



**A BIG SANDY CRAYFISH (*CAMBARUS CALLAINUS*) SURVEY  
FOR A WATER MAIN RELOCATION ON RUSSELL FORK  
LOCATED IN ELKHORN CITY, KENTUCKY**

**Prepared for:  
SUMMIT ENGINEERING, INC.**

**Authored by:  
Travis N. Lowe**

**ATS PROJECT NO. 1708.01**

**April 2017**

## I. INTRODUCTION

Appalachian Technical Services, Inc. was contracted by Summit Engineering, Inc. (Summit) to conduct a Big Sandy Crayfish (*Cambarus callainus*) (BSC) presence/absence survey on Russell Fork located in Elkhorn City, Kentucky.

The proposed water main relocation will involve cutting an open trench across the Russell Fork to place an 8" water line. The proposed crossing location and extent of the crayfish sampling sites are shown in Figure No.1.

## II. METHODS

ATS biologists performed surveys based on the methodology of surveying one site upstream of the proposed water main crossing and one site downstream of the proposed crossing. Surveys were conducted on 12 April 2018 by ATS senior biologists Travis Lowe and Chris Isaac, and biological technicians James Breeding and Brian Bledsoe.

### A. *Habitat*

Data collections for the aquatic biological assessment consisted of the Qualitative Habitat Evaluation Index (QHEI; OEPA 2006) and physiochemical water quality data. Water quality metrics such as temperature, percent dissolved oxygen, turbidity, pH and specific conductance was recorded with hand-held meters (YSI Pro Plus). Upon return to the lab all meters received a post-calibration check to ensure validity of all measurements recorded.



### B. *Big Sandy Crayfish*

Sample methodologies adhered to the *Big Sandy and Big Sandy Crayfish Survey Protocol* (May 2016) developed by the West Virginia Division of Natural Resources (WVDNR) and the U.S. Fish and Wildlife Service. Sampling effort consisted of a minimum of 10 seine hauls within each 125 m stream reach.





**LEGEND**

-  SAMPLE SITE RF1
-  SAMPLE SITE RF2




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**CITY OF ELKHORN  
 WATER MAIN RELOCATION**

**FIGURE NO. 1 - LOCATION MAP**

Designed By TNL	Drawn By TNL	Checked By TNL	Date 04/18
Project Number 1708.01	Coordinate System N/A	Quadrangle N/A	Drawing Number 1708.01-Y-LM1
			Sheet <b>01</b> of <b>01</b>



When sampling was completed all data was recorded including; total number of crayfish collected of each species per seine haul, sex and reproductive status (Form I, Form II, Female, Female Glair, Female-Ovig, Female-Attached Juveniles) and age. Additionally, the total carapace length for all crayfish captured was also recorded. Representative photos were taken of each species captured. Crayfish were outside of water no more than 5 minutes and were returned to the stream bottom upstream of their capture location and guided back the substrate in which they were collected.

### III. RESULTS

#### A. Habitat

Both stream sites habitats were suggested as excellent according to the QHEI index (Appendix A). All handheld meters passed post-calibration tests. All physiochemical water properties recorded with handheld meters appeared to be within normal limits (Appendix B).

#### B. Big Sandy Crayfish

Survey efforts captured the federally threatened Big Sandy Crayfish (*Cambarus callainus*) at both sample sites. Nine individuals were captured from 14 seine hauls at sampling site RF1 (0.64 CPUE) (Appendix C and D). Sampling site RF2 yielded 9 individuals from 12 seine hauls (0.75 CPUE) (Appendix C and D).

### IV. CONCLUSION

Temperature and water clarity were within protocols for conducting BSC surveys. QHEI habitat assessments suggested that the habitat was excellent at both sample sites. All physiochemical water properties recorded with handheld meters appeared to be within normal limits.

*Cambarus callainus* was the only species of crayfish observed. The Big Sandy Crayfish was abundant at the two sample sites and survey reaches provided excellent habitat for the crayfish.

The proposed water main relocation will occur within an area where the Big Sandy Crayfish is present. Depending on the method used for construction activities it may be necessary to have a crayfish biologist on-site during constructions activities to remove and relocate crayfish to prevent take of the Big Sandy Crayfish.



**Figure 2: RF1 upstream view**



**Figure 3: RF1 downstream view**





**Figure 4: RF2 upstream view**



**Figure 5: RF3 downstream view**

# APPENDIX A:

## QHEI DATA SHEETS



1) Check Two substrate TYPE BOXES; estimate % or note every type present (NAD 83 - decimal) 18

<b>BEST TYPES</b>		<b>POOL RIFFLE</b>		<b>OTHER TYPES</b>		<b>POOL RIFFLE</b>		<b>ORIGIN</b>		<b>QUALITY</b>											
<input checked="" type="checkbox"/> BLDG / SLABS [10]	<u>10</u>	<input checked="" type="checkbox"/> <u>40</u>	<input type="checkbox"/> HARDPAN [4]	<input type="checkbox"/> DETRITUS [3]	<input type="checkbox"/> LIMESTONE [1]	<input type="checkbox"/> SILT [1]	<input type="checkbox"/> TILLS [1]	<input type="checkbox"/> WETLANDS [0]	<input type="checkbox"/> SANDSTONE [0]	<input type="checkbox"/> RIP/RAP [0]	<input type="checkbox"/> LACUSTURINE [0]	<input type="checkbox"/> SHALE [-1]	<input type="checkbox"/> COAL FINES [-2]	<input type="checkbox"/> HEAVY [-2]	<input type="checkbox"/> MODERATE [-1]	<input checked="" type="checkbox"/> NORMAL [0]	<input type="checkbox"/> FREE [1]	<input type="checkbox"/> EXTENSIVE [-2]	<input checked="" type="checkbox"/> MODERATE [-1]	<input type="checkbox"/> NORMAL [0]	<input type="checkbox"/> NONE [1]
<input checked="" type="checkbox"/> BOULDER [9]	<u>10</u>	<input type="checkbox"/> GRAVEL [7]	<input type="checkbox"/> SAND [6]	<input type="checkbox"/> BEDROCK [5]	(Score natural substrates; ignore sludge from point-sources)		<input type="checkbox"/> SILT [2]	<input type="checkbox"/> ARTIFICIAL [0]	<input type="checkbox"/> SANDSTONE [0]	<input type="checkbox"/> RIP/RAP [0]	<input type="checkbox"/> LACUSTURINE [0]	<input type="checkbox"/> SHALE [-1]	<input type="checkbox"/> COAL FINES [-2]	<input type="checkbox"/> HEAVY [-2]	<input type="checkbox"/> MODERATE [-1]	<input checked="" type="checkbox"/> NORMAL [0]	<input type="checkbox"/> FREE [1]	<input type="checkbox"/> EXTENSIVE [-2]	<input checked="" type="checkbox"/> MODERATE [-1]	<input type="checkbox"/> NORMAL [0]	<input type="checkbox"/> NONE [1]

NUMBER OF BEST TYPES:  4 or more [2]  3 or less [0]

17  
Maximum 20

2) Indicate presence 0 to 3: 0-Absent; 1-Very small amounts or If more common of marginal quality; 2-Moderate amounts, but not of highest quality or in small amounts of highest quality; 3-Highest quality in moderate or greater amounts (e.g., very large boulders in deep or fast water, large diameter log that is stable, well developed rootwad in deep / fast water, or deep, well-defined, functional pools.

