Est. ☐P.C.	Riffle 0 %	Run 75 %	Pool 25 %	Reach Total
Silt/Clay (<0.06 mm)				60
Sand (0.06 – 2 mm)				10
Gravel (2-64 mm)				15
Cobble (64 – 256 mm)				15
Boulders (>256 mm)				0
Bedrock				0

NOTES/COMMENTS:

50' REACH

SITE NOT SAMPLED:

☐ Land owner denial ☐ Dry ☐ Too deep/Impounded
☐ Site not found/Secluded ☐ Unsafe
☐ Other (indicate under comments)

CONFIDENTIAL PROPRIETARY TRADE SECRET

RBP High Gradient Habitat

Habitat Parameter	Condition Category: 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 Score 13	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 Score 4	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 6	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 Score 4	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 Score 7	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 4	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 7 RB 7	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 7 LB RB 7	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 5 RB 5	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

84

NOTES/COMMENTS:

50' REACH USED.

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High Gradient Bioassessment Stream Visit Sheet

STREAM NAME: SKY-		**LOCATION:** BIGBONE,	
STATION #: N/A		**COUNTY:** BOONE	**PROGRAM:** **PROJECT:** G141890.0
INVESTIGATORS: CDK,		**DATE:** 10/16/15	**TIME (24hr)** **Start:** 11:45 **Finish:**
Verify Site LAT/LONG vs GPS ☐YES ☐NO ☒N/A			

	Station	Reach Downstream	Reach Upstream
LAT	38.89012 6	-	-
LONG	-84.62415 5	-	-

CANOPY COVER:
☒ Fully Exposed (0-25%)
☐ Partially Exposed (25-50%)
☐ Partially Shaded (50-75%)
☐ Fully Shaded (75-100%)

STREAM TYPE:
☒ Perennial
☐ Ephemeral
☐ Intermittent

WEATHER
Has there been a scouring rain in the last 14 days? ☐ Yes ☒ No

Now	Past 24 hours
☐	☐ Heavy rain
☐	☐ Steady rain
☐	☐ Intermittent showers
☒	☒ Clear/sunny
☐	☐ Cloudy

LOCAL WATERSHED FEATURES (Predominant Surrounding Land Use):

☐ Surface Mining	☐ Construction	☐ Forest
☐ Deep Mining	☐ Commercial	☒ Pasture/Grazing
☐ Oil Wells	☐ Industrial	☐ Silviculture
☐ Land Disposal	☐ Row Crops	☐ Urban Runoff/Storm Sewers
☐ Residential		

INSTREAM FEATURES
Stream Width 7 ft
Maximum Depth 0.25 ft
Reach Length 15.2 m
Riffle/Run/Pool Sequence (No. Sampled in Reach)
1 Riffle 1 Run 1 Pool

HYDRAULIC STRUCTURES
☐ Dams
☐ Bridge Abutments
☐ Island
☐ Waterfalls
☒ Other: CULVER

STREAM FLOW
☐ Dry
☐ Pooled
☒ Low
☐ High
☐ Normal

RIPARIAN VEGETATION
Dominate Type:
☐ Trees ☒ Herbaceous
☐ Grasses ☐ Shrubs
Number of strata 1 Dom.
Tree/Shrub Taxa
CONIUM MACULATUM, HELIANTHUS SP.

CHANNEL ALTERATIONS
☐ Dredging
☒ Channelization
(☒ Full ☐ Partial)

P-CHEM Instrument Used: _____ Date Calibrated: _____

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:
Invertebrates	☐ 1m² ☐ 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:
	☐ Herbicides ☐ Pesticides ☐ Ortho P ☐ Other:	

Duplicate Samples Taken:

Substrate Characterization

Substrate ☒Est. ☐P.C.	Riffle 35 %	Run 50 %	Pool 15 %	Reach Total
Silt/Clay (<0.06 mm)				35
Sand (0.06 – 2 mm)				15
Gravel (2-64 mm)				15
Cobble (64 – 256 mm)				35
Boulders (>256 mm)				0
Bedrock				0

NOTES/COMMENTS:
50' REACH

SITE NOT SAMPLED:
☐ Land owner denial ☐ Dry ☐ Too deep/Impounded
☐ Site not found/Secluded ☐ Unsafe
☐ Other (indicate under comments)

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RBP High Gradient Habitat

Habitat Parameter	Condition Category: 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 Score 4	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 Score 4	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 4	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 Score 4	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 Score 5	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 4	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 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.

