BIOLOGICAL ASSESSMENT EAST LOCUST CREEK PROPOSED RESERVOIR SULLIVAN COUNTY, MISSOURI

Prepared for:

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OLSSON PROJECT No. A11-1513

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Table of Contents

1.	Intro	oduction and Background	1
	1.1.	FEDERAL ACTION	
	1.2.	LOCAL SPONSOR AND INVOLVED AGENCIES	1
	1.3.	COVERED SPECIES	
2.	Pro	ject Description	4
	2.1.	PROJECT PURPOSES	6
	2.2.	PROJECT ELEMENTS	6
		2.2.1. East Locust Creek Dam Construction	6
		2.2.2. East Locust Creek Reservoir Downstream Flow	7
		2.2.3. Recreational Facilities Development	9
		2.2.4. Utilities and Transportation Relocation	11
		2.2.4.1. Existing Drinking Water Lines	11
		2.2.4.2. Electrical and Telecommunication Lines	11
		2.2.4.3. Transportation Relocation	11
		2.2.4.4. Raw Water Line	11
		2.2.5. Water Treatment, Transmission, and Distribution	13
		2.2.6. Reservoir Operation	15
		2.2.7. Potential Development Around the Project	15
		2.2.8 Unavoidable Impacts	
	2.3.	CONSERVATION MEASURES AND BENEFICIAL ENVIRONMENTAL EFFECTS	
		2.3.1. Minimization Measures	
		2.3.1.1. Winter Tree Clearing	
		2.3.1.2. Winter Hazard Tree Removal Plan	
		2.3.1.3. Potential Roosting Habitat	
		2.3.1.4. Lacustrine Habitat	
		2.3.1.5. Wetland and Stream Mitigation	
		2.3.1.6. Lake Authority Tree Clearing Restriction	22
		2.3.1.7. Water Systems Coordination with USFWS	23
		2.3.2 Habitat Compensation plan	
		2.3.2.1 Forest Creation	
		2.3.2.2 Forest Preservation	
		2.3.2.3 Conservation Easement	
		2.3.2.4 Forest Management Plan	
_		2.3.2.5 Financial Assurance	
3.		on Area	
	3.1.	GEOGRAPHIC AREA	_
	3.2.	CURRENT AND HISTORIC LAND COVER	
		3.2.1. Ecological Site Descriptions	
	0.0	3.2.2. Current Land Cover Composition	
	3.3.	ONGOING ACTIVITIES AND INFLUENCES	
		3.3.1. Forest Change in the 10-County Region	
	1:-4-	3.3.2. White Nose Syndrome	35
4.		ed Species and Critical Habitat in the Action Area	
	4.1.	MEAD'S MILKWEED	
		4.1.1. Mead's Milkweed ESA Listing	36 37
		4 LZ WIEROS WIIKWEED DROURI	. 4 /

		4.1.3. Mead's Milkweed Current Range and Population Status	37
		4.1.4. Mead's Milkweed Project Field Study	37
	4.2.	GRAY BAT	
		4.2.1. Gray Bat ESA Listing	38
		4.2.2. Gray Bat Habitat	38
		4.2.3. Gray Bat Current Range and Population Status	38
		4.2.4. Gray Bat Project Field Study	
	4.3.	INDIANA BAT	
		4.3.1. Indiana Bat ESA Listing	
		4.3.2. Indiana Bat Habitat	
		4.3.3. Foraging Habitat	40
		4.3.4. Indiana Bat Current Range and Population Status	40
		4.3.5. Indiana Bat Project Field Study	
	4.4.	NORTHERN LONG-EARED BAT	
		4.4.1. Northern Long-Eared Bat ESA Listing	47
		4.4.2. Northern Long-Eared Bat Habitat	
		4.4.3. Northern Long-Eared Bat Current Range and Population Status	
		4.4.4. Northern Long-Eared Bat Project Field Study	
5.	Effe	cts of the Proposed Action	
	5.1.	EFFECTS ON THE IMMEDIATE ENVIRONMENT	50
	5.2.	EFFECTS ON LISTED SPECIES	52
		5.2.1. Gray Bat	52
		5.2.2. NORTHERN LONG-EARED BAT	52
		5.2.2.1.DIRECT EFFECTS	52
		5.2.2.1NDIRECT EFFECTS	52
		5.2.3. Indiana Bat	54
		5.2.3.1. Direct Effects	54
		5.2.3.2. Indirect Effects	54
	5.3.	MEAD'S MILKWEED	57
6.	Con	clusion and Determination of Effect	57
	6.1.	MEAD'S MILKWEED	58
	6.2.	GRAY BAT	58
	6.3.	Indiana Bat	58
	6.4.	NORTHERN LONG-EARED BAT	59
7.		ature Cited	

APPENDIX C. Mead's Milkweed Study

APPENDIX D. Gray, Indiana, and Northern Long-Eared Bats Study

<u>List of Tables</u>			
Table 1. Summary of U.S. Fish and Wildlife Service Coordination			
Table 2. Unavoidable Forest Loss.			
Table 3. Forest Creation, Preservation, and Conservation Easement Summary (Figure 1	-		
Table 4. 10-County Region Ecological Sites (NRCS 2015)	29		
Table 5. Sullivan County Ecological Sites (NRCS 2015)			
Table 6. 10-County Region 2011 NLCD Land Cover.	33		
Table 7. Sullivan County 2011 NLCD Land Cover	33		
Table 8. Land Cover Change in the 10-County Region	34		
Table 9. Land Cover Change in Sullivan County.	35		
Table 10. East Locust Creek Bat Survey Maternity Roost Trees	43		
Table 11. Project Forest and Grassland Impacts			
Table 12. Project Forest Loss	53		
Table 13. Project Forest Loss.	55		
Table 14. Project Effects within 2.5-Mile Colony Forest Buffer	56		
List of Figures			
Figure 1. East Locust Creek Location Map.	2		
Figure 2. 10-County Region Served by the Project			
Figure 3. East Locust Creek Dam Construction.			
Figure 4. Project Recreation Impacts.			
Figure 5. Project Utilities and Transportation Relocation			
Figure 6. Water Treatment, Transmission, and Distribution			
Figure 7. Potential Development Around the Project.			
Figure 8. Tree Planting and Preservation and Natural Areas			
Figure 9. Tree Clearing Areas.			
Figure 10. Habitat Compensation Plan.			
Figure 11. Indiana Bat (MYSO) Summer and Winter Habitat (Emphasis added, USFV	٧S		
2007)Figure 12. Maternity Roost Trees Identified for the East Locust Creek Project			
Figure 13. Laela and Sushi Colony's Home Range			
Figure 14. MYSE Mist Net Locations and Home Range			
1 Iguie 17. III I DE IIII St Net Locations and Hollie Nange	73		
Appendices			
APPENDIX A. Tree Planting Plan			
APPENDIX B. NCMRWC Resolutions			

iii

1. INTRODUCTION AND BACKGROUND

The purpose of this biological assessment (BA) is to assess the effect of the proposed East Locust Creek Reservoir Project (Project) on those species listed as endangered or threatened under the Endangered Species Act (ESA) or on the designated critical habitats of those species. ESA section 7(a) instructs the Natural Resources Conservation Service (NRCS) to ensure that any action funded, authorized, or carried out by NRCS, United State Department of Agriculture (USDA) Rural Development (RD), U.S. Army Corps of Engineers (USACE), or Federal Highway Administration (FHWA) is not likely to jeopardize the continued existence of any endangered or threatened species (USFWS 1973).

The Project involves construction of a 2,328-acre multipurpose reservoir in Sullivan County, Missouri, approximately 6 miles north of Milan and west of Green City (Figure 1). The Project is located in Sections 5, 6, 7, and 8, Township 63 North, Range 19 West; Sections 1, 2, and 12, Township 63 North, Range 20 West; Sections 18, 19, 30, and 31, Township 64 North, Range 19 West; and Sections 13, 23, 24, 25, 26, 35, and 36, Township 64 North, Range 20 West. The Project center is located at 40.270517 degrees latitude and 93.081655 degrees longitude.

1.1. Federal Action

The proposed Project includes NRCS funding, USDA RD funding, FHWA funding and a USACE Clean Water Act (CWA) Section 404 individual permit.

The NRCS is the lead federal agency as it intends to fund construction of the Project under the Watershed Protection and Flood Prevention Act, Public Law (PL) 83-566. The NRCS is partially funding construction, engineering, land purchase, technical assistance, and Project administration to construct a multiple-purpose reservoir (approximately 2,328 acres) on East Locust Creek north of Milan, Missouri.

Because preliminary jurisdictional determinations (PJDs) identified wetlands and streams within the Project boundary, construction of the proposed Project would require a CWA Section 404 individual permit. A total of 362 wetland acres and 49 miles of stream were identified in the PJDs. A supplemental environmental impact statement is being completed concurrent with this BA to aid the Section 404 permit.

FHWA and USDA RD are providing funding for various components of the proposed Project. FHWA is providing funding through the 2019 Better Utilizing Investments to Leverage Development (BUILD) grant program. The funding will provide for road improvements and relocations to improve access and minimize transportation disturbances from the proposed Project. USDA RD is providing loans and grants to aid the sponsor in meeting the local cost share obligations.

State permits including Missouri Department of Natural Resources (MoDNR) dam safety, MoDNR drinking water, and MoDNR Land Disturbance permits will be needed.

1.2. Local Sponsor and Involved Agencies

The Project's local sponsor is the North Central Missouri Regional Water Commission (NCMRWC). Various levels of involvement including primarily agency meetings have occurred

with the Missouri Department of Conservation (MDC), MoDNR, U.S. Environmental Protection Agency (EPA), U.S. Fish and Wildlife Service (USFWS), USACE, and NRCS.

Early coordination and consultation with the USFWS were conducted during a series of site visits, meetings, and emails including those in Table 1.

Table 1. Summary of U.S. Fish and Wildlife Service Coordination.

Date	Meeting Summary		
July 8, 2004	Meeting concerning content and preparation of the EIS portion of the		
July 6, 2004	watershed plan.		
August 17, 2004	Meeting concerning content and preparation of the EIS portion of the		
7 tagast 17, 2001	watershed plan.		
	Meeting to discuss mitigation strategies related to impacts of project		
April 27, 2005	measures to wetlands, streams resources, fish and wildlife habitats,		
	and threatened and endangered species.		
May 2, 2006	USFWS's final environmental impact statement's comment letter.		
May 25, 2006	Meeting to discuss agency USFWS comments on the draft EIS.		
	USACE, EPA, MDNR, USFWS, Allstate Consultants LLC, NCMRWC,		
February 25, 2015	Olsson meeting to discuss the supplemental environmental impact		
	statement's purpose and need.		
September 20, 2016	Introductory meeting to discuss Indiana bat and northern long-eared		
•	bat.		
February 1, 2018	USFWS Information, Planning, and Conservation (IPaC) response.		
October 6, 2017	Meeting to discuss impacts to Indiana bat and northern long-eared		
0010001 0, 2017	bat.		
October 24, 2017	Meeting to discuss impacts to Indiana bat and northern long-eared		
0010001 21, 2017	bat.		
December 12, 2017	Project site visit.		
April 16, 2019	USFWS comments provided on Draft Environmental Impact		
7 10, 2010	Statement.		
July 3, 2019	Meeting to discuss draft Biological Assessment.		
July 11, 2019	USFWS comments provided on Draft Biological Assessment.		
October 23, 2019	BA to USFWS		
December 4, 2019	USFWS comments on BA		
February 14, 2020	Biological Assessment to NRCS for distribution to USFWS		
February 28 2020	Biological Assessment and request for formal consultation sent to		
March 27, 2020	Received comments from USFWS on Biological Assessment		
April 7, 2020	Project team meets with NRCS and USFWS to discuss BA and		
May 1, 2020	Biological Assessment to NRCS for distribution and USFWS for		
June 10, 2020	Received USFWS comments on BA		
August 13, 2020	Final BA sent to NRCS, USDA-RD, USFWS		

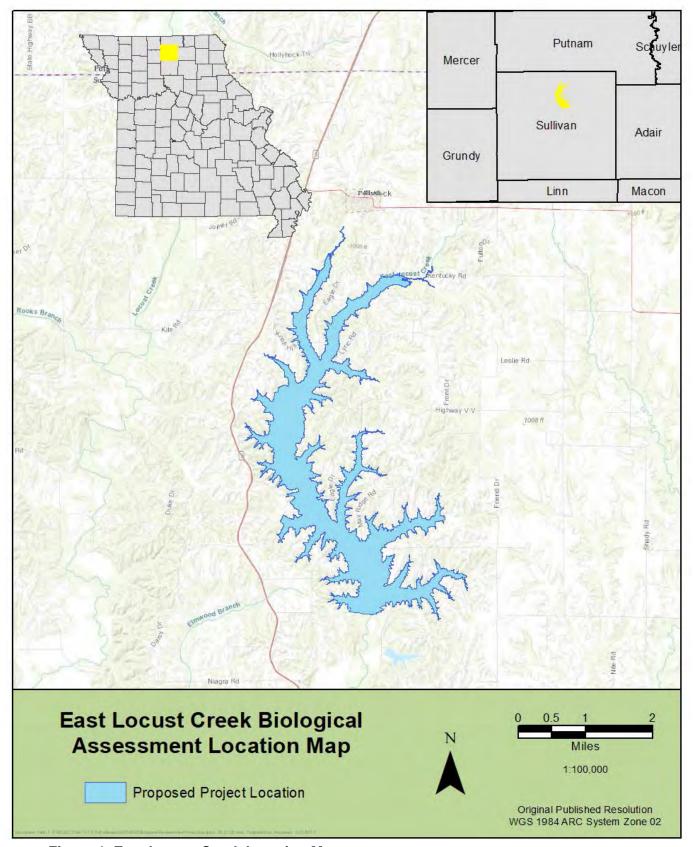


Figure 1. East Locust Creek Location Map.

1.3. Covered Species

An official species list was requested from the U.S. Fish and Wildlife Service (USFWS) on February 1, 2018. The Project has the potential to affect the following ESA-listed species that may occur in the area:

- Indiana bat (Myotis sodalis; MYSO) federal and state endangered
- Northern long-eared bat (Myotis septentrionalis; MYSE) federal threatened and state endangered
- Mead's milkweed (Asclepias meadii; ASME) federal threatened and state endangered
- Gray bat (Myotis grisescens; MYGR) federal and state endangered

No critical habitat has been designated in Sullivan County, Missouri, for any threatened or endangered species.

This BA addresses and contains analyses for two species, the federally-listed endangered Indiana bat and the federally-listed threatened northern long-eared bat and identifies activities that are likely to result in no effect to the species, may affect but are not likely to adversely affect them, or are likely to adversely affect them. A final 4(d) rule (81 FR 1900) was published for MYSE on January 14, 2016 (effective February 16, 2016). The final 4(d) rule specifies what constitutes prohibited taking of MYSE. The rule does not remove, or alter in any way, the consultation requirements under Section 7 of the ESA. However, the USFWS' Programmatic Biological Opinion on the final 4(d) rule (USFWS 2016) provides a streamlined consultation framework as an option for federal agencies to use.

2. PROJECT DESCRIPTION

The Project would provide a water supply, reduce flood damages, and increase recreational opportunities in the 10-county region. The 10-county region includes Adair, Chariton, Grundy, Linn, Livingston, Macon, Mercer, Putnam, Schuyler, and Sullivan counties (Figure 2). Residential development is anticipated to occur outside NCMRWC property because of the recreational opportunities provided by the Project.

Construction activities are proposed to start in the fall of 2020 and be completed in 2022. It is estimated that the Project will reach a normal pool level within 2-10 years following dam construction, depending on rainfall events. The Project will impact forest resources that are currently estimated at approximately 1,341 acres (Table 2). The Project would also preserve 683 acres of forest habitat and create 553 acres of forest habitat on land owned by NCMRWC (Table 3).

The Project includes construction of a dam that would inundate a section of stream, adjacent to and including East Locust Creek, during normal flow conditions (normal pool) and would inundate a larger area during flood conditions (flood pool). Land has been purchased to the top-of-dam height. Additional construction activities associated with the Project would include constructing recreational facilities that would allow boating, camping and fishing access, relocating existing utilities and roads, constructing a raw water line from the Project to the Milan water treatment plant, upgrading the Milan water treatment facility, and constructing new water transmission lines within the 10-county region.

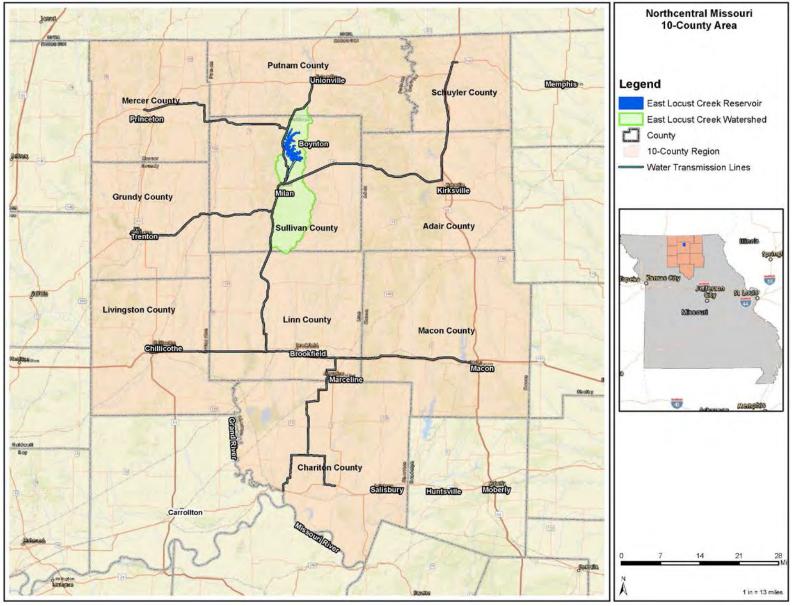


Figure 2. 10-County Region Served by the Project.

2.1. Project Purposes

The Project would provide water supply, flood damage reduction, and water-based recreation. The reservoir would have a contributing drainage area of 32.7 square miles, and the 0.5-milelong dam would impound water to a normal pool maximum depth of 56 feet. At this depth, the Project would have a normal pool surface area of 2,328 acres and a storage volume of 54,000 acre-feet. This baseline storage volume was established in the final environmental impact statement and would provide the 7 million gallons per day (MGD) average daily demand needed for water supply.

The 2,328-acre reservoir would provide recreational opportunities to the 10-county region. The 2,328-acre lake is estimated to provide 91,956 user days of recreation. Recreational facilities including a boat ramp, docks, access lane, and parking spaces would be constructed to support recreational opportunities for the 10-county region.

The Project would provide a 50 percent reduction to damages incurred by flooding along the 22.5 miles of East Locust Creek between 6 miles south of Pollock and Browning, Missouri. The Project would result in an estimated flood damage reduction benefit of \$173,600 annually.