<u>1</u> UNDERCUT BANKS [1]	<u>2</u> POOLS > 70cm [2]	<u>1</u> OXBOWS, BACKWATERS [1]	<input type="checkbox"/> EXTENSIVE >75% [11]
<u>1</u> OVERHANGING VEGETATION [1]	<u>1</u> ROOTWADS [1]	<u>1</u> AQUATIC MACROPHYTES [1]	<input checked="" type="checkbox"/> MODERATE 25-75% [7]
<u>2</u> SHALLOWS (IN SLOW WATER) [1]	<u>2</u> BOULDERS [1]	<u>1</u> LOGS OR WOODY DEBRIS [1]	<input type="checkbox"/> SPARSE 5-<25% [3]
<u>1</u> ROOTMATS [1]			<input type="checkbox"/> NEARLY ABSENT <5% [1]

14  
Maximum 20

3) Check ONE in each category (Or 2 & average)

<b>SINUOSITY</b>	<b>DEVELOPMENT</b>	<b>CHANNELIZATION</b>	<b>STABILITY</b>
<input type="checkbox"/> HIGH [4]	<input type="checkbox"/> EXCELLENT [7]	<input checked="" type="checkbox"/> NONE [6]	<input checked="" type="checkbox"/> HIGH [3]
<input type="checkbox"/> MODERATE [3]	<input checked="" type="checkbox"/> GOOD [5]	<input type="checkbox"/> RECOVERED [4]	<input type="checkbox"/> MODERATE [2]
<input checked="" type="checkbox"/> LOW [2]	<input type="checkbox"/> FAIR [3]	<input type="checkbox"/> RECOVERING [3]	<input type="checkbox"/> LOW [1]
<input type="checkbox"/> NONE [1]	<input type="checkbox"/> POOR [1]	<input type="checkbox"/> RECENT OR NO RECOVERY [1]	

16  
Maximum 20

4) River right looking downstream Check ONE in each category for (Or 2 per bank & average)

<b>EROSION</b>	<b>RIPARIAN WIDTH</b>	<b>FLOOD PLAIN QUALITY</b>	<b>CONSERVATION TILLAGE</b>
<input checked="" type="checkbox"/> NONE / LITTLE [3]	<input type="checkbox"/> WIDE > 50m [4]	<input type="checkbox"/> FOREST, SWAMP [3]	<input type="checkbox"/> URBAN OR INDUSTRIAL [0]
<input type="checkbox"/> MODERATE [2]	<input type="checkbox"/> MODERATE 10-50m [3]	<input type="checkbox"/> SHRUB OR OLD FIELD [2]	<input type="checkbox"/> MINING / CONSTRUCTION [0]
<input type="checkbox"/> HEAVY / SEVERE [1]	<input type="checkbox"/> NARROW 5-10m [2]	<input checked="" type="checkbox"/> RESIDENTIAL, PARK, NEW FIELD [1]	
	<input checked="" type="checkbox"/> VERY NARROW < 5m [1]	<input type="checkbox"/> FENCED PASTURE [1]	
	<input checked="" type="checkbox"/> NONE [0]	<input checked="" type="checkbox"/> OPEN PASTURE, ROWCROP [0]	

Indicate predominant land use(s) past 100m riparian.

5  
Maximum 10

5) **MAXIMUM DEPTH** Check ONE (ONLY)

- > 1m [6]
- 0.7-<1m [4]
- 0.4-<0.7m [2]
- 0.2-<0.4m [1]
- < 0.2m [0]

**CHANNEL WIDTH** Check ONE (Or 2 & average)

- POOL WIDTH > RIFFLE WIDTH [2]
- POOL WIDTH = RIFFLE WIDTH [1]
- POOL WIDTH > RIFFLE WIDTH [0]

**CURRENT VELOCITY** Check ALL that apply

- TORRENTIAL [-1]
- SLOW [1]
- VERY FAST [1]
- INTERSTITIAL [-1]
- FAST [1]
- INTERMITTENT [-2]
- MODERATE [1]
- EDDIES [1]

Indicate for reach - pools and riffles.

**Recreation Potential**  
(circle one end comment on back)

12  
Maximum 12

Indicate for functional riffles; Best areas must be large enough to support a population of riffle-obligate species: Check ONE (Or 2 & average).  NO RIFFLE [metric=0]

<b>RIFFLE DEPTH</b>	<b>RUN DEPTH</b>	<b>RIFFLE / RUN SUBSTRATE</b>	<b>RIFFLE / RUN EMBEDDEDNESS</b>
<input checked="" type="checkbox"/> BEST AREAS > 10cm [2]	<input checked="" type="checkbox"/> MAXIMUM > 50cm [2]	<input checked="" type="checkbox"/> STABLE (e.g., Cobble, Boulder) [2]	<input type="checkbox"/> NONE [2]
<input type="checkbox"/> BEST AREAS 5-10cm [1]	<input type="checkbox"/> MAXIMUM < 50cm [1]	<input type="checkbox"/> MOD. STABLE (e.g., Large Gravel) [1]	<input type="checkbox"/> LOW [1]
<input type="checkbox"/> BEST AREAS < 5cm [metric=0]		<input type="checkbox"/> UNSTABLE (e.g., Fine Gravel, Sand) [0]	<input checked="" type="checkbox"/> MODERATE [0]
			<input type="checkbox"/> EXTENSIVE [-1]

6  
Maximum 8

6) **DRAINAGE AREA** (ft/mi)  VERY LOW - LOW [2-4]  MODERATE [6-10]  HIGH - VERY HIGH [10-6]

**%POOL:** 20 **%GLIDE:** 0

**%RUN:** 40 **%RIFFLE:** 40

10  
Maximum 10

Comment RE: Reach consistency/ Is reach typical of stream?, Recreation/ Observed - Inferred, Other/ Sampling observations, Concerns, Access directions, etc.

Check ALL that apply

**METHOD**

- BOAT
- WADE
- L. LINE
- OTHER

**STAGE**

- HIGH
- UP
- NORMAL
- LOW
- DRY

**DISTANCE**

- 0.5 Km
- 0.2 Km
- 0.15 Km
- 0.12 Km
- OTHER

**CLARITY**

- 1st --sample pass-- 2nd
- < 20 cm
  - 20-<40 cm
  - 40-70 cm
  - > 70 cm/ CTB
  - SECCHI DEPTH

meters

**CANOPY**

- > 85%- OPEN
- 55%-<85%
- 30%-<55%
- 10%-<30%
- <10%- CLOSED

- 1st \_\_\_\_\_ cm
- 2nd \_\_\_\_\_ cm

- NUISANCE ALGAE
- INVASIVE MACROPHYTES
- EXCESS TURBIDITY
- DISCOLORATION
- FOAM / SCUM
- OIL SHEEN
- TRASH / LITTER
- NUISANCE ODOR
- SLUDGE DEPOSITS
- CSOs/SSOs/OUTFALLS