Total Score

58

NOTES/COMMENTS:

50' REACH USED.

CONFIDENTIAL PROPRIETARY TRADE SECRET

High Gradient Bioassessment Stream Visit Sheet

STREAM NAME: SKY- | **LOCATION:** BIGBONE,

STATION #: N/A | **COUNTY:** BOONE | **PROGRAM:** / **PROJECT:** G141890.0

INVESTIGATORS: CDK, | **DATE:** 10/16/15 | **TIME (24hr)** Start: 11:30 Finish:

Verify Site LAT/LONG vs GPS ☐YES ☐NO ☒N/A

	Station	Reach Downstream	Reach Upstream
LAT	38.89016 5	-	-
LONG	-84.62363 2	-	-

CANOPY COVER:
- ☒ Fully Exposed (0-25%)
- ☐ Partially Exposed (25-50%)
- ☐ Partially Shaded (50-75%)
- ☐ Fully Shaded (75-100%)

STREAM TYPE:
- ☐ Perennial
- ☐ Ephemeral
- ☒ Intermittent

WEATHER

Has there been a scouring rain in the last 14 days? ☐ Yes ☒ No

Now	Past 24 hours
☐	☐ Heavy rain
☐	☐ Steady rain
☐	☐ Intermittent showers
☒	☒ Clear/sunny
☐	☐ Cloudy

LOCAL WATERSHED FEATURES (Predominant Surrounding Land Use):

☐ Surface Mining	☐ Construction	☐ Forest
☐ Deep Mining	☒ Commercial	☐ Pasture/Grazing
☐ Oil Wells	☒ Industrial	☐ Silviculture
☐ Land Disposal	☐ Row Crops	☐ Urban Runoff/Storm Sewers
☐ Residential		

INSTREAM FEATURES
- Stream Width: 8 ft
- Maximum Depth: 0.08 ft
- Reach Length: 15.2 m

Riffle/Run/Pool Sequence (No. Sampled in Reach)
1 Riffle 0 Run 0 Pool

HYDRAULIC STRUCTURES
- ☐ Dams
- ☐ Bridge Abutments
- ☐ Island
- ☐ Waterfalls
- ☒ Other: CULVER

STREAM FLOW
- ☐ Dry
- ☐ Pooled
- ☒ Low
- ☐ High
- ☐ Normal

RIPARIAN VEGETATION

Dominate Type: ☐ Trees ☒ Herbaceous ☐ Grasses ☐ Shrubs

Number of strata 1 Dom. Tree/Shrub Taxa LONICERA SP., FRAXINUS AMERICANA, SOLIDAGO SP

CHANNEL ALTERATIONS
- ☐ Dredging
- ☒ Channelization (☒ Full ☐ Partial)

P-CHEM Instrument Used: _____ Date Calibrated: _____

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:
Invertebrates	☐ 1m² ☐ 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:
	☐ Herbicides ☐ Pesticides ☐ Ortho P ☐ Other:	

Duplicate Samples Taken:

Substrate Characterization

Substrate ☒Est. ☐P.C.	Riffle 100 %	Run 0 %	Pool 0 %	Reach Total
Silt/Clay (<0.06 mm)				25
Sand (0.06 – 2 mm)				0
Gravel (2-64 mm)				25
Cobble (64 – 256 mm)				50
Boulders (>256 mm)				0
Bedrock				0

NOTES/COMMENTS:

50' REACH

SITE NOT SAMPLED:

☐ Land owner denial ☐ Dry ☐ Too deep/Impounded

☐ Site not found/Secluded ☐ Unsafe

☐ Other (indicate under comments)

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RBP High Gradient Habitat

Habitat Parameter	Condition Category			
	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 Score 4	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 Score 8	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 3	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 Score 3	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 2	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 Score 3	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 2	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 7 / RB 7	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 LB 3 / 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 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.

Total Score

49

NOTES/COMMENTS:

50' REACH USED.