2.2. Project Elements

The project elements are the components of the proposed Project needed to meet the purpose and need of the proposed action. The project elements include: East Locust Creek dam construction; East Locust Creek reservoir operation; normal pool inundation; recreational facilities development; utilities and transportation relocation; water treatment, transmission, and distribution; and potential private development around the Project.

2.2.1. EAST LOCUST CREEK DAM CONSTRUCTION

The dam design is approximately 0.5-mile-long, 25 acres, and is located approximately 1 mile south of State Highway N at Boynton. The dam would be constructed in three phases, building the dam on the eastern and western sides of East Locust Creek prior to constructing the center portion that blocks East Locust Creek. Six borrow areas totaling 84 acres are designed to provide fill for the dam (Figure 3). Four of the six borrow sites are located north of the dam and within the reservoir's normal pool. The two borrow sites located outside the normal pool are located west of the dam (25 acres) and northwest of the dam (22 acres). These borrow sites were selected to avoid tree clearing and the marina was selected on a borrow area to provide a secondary use.

A concrete spillway would be constructed on the eastern end of the dam and would extend 1,247 feet southwest to the East Locust Creek main channel (Figure 3). The spillway will provide the downstream flow in East Locust Creek because there will be no outlet pipe in the dam. The spillway would be 55 feet wide and would taper down to 25 feet wide. The spillway impact area would total 1.3 acres.

Two, 25-foot-wide temporary roads would provide dam construction access from the eastern and western sides of East Locust Creek. The eastern access road would extend from Finch Road and would be 2,266 feet from Finch Road to the dam. The eastern temporary road access would be entirely within the normal pool. The western temporary access road would extend from England Road and would be 4,430 feet from England Road to the dam. The western temporary access

road would be partially within the dam footprint and borrow site footprints and would create 2,153 feet (1.2 acres) of additional impacts outside the dam and borrow site. A total of 23 forest acres will be impacted as a result of dam construction activities. Forest acres inundated by the normal pool are included in the normal pool impacts and are not included in the dam construction impacts. The normal pool overlaps the dam and there are forest impacts associated with the overlapping area. Forest acres that overlap the dam and the normal pool (upstream side of the dam) are included with the normal pool impacts. The normal pool forest impacts total 973 acres because of inundation (Table 2).

2.2.2. EAST LOCUST CREEK RESERVOIR DOWNSTREAM FLOW

The proposed Project spillway is a two-stage labyrinth weir with the first stage at normal pool and the second stage at the 25-year flood level. There is no auxiliary or emergency spillway as the principal spillway is designed to handle all events up to 75 percent of the probable maximum precipitation (PMP) storm. Approximately 10 feet below normal pool will be a passive flow system that will pass an average of 0.5 cubic feet per second (cfs) to the existing stream below the reservoir. The passive flow system will allow flow at diminishing rates as the reservoir water level drops until flow ceases when the lake is approximately 10 feet below normal pool. The openings may be outfitted with changeable plates so that outfall rates can occasionally be modified through an adaptive management process. In addition, minor seepage through the dam is expected to pass additional flow downstream.

The proposed reservoir is expected to provide a more reliable low flow to the stream below the dam because of the passive flow system and seepage through the dam. East Locust Creek currently goes dry and could also run dry during reservoir operation under an extended drought when the reservoir level drops more than 10 feet. Storm pulses will be passed down stream through the principal spillway during times when the reservoir is full or near full. When the reservoir is below normal pool, some storm pulses will not be able to pass through the reservoir.

Detention by the reservoir will result in less floodplain flow but not in relatively small events where the floodplain is already disconnected. The largest reduction in floodplain flows will be for events between the 5-year and 25-year thresholds. During storms bigger than the 25-year storm, the second stage of the principal spillway will be activated and allow relatively unimpeded flow through the spillway. Impacts to the riparian corridor including forested areas is difficult to determine. Tree species are anticipated to continue to persist, but species composition may be modified based on changes to overland flow during flood events. Changes in species composition are not anticipated to impact listed bat species.

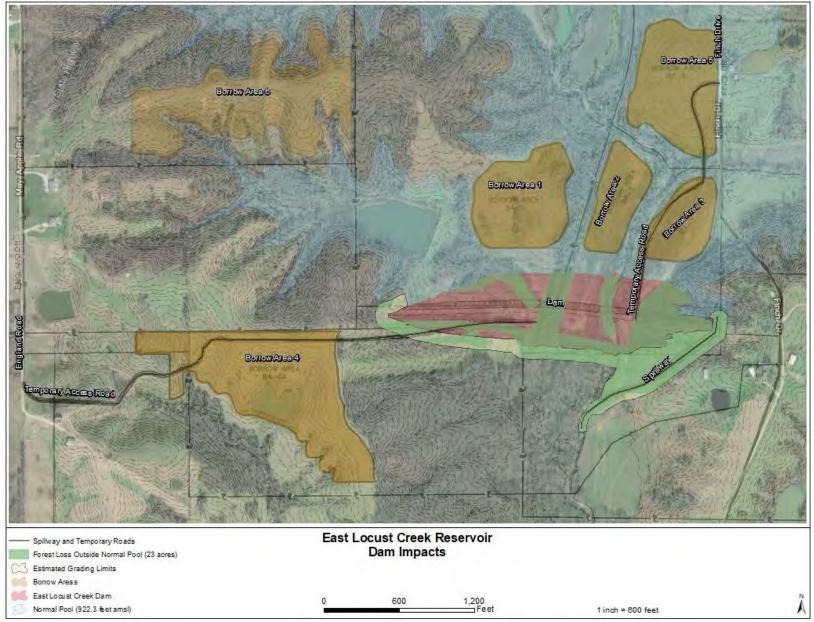


Figure 3. East Locust Creek Dam Construction.

2.2.3. RECREATIONAL FACILITIES DEVELOPMENT

Recreational fishing, boating, camping, and picnic facilities around the Project are intended to be designed in coordination with Missouri Department of Conservation (MDC). Design and MDC coordination is intended to be completed following the permitting process. Forest impacts related to recreational facility development and operation would total 27 acres. These acres are primarily a result of the marina development since the campsites were selected in areas that are not forested. Camping is assumed to be a compatible use with bat species and additional tree clearing by the campers will not be allowed.

A full-service marina is planned for the southwestern side of the lake near the dam. The marina would include a boat ramp, docks, and parking. The marina has yet to be designed, and the needed number of parking stalls, docks, and boat ramps is not known. The area designed as a marina totals 48 acres (27 forest acres and 21 pastures acres) and may include primitive and recreational vehicle (RV) camping. The marina area was selected to coincide with a soil borrow area that would be reestablished to permanent herbaceous vegetation.

Designated primitive camping areas may occur throughout the property owned by the NCMRWC as well as at two locations on the northern side of the reservoir (Figure 4). Camping sites will be designated for both primitive and RV camping areas. Handicap-accessible facilities will be associated with the marina, campgrounds, jetties, and at reservoir access locations throughout the reservoir.

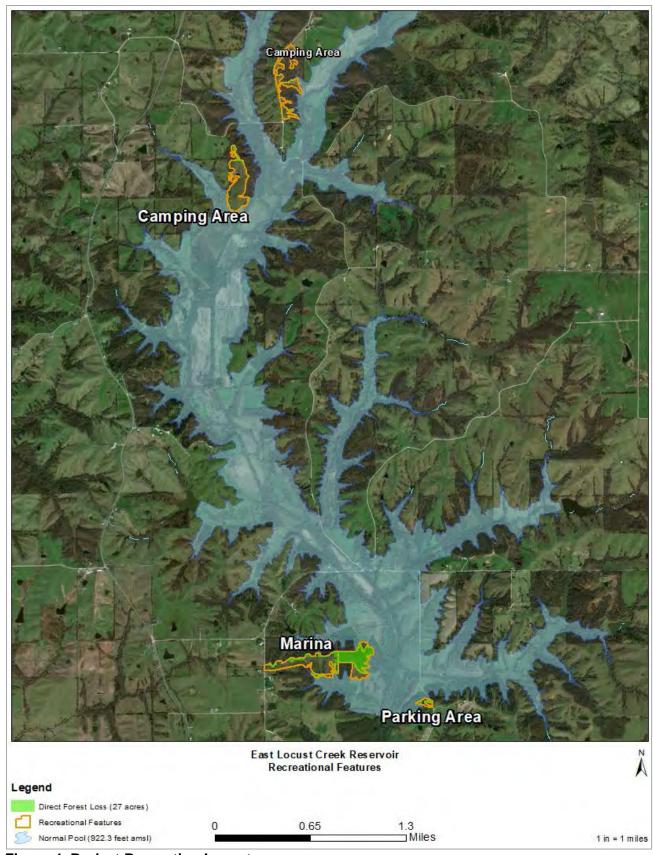


Figure 4. Project Recreation Impacts.

2.2.4. UTILITIES AND TRANSPORTATION RELOCATION

Funding has recently been identified through the 2019 Better Utilizing Investments to Leverage Development (BUILD) grant program. Through this program federal funding is provided through the BUILD project sponsor (MoDOT) to invest in road, rail, and transit projects.

Forest impacts from utilities and transportation relocation are estimated to total 34 acres based on the National Land Cover Database (NLCD) forest layer (Figure 5).

2.2.4.1. Existing Drinking Water Lines

The Project will affect drinking water lines and pressure zones through dam creation and inundation. Impacts will occur to two pressure zones that will affect the flows, pressures, and recovery rates of the two elevated storage tanks.

To maintain the existing flow, pressures, and system recovery capacity, the existing radial lines that will be inundated will be combined prior to inundation and replaced with two lake crossings in the area of Knob Hill Road and the dam. Construction of the new lines would be included in the right-of-way with the electrical and telecommunication line relocations.

2.2.4.2. Electrical and Telecommunication Lines

The Project will affect single-phase and three-phase power lines and telecommunication lines located along Route N and nearby gravel roads. To replace the existing service, the areas with disconnected service would be served by a new utility corridor south of the dam and on an earthen utility corridor built across the Project along the Knob Hill Road to Highway VV corridor.

2.2.4.3. Transportation Relocation

The Project will inundate 5 miles of existing county roads and 1 mile of state highway. The Project inundation results in the loss of two East Locust Creek bridge crossings that represent the only stream crossings between Highway 6 at Milan to the Village of Pollock located approximately 13 miles to the north. The bridges will be left in place and would be inundated after dam construction.

The BUILD Grant surface transportation project will result in the improvement of a network of roads that include: the replacement of portions of Missouri Route N with county roads downstream from the dam; the replacement of county roads connecting Missouri Route VV to Missouri Route 5; improvements to Missouri Route 5 intersections with county routes; and upgrades to county roads accessing the new Reservoir. This surface transportation project is needed to assist in developing the transportation roadway safety and capacity improvements for safe access, emergency response, and intersection turn lanes.

2.2.4.4. Raw Water Line

An approximately 24,700-foot raw water line would be constructed from a water intake near the dam and run to the water treatment plant at Milan. The raw water line would cause impacts to a width of approximately 40 feet and would run generally along the existing abandoned rail line to the southwest until it reaches the water treatment plant north of Milan. The alignment may vary from that shown in Figure 5 where doing so would minimize impacts. A maintenance easement would be established within the 40-foot width and would be maintained clear of trees and result in permanent impacts to forested areas. Forest impacts would total 4.2 acres.

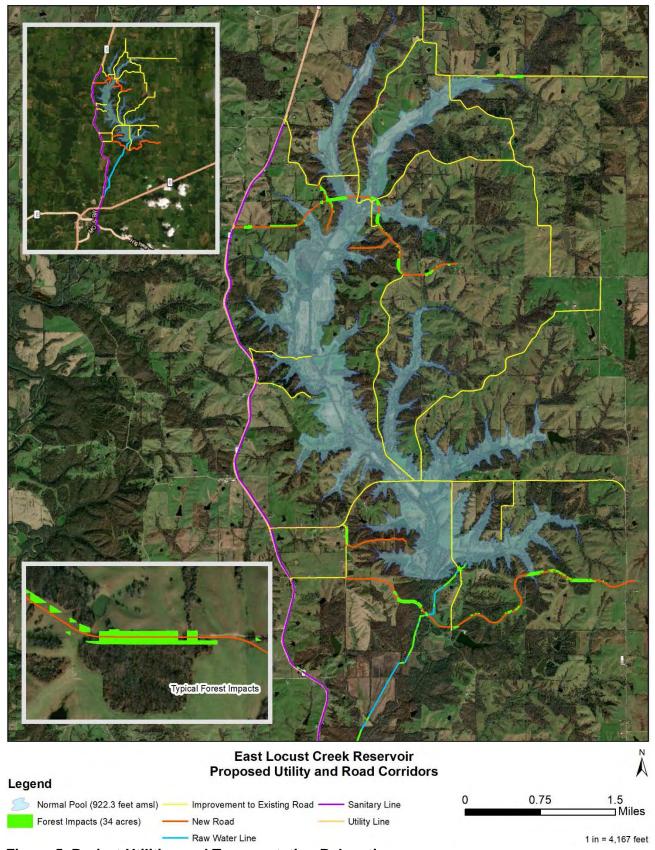


Figure 5. Project Utilities and Transportation Relocation.

2.2.5. WATER TREATMENT, TRANSMISSION, AND DISTRIBUTION

The water treatment plant at Milan has a current capacity of 2.2 MGD and will need to be expanded to the 7 MGD design capacity over the life of the reservoir. The water treatment plant expansion would occur on-site and would not have additional environmental or forest impacts.

The Milan water treatment plant currently serves three water systems. There are 19 primary water systems that serve the 10-county region. Three of these water systems are outside the 10-county region and would not be supplied water by the Project. Water transmission lines would be needed to provide water to a subset of the 16 primary water systems that currently provide water to the 10-county region. The Project does not have water storage capacity to serve all the water suppliers in the entire 10-county region, but will serve the water suppliers within the 10-county region that are projected to have an inadequate water supply during the drought of record. New water transmission lines would be needed to serve water to the 10-county region and would follow existing utility and roadway corridors with very limited exceptions. The new water transmission lines would be constructed at the time that the primary water producers need a new water supply or to add resiliency to their existing water supplies. Figure 6 shows a potential configuration of water transmission lines in the 10-county region.

Forest loss from future transmission lines could occur in existing rights-of-way or should a new right-of-way be needed. Because of costs and to minimize forest losses, new rights-of-way will be designed to avoid forest impacts. Because transmission lines have not been designed, the exact alignment is not known. Forest losses are estimated at 53 acres to account for new rights-of-way and forested rights-of-way. The 53 acres of forest loss were calculated by totaling the forested acres within a 50-foot utility easement (210 acres) using the NLCD and allowing for a 25 percent loss in forest (Figure 6). Because the transmission line rights-of-way would not be owned by the NCMRWC, the tree clearing would not be done by the NCMRWC, and the forest impacts are not known, transmission lines are not covered in this Section 7 consultation.

New water distribution lines are not anticipated, except as ongoing maintenance is required. All 16 primary water systems already have distribution lines in place, and the distribution systems will continue to be the primary water systems responsibility. There are no forest impacts anticipated because of distribution lines. Additionally, because the distribution lines rights-of-way would not be owned by the NCMRWC, the tree clearing would not be done by the NCMRWC, and the forest impacts are not anticipated, distribution lines are not covered in this Section 7 consultation.

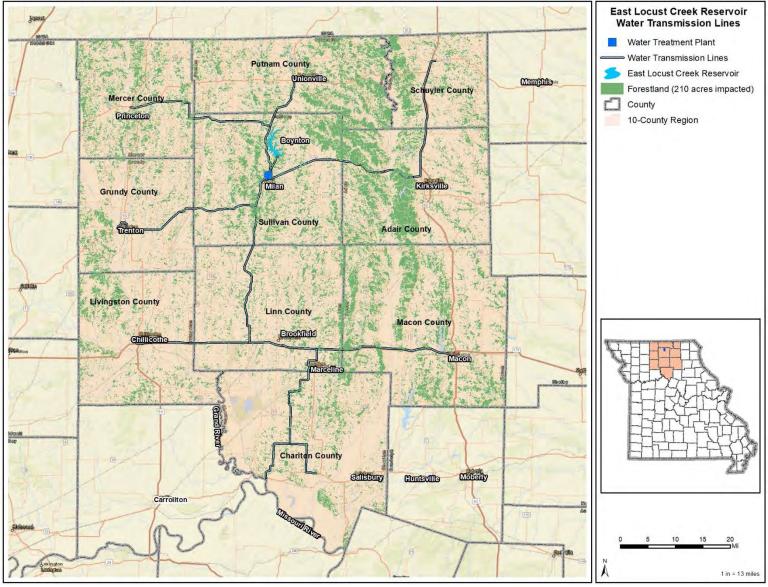


Figure 6. Water Treatment, Transmission, and Distribution.

Note: Forest Layer based on National Land Cover Database (Homer et al. 2015).

2.2.6. RESERVOIR OPERATION

The reservoir operation includes the ongoing needs for the Project to supply a 7 mgd water supply, provide 91,956 user days of recreation and reduce flood damages on 22.5 miles of East Locust Creek. The NCMRWC staff will provide the reservoir operation to meet the Project purposes. Reservoir operation will include maintaining and operating pumps that withdraw water from the reservoir and pump water to treatment facilities; maintaining access roads for public recreation and to reservoir components (i.e. pumps, spillway, dam); and maintaining recreational facilities including campgrounds, docks, and boat ramps. Forest loss is not anticipated with reservoir operation; however, snags may become present at recreational facilities or access roads. A winter inspection of access roads and recreational facilities will be performed to identify snags and potential snags. Any snags identified will be cleared between November 1 and March 31. Should snags be created outside the November 1 and March 31 clearing period, they will be removed immediately to reduce the risk to human life.

2.2.7. POTENTIAL DEVELOPMENT AROUND THE PROJECT

The potential residential development area (Figure 7) was determined by drawing land outside the NCMRWC property that is within the East Locust Creek watershed and within 0.5 mile of the normal pool. Land outside the East Locust Creek watershed would slope away from the reservoir and would have reduced reservoir visibility and reduced development value. Similarly, land farther than 0.5 mile from the normal pool would have reduced reservoir access and reduced development value. The 0.5-mile distance would allow multiple layers of lakeview property.

There are 1,622 forested acres within the potential residential development area. An estimated ten percent or 162 acres are estimated for tree clearing because of residential development.

In 2009, the NCMRWC began contemplating water protection, source water protection, land oversight and habitat preservation when it drafted and advocated for passage of first-of-kind Lake Authority Legislation that provides the NCMRWC the ability to control and prevent contamination threats from the top of the watershed to the dam even on private property. The Lake Authority was passed as Revised Statute of Missouri 67.4520 and allows zoning and planning powers. The NCMRWC has also implemented a 100-foot buffer along streams within the High Impact Zone. The High Impact Zone extends 500 feet outside NCMRWC-owned property and surrounds the reservoir. The High Impact Zone was established through Resolution #6-2018 by the NCMRWC. The 100-foot buffer preserves 50 forest acres and will protect water quality and bat habitat within the High Impact Zone.