**AREA DEPTH**

- >100ft<sup>2</sup>
- >3ft

- PUBLIC / PRIVATE / BOTH / NA
- ACTIVE / HISTORIC / BOTH / NA
- YOUNG-SUCCESSION-OLD
- SPRAY / SNAG / REMOVED
- MODIFIED / DIPPED OUT / NA
- LEVEED / ONE SIDED
- RELOCATED / CUTOFFS
- MOVING-BEDLOAD-STABLE
- ARMoured / SLUMPS
- ISLANDS / SCOURED
- IMPOUNDED / DESICCATED
- FLOOD CONTROL / DRAINAGE

Circle some & COMMENT

- WWTP / CSO / NPDES / INDUSTRY
- HARDENED / URBAN / DIRT&GRIME
- CONTAMINATED / LANDFILL
- BMPs-CONSTRUCTION-SEDIMENT
- LOGGING / IRRIGATION / COOLING
- BANK / EROSION / SURFACE
- FALSE BANK / MANURE / LAGOON
- WASH H<sub>2</sub>O / TILE / H<sub>2</sub>O TABLE
- ACID / MINE / QUARRY / FLOW
- NATURAL / WETLAND / STAGNANT
- PARK / GOLF / LAWN / HOME
- ATMOSPHERE / DATA PAUCITY

- $\bar{x}$  width
- $\bar{x}$  depth
- max. depth
- $\bar{x}$  bankfull width
- bankfull  $\bar{x}$  depth
- W/D ratio
- bankfull max. depth
- floodprone  $x^2$  width
- entrench. ratio



1] Check Two substrate TYPE BOXES; estimate % or note every type present. Check ONE (Or 2 & average)

<b>BEST TYPES</b>	<b>POOL RIFFLE</b>	<b>OTHER TYPES</b>	<b>POOL RIFFLE</b>	<b>ORIGIN</b>	<b>QUALITY</b>
<input checked="" type="checkbox"/> BLDR /SLABS [10]	<input checked="" type="checkbox"/> 50	<input type="checkbox"/> HARDPAN [4]	<input type="checkbox"/>	<input type="checkbox"/> LIMESTONE [1]	<input type="checkbox"/> HEAVY [-2]
<input checked="" type="checkbox"/> BOULDER [9]	<input checked="" type="checkbox"/> 20	<input type="checkbox"/> DETRITUS [3]	<input type="checkbox"/>	<input type="checkbox"/> TILLS [1]	<input checked="" type="checkbox"/> MODERATE [-1]
<input type="checkbox"/> COBBLE [8]	<input checked="" type="checkbox"/>	<input type="checkbox"/> MUCK [2]	<input type="checkbox"/>	<input type="checkbox"/> WETLANDS [0]	<input type="checkbox"/> NORMAL [0]
<input type="checkbox"/> GRAVEL [7]	<input type="checkbox"/>	<input type="checkbox"/> SILT [2]	<input checked="" type="checkbox"/>	<input type="checkbox"/> HARDPAN [0]	<input type="checkbox"/> FREE [1]
<input checked="" type="checkbox"/> SAND [6]	<input checked="" type="checkbox"/> 40	<input type="checkbox"/> ARTIFICIAL [0]	<input type="checkbox"/>	<input checked="" type="checkbox"/> SANDSTONE [0]	<input checked="" type="checkbox"/> EXTENSIVE [-2]
<input type="checkbox"/> BEDROCK [5]	<input type="checkbox"/>	(Score natural substrates; ignore sludge from point-sources)		<input type="checkbox"/> RIP/RAP [0]	<input checked="" type="checkbox"/> MODERATE [-1]
<b>NUMBER OF BEST TYPES:</b>	<input type="checkbox"/> 4 or more [2]			<input type="checkbox"/> LACUSTURINE [0]	<input type="checkbox"/> NORMAL [0]
	<input checked="" type="checkbox"/> 3 or less [0]			<input type="checkbox"/> SHALE [-1]	<input type="checkbox"/> NONE [1]
				<input type="checkbox"/> COAL FINES [-2]	

14 Maximum 20

2] Indicate presence 0 to 3: 0-Absent; 1-Very small amounts or if more common of marginal quality; 2-Moderate amounts, but not of highest quality or in small amounts of highest quality; 3-Highest quality in moderate or greater amounts (e.g., very large boulders in deep or fast water, large diameter log that is stable, well developed rootwad in deep / fast water, or deep, well-defined, functional pools. Check ONE (Or 2 & average)

<b>AMOUNT</b>	<b>UNDERCUT BANKS [1]</b>	<b>POOLS &gt; 70cm [2]</b>	<b>OXBOWS, BACKWATERS [1]</b>
<input type="checkbox"/> EXTENSIVE >75% [11]	<input checked="" type="checkbox"/> 2	<input checked="" type="checkbox"/> 2	<input type="checkbox"/> AQUATIC MACROPHYTES [1]
<input checked="" type="checkbox"/> MODERATE 25-75% [7]	<input type="checkbox"/> 1	<input type="checkbox"/> 1	<input type="checkbox"/> LOGS OR WOODY DEBRIS [1]
<input type="checkbox"/> SPARSE 5-<25% [3]	<input type="checkbox"/> 0	<input type="checkbox"/> 0	
<input type="checkbox"/> NEARLY ABSENT <5% [1]	<input type="checkbox"/> 0	<input type="checkbox"/> 0	
	<input type="checkbox"/> 0	<input type="checkbox"/> 0	

14 Maximum 20

3] Check ONE in each category (Or 2 & average)

<b>SINUOSITY</b>	<b>DEVELOPMENT</b>	<b>CHANNELIZATION</b>	<b>STABILITY</b>
<input type="checkbox"/> HIGH [4]	<input type="checkbox"/> EXCELLENT [7]	<input checked="" type="checkbox"/> NONE [6]	<input checked="" type="checkbox"/> HIGH [3]
<input type="checkbox"/> MODERATE [3]	<input checked="" type="checkbox"/> GOOD [5]	<input type="checkbox"/> RECOVERED [4]	<input type="checkbox"/> MODERATE [2]
<input checked="" type="checkbox"/> LOW [2]	<input type="checkbox"/> FAIR [3]	<input type="checkbox"/> RECOVERING [3]	<input type="checkbox"/> LOW [1]
<input type="checkbox"/> NONE [1]	<input type="checkbox"/> POOR [1]	<input type="checkbox"/> RECENT OR NO RECOVERY [1]	

16 Maximum 20

4] Check ONE in each category for (Or 2 per bank & average)

<b>EROSION</b>	<b>RIPARIAN WIDTH</b>	<b>FLOOD PLAIN QUALITY</b>	<b>CONSERVATION TILLAGE [1]</b>
<input checked="" type="checkbox"/> NONE / LITTLE [3]	<input type="checkbox"/> WIDE > 50m [4]	<input type="checkbox"/> FOREST, SWAMP [3]	<input checked="" type="checkbox"/> URBAN OR INDUSTRIAL [0]
<input type="checkbox"/> MODERATE [2]	<input type="checkbox"/> MODERATE 10-50m [3]	<input type="checkbox"/> SHRUB OR OLD FIELD [2]	<input checked="" type="checkbox"/> MINING / CONSTRUCTION [0]
<input type="checkbox"/> HEAVY / SEVERE [1]	<input type="checkbox"/> NARROW 5-10m [2]	<input checked="" type="checkbox"/> RESIDENTIAL, PARK, NEW FIELD [1]	
	<input checked="" type="checkbox"/> VERY NARROW < 5m [1]	<input type="checkbox"/> FENCED PASTURE [1]	
	<input checked="" type="checkbox"/> NONE [0]	<input type="checkbox"/> OPEN PASTURE, ROWCROP [0]	