APPENDIX B
Descriptions of Soils Found Within the Project Study Area

Soil Unit Symbol	Soil Unit Name	% in 20-Foot Corridor	Acres	Hydric
AsB	Ashton silt loam, 2 to 6 percent slopes (occasionally flooded)	0.08%	0.02	No
Bo	Boonesboro silt loam (0 to 4 percent slopes, occasionally flooded)	0.91%	0.22	No
BrC	Brashear silty clay loam, 6 to 12 percent slopes	0.74%	0.18	No
BsD3	Brashear silty clay, 12 to 20 percent slopes, severely eroded	1.44%	0.35	No
CyF	Cynthiana flaggy silty clay loam, 20 to 50 percent slopes	1.42%	0.35	No
EdE2	Eden silty clay loam, 20 to 35 percent slopes, eroded	10.28%	2.53	No
Eg	Egam silty clay loam, (woolper 0 to 4 percent slopes)	1.54%	0.38	No
FcC	Faywood silty clay loam, 6 to 12 percent slopes	2.68%	0.66	No
FcD	Faywood silty clay loam, 12 to 20 percent slopes	15.57%	3.83	No
FdD3	Faywood silty clay, 12 to 20 percent slopes, severely eroded	6.00%	1.47	No
JeB	Jessup silt loam, 2 to 6 percent slopes	1.08%	0.27	No
JeC	Jessup silt loam, 6 to 12 percent slopes	1.17%	0.29	No
LkB	Licking silt loam, 2 to 6 percent slopes	1.06%	0.26	No
LlC	Licking silty clay loam, 6 to 12 percent slopes	2.78%	0.68	No
LlD	Licking silty clay loam, 12 to 20 percent slopes	2.22%	0.55	No
Ln	Lindside silt loam (0 to 3 percent slopes, occasionally flooded)	0.58%	0.14	No
Nk	Newark silt loam (0 to 2 percent slopes, occasionally flooded)	0.01%	0.00	No
NlB	Nicholson silt loam, 2 to 6 percent slopes	6.24%	1.53	No
NlC	Nicholson silt loam, 6 to 12 percent slopes	1.73%	0.43	No
No	Nolin silt loam (0 to 2 percent slopes, occasionally flooded)	30.50%	7.50	Yes
RsB	Rossmoyne silt loam, 0 to 6 percent slopes	6.11%	1.50	No
RsC	Rossmoyne silt loam, 6 to 12 percent slopes	4.07%	1.00	No
W	Water	0.23%	0.06	No
WoC	Woolper silty clay loam, 6 to 12 percent slopes	1.57%	0.39	No

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Table 1
Impact Summary for Waterbody Crossings