The NCMRWC will not be involved in land development outside NCMRWC property. The land within the East Locust Creek watershed upstream of the dam will be subject to watershed zoning regulations to protect the water quality of the reservoir. Residential development would be allowed by the zoning regulations and may occur outside the NCMRWC property boundary. The rate of development, areas that will develop, and types of development that will occur are not known. Because the land development property would not be owned by the NCMRWC, the tree clearing would not be done by the NCMRWC, and the forest impacts are not known and may not occur, potential development around the project is not covered in this Section 7 consultation.

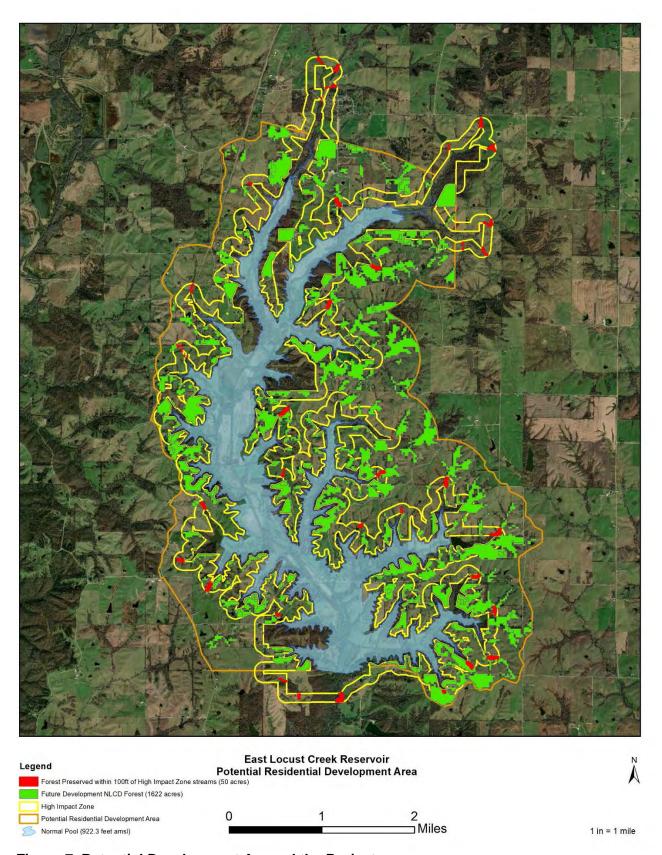


Figure 7. Potential Development Around the Project.

The NCMRWC will maintain control of the approximately 2,360 acres of land outside the reservoir's normal pool (2,328 acres, Figure 8). A NCMRWC property use breakdown is included in the diagram below. The land outside the reservoir's normal pool includes land within the top-of-dam elevation and parcels outside the top-of-dam elevation that could not reasonably be split.

A conservation easement will be established on 1,236 acres that includes 683 acres of forest preservation and 553 acres of tree plantings. The tree plantings are focused on areas near the Indiana bat maternity roost trees and along streams. The conservation easement areas are intended to provide the highest benefit to bat species by preserving and planting trees near maternity roost trees and foraging corridors.

The primary purpose of the remaining forest owned by the NCMRWC outside the normal pool but without a conservation easement is to serve as a vegetative buffer to protect lake water quality. The NCMRWC property outside the normal pool and not under a conservation easement totals 1,124 acres. There are 458 acres of forest and 666 acres of prairie outside the normal pool that will not have a conservation easement outside the normal pool. However, to support recreational development, utilities and road relocation and dam construction activities additional tree clearing will occur. Also, it is also possible that neighbors may ask to clear trees to allow lake visibility from adjacent properties. Any such tree clearing is anticipated to be minimized to the extent possible and will require approval by the NCMRWC. An estimated 15 percent, or 69 forested acres, may be cleared for a lake view. Where the purpose of this clearing is only to allow a view of the lake, the cleared area will be converted to permanent vegetation. Additionally, areas currently in crop or pasture will be maintained as permanent vegetation. A total of 328 acres of forest are anticipated to be established and/or managed, but will not have a conservation easement.

NCMRWC Property Use Breakdown

- NCMRWC Property 4,688
 - o Normal Pool 2,328 acres
 - Land Outside the Normal Pool -2,360 acres
 - Conservation Easement 1,236 acres
 - Preservation 683 acres
 - Tree Planting 553 acres
 - Non-Conservation Easement 1,124 acres
 - Cropland/Pasture (To Be Prairie) 666 acres
 - May be maintained as permanent herbaceous vegetation or allowed to "go-back" to forest (no easement).
 - Forested 458
 - Anticipated impacts due to development = 69 acres*
 - Anticipated impacts due to recreation = 27 acres
 - Anticipated impacts due to utilities/road relocation= 11 acres
 - Anticipated impacts due to dam construction = 23 acres
 - Anticipated preserved forest (no easement) = 328 acres

^{*} Impacts due to development are included in the previous discussions on 15 percent tree clearing for a lake view.

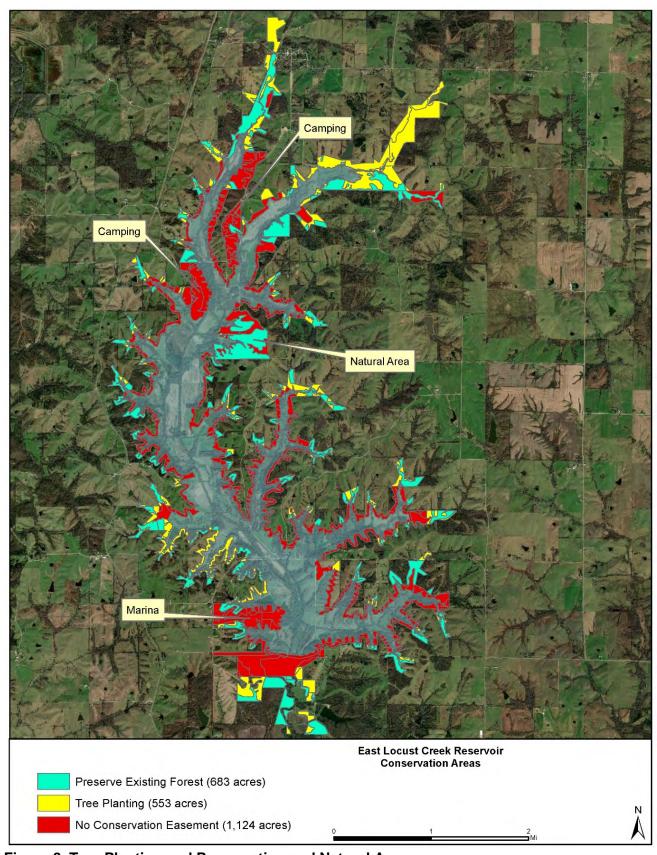


Figure 8. Tree Planting and Preservation and Natural Areas.

2.2.8 Unavoidable Impacts

Unavoidable impacts (Table 2) include the impacts directly related to reservoir construction and inundation or future clearing on NCMRWC property.

Table 2. Unavoidable Forest Loss.

Project Element	Direct and Predicted Future Forest Loss (acres)	
Normal Pool Inundation	973	
Recreational Facilities Development	27	
Utilities and Road Relocation	34	
Dam Construction, Borrow Sites, Spillway Construction,	23	
and Temporary Dam Access Roads	-	
Tree Clearing on NCMRWC Property Because of	69	
Development		
Residential Development	162	
Future Water Transmission Lines	53	
TOTAL FOREST LOSS	1,341	

Note: Forest loss because of residential development and future water transmission are not controlled by the NCMRWC and may be avoided upon design and construction.

2.3. Conservation Measures and Beneficial Environmental Effects

The Project would implement conservation measures or would have beneficial effects to the chemical, physical, or biotic environmental components. Conservation measures and beneficial environmental impacts aid in avoiding, minimizing, and mitigating for unavoidable environmental impacts.

2.3.1. MINIMIZATION MEASURES

2.3.1.1. Winter Tree Clearing

Tree clearing prior to project construction will occur to harvest trees with commercial value and to clear construction zones and areas of the main body of the reservoir intended for boat navigation. A commercial tree harvesting company will be contracted by the NCRMWC to harvest hickory, mixed hardwoods, and red and white oaks. Timber harvest will occur within the normal pool but will be limited by truck access (Figure 9). Trees cleared for timber harvest and to aid in navigation will occur within the normal pool and would not persist because of inundation. All tree clearing will occur between November 1 and March 31.

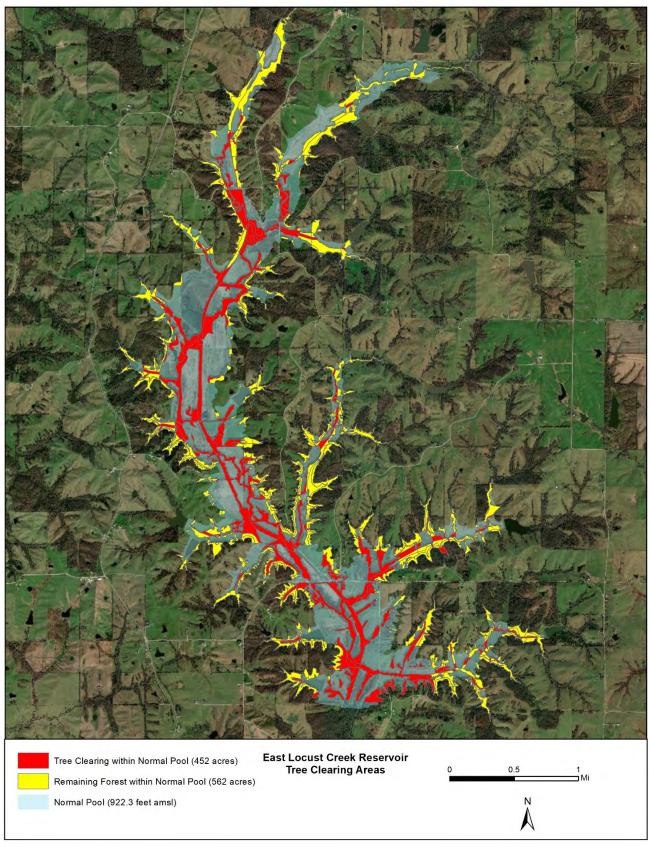


Figure 9. Tree Clearing Areas.

2.3.1.2. Winter Hazard Tree Removal Plan

Hazard trees may impede recreational facilities, public activities, or reservoir operation. These hazard trees will be removed immediately to allow reservoir operation and for public safety. MYSO and MYSE use snags for roosting habitat and these trees could be identified as hazard trees if in association with recreational facilities, areas with public activities (campgrounds), or reservoir operation areas (access roads). To minimize impacts to MYSE and MYSO, potential hazard trees will be identified through a targeted hazardous tree search of recreational facilities, public activity areas and reservoir operation areas. Potential hazard trees identified during the targeted search will be removed between November 1 and March 31 (clearing period). Hazard trees created outside the clearing period by storm events, high-wind events or other natural events may be removed immediately to allow for reservoir operation or to protect public safety. Their immediate removal will reduce the likelihood of use by roosting bats.

2.3.1.3. Potential Roosting Habitat

Standing trees within the shallow water reservoir arms and other areas with shallow water will be permanently inundated by the normal pool. The standing trees will die because of the permanent inundation, thus creating short-term habitat (snags) that could provide habitat for bat species (USFWS 2009a). Following one cycle of decay, the trees will no longer provide habitat and no new snags would be created. However, over the short term, the snags may provide roosting bat habitat. The proposed Project would include 190 acres of forest in water that is 10 feet deep or less and 70 acres of forest in water that is five feet deep or less.

MYSO prefer dead, broken, or damaged trees located within 0.6 mile of water for summer roosting (USDA 2003; Carter 2006). Studies indicate that roosts are often located in bottomland hardwood forests because of large-scale disturbances such as flooding. Flooding occurs frequently in bottomland hardwood forest and creates standing dead trees and snags suitable for roosting (Carter and Feldhamer 2005). Disturbances that occur in upland forests farther from flooding events tend to be smaller scale and leave fewer dead trees than riparian flooding disturbances that could support roosting bats (Carter and Feldhamer 2005).

Flooding outside the normal pool could inundate up to 1,141 acres of forested habitat at top-of-dam elevation. A permanent conservation easement would be established on 683 acres of forested habitat to maintain the forest in perpetuity. See the following section for information about forest creation and preservation. The flooding would create snags similar to conditions in the existing East Locust Creek floodplain. The flooding outside the normal pool could create sustainable, long-term bat roosting habitat outside the normal pool. The spillway is designed to empty the retarding pool in 10 days or less. The retarding pool is the portion of the reservoir between the auxiliary spillway and the principle spill ways. Thus, any flooding that occurs to forest habitat will be limited in duration to 10 days or less.

Thousand Hills State Park, located 23 miles to the east of the Project, surrounds a 580-acre lake (Forest Lake) and provides habitat to multiple bat species including MYSO and MYSE (Zimmerman 2015). Radio telemetry was completed in 2013 and 2014 for MYSE, and multiple roost trees were identified near Forest Lake. Bats (not identified) were observed foraging over the lake (Zimmerman 2015).

2.3.1.4. Lacustrine Habitat

The Project would provide lacustrine habitat that includes 2,328 acres of open water and 82 miles of shoreline. The shoreline and open water may provide habitat for foraging bats. Bats forage for both terrestrial and aquatic insects and use foraging habitat along bottomland forests and impounded bodies of water (USFWS 2008). Bats use forested areas along the edges of lakes for protection of young during the summer. They also forage along edges of reservoirs where forests have not been cleared (IUCN 2008).

2.3.1.5. Wetland and Stream Mitigation

The Project will implement compensatory mitigation to offset unavoidable impacts to streams and wetlands. The mitigation will provide for replacement of wetland acreage and function lost during construction and inundation. Stream resources, including some riparian forest, will also be restored or enhanced to meet the Clean Water Act Section 404 mitigation obligation. The wetland and stream mitigation would provide beneficial impacts for bats that could include both foraging habitat and roosting habitat.

Mitigation for waters of the U.S. is currently being considered under the 1980's waters of the U.S. jurisdiction rules and subsequent supreme court cases (i.e. Rapanos) and the recently passed (June 2020) navigable waters protection rule. Wetland mitigation under the 1980's guidance would address impacts to 354 wetland acres consisting of 280 acres of emergent wetlands, 64 acres of forested wetlands, and 10 acres of shrub-scrub wetlands. Stream mitigation would be provided for 48.4 miles of stream, which includes 25.9 miles of ephemeral, 13.7 miles of intermittent, and 8.8 miles of perennial stream within the normal pool. Under the recently passed navigable waters protection rule, the ephemeral streams and any wetland adjacent to an ephemeral stream would be considered non-jurisdictional and would not be included in the wetland and stream mitigation plan, but jurisdictional determinations have not been made under the navigable waters protection rule.

2.3.1.6. Lake Authority Tree Clearing Restriction

The North Central Missouri Regional Water Commission (NCMRWC) led the efforts to pass Lake Authority legislation allowing creation of the Lake Authority, an independent political subdivision, to be set up specifically for the protection of the reservoir environment and the management, influence and control of upstream private land-owner activities. The NCMRWC has committed to and are obligated to follow restrictions on clearing trees greater than 3 inches diameter at breast height between March 31 and November 1 on NCMRWC property and related to the reservoir development.

The NCMRWC will lead and underwrite the establishment of the Lake Authority, including the drafting of by-laws and policies. As part of that effort, we are currently preparing zoning requirements and recommendations for the entire East Locust Creek watershed, with a particular emphasis on what we have termed the High Impact Zone, which encompasses approximately 500 feet back from the NCMRWC property line on private property. The primary purpose is the protection of the environment in and around the lake.

The NCMRWC commits to recommending restrictions on tree cutting as prescribed by the USFWS. With that said, the NCMRWC cannot, legally, encumber another political subdivision.

However, inasmuch-as the Lake Authority Legislation was created, in large part, for the promulgation and enforcement of restrictions similar to those required by USFWS, we believe that NCMRWC's recommendations will be accepted and adopted.

On August 10, 2020 NCMRWC passed a resolution recommending that the Lake Authority require all clearing of deciduous trees larger than 3" DBH within the High Impact Zone be done in the inactive season, November 1 through March 31, and that they require the property owners to self-certify that they acted in compliance with this requirement before receiving any construction permit from the Lake Authority. Appropriate provisions will be included for the removal of trees that pose a safety hazard to life and property. See Appendix B for the Lake Authority Tree Clearing resolution.

2.3.1.7. Water Systems Coordination with USFWS

The proposed reservoir would supply water to the 10-county region through transmission lines to water systems throughout the region. Water mains and water distribution lines are, in an overwhelming majority of cases, run along existing and already disturbed Right of Ways. Moreover, community water distributors or water districts in nearly every case involved State (MDNR) or Federal (USDA-RD, CDBG [Community Development Block Grant]) grants and/or loans, which, by their own statutory requirements, require strict adherence to NEPA requirements and USFWS review. However, the NCMRWC does commit to requiring adherence to NEPA, if not already held to account by another State or Federal entity.

On August 10, 2020 the NCMRWC passed a resolution requiring that any entity removing trees for construction of water transmission lines for the purpose of purchasing and transmitting water from the East Locust Creek Reservoir or the NCMRWC water treatment plant to the entity's water system must confer with USFWS regarding impacts to federally listed species that could result from transmission line construction. See Appendix B for the Water System USFWS Coordination resolution.

2.3.2 HABITAT COMPENSATION PLAN

The habitat compensation plan details the unavoidable impacts and the forest creation and preservation that will occur to minimize those impacts. The goal of the plan is to preserve or replace nearby forest to account for all forest impacts.

Voluntary measures to compensate for the loss of forested bat habitat and impacts to bats that could not be avoided and minimized include tree planting on NCMRWC property, tree preservation on NCMRWC property and within the High Hazard Zone, preservation of forested acres that will not be under a conservation easement, and wetland forest mitigation.

2.3.2.1 Forest Creation

Many areas outside the normal pool and within NCMRWC property will be planted to forest. A total of 553 acres of new forest will be created because of this planting (Figure 10). Tree species will be selected based on the natural forest community and on favorable tree species for bat roosting habitat (see Appendix A, Tree Planting Plan). The 553 acres of new forest will be planted on NCMRWC property with at least one-half acre of land available for forest planting.

Parcels with acreage less than one-half acre, generally found along the reservoir, will not be planted with trees because of the small size of these areas. A total of 30 acres within 182 unique

parcels of the property will remain unplanted; however, through natural succession, these small areas may eventually form forests or serve as foraging bat habitat. The 30 acres is additional to the 553 acres of forest creation.

2.3.2.2 Forest Preservation

A total of 683 acres of existing forest outside the normal pool and on NCMRWC property will be preserved and will have a permanent conservation easement established. The preservation of these existing forested areas will provide permanent forested areas and bat roosting habitat. A USFWS-approved forest management will be implemented to maintain the long-term integrity of the forest for bat habitat.