5 Maximum 10

5] **MAXIMUM DEPTH** Check ONE (ONLY!) **CHANNEL WIDTH** Check ONE (Or 2 & average) **CURRENT VELOCITY** Check ALL that apply

<input checked="" type="checkbox"/> > 1m [6]	<input checked="" type="checkbox"/> POOL WIDTH > RIFFLE WIDTH [2]	<input type="checkbox"/> TORRENTIAL [-1]	<input checked="" type="checkbox"/> SLOW [1]
<input type="checkbox"/> 0.7-<1m [4]	<input type="checkbox"/> POOL WIDTH = RIFFLE WIDTH [1]	<input checked="" type="checkbox"/> VERY FAST [1]	<input type="checkbox"/> INTERSTITIAL [-1]
<input type="checkbox"/> 0.4-<0.7m [2]	<input type="checkbox"/> POOL WIDTH > RIFFLE WIDTH [0]	<input checked="" type="checkbox"/> FAST [1]	<input type="checkbox"/> INTERMITTENT [-2]
<input type="checkbox"/> 0.2-<0.4m [1]		<input checked="" type="checkbox"/> MODERATE [1]	<input type="checkbox"/> EDDIES [1]
<input type="checkbox"/> < 0.2m [0]		Indicate for reach - pools and riffles.	

Recreation Potential (circle one and comment on back)

12 Maximum 12

Indicate for functional riffles; Best areas must be large enough to support a population of riffle-obligate species: Check ONE (Or 2 & average)

<b>RIFFLE DEPTH</b>	<b>RUN DEPTH</b>	<b>RIFFLE / RUN SUBSTRATE</b>	<b>RIFFLE / RUN EMBEDDEDNESS</b>
<input checked="" type="checkbox"/> BEST AREAS > 10cm [2]	<input checked="" type="checkbox"/> MAXIMUM > 50cm [2]	<input checked="" type="checkbox"/> STABLE (e.g., Cobble, Boulder) [2]	<input type="checkbox"/> NONE [2]
<input type="checkbox"/> BEST AREAS 5-10cm [1]	<input type="checkbox"/> MAXIMUM < 50cm [1]	<input type="checkbox"/> MOD. STABLE (e.g., Large Gravel) [1]	<input type="checkbox"/> LOW [1]
<input type="checkbox"/> BEST AREAS < 5cm [metric=0]		<input type="checkbox"/> UNSTABLE (e.g., Fine Gravel, Sand) [0]	<input checked="" type="checkbox"/> MODERATE [0]
			<input type="checkbox"/> EXTENSIVE [-1]

6 Maximum 8

6] **DRAINAGE AREA** (ft/mi)  VERY LOW - LOW [2-4] **%POOL:** 10 **%GLIDE:**

(mi<sup>2</sup>)  MODERATE [6-10] **%RUN:** 20 **%RIFFLE:** 70 **Maximum 10**

HIGH - VERY HIGH [10-6]

Comment RE: Reach consistency/ Is reach typical of stream?, Recreation/ Observed - Inferred, Other/ Sampling observations, Concerns, Access directions, etc.

Check ALL that apply

**METHOD**

BOAT

WADE

L. LINE

OTHER

**DISTANCE**

0.5 Km

0.2 Km

0.15 Km

0.12 Km

OTHER

200  
meters

**STAGE**

1st-sample pass- 2nd

HIGH

UP

NORMAL

LOW

DRY

**CLARITY**

1st --sample pass-- 2nd

< 20 cm

20-40 cm

40-70 cm

> 70 cm/ CTB

SECCHI DEPTH

**CANOPY**

1st \_\_\_\_\_ cm

2nd \_\_\_\_\_ cm

> 85%- OPEN

55%-<85%

30%-<55%

10%-<30%

<10%- CLOSED

NUISANCE ALGAE

INVASIVE MACROPHYTES

EXCESS TURBIDITY

DISCOLORATION

FOAM / SCUM

OIL SHEEN

TRASH / LITTER

NUISANCE ODOR

SLUDGE DEPOSITS

CSOs/SSOs/OUTFALLS

AREA DEPTH

>100ft<sup>2</sup>  >3ft

PUBLIC / PRIVATE / BOTH / NA

ACTIVE / HISTORIC / BOTH / NA

YOUNG-SUCCESSION-OLD

SPRAY / SNAG / REMOVED

MODIFIED / DIPPED OUT / NA

LEVEED / ONE SIDED

RELOCATED / CUTOFFS

MOVING-BEDLOAD-STABLE

ARMoured / SLUMPS

ISLANDS / SCoured

IMPOUNDED / DESICCATED

FLOOD CONTROL / DRAINAGE

Circle some & COMMENT

WWTP / CSO / NPDES / INDUSTRY

HARDENED / URBAN / DIRT&GRIME

CONTAMINATED / LANDFILL

BMPs-CONSTRUCTION-SEDIMENT

LOGGING / IRRIGATION / COOLING

BANK / EROSION / SURFACE

FALSE BANK / MANURE / LAGOON

WASH H<sub>2</sub>O / TILE / H<sub>2</sub>O TABLE

ACID / MINE / QUARRY / FLOW

NATURAL / WETLAND / STAGNANT

PARK / GOLF / LAWN HOME

ATMOSPHERE / DATA PAUCITY

$\bar{x}$  width

$\bar{x}$  depth

max. depth

$\bar{x}$  bankfull width

bankfull  $\bar{x}$  depth

W/D ratio

bankfull max. depth

floodprone x<sup>2</sup> width

entrench. ratio



# **APPENDIX B:**

## **CRAYFISH SURVEY FIELD DATA SHEETS**

# Cambarus callainus/Cambarus veteranus Survey Data Sheet

Date: 4 / 12 / 18 Project Name: 1708.01 EIKHORN CITY BSC SURVEY

Stream name: RUSSELL FORK Collection #: RF1 (DOWNSTREAM)

Trib. of: LEUSA FORK Basin: BIG SANDY RIVER Co: PIKE CO, KY

Town: EIKHORN CITY Geographic marker: 30m US OF EIKHORN CREEK CONFLUENCE

0.15 miles (NSE W) of EIKHORN CITY Elevation: 760 +/- Stream Order: 4

Road/bridge: 200m DS OF RTE 80 BRIDGE Specific Location: 200m DS OF ROUTE 80

BRIDGE CROSSING THE RUSSEL FORK

\_\_\_\_\_ Northing: 4629324.28 Easting: ~~380028.62~~ (NAD83, Zone 17)

Stream Width: +/- 70' Stream Depth: 3.0 Total # Seine Hauls: 14

Investigators/Firm: ATS T. LOWE C. ISAAC

Collectors: T. LOWE, C. ISAAC, J. BREEDING, B. BLUESIE

Temp(C)	SpCon(mS/cm)	TDS(g/L)	Sal(ppt)	pH	Turb(NTU)	%DO
12.6	364.4	—	—	8.42	23	11.72

## Species Collected

Species	I♂	II♂	♀	B♀	Juv.	Total
1.) <i>C. callainus</i>		5	4			9
2.)						
3.)						
4.)						
5.)						