Waterbody ID	Waterbody Name	Flow Regime	Top of Bank Width (feet)	Average OHWM Width (feet)	Quality Rating (RBP)	Length within 30' Construction Workspace (linear feet)[1]	Crossing Method / Comments	TNW Connection	Latitude	Longitude
S001	UNT to Big Bone Creek	Intermittent	4	3.5	Poor	28	Open Cut	Ohio River	38.888648	-84.751589
S003	UNT to Big Bone Creek	Intermittent	6	3	Poor	27	Open Cut	Ohio River	38.888194	-84.742755
S004	UNT to Big Bone Creek	Intermittent	8	4	Poor	28	Open Cut	Ohio River	38.887106	-84.740995
S005	UNT to Big Bone Creek	Intermittent	5	4	Poor	28	Open Cut	Ohio River	38.886221	-84.739258
S006	UNT to Big Bone Creek	Ephemeral	2	1	-	37	Open Cut	Ohio River	38.886054	-84.738946
S008	UNT to Big Bone Creek	Intermittent	4	3	Poor	33	Open Cut	Ohio River	38.883806	-84.734229
S009	UNT to Big Bone Creek	Intermittent	3	2	Poor	18	Open Cut	Ohio River	38.883848	-84.732743
S010	UNT to Big Bone Creek	Ephemeral roadside drainage	2	1	Poor	0	HDD Bore in conjunction with Big Bone Creek	Ohio River	38.88485	-84.729948
S011	UNT to Big Bone Creek	Ephemeral	4	3	-	91	Open Cut	Ohio River	38.88538	-84.728482
S012	UNT to Big Bone Creek	Intermittent	2.5	2	Poor	10	Open Cut	Ohio River	38.885814	-84.723852
S013	UNT to Big Bone Creek	Ephemeral	4	3	-	8	Open Cut	Ohio River	38.885824	-84.725235
S016	UNT to Big Bone Creek	Ephemeral	3	2	-	50	Open Cut	Ohio River	38.88448	-84.716437
S017	UNT to Big Bone Creek	Perennial	10	8	Poor	32	Open Cut	Ohio River	38.884484	-84.716351
S018	UNT to Big Bone Creek	Ephemeral	3	2	-	5	Open Cut	Ohio River	38.883974	-84.71394
S019	UNT to Big Bone Creek	Ephemeral	2	1	-	8	Open Cut	Ohio River	38.883721	-84.712932
S020	UNT to Big Bone Creek	Ephemeral	2	1	-	30	Open Cut	Ohio River	38.883149	-84.710867
S021	UNT to Big Bone Creek	Ephemeral	3	2	-	30	Open Cut	Ohio River	38.883099	-84.71069
S022	UNT to Big Bone Creek	Ephemeral	2	1	-	15	Open Cut	Ohio River	38.8837	-84.712677
S023	UNT to Beaver Branch	Perennial	4	3	-	35	Open Cut	Ohio River	38.880417	-84.704449
S024	UNT to Beaver Branch	Ephemeral roadside drainage	2	1	-	138	Open Cut	Ohio River	38.879475	-84.70174
S025	UNT to Beaver Branch	Intermittent	4	3	Poor	166	Open Cut; pipeline will not be installed paralell to stream within the stream's jurisdictional area; much of stream is near edge of work space.	Ohio River	38.879072	-84.70048
S026	UNT to Beaver Branch	Ephemeral	1.5	1	-	11	Open Cut	Ohio River	38.878827	-84.699772
S027	UNT to Beaver Branch	Ephemeral	1.5	1	-	15	Open Cut	Ohio River	38.878877	-84.699924
S028	UNT to Beaver Branch	Perennial	15	9	Poor	31	Open Cut	Ohio River	38.879076	-84.699109
S029	UNT to Beaver Branch	Ephemeral	3	2	-	2	Open Cut	Ohio River	38.879131	-84.698998
S030	UNT to Beaver Branch	Ephemeral	2	1	-	29	Open Cut	Ohio River	38.879131	-84.699113
S031	UNT to Beaver Branch	Intermittent	6	5	Poor	105	Open Cut	Ohio River	38.885909	-84.692433
S032	UNT to Mud Lick Creek	Ephemeral	3	2	-	25	Open Cut	Ohio River	38.887165	-84.689459
S033	UNT to Mud Lick Creek	Intermittent	7	6	Poor	8	Open Cut	Ohio River	38.893733	-84.673369
S035	UNT to Mud Lick Creek	Ephemeral	2	1	-	17	Open Cut	Ohio River	38.900786	-84.650065
S036	UNT to Mud Lick Creek	Ephemeral	2	1	-	34	Open Cut	Ohio River	38.900811	-84.650081
S037	UNT to Mud Lick Creek	Intermittent	3	2	Poor	31	Open Cut	Ohio River	38.904096	-84.645433
S038	UNT to Mud Lick Creek	Ephemeral roadside (a portion)	3	1.5	-	82	Open Cut	Ohio River	38.888835	-84.630148
S041	UNT to Mud Lick Creek	Ephemeral	2	1	-	1	Open Cut	Ohio River	38.888275	-84.614664
S044	UNT to Mud Lick Creek	Perennial	3	2	Poor	65	Open Cut	Ohio River	38.889085	-84.615168
S045	UNT to Mud Lick Creek	Ephemeral	2	1	-	34	Open Cut	Ohio River	38.888522	-84.615012
S046	UNT to Mud Lick Creek	Intermittent	2	1	Poor	33	Open Cut	Ohio River	38.888731	-84.615091
SKY-CDK-001	UNT to Big Bone Creek	Ephemeral	3	1.5	-	34	Open Cut	Ohio River	38.883047	-84.710558
SKY-CDK-004	UNT to Big Bone Creek	Ephemeral	3.5	3	-	40	Open Cut	Ohio River	38.883661	-84.712715
SKY-CDK-005	UNT to Big Bone Creek	Ephemeral roadside drainage	5	4	-	51	Open Cut	Ohio River	38.884474	-84.71623