An additional 328 acres of existing forest is intended to remain in perpetuity to protect water quality surrounding the reservoir. This area will be owned by the NCMRWC and will be intended to protect water quality, but in the interest of providing NCMRWC with flexibility to manage their property, will not have a permanent conservation easement established. The 328 acres was calculated by subtracting the recreational facilities, potential tree clearing on NCMRWC property, utilities and road relocation on NCMRWC property, and dam construction impacts from the forested acres without a conservation easement.

The Lake Authority will protect 50 acres of forest preservation along stream resources within 500 feet of the NCMRWC property boundary by creating a stream buffer requirement. The 50 acres of forest preservation are comprised of multiple, small riparian parcels on neighboring property. The Lake Authority has determined that protection of these riparian areas will help protect the reservoir's water quality.

2.3.2.3 Conservation Easement

A permanent conservation easement will be established on 1,236 acres for 553 acres of tree planting and 683 acres of forest preservation (Table 3, Figure 10). The conservation easement will allow for the implementation of the Habitat Compensation Plan and prohibit incompatible uses that might jeopardize the quality of bat habitat. Discussions with the Ozark Land Trust have occurred about having a certified land trust hold the conservation easement.

The 50 forest acres along streams within the High Impact Zone will not have a permanent conservation easement, but will be included as a zoning requirement under the Lake Authority. The zoning requirement was passed by the NCMRWC and is legally enforceable. Table 3 provides a summary of forest creation, forest preservation, and the conservation easements.

Table 3. Forest Creation, Preservation, and Conservation Easement Summary (Figure 10).

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Habitat Compensation	Acres	Conservation Easement		
NCMRWC Property - Forest Creation	553	Yes		
NCMRWC Property - Forest Preservation	683	Yes		
TOTAL	1,236	Yes		
Other Forest Creation and Preservation				
High Impact Zone Riparian Forest Preservation	50	No ^a		
TOTAL	50			

^a Zoning Requirement under the Lake Authority.

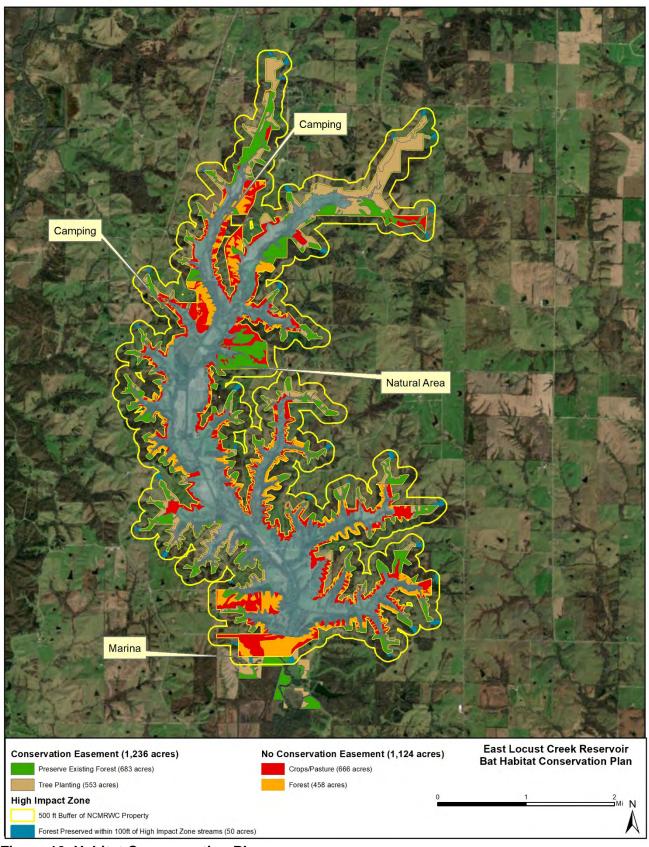


Figure 10. Habitat Compensation Plan.

Final negotiations are under way with the Missouri Conservation Heritage Foundation (MCHF) to hold the conservation easements. The reservoir property is being broken into management compartments with varying compatible uses, including tree preservation and planting in many compartments. Management activities and compatible uses for each compartment will make up a comprehensive management plan written to meet the endangered species preservation goals. Those compartments with tree preservation and planting, will have associated shape files specifying the bat preservation and planting areas for monitoring and maintenance. The NCMRWC looks forward to collaborating with the USFWS and MCHF to complete the management plan.

Plan for USFWS Review and Approval of Easement Terms (Time Period Actions)

• June-July 2020

- The project team investigated options for having NRCS, Ozark Land Trust or Missouri Conservation Heritage Foundation (MCHF) be the easement holder.
- Final negotiations are under way with the Missouri Conservation Heritage Foundation

August 2020

- Finalize 2020 draft of the ELCR Long Range Resource Protection and Utilization Plan, which details the individual compartments and present it to USFWS as a critical element in the management of conservation easements.
- Project team to consult with USFWS and draft the Forest Management Plans for discrete compartments
- Draft proposed monitoring plan and endowment provided by MCHF for review and discussion with project team and USFWS.
- Present plan to North Central Missouri Regional Water Commission on August
 10 and seek Commission authorization to engage in final negotiations.
- Concurrence with USFWS, MCHF on form and format of forest management plans and monitoring plans.

• September-November 2020

- Finalize Forest Management Plans
- Finalize Compartment Monitoring Plans

December 2020

- Write compartment legal descriptions
- Record Easements

2.3.2.4 Forest Management Plan

A USFWS-approved forest management plan has been initiated and will be submitted following completion.

2.3.2.5 Financial Assurance

The NCMRWC is a joint municipal utility and political subdivision of the State of Missouri as established by statute. The NCMRWC was created for the purpose of providing wholesale water to cities, public water supply districts and other public entities within its service area for retail sale to their respective customers. The NCMRWC was formed pursuant to a Joint Contract dated

August 20, 2001 among the cities of Milan, Green City and Green Castle, Missouri, and Public Water Supply District No. 1 of Sullivan County, Missouri. The NCMRWC is providing water to these entities through water supply facilities that the NCMRWC acquired from Milan in 2006.

The NCMRWC is also charged with construction of the East Locust Creek Reservoir to end severe and chronic water shortages in a 10-county area. As a political subdivision and per its own policies the NCMRWC is committed and obligated to meeting all pertinent state and federal statutory requirements including those to comply with National Environmental Policy Act (NEPA) and to meet its compensatory mitigation requirement, which requires maintenance.

The Project's Plan-of-Finance fully funds all required mitigation solutions as well as their ongoing maintenance. The majority of the mitigation project funding will come from NRCS with the NCMRWC providing a smaller portion in match funds from a USDA RD loan, grant package supported by NCMRWC revenues, and state appropriations through the Multi-Purpose Water Resources Fund.

NRCS is contracted and obligated to fund the following categories for the proposed Project at the following allocations:

- Mitigation credit identification: Permitting, 100 percent NRCS
- Identification of potential projects: Permitting, 100 percent NRCS
- Designing the projects: Engineering and Design, 100 percent NRCS
- Determining the amount of credits granted for each project: Engineering and Design,
 100 percent NRCS
- Purchasing property rights: Land Acquisition, 50 percent
- Uniform Relocation Act (URA) payments: URA, 54.4 percent NRCS
- Building the projects: Construction, 75 percent NRCS
- Draft a long-term maintenance plan: Engineering and Design, 100 percent NRCS

The funding cost share for the actual long-term maintenance implementation (last bullet above), needs to be determined. The long-term maintenance consists of the long-term (currently estimated at 10 years) worth of monitoring, maintenance, & replacement of the mitigation projects. The PL 83-566 program does not allow NRCS to engage in long-term obligations for mitigation. In order to garner the value for all funding partners of required mitigation, the NCMRWC plans to convert the estimated future mitigation costs to a single present value element similar to a mitigation credit to eliminate the long-term funding obligation. By doing so, this would allow NRCS to participate at a 50% cost share (for that portion of the mitigation project) and eliminate long-term funding obligations.

The NCMRWC will pursue options to self-provide or outsource though a private or governmental partner, the long-term mitigation obligations. It is possible that this is a service the MDNR or other state agency could provide and further possible that they would do so, or at least partially, as an in-kind contribution to the project.

The USDA RD loan and grant package is currently documented with a draft Letter of Conditions that will be executed upon the completion of a Legal Opinion for Land Acquisition, a Biological Opinion, the NEPA Record of Decision and the State of Missouri's Annual Appropriation Debt Cost Share Contract which is under negotiation.

The NCMRWC has passed a resolution that commits to the Bat Habitat Conservation Plan detailed in the biological assessment (Appendix B). When an appropriate land trust or other USFWS approved entity can be identified to hold the easements, an endowment will be made to the trust to cover long-term monitoring.

3. ACTION AREA

The action area is the geographic area where the physical, chemical, and biotic effects will occur. The historic and current land cover are compared below to identify historic trends in land cover within the action area. The current land cover trends, ongoing activities, and influences on federally listed species are discussed to identify current impacts on the species. The Project-related effects are described to show the impacts of the Project on the physical, chemical and biotic environment.

3.1. Geographic Area

The reservoir is entirely located within Sullivan County, and the Project impacts are concentrated in the county and within the East Locust Creek watershed. The 10-county region (Figure 2) includes all extents that have direct or indirect effects and foreseeable cumulative effect resulting from the federal actions or through interrelated or interdependent actions. The geographic extent of the action area includes the 10-county region that would receive the water supply and be supplied recreational opportunities from the Project. The 10-county region will experience varying impacts based on direct effects, indirect effects, and interrelated or interdependent actions.

3.2. Current and Historic Land Cover

The NRCS ecological site descriptions and the NLCD land covers are used to compare the historic and current land cover to show the historic land cover trend.

3.2.1. ECOLOGICAL SITE DESCRIPTIONS

The topography of the 10-county region includes rolling hills but lacks caves, mines, and karst topography (Elliot 2010). The pre-Euro-American settlement Project area consisted of forests, woodlands, savanna, and prairie ecological sites (NRCS 2015). Based on soils types, the 10-county region historically consists of 72 percent rangeland and 27 percent forest ecological site types, with the remaining areas consisting of water or undefined areas. NRCS mapped the ecological sites based on the region's soil types, and the ecological sites were determined by historical data, professional experience, field reviews, and scientific studies (NRCS 2015). The primary ecological sites comprise 62 percent of the 10-county region and include Till Upland Savanna (23 percent), Loess Upland Prairie (12 percent), Till Backslope Savanna (11 percent), Wet Floodplain Prairie (8 percent), and Till Protected Backslope Forest (8 percent). The remaining 43 ecological sites comprise 37 percent of the 10-county region (Table 4).

Table 4. 10-County Region Ecological Sites (NRCS 2015).

Ecological Site	Acres	Percent of 10- County Region
43 Remaining Ecological Sites Combined	1,362,271	37
Till Upland Savanna	821,398	23
Loess Upland Prairie	420,636	12
Till Backslope Savanna	391,287	11
Till Protected Backslope Forest	301,435	8
Wet Floodplain Prairie	288,998	8
Water	34,928	1
Ecological Site Undefined	14,569	n/a ¹
TOTAL ACRES	3,635,522	100

¹ Less than 1 percent

Sullivan County has a similar, but more focused composition of ecological sites than the 10-county region. Based on soils types, Sullivan County consists of 67 percent rangeland and 32 percent forestland, with the remaining areas consisting of water and undefined areas. The primary ecological sites comprise 65 percent of Sullivan County and include Till Upland Savanna (41 percent), Till Backslope Savanna (13 percent), and Till Protected Backslope Forest (12 percent). The remaining 19 ecological sites comprise 34 percent of Sullivan County (Table 5).

Table 5. Sullivan County Ecological Sites (NRCS 2015).

Ecological Site	Acres	Percent of
_oological one	710100	Sullivan County
Till Upland Savanna	170,384	41
19 Remaining Ecological Sites Combined	142,565	34
Till Backslope Savanna	51,944	13
Till Protected Backslope Forest	49,949	12
Water	1,682	n/a¹
Ecological Site Undefined	412	n/a ¹
TOTAL ACRES	416,936	100

¹ Less than 1 percent

In the 10-county region and in Sullivan County, the forestland ecological sites were primarily Till Protected Backslope Forest, Loamy Floodplain Forest, and Till Upland Woodland. These forestland ecological sites comprise 81 percent of the forestland ecological sites in Sullivan County and 68 percent of the forestland ecological sites in the 10-county region. However, the Loamy Floodplain Forest and Till Upland Woodland are not the dominant ecological sites in Sullivan County or the 10-county region in the 43 remaining or 19 remaining ecological sites. The primary ecological sites and forestland ecological sites in Sullivan County and the 10-county region are described below.

Till Upland Savanna (Rangeland Ecological Site Type)

Till Upland Savanna comprises 821,398 acres (23 percent) of the 10-county region and 170,384 acres (41 percent) of Sullivan County. The following is an excerpt from the Till Upland Savanna Ecological Site Description (NRCS 2015):

The reference plant community is characterized as till upland oak savanna unit dominated by big and little bluestem, Indian grass, switch grass, eastern gamagrass and a wide variety of prairie wildflowers. Trees and shrubs such as bur oak, swamp white oak, post oak, American hazelnut, prairie willow and wild plum occurred in groves or as scattered individuals across the ecological site. In addition, prairie species such as switch grass, Culver's root, Michigan lily, and bunchflower were added to the mix of upland species in areas where more moisture was present...

...Today, Till Upland Savannas are nearly extirpated from the region as the former prairies and savannas have been converted to intensive agriculture. A few known remnants exist but are degraded by fire suppression and grazing by domestic livestock. While re-establishing prairie and savanna on agriculture sites is beneficial to wildlife, restoration to the reference state from agricultural land is a long-term proposition with uncertain outcomes.

Loess Upland Prairie (Rangeland Ecological Site Type)

Loess Upland Prairie comprises 420,636 acres (12 percent) of the 10-county region and 17,718 acres (4 percent) of Sullivan County. The following is an excerpt from the Loess Upland Prairie Ecological Site Description (NRCS 2015):

Loess upland prairies are natural communities dominated by perennial grasses and forbs with scattered shrubs. Patches and mosaic patterns of shrubs co-existed as shown in historical accounts and land surveyor records... The prairies of Missouri are considered "tall grass" prairies, an ecosystem indigenous to central North America, because native warm season grasses (6 to 8 feet tall) dominate the rolling uplands common to this region

...Today's tall grass prairies developed during the current interglacial period (beginning over 10,000 years ago) when the climate experience a long drying period... This area expanded later when warmer, drier conditions continued and fires set by Native Americans increased in frequency and intensity as their populations increased. Missouri's grasslands were part of this larger tall grass expansion...

...The reference community, a Loess Upland Prairie, is characterized as a tallgrass prairie unit dominated by big bluestem (*Andropogon gerardii*), Indian grass (*Sorghastrum nutans*), prairie dropseed (*Sporobolus heterolepis*), and a wide variety of prairie forbs. On lower slopes and draws where water periodically accumulates, more mesic prairie species such as switch grass (*Panicum virgatum*), eastern gamagrass (*Tripsacum dactyloides*), Culver's root (*Veronicastrum virginicum*), Michigan lily (*Lilium michiganense*), and bunchflower (*Veratrum virginicum*) are added to the diverse mix of prairie species...

Till Backslope Savanna (Rangeland Ecological Site Type)

Till Backslope Savanna comprises 391,287 acres (11 percent) of the 10-county region and 51,944 acres (13 percent) of Sullivan County. The following is an excerpt from the Till Backslope Savanna Ecological Site Description (NRCS 2015):

The reference plant community is characterized as oak savanna unit dominated by big and little bluestem, Indian grass, switch grass, eastern gamagrass and a wide variety of prairie wildflowers. Trees and shrubs such as bur oak, post oak, shingle oak, American hazelnut, prairie willow and wild plum occurred in groves or as scattered individuals throughout the grassland landscape...

...Today, Till Backslope Savannas are nearly extirpated from the region as the former prairies and savannas have been converted to intensive agriculture. A few known remnants exist but are degraded by fire suppression and grazing by domestic livestock. While re-establishing prairie and savanna on agriculture sites is beneficial to wildlife, restoration to the reference state from agricultural land is a long-term proposition with uncertain outcomes.

Till Protected Backslope Forest (Forestland Ecological Site Type)

Till Protected Backslope Forest comprises 301,435 acres (8 percent) of the 10-county region and 49,949 acres (12 percent) of Sullivan County. The following is an excerpt from Till Protected Backslope Forest Ecological Site Description (NRCS 2015):

Till Protected Backslope Forests historically occurred in the most protected landscape positions on lower, steep slopes in the deeper valleys furthest from the prairie uplands. The reference plant community is a forest dominated by white (*Quercus alba*) and northern red oaks (*Quercus rubra*) and characterized by a tall (70 to 90 feet), closed canopy (80 to 100 percent) with a well-developed understory of white ash (*Fraxinus americana*), eastern hop hornbeam (*Ostrya virginiana*), Ohio buckeye (Aesculus glabra) and haws (*Viburnum* sp.), providing woody structural diversity not found in many adjacent woodland communities. The ground flora has many spring ephemerals and other shade loving herbaceous plant species ...

...Today, these ecological sites have been cleared and converted to pasture or have undergone repeated timber harvest and domestic grazing. Most existing forested ecological sites have a younger (50 to 80 years) canopy layer whose species composition and quality has been altered by timber harvesting practices. An increase in maple (*Acer* sp.) and hickories (*Carya* sp.) over historic conditions is not uncommon. In addition, in the absence of fire, the canopy, sub-canopy and understory layers are more fully developed. On protected slopes, the absence of periodic fire has allowed more shade tolerant tree species, such as sugar maple (*Acer saccharum*), white ash, and hickories to increase...

Wet Floodplain Prairie (Rangeland Ecological Site Type)

Wet Floodplain Prairie comprises 288,998 acres (8 percent) of the 10-county region and 15,146 acres (4 percent) of Sullivan County. No Wet Floodplain Prairie ecological site description is available.

Loamy Floodplain Forest (Forestland Ecological Site Type)

Loamy Floodplain Forest comprises 193,006 acres (5 percent) of the 10-county region and 29,265 acres (7 percent) of Sullivan County. The following is an excerpt from the Loamy Floodplain Forest Ecological Site Description (NRCS 2015):

The reference plant community is a forest dominated by an overstory of American elm and hackberry with sycamore, green ash and other early successional species scattered throughout. Canopy height is 80 to 100 feet with a canopy closure of 80 to 100 percent. Occasionally bur oak, shellbark hickory, black walnut and other hardwood species may occur in later stages of development. Loamy Floodplain Forests were a common natural community throughout the region. They occur on natural levees and low floodplains that flood frequently.

Flooding of these ecological sites commonly occurs annually or at least once every 3 years. Loamy sediments, originating from the loess and till in the surrounding uplands, make up a significant portion of the alluvium in these floodplains....

...Oak, shellbark hickory and black walnut begin to accumulate in these later stages of succession. Catastrophic floods will often partially or completely knock down the early species and regenerate this site creating a mosaic of early to late successional floodplain forests.