Species	Number of Species Per Seine Haul									
	1	2	3	4	5	6	7	8	9	10
<i>O. cristivarius</i>										
<i>C. theepiensis</i>										
<i>C. hatfieldi</i>										
<i>C. callainus</i>					2	1	3	1		
<i>C. veteranus</i>										

	11	12	13	14
<i>C. callainus</i>			2	











# **APPENDIX C:**

## **BIG SANDY CRAYFISH PHOTOS**



Photo 1 - Form II Male 25CL collected at RF1



Photo 2 - Female 26CL collected at RF1





Photo 3 – Female 41CL collected at RF1



Photo 4 – Female 40CL collected at RF1



Photo 5 – Female 36CL collected at RF1



Photo 6 - Form II Male 28CL collected at RF1





Photo 7 - Form II Male 37CL collected at RF1



Photo 8 - Form II Male 25CL collected at RF1





Photo 9 - Form II Male 25CL collected at RF1



Photo 10 - Female 41CL collected at RF2



Photo 11 - Female 42CL collected at RF2



Photo 12 - Form I Male 44CL collected at RF2





Photo 13 - Female 41CL collected at RF2



Photo 14 - Female 43CL collected at RF2





Photo 15 - Female 44CL collected at RF2



Photo 16 - Female 40CL collected at RF2



Photo 17 - Female 40CL collected at RF2



Photo 18 - Female 39CL collected at RF2

**APPENDIX D:**

**COLLECTING PERMIT  
& USFWS STUDY PLAN APPROVAL**





## Issuing Office:

Department of the Interior  
U.S. FISH & WILDLIFE SERVICE  
Ecological Services Permit Office  
1875 Century Boulevard  
Atlanta, GA 30345  
permitsR4ES@fws.gov



CHIEF, DIVISION OF ENVIRONMENTAL REVIEW

## Permittee:

**TIMOTHY B COMPTON**  
dba APPALACHIAN TECHNICAL SERVICES  
P.O. BOX 3537  
WISE, VA 24293  
U.S.A.

Authority: Statutes and Regulations: 16 USC 1539(a), 16 USC 1533(d); 50 CFR 17.22, 50 CFR 17.32, 50 CFR 13.

**Location where authorized activity may be conducted:**  
**SEE CONDITION C.1. (below)**

**Reporting requirements:**

Annual reports are due by January 31 following each year that this permit is in effect.

**Conditions and Authorizations:**

A. General conditions set out in Subpart B of 50 CFR 13, and specific conditions contained in Federal regulations cited above, are hereby made a part of this permit. All activities authorized herein must be carried out in accordance with and for the purposes described in the application submitted. Continued validity, or renewal of this permit is subject to complete and timely compliance with all applicable conditions, including the filing of all required information and reports.

B. The validity of this permit is also conditioned upon strict observance of all applicable foreign, state, local tribal, or other federal law.

**C.1. Location of permitted activities:**

**Bats:** Alabama, Georgia, Indiana, Kentucky, Mississippi, North Carolina, Ohio, Pennsylvania, Tennessee, Virginia, and West Virginia.

**Fish, Mussels, and Crayfish:** Kentucky, Tennessee, Virginia, and West Virginia

**C.2.** The following individuals are authorized to conduct activities as authorized by this permit: ***For All Species/Activities:*** Christopher L. Isaac and Travis N. Lowe; ***For All Bat Species/Activities:*** Franklin D. Colyer, III; ***For Indiana Bat And Northern Long-Eared Bats/All Activities Except Entering Hibernacula And Harp***



**Trapping:** James Breeding.

Trained assistants not named on this permit may work on permitted activities under the direct and on-site supervision of the individuals named above. However, trained assistants may not work independently at a site. All site investigators that will handle fish, mussels, crayfish, and bats shall be trained in their identification and handling techniques, advised on the laws and restrictions related to listed species, and apprised of permit conditions. The number of site investigators at any site shall be of an appropriate, manageable, size so that the permittee shall observe actions and prevent or limit harm to listed species and their habitats.

D. Acceptance of this permit serves as evidence that the permittee understands and agrees to abide by the terms of this permit and all sections of title 50 Code of Federal Regulations, Parts 13 and 17, pertinent to issued permits. Section 11 of the Endangered Species Act of 1973, as amended, provides for civil and criminal penalties for failure to comply with the permit conditions. In addition, the permittee shall have all other applicable Federal, Tribal, State, and/or local government permits prior to the commencement of activities authorized in this permit.

E. The permitted activities described herein require prior, site-specific approval from the U.S. Fish and Wildlife Service (USFWS) Field Supervisor in the State(s) where the project will occur. Permittee shall notify the USFWS Field Supervisor for the State in which activities are proposed to occur at least 15 days prior to conducting any activities. Contact information is in Condition N., below. Your request for this site-specific approval must be in writing and must indicate:

1. The purpose and a description of the activities proposed (e.g., surveys, radio telemetry studies, etc.).
2. Location of proposed activities, including project site (legal description and lat/long), county, and state.
3. Dates when the project is proposed to take place.
4. You may proceed with activities only upon receipt of written concurrence from the applicable USFWS Field Supervisor. *Your concurrence letter must be carried with this permit to authorize site-specific activities.*

**This permit is not valid without applicable concurrence letter(s) for activities and any required State permits.**

F. Permittee is authorized to take (enter hibernacula, capture with mist nets or harp traps, handle, band, radio-tag, and release) **BATS:** Indiana bats (*Myotis sodalis*), gray bats (*Myotis grisescens*), northern long-eared bats (*Myotis septentrionalis*), Virginia big-eared bats (*Corynorhinus towusendii virginianus*); take (capture via seining, netting, trapping, or electroshocking, handle, identify, and release) **FISH:** blackside dace (*Phoxinus cumberlandensis*), Cumberland darter (*Etheostoma susanae*), duskytail darter (*Etheostoma percnurum*), Kentucky arrow darter (*Etheostoma spilotum*); take (remove from the substrate for identification, data collection, tagging, and return) **MUSSELS:** Appalachian monkeyface (*Quadrula sparsa*), birdwing pearl mussel (*Conradilla caelata*), clubshell (*Pleurobema decisum*), cracking pearl mussel (*Heuistena lata*), Cumberland bean (*Villosa trabilis*), Cumberland combshell (*Epioblasma brevidens*), Cumberland elktoe (*Alasmidonta atropurpurea*), Cumberland monkeyface (*Quadrula intermedia*), Cumberlandian combshell (*Epioblasma brevidens*), dromedary pearl mussel (*Dromus dromas*), fanshell (*Cyprogenia stegaria*), fat pocketbook (*Potamilus capax*), fine-rayed pigtoe (*Fusconia cor*), fluted kidneyshell (*Ptychobrauchus subtentum*), littlewing pearl mussel (*Pegias fabula*), northern riffleshell (*Epioblasma*