Table 1
Impact Summary for Waterbody Crossings

Waterbody ID	Waterbody Name	Flow Regime	Top of Bank Width (feet)	Average OHWM Width (feet)	Quality Rating (RBP)	Length within 30' Construction Workspace (linear feet)[1]	Crossing Method / Comments	TNW Connection	Latitude	Longitude
SKY-CDK-006	Big Bone Creek (KY OSRW)[2]	Perennial	120	50	Fair	0	HDD Bore	Ohio River	38.884966	-84.729662
SKY-CDK-007	UNT to Big Bone Creek	Perennial	10	8	Poor	36	Open Cut	Ohio River	38.884692	-84.736427
SKY-CDK-008	Gum Branch	Perennial	50	20	Poor	0	HDD Bore	Ohio River	38.888249	-84.755236
SKY-CDK-009	UNT to Gum Branch	Ephemeral roadside drainage	3	0.33	-	296	Open cut. Pipeline will not be installed paralell to stream within the stream's jurisdictional area. Pipeline trench will be within the road or along edge of pavement.	Ohio River	38.887815	-84.756859
SKY-CDK-010	UNT to Gum Branch	Perennial	10	5	Poor	26	Open Cut	Ohio River	38.887871	-84.75621
SKY-CDK-011	UNT to Big Bone Creek	Intermittent	9	7	Poor	27	Open Cut	Ohio River	38.888879	-84.748893
SKY-CDK-012	Beaver Branch	Perennial	9	7	Poor	72	Open Cut	Ohio River	38.879352	-84.701436
SKY-CDK-013	UNT to Mud Lick Creek	Perennial	14	13	Poor	30	Open Cut	Ohio River	38.897422	-84.662598
SKY-CDK-014	UNT to Mud Lick Creek	Perennial	6	5	Poor	13	Open Cut	Ohio River	38.893772	-84.673271
SKY-CDK-015	UNT to Beaver Branch	Intermittent	3.5	3	Poor	58	Open Cut	Ohio River	38.879312	-84.698893
SKY-CDK-016	UNT to Mud Lick Creek	Perennial	11	10	Poor	0	HDD Bore	Ohio River	38.888883	-84.685416
SKY-CDK-017	Mud Lick Creek	Perennial	14	10	Poor	30	Open Cut	Ohio River	38.899227	-84.653121
SKY-CDK-018	UNT to Mud Lick Creek	Perennial	20	10	Poor	143	Open Cut	Ohio River	38.898454	-84.650902
SKY-CDK-019	UNT to Mud Lick Creek	Ephemeral	4	3	-	33	Open Cut	Ohio River	38.906236	-84.642276
SKY-CDK-020	UNT to Mud Lick Creek	Perennial	7	6	Poor	46	Open Cut	Ohio River	38.895255	-84.648025
SKY-CDK-021	UNT to Mud Lick Creek	Ephemeral	4	3	-	33	Open Cut	Ohio River	38.891389	-84.643068
SKY-CDK-022	UNT to Mud Lick Creek	Perennial	10	8	Poor	35	Open Cut	Ohio River	38.889876	-84.640097
SKY-CDK-023	UNT to Mud Lick Creek	Ephemeral	2	1	-	30	Open Cut	Ohio River	38.887824	-84.632885
SKY-CDK-024	UNT to Mud Lick Creek	Intermittent	8	6	Poor	32	Open Cut	Ohio River	38.8896	-84.62685
SKY-CDK-025	UNT to Mud Lick Creek	Ephemeral	5	4	-	36	Open Cut	Ohio River	38.889815	-84.625822
SKY-CDK-026	UNT to Mud Lick Creek	Perennial	7	6	Poor	31	Open Cut	Ohio River	38.89017	-84.624154
SKY-CDK-027	UNT to Mud Lick Creek	Perennial	10	5	Poor	43	Open Cut	Ohio River	38.890222	-84.623559
Total		-	-	-	-	2,515	-	-	-	-

[1] Includes planned areas that will be impacted by construction assuming a 30-foot wide corridor for work space. Additional work space, access, and staging areas not yet identified.

[2] OSRW - Designated by KDOW as Outstanding State Water Resource

Note: Without the jurisdictional roadside drainages, approximatly 2,063 LF of stream is located within the planned construction right-of-way. Not all stream reaches will be temporary impacted as many are located near the edge of the right-of-way.