These sites are very productive. Today most of these ecological sites have been cleared and converted to agriculture. While some cleared fields have retained a narrow strip of forest along the river, other sites are often cleared right up to the bank. In such cases, flooding may cause severe stream bank erosion.

Till Upland Woodland (Forestland Ecological Site Type)

Till Upland Woodland comprises 159,539 acres (4 percent) of the 10-county region and 29,781 acres (7 percent) of Sullivan County. The following is an excerpt from the Till Upland Woodland Ecological Site Description (NRCS 2015):

The reference plant community is woodland dominated by an overstory of white oak and black oak. This woodland type has a moderate canopy closure (50 to 80 percent), with an open understory and a dense, diverse herbaceous ground flora. Historically, white oak dominated the canopy, along with black oak and occasional hickories, bur oak and post oak...

...Today, this community has either been cleared and converted to pasture, or has grown dense in the absence of fire. Most occurrences today exhibit canopy closure of 80 to 100 percent. In addition, the sub-canopy and understory layers are better developed. Black oak and hickory now share dominance with white oak with considerable more saplings in the understory. Under these denser, more shaded conditions, the original sun-loving ground flora has diminished in diversity and cover. While some woodland species persist in the ground flora, many have been replaced by more shade-tolerant species.

3.2.2. CURRENT LAND COVER COMPOSITION

The National Land Cover Database (NLCD) shows the current land cover in the 10-county region by examining spectral changes in aerial images (Homer et al. 2015). Land cover in the 10-county region and in Sullivan County is primarily cultivated crops, forest, and hay/pasture/herbaceous. The primary differences between the 10-county region and Sullivan County on a relative basis are in the cultivated crops and hay/pasture/herbaceous land. Sullivan County has 14 percent less land that is cultivated crops and 13 percent more hay/pasture/herbaceous land. The remaining land covers are generally consistent with the next largest difference on a relative basis occurring between forest land covers (4 percent difference). The NLCD is summarized for the 10-county region in Table 6 and for Sullivan County in Table 7.

Table 6. 10-County Region 2011 NLCD Land Cover

Table 6. 10-County Region 201	I NEOD Land	JOVEI.
NLCD Land Cover	Acres	Percent
		of Total
Barren Land	2,346	0*
Cultivated Crops	848,696	23
Forest – Deciduous, Mixed,	798,773	22
Evergreen and Forested Wetlands		
Developed - High, Medium, and	176,330	5
Low Intensity and Open Space	170,330	
Grassland - Hay, Pasture,		
Herbaceous, Emergent Wetlands,	1,769,181	49
and Shrub/Scrub Wetlands		
Open Water	40,344	1
TOTAL ACRES	3,635,670	100

^{*} Value less than 1.

Table 7. Sullivan County 2011 NLCD Land Cover.

NLCD Land Cover	Acres	Percent
		of Total
Barren Land	63	0*
Cultivated Crops	38,401	9
Forest – Deciduous, Mixed, Evergreen	102,028	25
and Forested Wetlands		
Developed - High, Medium, and Low	16,741	4
Intensity and Open Space		
Grassland - Hay, Pasture, Herbaceous,	256,876	62
Emergent Wetlands, and Shrub/Scrub		
Wetlands		
Open Water	2,827	1
TOTAL ACRES	416,936	100

^{*}Value less than 1.

3.3. Ongoing Activities and Influences

The ongoing activities and influences includes current and historic forest changes and the impacts of white-nose syndrome on bat species.

3.3.1. FOREST CHANGE IN THE 10-COUNTY REGION

The NLCD land covers and the ecological sites do not exactly match but can be grouped to show a general trend. Barren land and undefined land covers do not have similar corresponding land covers but comprise a small portion of the total land covers (less than 5 percent).

Comparing the historic land cover to the current land cover shows the loss of grassland and forestland resources since the 10-county region was settled and developed. The NLCD data shows the 10-county region has a 17 percent loss in forest (Table 8), and Sullivan County has a 24 percent loss (Table 9) when compared to the NRCS ecological sites. The Sullivan County ecological sites historically had 5 percent more forestland area than the 10-county region.

Table 8. Land Cover Change in the 10-County Region.

NLCD Land Cover	NLCD Land	Ecological	Land Cover	Percent
	Cover	Site Land	Change	Change
	(Acres)	Cover (Acres)	(Acres)	
Barren Land	2,346	0	2,346	*
Cultivated Crops	848,696	0	848,696	*
Forest - Deciduous, Mixed,				
Evergreen and Forested	798,773	965,369	-166,596	-17
Wetlands				
Developed - High, Medium,	176,330	0	176,330	*
and Low Intensity and Open	,		,	
Grassland - Hay, Pasture,				
Herbaceous, Emergent	1,769,181	2,620,656	-851,475	-33
Wetlands, and Shrub/Scrub	, ,	, ,	,	
Wetlands				
Open Water	40,344	34,928	5,416	16
Undefined	0	14,717	-14,717	*
TOTAL ACRES	3,635,670	3,635,670	n/a	n/a

^{*} Not applicable.

Table 9. Land Cover Change in Sullivan County.

NLCD Land Cover	NLCD Land	Ecological	Land Cover	Percent
	Cover	Site Land	Change	Change
	(Acres)	Cover (Acres)	(Acres)	
Barren Land	63	0	63	*
Cultivated Crops	38,401	0	38,401	*
Forest - Deciduous, Mixed,				
Evergreen and Forested	102,028	134,822	-32,794	-24
Wetlands				
Developed - High, Medium,	16,741	0	16,741	*
and Low Intensity and Open	,,,,,,,,		,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	
Grassland - Hay, Pasture,				
Herbaceous, Emergent	256,876	280,020	-23,144	-8
Wetlands, and Shrub/Scrub				
Wetlands				
Open Water	2,827	1,682	1,145	68.1
Undefined	0	412	-412	*
TOTAL ACRES	416,936	416,936	0	n/a

^{*} Not applicable.

More recent trends show a net gain in forest area in the 10-county region. From 2003 to 2013, the 10-county region had the following change in forest area (USFS 2016):

O-10 Percent Loss:
 O-10 Percent Gain:
 Greater than 10 Percent Gain:
 Adair County, Grundy County, and Chariton County
 Sullivan County, Linn County, and Schuyler County
 Putnam County, Mercer County, Macon County, and Livingston County

Adair, Grundy, and Chariton counties are the only counties in the 10-county region that have experienced a loss in forest area of 0 to 10 percent from 2003 to 2013. Putnam, Mercer, Macon, and Livingston counties have experienced a greater than 10 percent gain in forest area. Sullivan County has had a 0 to 10 percent gain in forest area. Statewide, Missouri has experienced no net change in forest area in the same period (USFS 2016).

3.3.2. WHITE NOSE SYNDROME

The greatest current threat to hibernating bats is white nose syndrome (WNS). WNS was first documented in New York in February of 2006 and has since spread rapidly from the northeastern United States to the central and southeastern United States. As of June, 2019, WNS has been confirmed in 33 states and in seven Canadian provinces (USFWS 2019b). Overall mortality rates from WNS have ranged from 90 to 100 percent in hibernacula in the northeastern United States. It is estimated that 5.7 to 6.7 million bats have died from WNS in infected regions nationwide since 2012 (USFWS 2012b).

WNS is a disease caused by a white fungus, *Pseudogymnoascus destructans*, that infects the skin on the muzzle, ears, and wings of hibernating bats (USGS 2018). WNS is transmitted from bat to bat during the winter months, when hibernating bats are in close contact with one another for extended periods of time. Further, hibernating bats have reduced immune function and body

temperature, making them more susceptible to infection than non-hibernating populations (Cornwell et al. 2017). Bats infected with WNS exhibit erratic behaviors such as early or mid-hibernation arousal, flying outside during daylight or freezing temperatures, and clustering near the hibernacula entrance (USGS 2018; USFWS 2015a). These erratic behaviors ultimately result in emaciation, dehydration, and mortality in infected bats.

WNS has spread rapidly in all directions from the epicenter in the northeastern United States since 2006. WNS first appeared in Missouri during the winter of 2009-2010 and has increased in occurrence in years since (www.whitenosesyndrome.org/resources/map). While there has been no documented report of WNS in Sullivan County, Missouri, to date, each year since 2010 has seen an increase in the number of counties with WNS occurrences than had the year before (www.whitenosesyndrome.org/resources/map). If current trends continue, it is likely that additional reductions in bat populations will occur in this region.

4. LISTED SPECIES AND CRITICAL HABITAT IN THE ACTION AREA

According to the USFWS's official species list (USFWS 2018a), MYGR, MYSO, MYSE, and ASME are the federally listed species that are within the Project location and may be affected by the Project. MYSO and MYGR are listed as endangered, and MYSE and ASME are listed as threatened. No critical habitat is designated for any of the four species in the 10-county region. Olsson conducted sampling for all four species in 2016. MYSO and MYSE were identified during the sampling effort, but no ASME or MYGR were identified (Olsson 2017; Olsson 2018).

4.1. Mead's Milkweed

ASME has a single, wax-coated stalk that stands 8 to 16 inches high. The leaves branch opposite each other, are approximately 2 to 3 inches long, and are three-eighths to 2 inches wide. The tip of the milkweed has a drooping cluster of six to 15 greenish to cream-colored flowers (USFWS 2005). ASME may take 15 years or more to mature from a germinating seed to a flowering plant (USFWS 2003). The species flowers as early as late May in the south (southern Kansas and Missouri) through mid- to late June in the north (Illinois). Observations show that individual plants flower for two or three years and then rest, and in some cases, completely disappear (USFWS 2005).

4.1.1. MEAD'S MILKWEED ESA LISTING

ASME was listed as threatened under the ESA on September 1, 1988. Declines of ASME can be attributed to alteration of the tallgrass prairie by multiple factors including (1) agricultural use; (2) urban growth; (3) industrial; (4) commercial development; (5) recreational use of sites; and (6) hay mowing (USFWS 1988).

The status of ASME at the time of listing was detailed in the Federal Register when the species was listed as threatened. Federal Register/ Vol. 53, No. 170/Pg. 33992/Thursday, September 1, 1988/Rules and Regulations (USFWS 1988) states this:

"The plant is believed to be extirpated from Indiana and Wisconsin. It is threatened by destruction and modification of the 'tall grass' prairie due to agricultural expansion, urban growth, and agricultural practices that such as mowing and grazing, which are detrimental to the plant's reproductive cycle."

4.1.2. MEAD'S MILKWEED HABITAT

ASME habitat includes mesic to moderately dry upland tallgrass prairies throughout the eastern tallgrass prairie, from Kansas through Missouri and Illinois and north to southern Iowa and northwestern Indiana. ASME is found in virgin, tallgrass prairies that are managed for light grazing and hay production (USFWS 2003). USFWS (1988) cited personal communication with Ronald McGregor (University of Kansas) that he has only found ASME in tallgrass prairies. Similarly, an unpublished report by S.W. Morgan at MDC in 1980 stated that ASME in Missouri is found in unplowed bluestem prairie (USFWS 1988).

4.1.3. MEAD'S MILKWEED CURRENT RANGE AND POPULATION STATUS

In 1988, approximately 81 populations of ASME were known. Of those, 38 were in Kansas, three were in Illinois, two were in Iowa, and 17 were in Missouri (USFWS 1988). ASME is currently known in 34 counties in Kansas, Missouri, Iowa, and Illinois at 171 sites (USFWS 2005). There are 330 extant populations with three populations identified as highly viable (USFWS 2012a). A highly viable population was defined as having a population with 50 genetically diverse mature plants with seed production on at least 125 acreage that is late successional stage, has conservation easement, and is managed with a fire regimen. Sullivan County does not have a known current or historic ASME population, but three extant populations are in the Missouri glaciated plains physiographic region, in which Sullivan County is located (USFWS 2012a).

4.1.4. MEAD'S MILKWEED PROJECT FIELD STUDY

During the summer of 2016, Olsson biologists assessed grassland within the Project area (Olsson 2018). The assessment consisted of two parts: a desktop review to identify grassland habitat and a follow-up field verification to determine potential ASME habitat and species occurrence. The desktop review identified grassland areas that could contain ASME habitat from aerial photographs. Specifically, grassland sites were identified that have never been plowed, were not currently or previously developed, and that lacked over 50 percent tree or shrub canopy cover. Woodland areas, open waters, and cropped areas (historically or present) were eliminated, since these would have a low likelihood of providing suitable habitat for the species. Multiple research documents list habitat for ASME as virgin, tallgrass prairie (USFWS 1988), which would not include cool-season grass pastures. Cool-season grasses are considered undesirable prairie species and are consistent with a degraded prairie (Kindscher et al. 2008). Resources used during the desktop review included:

- Earth Sciences Resources Institute (ESRI) Aerial Imagery
- Google Earth ® Historical Aerial Photographs

Following the desktop review, Olsson performed a field verification survey for the identified sample locations. Each survey area, identified as grassland through the desktop review, was walked to determine whether vegetation was native or non-native to Missouri. Non-native grassland vegetation included tall fescue, smooth brome (*Bromis inermis*), and reed canarygrass (*Phalaris arundinacea*). Based on the desktop review, the dam and inundation area included approximately 452 acres of grassland areas potentially suitable for ASME at 58 unique sites. A field verification survey was performed at the 58 unique sites, and four sites were found to contain native vegetation consistent with ASME habitat. The remaining 54 sites contained cool-season

grasses and were not considered ASME habitat. The four sites with native vegetation averaged 4.7 acres size, and a 30-minute wandering survey was performed to search for ASME. No ASME ramets (individual stalks) were identified at the four sites (Olsson 2018). The Mead's milkweed study is included in Appendix C.

4.2. Gray Bat

MYGR has an even, gray color on its dorsal fur that is the same color from base to tip. MYGR is about 3.5 inches in length, has a wing span of 10 to 11 inches, and weighs between 7 and 16 grams. The wing membrane attaches to the foot at the ankle instead of at the base of the toes like other *Myotis* (USFWS 2011).

4.2.1. GRAY BAT ESA LISTING

MYGR was listed as endangered under the ESA of 1973 on April 28, 1976. The species decline was attributed to human disturbances of caves, habitat loss and degradation, and contamination from pesticides (USFWS 2011). Recently, WNS was attributed to thousands of bat mortalities including MYGR mortalities (USFWS 2009b).

4.2.2. GRAY BAT HABITAT

MYGR inhabits caves year-round and occupies cold hibernating caves in the winter and warm caves during the summer (USFWS 2009b). Wintering caves tend to be deep and vertical. During the summer months, pregnant females form maternity colonies in caves that have domed ceilings. MYGR does not use houses or barns for habitat (USFWS 2018c; MDC 2000). Maternity colonies are formed on the cave ceilings and range from a few hundred individuals to a few thousand individuals. Summer foraging habitat includes open water of rivers, streams, and lakes or reservoirs. MYGRs may travel up to 35 kilometers between maternity colonies and foraging areas; however, most foraging areas are located 1 to 4 kilometers from a maternity colony's cave (USFWS 2009b). MYGRs forage approximately 3 meters above the water's surface for aquatic insects, especially mayflies, caddisflies, and stoneflies (USFWS 2009b).

4.2.3. GRAY BAT CURRENT RANGE AND POPULATION STATUS

MYGR is found in limestone karst areas that primarily include Alabama, Arkansas, Kentucky, Missouri, and Tennessee with smaller populations in adjacent states (USFWS 2009b). In Missouri, the range extends throughout the entire state except for the northwestern and northcentral portions of the state. Sullivan County is within MYGR's range. Most of the winter population in Missouri hibernates in three caves in the southern part of the state from October through April. In the spring, MYGR migrates to over 50 other caves throughout the Ozarks (MDC 2000).

4.2.4. GRAY BAT PROJECT FIELD STUDY

Because Sullivan County has potential MYGR foraging habitat, Olsson conducted mist netting and acoustic monitoring from June 2 – July 10, 2016, to determine the presence or probable absence of MYGRs. The sampling methodology followed the Indiana Bat Draft Recovery Plan and the Range-wide Indiana Bat Summer Survey Guidelines (USFWS 2015b). The 2016 sampling did not identify MYGRs, based on 81 net nights and 35 detector nights (Olsson 2017). See Appendix D for the bat study.

4.3. Indiana Bat

MYSO is a medium-sized bat with a forearm length of 35–41 millimeters (mm) and a head and body length of 41–49 mm. MYSO closely resembles the little brown bat (*Myotis lucifugus*) and the MYSE. However, the MYSO is differentiated from the MYSE by its long, pointed, symmetrical tragus. MYSO is differentiated from the little brown bat by its keeled calcar. MYSO's nose is a lighter color than that of the little brown bat (USFWS 2007).

4.3.1. INDIANA BAT ESA LISTING

MYSO was listed as endangered under the Endangered Species Preservation Act of 1966, which preceded the current ESA. While the original reasons for listing were not identified, they were later identified as (A) habitat destruction, modification, or curtailment; (B) overutilization for commercial, recreational, scientific, or educational purposes; (C) disease or predation; (D) inadequate regulatory mechanisms; and (E) other natural or man-made factors affecting the MYSO's continued existence. More recently, WNS has caused substantial population declines (USFWS 2017a).

4.3.2. INDIANA BAT HABITAT

MYSO is a migratory species that migrates from summer foraging and maternity roost habitat to winter hibernating habitat. In the fall, prior to hibernation, swarming occurs around hibernacula to increase fat supplies and conduct mating activities (USFWS 2007). MYSO hibernacula is restricted to caves and mines found in karst areas of the east-central U.S. Bats enter a hibernaculum by the end of November and emerge in April and May. Females emerge in April, followed by the males in early May. Hibernacula have stable temperatures that remain below 50 degrees Fahrenheit (F) and above freezing. MYSO temperature requirements for caves are not commonly found (USFWS 2007). No known hibernacula are within the 10-county region of the Project area (USFWS 2007).

Summer roost trees for MYSO are typically large, often dead, with exfoliating bark. The tree species primarily associated with MYSOs are ash (*Fraxinus*), elm (*Ulmus*), hickory (*Carya*), maple (*Acer*), poplar (*Populus*), or oak (*Quercus*). Roost trees typically receive sunlight for part of the day and are often in open forest canopies (USFWS 2007). In Missouri, the average roost tree diameter is 22 inches. The average height of roost trees ranges from 52 to 85 feet, and the minimum height exceeded 12 feet for a primary roost (USFWS 2007).

The female MYSO uses a maternity roost tree to give birth to a single pup in June or early July. Maternity roosts can be primary or alternate, based on the number of individuals using the roost. In Missouri, primary roost trees are typically dead trees in open, interior woodlands. Shagbark hickory trees are more likely to provide alternative maternity roosts (USFWS 2007). A maternity colony may roost in 10 to 20 trees per year, but only one to three trees may be primary roost trees (USFWS 2007). MYSOs switch roost trees an average of every two to three days, which may vary based on reproductive condition and roost type (USFWS 2007). MYSOs return to maternity roosts annually. All roost trees eventually decay and become unusable by MYSOs. Having alternative maternity roosting options may provide replacements for primary maternity roost trees (USFWS 2007).