*torulosa rangiana*), orangefoot pimpleback (*Plethobasus cooperianus*), oyster mussel (*Epioblasma capsaeformis*), pink mucket (*Lampsilis abrupta*), purple bean (*Villosa perpurpurea*), purple cat's paw (*Epioblasma obliquata obliquata*), rabbitsfoot (*Quadrula cylindrica* ssp. *cylindrica*), ring pink (*Obovaria retusa*), rough pigtoe (*Pleurobema plenum*), rough rabbitsfoot (*Quadrula cylindrica strigillata*), sheepnose mussel (*Plethobasus cyphus*), shiny pigtoe (*Fusconia cuneolus*), slabside pearl mussel (*Pleuonaia dolabellodes*), snuffbox mussel (*Epioblasma triquetra*); take (capture via seining, handle, identify, and release **CRAYFISH**: Guyandotte River crayfish (*Cambarus veteranus*) and Big Sandy crayfish (*Cambarus callainus*) while conducting presence/absence surveys and scientific research aimed at recovery of the species, as specified in permittee's June 15, 2016, and previous applications, and as conditioned below:

1. **Bats:**

- a. The federally listed bats specified above may be captured following the protocol(s) provided by the USFWS, when available. Permittees must contact the USFWS FO in the State(s) in which activities are proposed to ensure correct protocol(s) are used. For example, the current Range-wide Indiana Bat Summer Survey Guidelines are available at: <http://www.fws.gov/midwest/endangered/mammals/inba/inbasummersurveyguidance.html>. The monitoring interval for mist nets is once every 10 minutes. Harp traps must be continually monitored.
- b. Captured bats may be held for a maximum of 30 minutes, unless injured. If an exception is required to this prohibition, permittee must receive prior written approval from the USFWS Field Supervisor for the state in which the activities are proposed to occur.
- c. Permittees shall carry out non-intrusive measurements on all captured bats. Data shall be recorded for all bats captured and include, but not be limited to, the data requested in any automated or species specific data form provided by the USFWS (e.g., USFWS Bat Reporting Form available at: <http://www.fws.gov/midwest/Endangered/mammals/inba/inbasummersurveyguidance.html>). Handling should be limited to the maximum extent practicable and should cease immediately at signs of undue stress (e.g., bat becoming unresponsive, etc.). Bats that appear stressed from handling should be placed in a dark, quiet location away from activity where it can safely fly away after recovery, and should be checked to ensure successful recovery before leaving the study site. Photographs of the identifying characteristics for each individual federally listed species captured are encouraged. The permittee may be requested to provide individual photographs after submittal of annual reporting data.
- d. If bands are applied, they must be lipped metal bands having a unique identifier. Bands should be applied to the forearm of captured bats prior to release. No more than one band per bat may be used. Position the band on the wing so that when the bat is hanging upside down, the band numbers are right-side up. A single band should be placed on the right forearm of each male and the left forearm of each female bat.
- e. Radio transmitters may be applied during spring, summer, and fall roosting and migration periods via nontoxic skin bond adhesive. The total weight of the transmitter may not exceed 5% of the bat's body weight and the total weight of the package (transmitter and adhesive) may not exceed 6% of the bat's body weight. The lightest package (both transmitter and adhesive) capable of accomplishing the required task should be used, especially with pregnant females and newly volant juveniles. Bats carrying transmitters must be monitored daily for at least five days, or until



the transmitter falls off, whichever occurs first. \* *Although not required as a condition of this permit, in order to gather needed information to promote the conservation of the northern long-eared bat, it is recommended that the permittee radio-track female and juvenile northern long-eared bats captured when conducting mist-netting and radio-tracking of Indiana bats within the white-nose syndrome (WNS) zone of the range of the northern long-eared bat. Specifics on the number of females and juvenile bats to be tracked will be determined in coordination with the appropriate Field Office, as specified in Condition E (above).*

f. No capture activities shall occur within 20 meters of a known or potential summer or winter roost site, either natural or artificial, of a federally listed bat. If an exception is required to this prohibition, permittee must receive prior written approval from the USFWS Field Supervisor for the State in which the activities are proposed to occur.

g. Equipment used to capture and handle bats shall be cleaned and decontaminated, including personal gear such as boots and gloves, using products cited in decontamination guidelines and in compliance with label directions. The most recent decontamination guidance is found on the web at: <http://whitenosesyndrome.org/>.

h. Caves, mines, or other suitable hibernation sites may be quietly searched in a manner that minimizes disturbance by utilizing the minimum number of people and time required to complete the survey. Surveys of known hibernacula conducted during the winter hibernation season shall follow the guidelines established in the recovery plans for each federally listed bat species with regards to how often a site may be visited and other species-specific requirements related to entering hibernaculum (for example, for Indiana bats, winter surveys should not be repeated more often than once every other year in any given hibernaculum), unless authorized by the appropriate USFWS Recovery Lead identified in Condition O (below).

Under no circumstances should multiple trips to the hibernation area occur within the same year without written approval of the USFWS Field Supervisor for the state in which activities are proposed.

Bats may be handled during winter surveys in order to collect band information and confirm the identification of listed species. When possible, bands should be read without touching the bat. Banded bats should only be handled if easily accessible and removal of the bat does not disturb a large number of additional bats and is unlikely to result in injury to the bat. Detailed photographs should be taken to document the presence of listed species in previously undocumented hibernaculum. Where hibernacula area and safety conditions allow, individuals entering hibernacula are recommended to utilize night vision goggles or red-filtered light and to remain in the site no more than 90 minutes to complete the work.

i. Surveys of gray bat and Virginia big-eared bat maternity roosts and their other known summer roost sites shall be conducted by observing the bats with night vision equipment and/or infrared light sources (e.g., thermal infrared) as they emerge from their roosts to avoid any possible disturbance to these bats. At previously undocumented sites for these species, the accepted method to determine if they are present is to carefully and slowly enter the potential roost site to check for evidence of presence/use, such as visual observation of bats, significant quantities or a strong smell of guano, or the audible sounds produced by bats roosting at the site. As soon as any evidence is obtained that the roost site is being used by a federally listed bat species, survey team members shall immediately exit the roost site and make further observations from outside the entrance to the roost. All further observations shall be made from the entrance during the evening emergence.

j. Upon determination that endangered bats are present, permittee shall notify the following offices immediately (not to exceed 1 business day): the USFWS Field Office within the geographic location of study areas (Condition N.).

## 2. Fish:





- a. Freshwater fishes may be captured by hand seining, netting, or electro-fishing (except where prohibited) and observed via wading, snorkeling, scuba diving.
- b. Electrofishing may be employed only as a last resort measure for approved research projects if the conditions are appropriate for the presence of the species and if no individuals are located through seining or visual methods.
- c. Electrofishing equipment shall be used to elicit fright or narcosis only, not tetany, and, when used, shall be at minimal levels, in combination with a seine or downstream nets to minimize harm to listed species.
- d. Electrofishing may not be used when conducting fish surveys in Guyandotte River crayfish (*Cambarus veteranus*) and Big Sandy crayfish (*Cambarus callainus*) sites.
- d. No endangered or threatened fish may be retained as voucher specimens.
- e. Before any site investigations, the permittee shall ensure that conditions are favorable for observation and sampling of all suitable in-stream habitats and the acquisition of a representative sample of the aquatic community.
- f. If collected fishes must be held temporarily during survey efforts, they must be kept in containers with flowing water (i.e., aerated holding buckets, submerged seine). If an aerated bucket is used, the bucket shall be kept cool (out of direct sun) and clean (e.g., did not previously contain formalin or other preservatives or toxins) and shall not contain other species (e.g., crayfish or other fish species). Holding shall be limited to 30 minutes.
- g. Captured fish shall be released as close as possible to the point of capture. They shall be released by hand at the substrate level to avoid higher risk of predation and allowed to swim under their own power from the hand to the substrate.
- h. If a federally listed fish species that is not included in this permit is found in the action area or outside of its currently known range, the permittee shall promptly notify the appropriate USFWS office identified in Condition N., below.