Table 2
Impact Summary for Wetland Crossings

Wetland ID	Cowardin Classification[a]	Latitude	Longitude	Length of Crossing at Centerline (feet)[b]	Wetland Impacts[c]	
					Construction	Operation
W004	PEM	38.885708	-84.726986	0	0.003	0.00
W005	PEM	38.885822	-84.724037	0	0.004	0.00
W006	PEM	38.885752	-84.722876	0	0.006	0.00
W007	PEM	38.878859	-84.699792	0	0.031	0.00
W008	PEM	38.879244	-84.698957	81	0.055	0.00
W009	PSS	38.889845	-84.640052	69	0.045	0.045
W010	PEM	38.889389	-84.62865	0	0.016	0.00
W011	PEM	38.889431	-84.627939	7	0.032	0.00
W013	PEM	38.889094	-84.615142	44	0.029	0.00
Totals	-	-	-	**202**	**0.22**	**0.05**

a PEM – Palustrine Emergent; PSS – Palustrine Scrub Shrub; PFO – Palustrine Forested

b A length of crossing at centerline equal to zero indicates that a wetland is not crossed by the Project centerline, but is within the construction right-of-way (workspace).

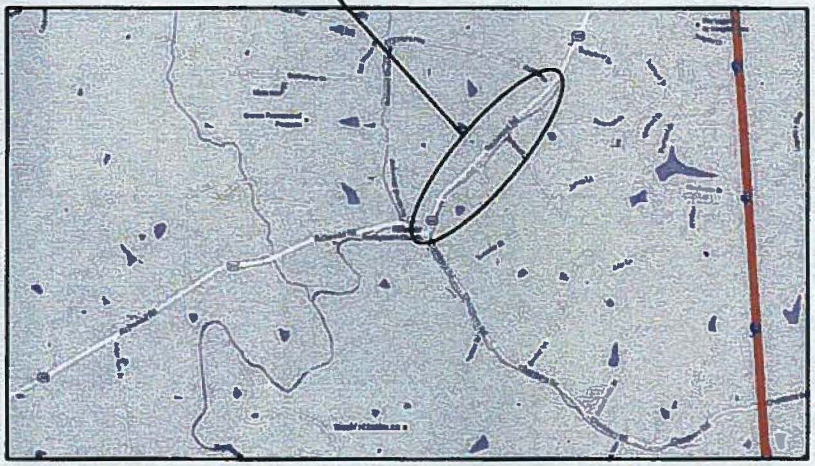
c Construction acreage of wetland impacts is based on a 30-foot wide construction corridor. There is no operational impact to PEM wetlands, because there is no planned change in the pre- and post-construction vegetation cover type.

DUKE ENERGY

GAS DEPARTMENT
DUKE ENERGY
ERLANGER DISTRICT

CONTACT GAS SYSTEMS OPERATIONS SUPERVISOR PRIOR TO STARTING JOB TO VERIFY GAS FLOW

AREA OF WORK



VICINITY MAP
N.T.S.

IFI
MAR 8, 2016
DRAWINGS

LEGEND

— — —	EX. GAS
———	CONT. GAS
———	PROP. GAS
— OE — OE —	ELECTRIC
— W.AL —	WATER
— SEW —	SEWER
— - — -	CENTERLINE
- - - -	E.O.P.
- - - -	R/W
— — —	EASEMENT
———	PARCEL

WELDING PROCEDURE(S) REQUIRED

SPEC. •
SPEC. •
SPEC. •
SPEC. •
SPEC. •

PIPE INSTALLED ON JOB

SIZE	KIND	WALL THICKNESS	EST. QUANTITIES	ACTUAL QUANTITIES
12"	SPCW XS2	0.250"	5'	
12"	PL		3934'	

TOTAL ACTUAL INSTALLED

PERMIT(S) REQUIRED
BOONE COUNTY
KYTC HIGHWAY

UTILITY LOCATION CONTACTS

TELEPHONE:	1-800-752-6007
ELECTRIC:	1-800-752-6007
SAN. SEWER:	1-800-752-6007
STORM SEWER:	1-800-752-6007
WATER:	1-800-752-6007
CABLE T.V.:	1-800-752-6007
MUNICIPALITY:	
WARREN COUNTY:	1-859-334-3600

SYSTEM OPERATION SUPERVISOR VALVES AND NUMBERS REVIEWED
REVIEWED BY ______
DATE ______

VALVES THAT HAVE BEEN ABANDONED AND BOX REMOVED

DESIGN REVIEW OF COMPLETED CONSTRUCTION JOB
SPONSOR ______ DATE ______
FIELD CHANGE REQUEST DOCUMENT REQUIRED: YES ☐ NO ☐
TRANSMISSION DESIGN DOCUMENT REQUIRED: YES ☐ NO ☐