4.3.3. FORAGING HABITAT

Foraging habitat typically includes semiopen to closed forest habitat, forest edges, and riparian areas (USFWS 2007). MYSOs feed on flying insects that include moths, flies, beetles, and caddisflies. MYSOs forage at night and fly within 2 to 30 meters above ground level.

Womack et al. (2013) identified the distance traveled by lactating MYSOs in northern Missouri from roost tree to foraging area as 1.3 miles (50 percent probability) to 5.8 miles (95 percent probability). USFWS found that females forage from 0.3 to 5.2 miles from their roost habitat; however, studies have found that most females are captured within less than 2.6 miles from their roost (USFWS 2007). Based on this research, the home range was shown to vary from 1.3 miles (3,398 acres) to 5.8 miles (67,637 acres) with most females captured within a 2.5-mile (12,566-acre) range.

4.3.4. INDIANA BAT CURRENT RANGE AND POPULATION STATUS

Missouri is within the historic and current range of MYSO and has documented occurrences in winter and summer (USFWS 2007). As shown in Figure 11, Sullivan County, Missouri, has known maternity roosts and summer habitat for MYSOs. The nearest Priority 1 hibernaculum is approximately 115 miles southeast of Sullivan County. Currently, efforts have been made to protect underground hibernacula with a goal of protecting 80 percent of the Priority 1 hibernacula, which include hibernacula with a population of more than 10,000 individuals. Priority 3 and 4 hibernacula are approximately 60 miles southeast of the Project. Priority 3 hibernacula have current or historic populations of 50 to 1,000 bats, and Priority 4 hibernacula have current or historic populations of fewer than 50 bats. Females MYSOs have documented as migrating up to 357 miles to their summer habitat (USFWS 2007). A large portion of the male MYSO population does not migrate from its hibernaculum. Forested areas of Sullivan County, suitable for maternity roost colonies, could support MYSOs (USFWS 2007).

The 2019 MYSO population status includes 537,297 bats that occur within hibernacula in 16 states (USFWS 2019a). According to USFWS (2019a), Missouri has the largest population of MYSOs (195,157 bats) followed by Indiana (184,848 bats) and Illinois (78,403 bats). The total population has declined 19 percent in the last 12 years, which corresponds with the discovery of WNS. Seven states have experienced greater than 10 percent declines in MYSO populations (USFWS 2017b).

Missouri has had a statewide population decrease of 17,785 MYSO bats (8 percent) from 2011 to 2019. Missouri is within the Ozark-Central Recovery Unit, which has had a population increase of approximately 4,944 bats (2 percent) since 2011 (USFWS 2019a). WNS was identified in the Ozark-Central region in 2013, and the population regionwide decreased by 5,814 bats (2 percent) from 2013 to 2019. In Missouri, the population decreased by 19,296 bats (9 percent) from 2013 to 2019 (USFWS 2019a)

The Missouri population had remained relatively stable from 2011 to 2017 with a range of 210,000 to 220,000 MYSO individuals (USFWS 2019a). In 2019, there was a 10 percent drop from the 2017 population and the 2019 population is the lowest population recorded in eight years. This is primarily because of an eight percent drop in MYSO recorded at the Sodalis Nature Preserve.

The Midwest region had a decline of 20 percent, the Northeast region had a decline of 16 percent, and the Appalachia region had a decline of 94 percent from 2011 to 2019.

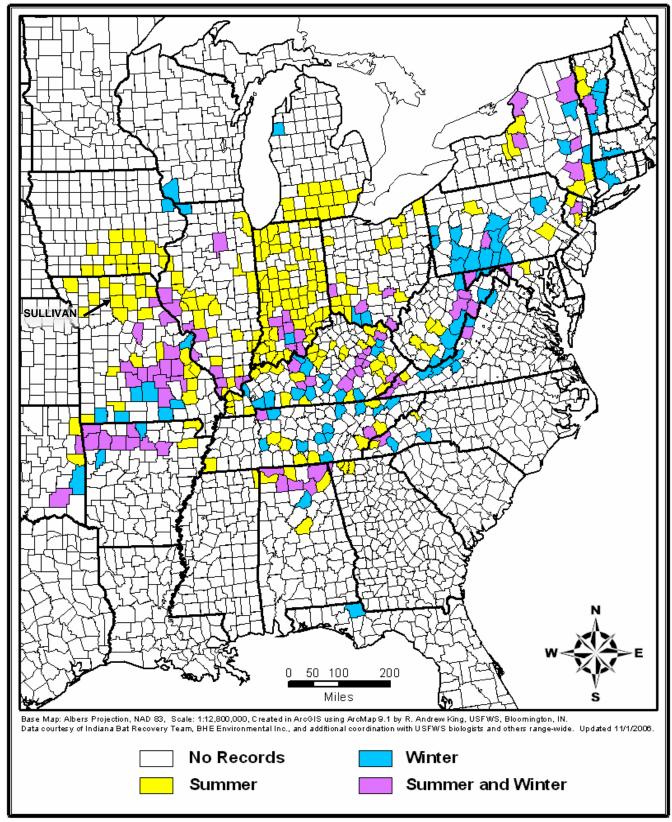


Figure 11. Indiana Bat (MYSO) Summer and Winter Habitat (Emphasis added, USFWS 2007).

4.3.5. INDIANA BAT PROJECT FIELD STUDY

Because Sullivan County has potential MYSO habitat, mist netting and acoustic monitoring was conducted from June 2 – July 10, 2016, to determine the presence or probable absence of MYSOs. The sampling methodology followed the Indiana Bat Draft Recovery Plan and the Rangewide Indiana Bat Summer Survey Guidelines (USFWS 2007; 2015b). Results of the sampling included the capture of 10 MYSO within the Project boundary based on 81 net nights, and there was positive detection in eight of the nine regions based on 35 detector nights (Olsson 2017).

Four maternity roost trees were identified that were clustered in two groups of two maternity roost trees. A maternity roost tree was identified as having more than five bats identified during the emergence count (Olsson 2017). Callahan (1993) defined primary roost trees in Missouri as having 30 or more bats on multiple nights. However, Kurta et al. (1996) determined this number might not be applicable to small to moderate sized maternity colonies. As shown in Table 10, roost trees A and C were identified by the same bat (Laela) as were roost trees E and F (by Sushi). See Appendix D for the bat survey report.

Table 10. East Locust Creek Bat Survey Maternity Roost Trees.

Roost Name	Tagged Bat	Date	Species	Emergence Counts
А	Laela (Tree 1)	30-Jun-16	American Elm	19
А	Laela (Tree 1)	1-Jul-16	American Elm	31
А	Laela (Tree 1)	3-Jul-16	American Elm	0
С	Laela (Tree 2)	4-Jul-16	Shagbark Hickory	7
С	Laela (Tree 2)	5-Jul-16	Shagbark Hickory	7
E	Sushi (Tree 1)	6-Jul-16	Shagbark Hickory	22
E	Sushi (Tree 1)	8-Jul-16	Shagbark Hickory	38
F	Sushi (Tree 2)	7-Jul-16	Shagbark Hickory	7
F	Sushi (Tree 2)	8-Jul-16	Shagbark Hickory	2

Maternity Roost Trees

MYSOs exhibit site fidelity to maternity roost trees and use multiple roost trees within a season (Silvis et al. 2014). During short-term periods, MYSOs frequently switch roost trees but maintain primary roost trees, which are used by many MYSOs, and alternative maternity roost trees, which support fewer individual MYSO (Silvis et al. 2014). A MYSO colony typically uses one to three primary maternity roosts per season. Most of the colony will use a primary roost repeatedly (Silvis et al. 2014). Roost trees are ephemeral in nature, and the roost-switching behavior may allow alternative maternity roosts to replace a lost roost tree (Gumbert et al. 2002).

Four MYSO maternity roost trees were identified by the East Locust Creek bat survey (Olsson 2017), with two of the four MYSO maternity roost trees identified within the normal pool of the

Project (Figure 12). A lactating female bat was tracked to each of the four maternity roost trees, and the emergence count identified more than five bats.

The four maternity roost trees were in two groups of two maternity roost trees. The two groups of roost trees are less than 5 miles apart, which suggests there could be one or two MYSO colonies. Based on the dates from the emergence counts (Table 10), it is possible that there is only one colony. However, the proximity of the capture location, maternity roost trees, and alternate roost trees all suggest there may be two MYSO colonies (Figure 12). Minimum population size was estimated based on the emergence counts (Table 10) and assumed all bats leaving the trees are MYSOs. The two maternity roost colonies' minimum populations are estimated at 31 bats and 40 bats. MYSO individuals using alternative maternity roost sites would not be included in the minimum populations.

Maternity roost trees A and C (see Figure 12) were 0.6 mile apart from one another, and maternity roost trees E and F were 0.1 mile apart. The two groups of maternity roost trees were 4.9 miles apart at the farthest distance and 4.5 miles apart at the closest distance. Maternity roost sites C and F may be alternative maternity roost sites because of the low bat numbers (seven) recorded during the emergence counts. Additionally, they are near a maternity roost tree with emergence counts over 30 bats.

The home ranges for the Laela and Sushi colonies were determined based on a 2.5-mile buffer around the primary maternity roost trees (Figure 13). The forested areas within the 2.5-mile buffers totals 6,566 acres with 3,732 forested acres within Laela's home range and 2,880 forested acres within Sushi's home range. There are 46 forested acres of overlap between the two home ranges.

Nine alternative maternity roost trees were identified three of which were located in the normal pool. The nine alternative maternity roost trees had emergence counts of fewer than five bats.

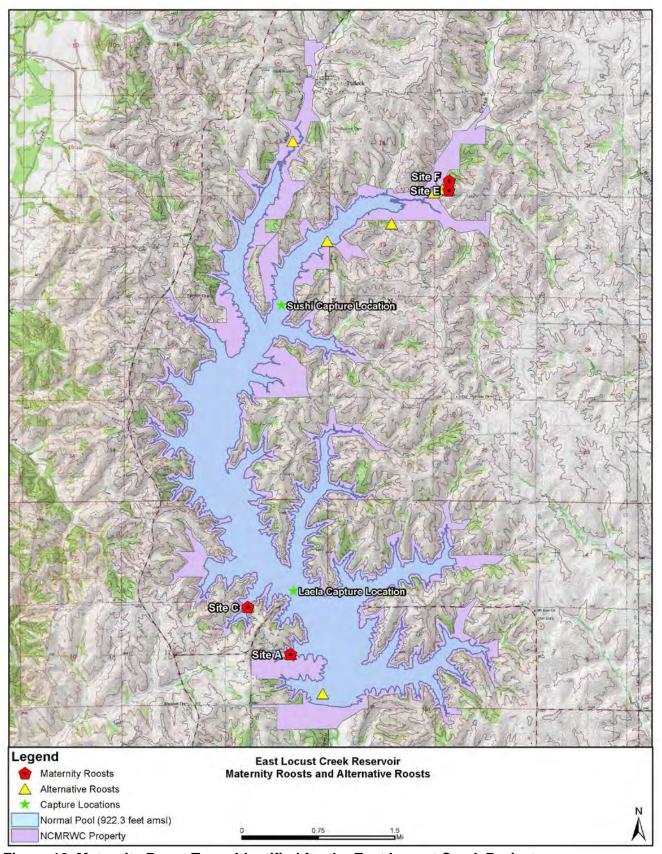


Figure 12. Maternity Roost Trees Identified for the East Locust Creek Project.

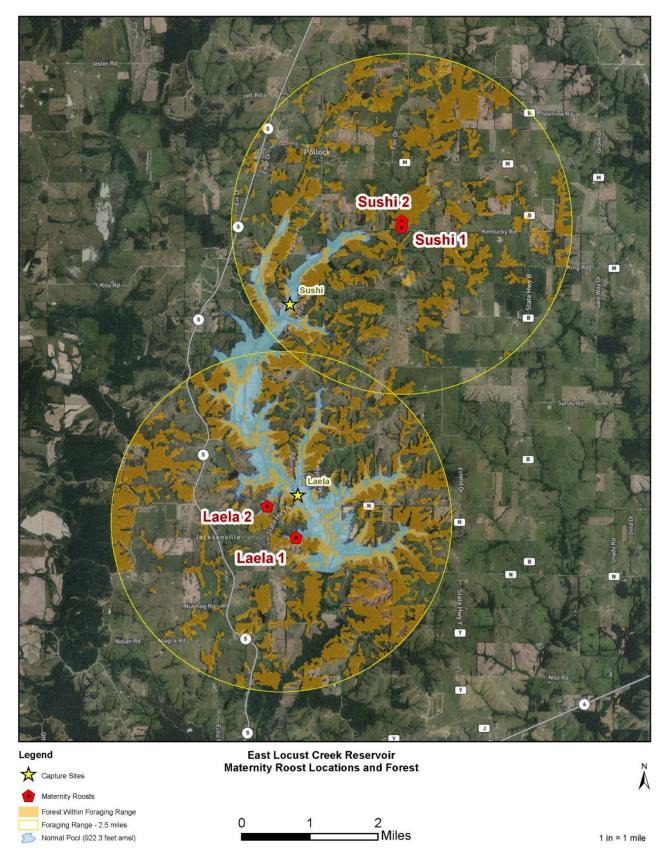


Figure 13. Laela and Sushi Colony's Home Range.

4.4. Northern Long-Eared Bat

MYSE is a medium-sized bat with a total body length of 78 mm. The fur of MYSE is medium to dark brown on the back and paler brown on the underside. This species of bat is differentiated among similar species in the genus *Myotis* by its long ears, which measure 17 to 19 mm, and its long tail, which measures 26 mm (Ollendorff 2002).

4.4.1. NORTHERN LONG-EARED BAT ESA LISTING

MYSE was listed as a threatened species under the ESA on April 2, 2015, and a final 4(d) rule was published on January 14, 2016. The primary threat to MYSE is WNS, which is a fungal disease that causes bats to leave their hibernacula during winter. The final 4(d) rule accounted WNS as the primary cause of MYSE decline, and not necessarily habitat loss. The 4(d) rule allows for tree clearing if it is does not take place within 0.25 mile of a known hibernaculum or within 150 feet of a known maternity roost tree during the pup season (June 1 through July 31; USFWS 2016a).

4.4.2. NORTHERN LONG-EARED BAT HABITAT

MYSE are insectivores that feed above the understory, but below the canopy, in a range of 3 to 10 feet above ground. MYSE prefer mature forests for foraging, but they also use open spaces such as small forest clearings, water, and along roads (USFWS 2015c). Summer habitats consist of forested or wooded areas where they roost, forage, and travel and may also include adjacent and interspersed non-forested habitats such as emergent wetlands and adjacent edges of agricultural fields. Summer habitat typically includes roost trees of varying sizes and species but may also include buildings, barns, bridges, and bat houses (USFWS 2018d). MYSE will roost individually or in colonies in cavities or crevices of live trees and snags. Winter habitat consists of hibernacula that include caves and abandoned mines. However, the MYSE can hibernate in small hibernacula, which can also include bridges, barns, and houses (USFWS 2018d). Hibernacula characteristics include relatively constant, cooler temperatures; high humidity; and no air currents (USFWS 2015c).

The MYSE migrates to and from its hibernacula in the spring and fall, and it typically occupies summer habitat between mid-May and mid-August. The MYSE selects roost trees with exfoliating bark or with crevices or cracks. The preferred tree species in Missouri include shagbark hickory (*Carya ovata*), eastern cottonwood, various oak species (*Quercus* sp.), silver maple (*Acer saccharinum*), and American elm (*Ulmus americana*). Suitable snags or standing dead trees with sloughing bark provide habitat regardless of species (USFWS 2014). There are no known maternity roosts or hibernacula in Sullivan County; however, potential MYSE roosting habitat is present within the county (USFWS 2007).

4.4.3. NORTHERN LONG-EARED BAT CURRENT RANGE AND POPULATION STATUS

The current status of MYSE in Missouri was detailed in the Federal Register when the species was listed as threatened. Federal Register /Vol. 80, No. 63 Pg. 17979/Thursday, April 2, 2015 /Rules and Regulations (USFWS 2015c) notes the following:

"The northern long-eared bat has been documented in 76 of 114 counties in Missouri; its abundance in the summer is variable across the State and is likely related to the presence

of suitable forest habitat and fidelity to historical summer areas. There are approximately 269 known northern long-eared bat hibernacula that are concentrated in the karst landscapes (characterized by underground drainage systems with sinkholes and caves) of central, eastern, and southern Missouri... Similar to other more predominantly karst areas, the northern long-eared bat is difficult to find in Missouri caves, and thus is rarely found in large numbers. Pseudogymnoascus destructans (Pd) [the fungus that causes WNS] was first detected in Missouri in the winter of 2009-2010; however, the majority of sites in the State that have been confirmed with WNS were confirmed more recently, during the winter of 2013–2014. Due to low numbers historically found in hibernacula in the State, it is difficult to determine if changes in count numbers are due to natural fluctuations or to WNS. However, there was one northern long-eared bat mortality observed during the winter of 2013–2014... Furthermore, Elliott (2015, pers. comm.) noted that surveyors are detecting indicators of decline (changes in bat behavior) as well as actual declines in numbers of northern long-eared bats in hibernacula in the State. As for summer survey data, mist-net and acoustic surveys conducted across Missouri in the summer of 2014 indicate continued distribution throughout the State. However, there were fewer encounters with northern longeared bats in some parts of the State in 2014, as compared to previous years. Specifically, surveys conducted on the Mark Twain National Forest in 2014 indicate a decline in the overall number of captures of all bat species, including fewer northern long-eared bats than expected... Further, in southwest Missouri, northern long-eared bats have been encountered during mist-net surveys conducted on the Camp Crowder Training Site in 2006, 2013, and 2014. Overall, the number of northern long-eared bat captures has decreased since 2006, relative to the level of survey effort (number of net nights)... Additionally, during a 2-year survey (2013–2014) at a State park in north-central Missouri, 108 northern long-eared bats were captured during the first year, whereas only 32 were captured during the second year, with a similar level of effort between years...

4.4.4. NORTHERN LONG-EARED BAT PROJECT FIELD STUDY

As with MYSOs and MYGRs, Sullivan County has potential MYSE habitat; therefore, mist netting and acoustic monitoring were conducted from June 2 – July 10, 2016, to determine the presence or probable absence of MYSEs. The sampling methodology followed the Indiana Bat Draft Recovery Plan and the Range-wide Indiana Bat Summer Survey Guidelines (USFWS 2015b). Results of the sampling included the capture of six MYSE within the Project boundary based on 81 net nights and had positive detection in seven of the nine regions based on 35 detector nights. See Appendix D for the bat survey report.

The East Locust Creek Bat Survey Report (Olsson 2017) documented six MYSE caught through mist netting within the normal pool; of the six, two were lactating females. Assuming a 3-mile home range from the lactating female capture sites, a MYSE maternity roost may be located in the Project area. There are known MYSE maternity roost trees in Adair, Putnam, and Schuyler counties. Project impacts in Adair, Putnam, and Schuyler counties are related to water transmission line activities, which are not likely to include tree clearing.