### 3. Freshwater mussels:

- a. Permittee may survey for mussels by hand collecting via wading, snorkeling, or scuba diving. Under certain circumstances, brailing (raking) may be used to collect specimens. In these instances, the methods of collection, handling, and release must be pre-approved by the USFWS lead recovery biologist for the species and all affected Field Office(s) (see list of offices in Condition N.).
- b. Permittee may temporarily hold specimens in mesh bags, either suspended in the water or held in a container containing river water, while awaiting identification and data collection. Specimens may be held for up to 3 hours provided that they are held in the water in bags that allow free movement of water the mussels were taken from or held in buckets of water that is changed every hour (every half-hour when air temperatures are at or above 80° F) and replaced with water freshly taken from where the mussels were collected. Specimens must be returned to the locality from which they were taken. No live specimens may be removed from the site unless authorized for relocation efforts. Live specimens that cannot be identified at the site must be photographed for identification purposes and immediately returned to the substrate.
- c. Collection of mussels must be done only when the air temperature is above 32° F and the water temperature is



above 40° F. Specimens shall be returned to the point of capture and hand-placed into the substrate. The substrate shall be loosened in a circular area with a diameter about 1.5 - 2 times the length of the mussel. Mussels shall be placed at least halfway or entirely into the substrate near the center of the loosened area, ensuring that the anterior of the shell is exposed to water with the siphon end up and pointing upstream.

d. All live mussels shall be measured (length and height) and, if possible, sexed and aged. No intrusive activities are permitted. Random samples will be taken and sample locations will be determined using a stratified, random design. Data collected will include descriptions of external morphometry and reproductive status.

e. Live mussels of sufficient size may be tagged or marked (etched) prior to returning to the substrate. Any marked mussels must be photographed with the mark clearly visible. Photos of marked mussels must be included in or attached to annual reports.

f. No live specimens may be removed from the survey sites, except for specimens encountered in circumstances which would reasonably be expected to result in stranding due to low or receding water, in which case such specimens must be moved to suitable habitat that is not in danger of low or receding water within the same water body as close as possible to the collection site.

#### **4. Guyandotte River crayfish and Big Sandy crayfish:**

a. Surveys shall be performed using an 8' x 4' seine, with double leads and double floats and 1/8" netting.

b. Surveys may not be conducted during the reproductive season of either species (July 20-September 10).

c. Surveys may be conducted only when water temperatures are above 50 degrees Fahrenheit (10 degrees Celsius).

d. Surveys may not be conducted for 72 hours following a precipitation event greater than 0.5 inches (1.3 centimeters).

e. Individuals may be held temporarily during field surveys in clean, aerated buckets or holding tanks, for a maximum time of 30 minutes. No more than five (5) individuals may be held in the same bucket or holding tank at any given time.

G. No injury or mortality is expected to occur to federally listed species covered under this permit. If any injury or mortality does occur, the permittee shall immediately notify the appropriate USFWS Field Office noted in Condition N., below. Notification shall also be made within 24 hours to the Region4 Permit Coordinator at the address and telephone number noted in Condition M.1., below. Based on consultation between these offices, a decision will be made as to whether any of the authorized activities can continue. Decisions will also be made concerning the disposition of any dead or injured specimens within 5 working days of an injury or mortality. The permittee shall provide a written statement to the Service offices noted in Conditions M. and N., below, which documents the cause of the injury or mortality, and identifies the remedial measures employed by the permittee to eliminate future mortality or injury events. The final decision on remedial measures rests with the Service.

H. Permittee must carry a copy of this permit at all times when conducting the authorized activities.

I. This permit is non-transferable.



J. Issuance of this permit does not constitute permission to conduct these activities on national wildlife refuges or any other public or private lands; such permission must be obtained separately from the appropriate landowner or land manager before beginning these authorized activities. This permit, neither directly nor by implication, grants the right of trespass.

K. Upon locating a dead, injured, or sick federally listed species, under circumstances not addressed in this authorization, initial notification must be made immediately to the USFWS Field Office in the State in which the specimen is found, identified in Condition N., below. Notification should also be made by the next work day to the USFWS' Region 4 Permit Coordinator identified in Condition M.I., below. Care should be taken in handling sick, injured, or dead specimens to ensure effective treatment or to preserve biological materials for later analysis. In conjunction with the care of sick or injured endangered or threatened species, and the preservation of biological materials from a dead animal, the finder should take responsible steps to ensure that the site is not unnecessarily disturbed.

L. Reports are due on January 31 following each year this permit is in effect and must be submitted to the offices identified in Conditions M, N, and (below). When possible, electronic copies shall be submitted in lieu of hard copies in MS Word, Portable Document Format, Rich Text Format, or other file format that is compatible with the receiving office. At a minimum, the report shall include:

**For All Species:**

1. The name(s) and organization affiliation of all members of the survey crew.
2. The project for which the survey was conducted and the target species.
3. The date of the survey.
4. Locations of the survey sites. Locations shall be noted using figures, maps, and by referencing a common coordinate system (e.g., latitude longitude, universal transverse mercator system, etc.).
5. Survey methods used and a map showing the survey location, with state and county designations, along with a description of the area sampled, noting biotic and abiotic features that might influence sample composition.
6. Species abundance and richness at each sample event, including parameters describing sampling effort.
7. The results of the sampling, with discussions and interpretations of the data in context to recovery of the species.
8. A description of any mortality, injuries, deformities, or other abnormalities observed and disposition of specimens.
9. Copies of all published data and reports.
10. Copies of all site-specific authorization letters required under Condition E.

**For Bats:**

10. All locations surveyed (regardless of whether federally listed bats were captured/observed).
11. Band numbers of all bats banded and all bats recovered/observed.
12. Location and characteristics of roost trees and bat colonies.
13. Data shall be submitted for all bats captured and include, but not be limited to, the data requested in any automated or species-specific data submission document provided by the USFWS (e.g., USFWS Bat Reporting spreadsheet available at: <http://www.fws.gov/midwest/Endangered/mammals/inba/inbasummersurveyguidance.html>). Photographs of the identifying characteristics for each individual federally listed species captured are encouraged. The permittee may be requested to provide individual photographs after submittal of annual reporting data.

**For Fish and Mussels:**

14. The length of each survey reach and the latitude/longitude of the start and end location of each stream reach
15. Water quality data, including velocity, visibility, temperature, DO, pH, turbidity, and conductivity
16. A narrative describing stream substrate, riparian vegetation, instream vegetation, and other notable site characteristics





17. A list of fish and mussels collected in each sample reach, the number collected per species in each sample reach, and whether each collected fish and mussel was released live, retained in captivity, injured, or killed.

**For Crayfish:**

18. A narrative describing notable site characteristics.

19. A list of crayfishes (all species) observed in each area, with coordinates and accompanying photographs (if available).