CORROSION ENGINEERING

FIELD PRESSURE TEST
ALL PIPELINES REQUIRED TESTING BEFORE PLACING INTO SERVICE. PRESSURE CHARTS AND FORMS SHOULD BE FORWARDED TO GAS ENGINEERING AND PLANNING
REQUIRED TEST PRESSURE RANGE:
MIN. ______ PSIG TO MAX ______ PSIG
HOURS ______ MEDIUM ______
TESTED BY ______ DATE ______

SUPERVISION BLOCK
SUPERVISOR OR CONTRACTOR ______
RECORDED BY ______
DATE STARTED ______ DATE PLACED IN SERVICE ______
PERMIT NO. ______

GAS CONTACTS
CONSTRUCTION:
MICHAEL FRANZEN
513-287-2568
ENGINEERING SPONSOR:
JOHN PERKINS
(O) 513-287-1276
(C) 513-315-8338

S05W02-13
S05W02-12
S05W02-11

	PROJECT	ACTIVITY
INSTALLATION		1

BIG BONE
MAIN EXTENSION
BOONE CO., KENTUCKY

MAP NO. S05W02-19 DRAWING NO. 9174348

CONFIDENTIAL PROPRIETARY TRADE SECRET

GAS DEPARTMENT
DUKE ENERGY

CONSTRUCTION NOTES

1. TARGET START DATE: 03-01-17
   TARGET FINISH DATE: 11-30-17

2. THE WINNING BIDDER MUST INSTALL THE MAIN IN ACCORDANCE WITH THE SPECIFIED BID INSTALLATION METHOD UNLESS AN ALTERNATIVE METHOD IS SUBMITTED TO AND APPROVED BY THE DUKE ENERGY DESIGN ENGINEER. ANY CHANGES IN INSTALLATION METHOD SHALL NOT INCREASE THE COST OF THE PROJECT TO DUKE. NOR SHALL PAYMENT BE MADE FOR RESTORATION NOT PERFORMED.

3. RESTRICTED HOURS, TRAFFIC CONTROL OR OTHER RESTRICTIONS IMPOSED BY THE PERMITTING AGENCY ARE THE SOLE RESPONSIBILITY OF THE BIDDERS AND NO EXTRAS WILL BE PAID BY DUKE ENERGY.

4. EXTRA DEPTH WILL BE PAID FOR DIRECT BURY INSTALLATIONS WHEN EXCAVATIONS ARE GREATER THAN 5-FEET TOTAL DEPTH AND DEPTH IS GREATER THAN 2-FEET OVER THE PLANNED EXCAVATION DEPTH.

5. ROCK EXCAVATION WILL BE PAID PER GD-150. THE DUKE ENERGY INSPECTOR AND THE CONTRACTOR MUST AGREE ON THE ACTUAL AMOUNT OF ROCK BEFORE BACKFILLING THE TRENCH IN DIRECT BURY INSTALLATIONS. NO ROCK EXCAVATION WILL BE PAID FOR DIRECTIONAL DRILLING INSTALLATIONS.

6. TIE-IN WORK WILL BE GIVEN TO THE WINNING CONTRACTOR AT THE DISCRETION OF DUKE ENERGY. DUKE ENERGY RETAINS THE RIGHT TO HAVE DUKE ENERGY CREWS PERFORM TIE-IN WORK.

7. ALL WORK MUST BE DONE IN ACCORDANCE WITH THE "SPECIFICATIONS FOR THE 2010 GAS MAIN REPLACEMENT, RELOCATION, AND EXTENSION PROJECTS" AND THE MOST CURRENT VERSION OF GD-150.

8. TIE-IN MAINS MUST BE ADEQUATELY EXPOSED FOR PROPER LINE-UP.

9. OFFSETS WILL BE PAID IF TWO (2) UNPLANNED ELBOWS ARE USED FOR THE AVOIDANCE OF AN UNFORESEEN OBSTACLE IN EITHER THE HORIZONTAL OR VERTICAL DIRECTION.

10. OUT OF BALANCED BIDS WILL BE REJECTED AND NOT CONSIDERED BY DUKE ENERGY.

11. _____

_____

_____

MARCH 8, 2016

GAS DEPARTMENT

MARCH 8, 2016

BOM SHEET

EXHIBIT 2(c) PUBLIC PAGES 318 THROUGH 323 ARE BEING FILED UNDER SEAL