The lactating MYSE were captured in different mist nets at the same site. The home ranges MYSE colony was determined based on a 3-mile buffer around the capture location (Figure 14). The forested areas within the 3-mile buffers totals 5,727 acres.

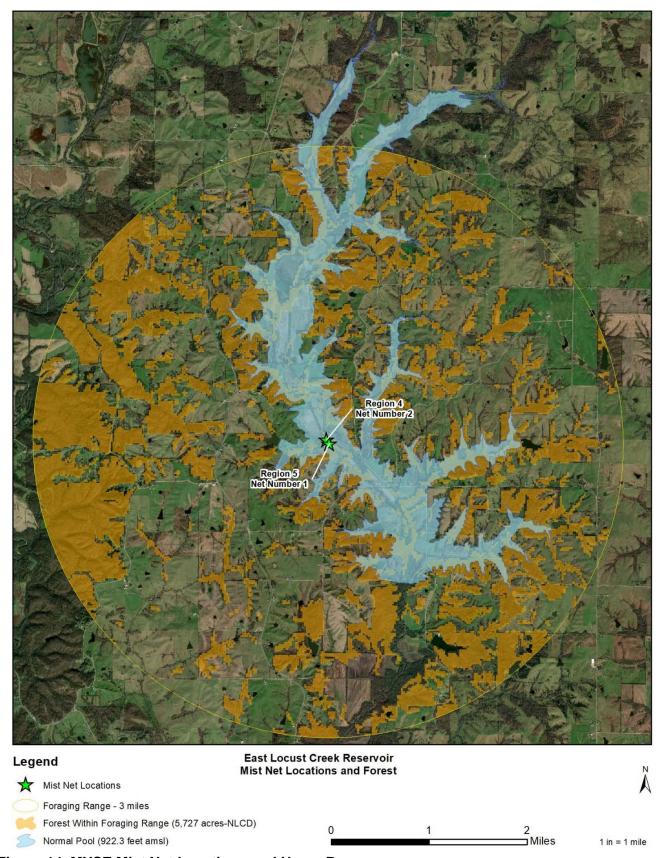


Figure 14. MYSE Mist Net Locations and Home Range.

5. EFFECTS OF THE PROPOSED ACTION

5.1. Effects on the immediate environment

Terrestrial Vegetation Loss or Conversion

The Project elements could result in the conversion of 1,341 acres of forest and 1,236 acres of grassland (Table 11). The normal pool inundation will include 973 acres of forest and 1,066 acres of grassland conversion. The remaining 289 acres of land conversion in the normal pool (2,328 acres total in normal pool) includes roads and rights-of-way, residential development (village of Boynton), and cropland. The forest loss would be 0.17 percent of forest in the 10-county region and 1.36 percent of forest in Sullivan County.

Table 11. Project Forest and Grassland Impacts.

Project Element	Projected Forest	Projected Prairie or
	Conversion	Grassland Conversion
	(acres)	(acres)
Normal Pool Inundation	973	1,066
Recreational Facilities Development	27	61
Utilities and Road Relocation	34 ³	69 ¹
Dam Construction, Borrow Sites,		
Spillway Construction, and Temporary	23	40
Dam Access Roads		
Tree Clearing on NCMRWC Property	69 ²	0
Because of Development	00	
Residential Development	162	506
Future Water Transmission Lines	53	
TOTAL LAND CONVERSION	1,341	1,742

¹ Includes permanent impacts only. Temporary impacts will be replanted to prairie or pasture vegetation.

Note: Forest loss because of residential development and future water transmission are not controlled by the NCMRWC and may be avoided upon design and construction.

The tree clearing on NCMRWC property related to development may occur to allow for a lake view. These impacts are included as project impacts. As stated in Section 2.2.6, 458 acres of forest on NCMRWC property are outside the normal pool and would not have conservation easement protection. As shown in Table 11, there are recreation, utilities and road relocation impacts and dam construction impacts that total 130 acres. The utilities and road relocation total 11 acres on NCMRWC property and 23 acres outside NCMRWC property. There are 328 acres that would remain in forest to protect water quality.

Wetland Losses

A wetland delineation was completed for the Project's normal pool area in 2015 and 2016 (Olsson 2016). Based on the wetland delineation conducted for the Project, approximately 362 acres of wetlands were determined to be in the normal pool. The 362 total wetland acres consist of 273 acres of palustrine emergent (PEM) wetlands, which are dominated by herbaceous vegetation; 79 acres of palustrine forest (PFO) wetlands, which are dominated by trees; and 10 acres of

² Assumes 15 percent of forest without a conservation easement could be cleared.

³ There are 11 acres of utility and road relocation forest impacts within the NCMRWC property.

palustrine shrub-scrub (PSS) wetlands, which are dominated by small woody plants (Olsson 2016).

The wetland quality is reduced for 224.5 wetland acres, because the wetlands were previously farmed, are currently farmed, or consist of over 50 percent cover of reed canarygrass (*Phalaris arundinacea*), which is an invasive species that provides reduced wetland functions. A 39.5-acre PEM wetland was created by the NRCS Wetland Reserve Program (WRP) and is included in the total PEM wetlands within the normal pool. The WRP wetland is required to be replaced in-kind based on NRCS rules.

Stream Losses

In 2015 and 2016, Olsson conducted a stream assessment for all streams within the normal pool of East Locust Creek (Olsson 2016). The stream assessment identified 49.1 miles of stream, which included 27.6 miles of ephemeral, 12.6 miles of intermittent, and 8.9 miles of perennial streams within the normal pool. The stream assessments for East Locust Creek (perennial) measured the ordinary high-water mark width of 12 to 25 feet and the top-of-bank width from 35 to 60 feet. The buffer vegetation along East Locust Creek included black walnut (*Juglans nigra*), multiflora rose (*Rosa multiflora*), red mulberry (*Morus rubra*), American elm (*Ulmus americana*), white oak (*Quercus alba*), black willow (*Salix nigra*), shagbark hickory (*Carya ovata*), tall fescue (*Schedonorus arundinacea*), silver maple (*Acer saccharinum*), hackberry (*Celtis occidentalis*), and river birch (*Betula nigra*).

Downstream Flow Impacts

Once constructed, the dam will block chemical, physical, and biotic movement upstream and downstream from the dam location. The natural water flow and sediment transport would be altered, and movements of fish, mussel, and other aquatic organism populations would be restricted. The Project would be designed to implement a flow regime that attempts to mimic natural flows, and a reservoir operations agreement would be created to require continued mimicry of natural flows. While this will help minimize the impacts to the stream, the need to use a portion of the water for the Project's public water supply purpose would limit the ability to exactly mimic the natural flows.

Water Quality Impacts

East Locust Creek from Pollock to south of Milan has been included on Missouri's draft 2018 303(d) List of Impaired Waters because of the dissolved oxygen and *E. coli* levels (MDNR 2017b). Agricultural nonpoint source pollution may be a potential source of the impairment to water quality in East Locust Creek.

Phase I and II environmental site assessments (ESAs) were completed throughout the project area for the identification and assessment of recognized environmental conditions (TetraTech 2012). The ESA results identified potential contaminants associated with the railroad lines and were in excess of state-established health-based benchmarks. Flooding along the railroad lines may result in minor arsenic releases from the railroad bed. The releases are anticipated to be small and have negligible effects on water quality.

Additional threats to water quality in the East Locust Creek watershed are from sediment, pathogens, nutrients, and toxic materials. Sediment sources include unstable channel banks, road ditches, and inadequately protected cropland, pasture, and forestland. Pathogens and nutrients can also arise from human, livestock, and wildlife sources.

It is anticipated that the Project would increase the dissolved oxygen level and reduce the *E. coli* concentration within the inundated section. It is possible that the Project would allow enough flow into the stream to reduce impairments downstream as well.

Sediment from the watershed and shoreline are primary pollutants that can compromise water quality. The Project would cause erosion and sedimentation rates to be reduced in the watershed because of changes to less intensive land uses, development of a vegetated buffer around the reservoir, and the stabilization of eroding gully systems.

The National Pollutant Discharge Elimination System (NPDES) rules require a stormwater pollution prevention plan (SWPPP) on construction sites disturbing one or more acres. Although a SWPPP would be prepared for the site, a short-term decline in water quality may occur from sediment discharge associated with construction activities.

5.2. Effects on listed species

5.2.1. GRAY BAT

MYGRs were not identified in the East Locust Creek bat survey. Additionally, because MYGR inhabits caves year-round, and because the topography in the 10-county region provides limited habitat for MYGR, there is a low probability of occurrence. Based on the limited habitat and lack of bat identification during the bat survey, the Project is not anticipated to cause effects to MYGR. Thus, the Project will have no effect on MYGR.

5.2.2. NORTHERN LONG-EARED BAT

5.2.2.1. Direct Effects

Direct effects are defined as Project impacts that occur immediately (i.e. injuring or killing MYSE). The Project elements described in section 2.2 and Project impacts shown in Table 12 are related to tree clearing and tree inundation. Tree clearing activities for all Project elements will occur during the MYSE hibernation period (November 1 – March 31) and thus minimize direct effects on MYSE. A reservoir water budget model indicates inundation will occur over a period of 2-10 years and the timing cannot be determined ahead of time or controlled. The model shows the reservoir would fill slowly over time and that during the wettest period since 1900 the reservoir would take 1.9 years to fill. Based on the model results, the bats would likely be able to avoid direct impact.

5.2.2.2. Indirect Effects

Indirect effects are defined as Project impacts that are reasonably certain to occur but occur later in time (i.e. forest loss that reduces maternity roost habitat and causes lower population size). Forest loss and impacts to maternity roosting colonies are the indirect effects further described.

Potential Forest Impacts

The Project will affect MYSE summer foraging and roosting habitat. The forest loss caused by Project construction and predicted future forest loss would reduce the available forest habitat by 1,341 acres and represents a 0.17 percent forest decline in the 10-county region and a 1.36 percent forest decline in Sullivan County. Table 12 shows the forest loss within the foraging areas of the maternity roost trees for the Project elements.

Table 12. Project Forest Loss.

Project Element	Direct and Predicted Future Forest Loss (acres)	Forest Loss within 3-Mile Buffer of MYSE Capture Sites (acres)
Normal Pool Inundation	973	895
Recreational Facilities Development	27	25
Utilities and Road Relocation	34	25
Dam Construction, Borrow Sites, Spillway Construction, and Temporary Dam Access Roads	23	10
Tree Clearing on NCMRWC Property Because of Development	69 ¹	58 ¹
Residential Development	162	11
Future Water Transmission Lines	53	129
TOTAL FOREST LOSS	1,341	1,153

¹ Assumes future development will affect 15 percent of forest.

Note: Forest loss because of residential development and future water transmission are not controlled by the NCMRWC and may be avoided upon design and construction.

Maternity Roosts and Home Range Impacts

MYSE were not tracked during the field study and the maternity roost locations are not known. Two lactating MYSE were captured at the same mist net site, but in separate nets. Based on a 3-mile range of the capture sites, there are assumed to be primary and alternative maternity roost trees nearby or impacted by the Project elements.

Within the 3-mile home range, there are 5,727 forest acres and 1,013 forest acres impacted by Project elements. This represents a loss of 18 percent of the MYSE colony's forested home range.

Loss of Individuals and Reduction in Population Size

The loss of roosting and foraging habitat could result in lower fecundity (reproductively) or lower survivorship. The loss of roosting and foraging habitat would require MYSE to find alternative maternity roosts and foraging area. Depending on the populations' health following hibernation, the energy requirements to find alternative maternity roosting and foraging habitat could result in lower fecundity or potentially survivorship of the existing population. Emergence counts were not conducted for MYSE, so population estimates are not available within the Project area.

The lower fecundity and survivorship are difficult to measure and cannot be avoided by the Project. Depending on fat reserves and the availability of alternative foraging and roosting habitat, the loss of individuals or future young is possible. If MYSE health is good following hibernation

and alternative maternity roosting and foraging habitat is available, then there may be no reduction in population. Conversely, if the MYSE populations' health are poor and alternative maternity roosting and foraging habitat is limited, then the populations could experience a reduction in individuals.

Depending on available habitat that helps determine carrying capacity, including roosting habitat and foraging habitat, a reduction in population because of reduced survivorship or fecundity may be short term. The habitat availability after reservoir construction and the ability of that habitat to support the current population sizes will determine the long-term impacts of the Project on MYSE populations. As described above, 18 percent of the MYSE forested home range would be lost because of Project elements. Conservation described below will partially minimize these impacts.

Winter Habitat

MYSE winter habitat consists of large hibernacula. Because of the increased presence of WNS, hibernacula have become of primary interest for MYSE conservation efforts. The closest winter habitat is in Howard County, placing the 10-county region outside winter habitat (USFWS 2016b).

Conservation

The forest planting and preserving and associated permanent conservation easements would occur on 683 acres for forest preservation and 553 acres for forest tree planting. Permanent conservation easements would be established on 1,236 acres of tree planting and forest preservation. Within the 3-mile buffer there are 1,013 forest acres impacted that equals 18 percent of the total forest. Tree plantings within the 3-mile buffer total 201 acres and tree preservation totals 496 acres. The tree plantings and preservation total 697 acres and equal 69 percent of the forest loss in the 3-mile buffer.

Additional conservation will occur through the stream and wetland mitigation and by the zoning in the High Impact Zone. The wetland mitigation will include a minimum of 79 acres of palustrine forest wetland and the High Impact Zone will include 50 acres of forest preservation. See Section 2.3.3 Habitat Compensation Plan.

5.2.3. INDIANA BAT

5.2.3.1. Direct Effects

Direct effects are defined as Project impacts that result in direct injury or killing MYSO. The Project elements described in section 2.2 and Project impacts shown in Table 13 are related to tree clearing and tree inundation. Tree clearing activities for all Project elements will occur during the MYSO hibernation period (November 1 – March 31) and thus have no direct effects on MYSO. Inundation will occur over a period of 2-10 years and the timing will not be able to be determined or controlled. The reservoir would fill slowly over time and the bats would be able to avoid direct impact.

5.2.3.2. Indirect Effects

Maternity Roost Impacts

The 2017 East Locust Creek Bat Survey Report (Olsson 2017) documented the capture of 10 MYSO within the normal pool. The MYSO were tracked back to their maternity roost trees and

their maternity roost trees were classified by their emergence counts as primary (more than 5 bats observed) and alternative (five or fewer bats observed). Two MYSO were tracked to four primary maternity roost trees within or near the Project area. Two of the primary maternity roosts were located within the normal pool. Additionally, there were nine alternative maternity roost trees identified with three alternative maternity roost trees in the normal pool. The two primary maternity roost trees and three alternative maternity roost trees within the normal pool would be inundated by the Project and would no longer provide roost tree habitat. To avoid inundation during the maternity roosting period, the trees would be cut down during the November 1 to March 31 hibernation period.

While MYSO use multiple roost trees, they tend to roost in the same areas year after year (Gumbert et al. 2002). Long-term familiarity with an area may help with predator avoidance, foraging efficiency, and emergency roost-switching induced by weather changes (Gumbert et al. 2002). The individual loss of the primary or alternative maternity roost trees may have reduced impacts on the MYSO colony because of roost-switching behavior (Gumbert et al. 2002). The ephemeral nature of roost trees and the roost-switching behavior would allow for alternative trees to replace the affected primary and alternative maternity roost trees (Gumbert et al. 2002). However, the cumulative loss of forest resources and potential impacts must also be considered.

Potential Forest Impacts

The Project will affect MYSO summer foraging and roosting habitat. The forest loss caused by Project construction and predicted future forest loss would reduce the available forest habitat by 1,341 acres and represents a 0.17 percent forest decline in the 10-county region and a 1.36 percent forest decline in Sullivan County. Table 13 shows the forest loss within the foraging range of the maternity roost trees for the Project elements.

Table 13. Project Forest Loss.

Project Element	Direct and Predicted	Forest Loss within 2.5-Mile
	Future Forest Loss	Buffer of MYSO Maternity
	(acres)	Roost Trees (acres)
Normal Pool Inundation	973	923
Recreational Facilities Development	27	25
Utilities and Road Relocation	34	27
Dam Construction, Borrow Sites,		
Spillway Construction, and	23	23
Temporary Dam Access Roads		
Tree Clearing on NCMRWC Property	69	41
Because of Development		
Residential Development	162	150
Future Water Transmission Lines	53	41
TOTAL FOREST LOSS	1,341	1,230

Note: Forest loss because of residential development and future water transmission are not controlled by the NCMRWC and may be avoided upon design and construction.

Home Range Impacts

Project elements would result in the loss of approximately 1,341 acres within the 10-county region. Forest loss within the home range of Laela and Sushi's maternity roost trees include 1,039 acres (Table 14). There are 6,566 total forested acres within Laela and Sushi's 2.5-mile home range with 46 acres of overlap. The loss of 1,039 acre represents 16 percent of the total forested acres in the two home ranges. Laela's home range has 3,732 forested acres and Sushi's home range has 2,880 forested acres. For Laela, the loss of 813 forested acres represents 22 percent of the forested home range and for Sushi, the loss of 226 forested acres represents 8 percent of the forested home range.

Forest impacts within the 2.5-mile colony forest buffer would be partially offset by tree planting and tree preservation. There are 1,236 acres of tree plantings and tree preservation within Laela and Sushi's home ranges. There are 179 acres of tree plantings in Laela's home range which equals 21 percent of the forest impacts. There are 301 acres of tree plantings in Sushi's home range which equals 130 percent of the forest impacts. All tree plantings would result in a temporal loss which includes the amount of time required for a tree planting to fully replace the forest loss. The temporal loss is estimated at 15-30 years for tree plantings to establish and provide roosting and foraging habitat.

Table 14. Project Effects within 2.5-Mile Colony Forest Buffer.

Project Element	Laela Forest	Sushi Forest
,	Impacts	Impacts
Normal Pool	718	205
Recreation	23	2
Utilities	20	7
Dam	23	0
NCMRWC Tree Clearing	29	12
TOTAL	813	226
Tree planting	179	301
Tree preservation	423	299
TOTAL	602	600

Loss of Individuals and Reduction in Population Size

The loss of roosting and foraging habitat could result in lower fecundity or lower survivorship. The loss of roosting and foraging habitat would require MYSO to find alternative maternity roosts and foraging area. Depending on the populations' health following hibernation, the energy requirements to find alternative maternity roosting and foraging habitat could result in lower fecundity or potentially survivorship of the existing population.

The existing MYSO population size is estimated based on the emergence counts to be two colonies of 31 and 40 individuals. The colonies are likely slightly larger based on individual MYSO roosting in alternative maternity roost trees.

The lower fecundity and survivorship are difficult to measure and cannot be avoided by the Project. Depending on fat reserves and the availability of alternative foraging and roosting habitat,

the loss of individuals or future young is possible. If MYSO health is good following hibernation and alternative maternity roosting and foraging habitat is available, then there may be no reduction in population. Conversely, if the MYSO populations' health are poor and alternative maternity roosting and foraging habitat is limited, then the populations could experience a reduction in individuals.