IF NO ACTIVITIES OCCURRED OVER THE COURSE OF THE YEAR, INDICATION OF SUCH SHALL BE SUBMITTED AS AN ANNUAL REPORT.

M. For purposes of monitoring compliance and administration of the terms and conditions of this permit, the contact office of the U.S. Fish and Wildlife Service is:

M.1.  
U.S. Fish and Wildlife Service (Region 4)  
Attn: Permit Coordinator  
1875 Century Boulevard  
Atlanta, Georgia 30345 3301  
Telephone: 404/679 7101  
Facsimile: 404/679 7081

In addition, copies of annual reports must be submitted to the Regional Offices listed below:

M.2.  
U.S. Fish and Wildlife Service (Region 3)  
Attn: Permit Coordinator  
Division of Endangered Species  
1 Federal Drive  
Fort Snelling, Minnesota 55111 4056  
Telephone: 612/725 3536  
Facsimile: 612/725 3526

M.3.  
U.S. Fish and Wildlife Service (Region 5)  
Division of Endangered Species  
300 Westgate Center Drive  
Hadley, Massachusetts 01035 9589 Telephone: 413/253 8627

N. Copies of annual reports shall also be sent to the following:

1. For studies conducted in Alabama:  
Field Supervisor  
U.S. Fish and Wildlife Service  
1208-B Main Street  
Post Office Box 1190  
Daphne, Alabama 36526  
Telephone: 251/441-5181



2. For studies conducted in Georgia:

Field Supervisor  
U.S. Fish and Wildlife Service  
247 South Milledge Avenue  
330 West Broadway Athens, Georgia 30605  
Telephone: 706/613-9493

3. For studies conducted in Indiana:

a. Lori Pruitt  
Endangered Species Coordinator for Indiana  
U.S. Fish and Wildlife Service  
Ecological Services Field Office  
620 S. Walker Street  
Bloomington, Indiana 47403-2121  
(812/334-4261 x1213; fax 812/334-4273)

b. Scott Johnson  
Indiana Department of Natural Resources  
5596 East State Road 46  
Bloomington, Indiana 47401  
(812/334-1137, ext. 3400)

4. For studies conducted in Kentucky:

Field Supervisor  
U.S. Fish and Wildlife Service  
JC Watts Federal Building, Room 266  
Frankfort, Kentucky 40601  
Telephone: 913/528-6481

5. For studies conducted in Mississippi:

Field Supervisor  
U.S. Fish and Wildlife Service  
6578 Dogwood View Parkway, Suite A  
Jackson, Mississippi 39213  
Telephone: 601/965 4900

6. For studies conducted in North Carolina:

6.a.  
Field Supervisor  
U.S. Fish and Wildlife Service  
160 Zillicoa Street  
Asheville, North Carolina 28801  
Telephone: 828/258-3939

6.b.  
Field Supervisor



Raleigh Field Office  
Post Office Box 33726  
Raleigh, North Carolina 27636-3726  
(919) 856-4520

7. For studies conducted in Ohio:

Field Supervisor  
U.S. Fish and Wildlife Service  
6950-H Americana Parkway  
Reynoldsburg, Ohio 43068  
Telephone: 614/469-6923  
Facsimile: 614/469-6919

8. For studies conducted in Pennsylvania:

Field Supervisor  
Pennsylvania Field Office  
315 So. Allen Street, Suite 322  
State College, PA 16801-4850  
(814) 234-4090

9. For studies conducted in Tennessee:

Field Supervisor  
U.S. Fish and Wildlife Service  
446 Neal Street  
Cookeville, Tennessee 38501  
Telephone: 931/528 6481

10. For studies conducted in Virginia:

Virginia Field Office  
U.S. Fish and Wildlife Service  
6669 Short Lane  
Gloucester, Virginia 23061

11. For studies conducted in West Virginia:

Field Supervisor  
U.S. Fish and Wildlife Service  
694 Beverly Pike  
Elkins, West Virginia 26241  
Telephone: 304/636-6586

O. Additionally, based on the bat species involved, reports and publications shall be submitted to the following Recovery Leads:

O.1. For activities/studies involving Indiana Bats:

Lori Pruitt, Recovery Lead  
U.S. Fish and Wildlife Service





Indiana Ecological Services Field Office  
620 S. Walker Street  
Bloomington, Indiana 47403-2121  
(812/334-4261 x1213; fax 812/334-4273)

O.2. For activities/studies involving Gray Bats:

Shauna Marquardt, Recovery Lead  
U.S. Fish and Wildlife Service  
Missouri Ecological Services Field Office  
101 Park De Ville Drive, Suite A  
Columbia, Missouri 65203  
(573/234-2132 x174; fax 573/234-2181)

O.3. For activities/studies involving Northern Long-eared Bats:

Jill Utrup, Recovery Lead  
U.S. Fish and Wildlife Service  
Twin Cities Ecological Services Field Office  
4104 American Blvd. E  
Bloomington, Minnesota 55425  
(612/725-3548 x207; fax 612/725-3609)

O.4. For Studies involving Virginia Big-eared Bats:

Barbara Douglas  
U.S. Fish and Wildlife Service  
West Virginia Ecological Services Field Office  
694 Beverly Pike  
Elkins, West Virginia 26241  
(304/636-6586 x19; fax 304/636-7824)

**END**

## Travis Lowe

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**From:** Martin, Santiago <santiago\_martin@fws.gov>  
**Sent:** Monday, April 02, 2018 7:50 AM  
**To:** Miller, Jessica  
**Cc:** Travis Lowe; Mike\_Floyd@fws.gov  
**Subject:** Re: [EXTERNAL] Study Plan for a Big Sandy Crayfish Survey for the City of Elkhorn Water Main Relocation

Travis,

The study plan looks good. You can proceed as soon as the weather cooperates.

Santiago Martín  
Fish and Wildlife Biologist  
U.S. Fish & Wildlife Service  
Kentucky Ecological Services Office  
330 W. Broadway, Room 265  
Frankfort, KY 40601  
(502) 695-0468 ext. 116 (office)  
(502) 695-1024 (fax)

[Imperiled Bat Conservation Fund- KNL T website](#)

*NOTE: This email correspondence and any attachments to and from this sender is subject to the Freedom of Information Act (FOIA) and may be disclosed to third parties.*

On Fri, Mar 30, 2018 at 1:01 PM, Miller, Jessica <[jessica\\_miller@fws.gov](mailto:jessica_miller@fws.gov)> wrote:  
Travis,

Summit Engineering submitted this project to our office last year and it was assigned to Santiago Martin in our office (cc'd on this email). He will be the one replying to you.

Jessi

On Thu, Mar 29, 2018 at 11:38 AM, Travis Lowe <[tlowe@atsone.com](mailto:tlowe@atsone.com)> wrote:

Jessica and Mike,

Please see the attached study plan for a Big Sandy Crayfish Survey for the City of Elkhorn Water Main Relocation. This is the project we talked about a few weeks ago. The crossing location is located approximately 130m downstream of the highway 80 bridge in Elkhorn City. As we discussed ATS is proposing to sample two sites, one upstream and one downstream of the project sites. Please let me know if you have any questions.

Thanks,

Travis



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Jessica Blackwood Miller  
Fish & Wildlife Biologist  
Kentucky Field Office  
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