Depending on available habitat that helps determine carrying capacity, including roosting habitat and foraging habitat, a reduction in population because of reduced survivorship or fecundity may be short term. The habitat availability after reservoir construction and the ability of that habitat to support the current population sizes will determine the long-term impacts of the Project on MYSO populations.

Winter Habitat

MYSO winter habitat consists of large hibernacula. Because of the increased presence of WNS, hibernacula have become of primary interest for MYSO conservation efforts. There are no known MYSO hibernacula within the 10-county region (USFWS 2016b).

Conservation

The forest planting and preserving and associated permanent conservation easements would occur on 683 acres for forest preservation and 553 acres for forest tree planting. Permanent conservation easements would be established on 1,236 acres of tree planting and forest preservation. Forest preservation and planting within the 2.5-mile buffers total 1,202 acres and the forest loss within the 2.5-mile buffers totals 1,039 forest acres.

Additional conservation will occur through the stream and wetland mitigation and by the zoning in the High Impact Zone. The wetland mitigation will include a minimum of 79 acres of palustrine forest wetland and the High Impact Zone will include 50 acres of forest preservation. See Section 2.3.3 Habitat Compensation Plan.

5.3. Mead's Milkweed

There are approximately 452 grassland acres at 58 sites within the East Locust Creek normal pool (Olsson 2018). Native vegetation is present at four of the 58 sites and totals 18.7 acres (Olsson 2018). The native vegetation indicates the sites may provide potential ASME habitat that includes virgin, tallgrass prairies that is managed for light grazing and hay production (USFWS 2003). The four sites were traversed for 30 minutes, but no ASME ramets were identified.

The Project elements will affect 1,236 grassland acres in Sullivan County. All grassland impacts outside Sullivan County will be temporary; however, temporary impacts could have permanent impacts on Mead's milkweed habitat. The impacts outside Sullivan County are anticipated to occur on existing utility corridors that would not provide habitat for Mead's milkweed since the utility corridors would have already been disturbed.

6. CONCLUSION AND DETERMINATION OF EFFECT

The conclusion and determination of effect make an ESA section 7 determination of the proposed Project's effect on federally listed species.

6.1. Mead's Milkweed

Presence of suitable habitat for ASME was assessed from a desktop analysis and field survey. No ASME ramets were identified within the Project area. No critical habitat has been designated for this species, and there are no records of occurrence in Sullivan County. There were 18.7 acres of native prairie identified within the normal pool. Any areas identified as virgin (nondisturbed) native prairie could be locations for potential ASME reintroduction. However, because of the small size of the native prairies, lack of association with larger prairies, and private ownership, these areas would have reduced viability as ASME reintroduction sites. Therefore, the Project will have no effect on ASME.

6.2. Gray Bat

MYGRs were not identified in the East Locust Creek bat survey. Additionally, MYGR inhabits caves year-round, and the topography in the 10-county region provides limited habitat for MYGR. Based on the limited habitat and lack of identification during the bat survey, the Project is not anticipated to cause effects to MYGR. Thus, the Project would have no effect on MYGR.

6.3. Indiana Bat

MYSO determination of effect is based on the Project impacts to roosting, foraging, and hibernating habitat; direct impacts to individuals and their habitat; or impacts that result in changes in fecundity or survivorship. Sullivan County does not provide the topography for MYSO hibernacula (Elliot 2010), and there are no known hibernacula that would be affected by the Project elements.

As described above, the Project elements would affect MYSO because of Laela maternity roost tree site A and site C inundation and because of foraging habitat loss. Additionally, there were 3 alternative maternity roost trees identified within the home ranges of the bat colonies and potentially other maternity roost trees that were not identified that would be impacted by Project elements. The unknown maternity roost trees may be cleared by timber harvest or tree clearing activities (46 percent of normal pool cleared); however, there may be maternity roost trees present at the time of reservoir inundation.

The effects would be minimized by tree plantings that represent replacement of 21 percent of Laela's home range loss and 130 percent (complete replacement) of Sushi's home range loss. Additionally, 683 acres of forest preservation that is managed in coordination with MDC and 50 acres of riparian corridor that is established and protected by the Lake Authority zoning powers, will establish permanent foraging and maternity roost habitat. All tree plantings would result in a temporal loss which includes the amount of time required for a tree planting to fully replace the forest loss. The temporal loss is estimated at 15 - 30 years for tree plantings to establish and provide roosting and foraging habitat.

MYSO would respond negatively to the loss of maternity roost trees and foraging corridors as a result of the Project elements. Therefore, the Project may affect, and is likely to adversely affect, MYSO.

6.4. Northern Long-Eared Bat

MYSE determination of effect is based on the Project impacts to roosting, foraging, and hibernating habitat; direct impacts to individuals and their habitat; or impacts that result in changes in fecundity or survivorship. WNS is listed as the predominant threat to MYSE in the threatened species listing (USFWS 2015c). Sullivan County is within the WNS zone, but WNS has not been identified in Sullivan County (USFWS 2018b).

As described above, the Project elements will cause the loss of 18 percent of the forested acres in the MYSE home range. While it is unknown if a primary or alternative maternity roost would be impacted, there is a high likelihood that either a primary or alternative maternity roost would be impacted. The unknown maternity roost trees may be cleared by timber harvest or tree clearing activities); however, there may be maternity roost trees present at the time of reservoir inundation.

The effects would be minimized by tree plantings that represent replacement of 20 percent of the home range loss. Additionally, 683 acres of forest preservation that is managed in coordination with MDC and 50 acres of riparian corridor that is established and protected by the Lake Authority zoning powers, will establish permanent foraging and maternity roost habitat. All tree plantings would result in a temporal loss which includes the amount of time required for a tree planting to fully replace the forest loss. The temporal loss is estimated at 15 – 30 years for tree plantings to establish and provide roosting and foraging habitat.

MYSE would respond negatively to the loss of maternity roost trees and foraging corridors as a result of the Project elements. According to the 4(d) rule for the MYSE (USFWS 2015c), "incidental take of northern long-eared bats outside of hibernacula resulting from activities other than tree removal is not prohibited". Tree removal that will occur as a result of the proposed Project will occur between November 1 and March 31 and will not result in take.

This project may affect the northern long-eared bat; however, there are no effects beyond those previously disclosed in the Service's programmatic biological opinion for the final 4(d) rule dated January 5, 2016. Any taking that may occur incidental to this project is not prohibited under the final 4(d) rule (50 CFR §17.40(o)). We request to use the streamlined consultation framework for the NLEB.

7. LITERATURE CITED

- Audubon n.d. Mississippi Flyway. A River of Birds. Available online at: https://www.audubon.org/mississippi-flyway.
- Callahan, E.V. 1993. Indiana bat summer habitat requirements. M.S. Thesis. University of Missouri, Columbia. 84 pp.
- Carter, Timothy C. 2006. Indiana bats in the Midwest: the importance of hydric habitats. Journal of Wildlife Management 70, no. 5. Pgs. 1185-1190.
- Carter, Timothy C., and George A. Feldhamer. 2005. Roost tree use by maternity colonies of Indiana bats and northern long-eared bats in southern Illinois. Forest Ecology and Management 219, no. 2-3. Pgs. 259-268.
- Cornwell, E., Elzinga, D., Stowe, S., and Capaldi, A. 2017. Modeling vaccination strategies to control white-nose syndrome in little brown bat colonies. Accessed May 2018: https://www.valpo.edu/mathematics-statistics/files/2014/09/Capaldi2017.pdf.
- Elliot, R. William. 2010. Below Missouri Karst. Missouri Department of Conservation. Nov. 2010. http://mdc.mo.gov/conmag/2000/03/below-missouri-karst?page=0,1. Accessed January 2016.
- Homer, C.G., Dewitz, J.A., Yang, L., Jin, S., Danielson, P., Xian, G., Coulston, J., Herold, N.D., Wickham, J.D., and Megown, K. 2015. Completion of the 2011 National Land Cover Database for the conterminous United States-Representing a decade of land cover change information. Photogrammetric Engineering and Remote Sensing, v. 81, no. 5, p. 345-354.
- Gumbert, M.W., O'Keefe, J.M., and MacGregor, J.R. 2002. Roost Fidelity in Kentucky. *The Indiana Bat: Biology and Management of an Endangered Species, A. Kurta and J. Kennedy, eds. Austin TX: Bat Conservation International,* pp 143-152.
- IUCN Red List of Threatened Species (IUCN). 2008. Myotis grisescens, Gray Myotis. Assessment by Arroyo-Cabrales, J. and Timm, R. Available online at: file:///C:/Users/kkelly/Downloads/10.2305_IUCN.UK.2008.RLTS.T14132A4403493.en%2 0(1).pdf.
- Kindscher, Kelly, Long, Quinn, and Byczynski, Lynn. 2008. Mead's Milkweed Reintroduction Plan for Marais Des Cygnes National Wildlife Refuge. Kansas Biological Survey Open File Report Number 152. November 15, 2008.
- Kurta, A., K.J. Williams, and R. Mies. 1996. Ecological, behavioural, and thermal observations of a peripheral population of Indiana bats (*Myotis sodalis*). Pp. 102-117 in R.M.R. Barclay and R. M. Brigham (eds.), Bats and Forests Symposium. Research Branch, British Columbia Ministry of Forests, Victoria, BC, Canada.
- Missouri Department of Conservation (MDC). 2000. Best Management Practices: Gray bat (*Myotis grisescens*). June 2000. Available online at: https://mdc.mo.gov/sites/default/files/downloads/9471.pdf.

- MDC. 2014. Missouri Forest Management Guidelines. Voluntary Recommendations for Well-Managed Forests. Accessed August 2019. Available online at: https://mdc.mo.gov/sites/default/files/downloads/forestmanagement1.pdf.
- Missouri Department of Natural Resources (MDNR). 2014. The State of Our Missouri Waters: Lower Grand River Watershed. Available online at: https://dnr.mo.gov/omw/docs/omw-lower-grand-summary.pdf.
- MDNR. 2017a. The Grand River Basin Project. January 2017. Available online at: http://www.nwk.usace.army.mil/Portals/29/docs/civilworks/Planning%20Studies%20and%20NEPA%20Docs/Grand%20River/2017-01-25_Grand%20Fact%20Sheet.pdf?ver=2017-02-01-140645-237.
- MDNR. 2017b. 2018 303(d) List Responses to Public Comments. Available online at: https://dnr.mo.gov/env/wpp/waterquality/303d/docs/summary-2018-303d-comments-dnr-responses.pdf.
- Natural Resources Conservation Service (NRCS). 2015. Soil Survey Staff, Natural Resources Conservation Service, United States Department of Agriculture. Web Soil Survey. Available online at http://websoilsurvey.nrcs.usda.gov/. Accessed January 2016.
- Ollendorff, J. 2002. "Myotis septentrionalis" (On-line), Animal Diversity Web. http://animaldiversity.org/accounts/Myotis_septentrionalis/
- Olsson Associates (Olsson). 2016. Wetland Delineation and Stream Assessment Report (Regions 1 12). Sullivan County, Missouri. Not published.
- Olsson. 2017. Bat Survey Report. East Locust Creek. Sullivan County, Missouri. February 2017. 264 pgs. Not published.
- Olsson. 2018. Mead's Milkweed Study. East Locust Creek Reservoir. Sullivan County, Missouri. January 2018. Not published.
- Silvis, A., Kniowski, A.B., Gehrt, S.D. and Ford, W.M., 2014. Roosting and foraging social structure of the endangered Indiana bat (Myotis sodalis). PLoS One, 9(5), p.e96937.
- TetraTech. 2012. Phase I and II Environmental Site Assessments. Multiple unpublished reports.
- U.S. Department of Agriculture (USDA). 2003. Indiana Bat Habitat Conservation Priorities in Missouri. Section II-F-4. Accessed May 2018: https://efotg.sc.egov.usda.gov/references/public/MO/INDIANA_BAT_HABITAT_REQUIRENTS.pdf.
- U.S. Forest Service (USFS). 2016. Missouri Forests. 2013. Northern Research Station. Resource Bulletin: NRS-108. Publication Date: December 2016.
- U.S. Fish and Wildlife Service (USFWS). 1973. The Endangered Species Act of 1973. As Amended through the 108th Congress. Department of Interior.
- USFWS. 1988. Endangered and Threatened Wildlife and Plants; Determination of Threatened Status for Asclepias Meadii (Mead's Milkweed). Federal Register. Volume 53, Number 170. Rules and Regulations. September 1, 1988.

- USFWS. 2003. Mead's Milkweed (*Asclepias meadii*) Recovery Plan. U.S. Fish and Wildlife Service, Fort Snelling, MN. 121 pp.
- USFWS. 2005. Mead's Milkweed (*Asclepias meadii*). U.S. Fish and Wildlife Service. Endangered Species. Midwest Region. https://www.fws.gov/midwest/endangered/plants/meads/meadsmil.html. Updated June 2005.
- USFWS. 2007. Indiana Bat (*Myotis sodalis*) Draft Recovery Plan: First Revision. U.S. Fish and Wildlife Service, Fort Snelling, MN. 258 pp.
- USFWS. 2008. Section 7 Technical Assistance: Summary of Indiana Bat Ecology. Available online

 at:

 https://www.fws.gov/midwest/endangered/section7/s7process/mammals/inba/INBAEcologySummary.html.
- USFWS. 2009a. Range-wide Indiana Bat Protection and Enhancement Plan Guidelines. July 2009. Accessed July 2018: https://www.fws.gov/frankfort/pdf/INBATPEPGuidelines.pdf.
- USFWS. 2009b. Gray Bat (*Myotis grisescens*) 5-Year Review: Summary and Evaluation. Accessed February 2018: https://ecos.fws.gov/docs/five_year_review/doc2625.pdf.
- USFWS. 2011. Gray Bat. Oklahoma Ecological Service Field Office. August 2011. Accessed February 2018: https://www.fws.gov/southwest/es/oklahoma/Documents/TE_Species/Species%20Profiles/Gray%20Bat.pdf.
- USFWS. 2012a. Mead's Milkweed (*Asclepias Meadii*). 5-Year Review: Summary and Evaluation. Accessed February 2018: https://www.fws.gov/midwest/endangered/plants/pdf/meads5yrreview.pdf
- USFWS. 2012b. North American bat death toll exceeds 5.5 million from white-nose syndrome:

 News Release. Accessed May 2018:

 https://www.whitenosesyndrome.org/sites/default/files/files/wns_mortality_2012_nr_final_0.pdf.
- USFWS. 2014. Northern Long-Eared Bat Interim Conference and Planning Guidance. Available online
 at:
 https://www.fws.gov/northeast/virginiafield/pdf/NLEBinterimGuidance6Jan2014.pdf
- USFWS. 2015a. White-nose syndrome: The devastating disease of hibernating bats in North America. Accessed May 2018: https://www.fws.gov/mountain-prairie/pressrel/2015/WNS%20Fact%20Sheet%20Updated%2007012015.pdf.
- USFWS. 2015b. Range-wide Indiana Bat Summer Survey Guidelines. April 1, 2015. U.S. Fish and Wildlife Service. Endangered Species. Midwest Region. http://www.fws.gov/midwest/Endangered/mammals/inba/inbasummersurveyguidance.html. Accessed January 2016.

- USFWS. 2015c. Endangered and Threatened Wildlife and Plants; Threatened Species Status for the Northern Long-Eared Bat With 4(d) Rule. 50 CFR Part 17. Excerpt from Federal Register /Vol. 80, No. 63 /Thursday, April 2, 2015 /Rules and Regulations.
- USFWS. 2016a. Northern Long-Eared Bats (*Myotis septentrionalis*). U.S. Fish and Wildlife Service. Endangered Species. Midwest Region. http://www.fws.gov/midwest/endangered/mammals/nleb/nlebFactSheet.html. Updated February, 2016. Accessed February 2016.
- USFWS. 2016b. Known Northern Long-eared Bat Hibernacula and Maternity Roost Trees in Missouri. Updated March 24, 2016. Accessed May 2018: https://www.fws.gov/midwest/endangered/mammals/nleb/pdf/MO NLEBHibMatRoostTre eMap24March2016.pdf.
- USFWS. 2017a. White-Nose Syndrome. The Devastating Disease of Hibernating Bats in North America. October 2017. Accessed February 2018: https://www.whitenosesyndrome.org/sites/default/files/resource/white-nose fact sheet 10-2017 1.pdf.
- USFWS. 2017b. 2017 Indiana Bat (*Myotis sodalis*) Population Status Update. Indiana Ecological Field Office. Revised July 5, 2017. Accessed February 2018: https://www.fws.gov/midwest/endangered/mammals/inba/pdf/2017IBatPopEstimate5July2017.pdf.
- USFWS. 2018a. Missouri Ecological Services Field Office. Official Species List. Consultation Code: 03E14000-2018-SLI-0820. Event Code: 03E14000-2018-E-01782. Project Name: East Locust Creek Reservoir. February 1, 2018.
- USFWS. 2018b. Northern Long-Eared Bat Final 4(d) Rule. White-Nose Syndrome Zone Around WNS/Pd Positive Counties/Districts. April 30, 2018. Accessed May 21, 2018: https://www.fws.gov/Midwest/endangered/mammals/nleb/pdf/WNSZone.pdf.
- USFWS. 2018c. Endangered Species: Gray Bat (*Myotis grisescens*). March 12, 2018. Available online at: https://www.fws.gov/midwest/Endangered/mammals/grbat_fc.html.
- USFWS. 2019a. 2019 Indiana Bat (Myotis sodalist) Population Status Update. Compiled by Andy King. Indiana Ecological Services Field Office. June 2019. Accessed online at: https://www.fws.gov/MIDWEST/endangered/mammals/inba/pdf/2019_IBat_Pop_Estimate_6_6_27_2019a.pdf.
- USFWS. 2019b. White-Nose Syndrome. A Coordinated Response to the Devastating Bat Disease. June 2019. Accessed online at: https://s3.amazonaws.com/org.whitenosesyndrome.assets/prod/a781e940-82f8-11e9-93b7-61a86857b722-wnsinfographicfinal_large_1.png.
- Womack, K. M., A. K. Sybill, and F. R. Thompson III. 2013. Summer Home Range Size of Female Indiana Bats (Myotis sodalis) in Missouri, USA. Acta Chiropterologica, 15(2); pgs. 423-429.
- Zimmerman, Casey L. 2015. Bat Survey of Thousand Hills State Park, Kirksville Missouri, with Emphasis on Documenting the Presence of the Northern Myotis (*Myotis Septentrionalis*).

Appendix A

Tree Planting Plan

East Locust Creek Reservoir Tree Planting Plan

Submitted by Matt Arndt, Matt's Healthy Woods & Wildlife SAF Certified Forester #171393 ISA Certified Arborist #MW-5038A

10/4/2019

The primary purpose of this planned tree planting is to mitigate losses of wooded bat habitat by the inundation of the East Locust Creek Reservoir (ELCR) through the establishment of new hardwood forest. The federally listed Northern Long-Eared and Indiana Bats utilize forested areas of varying canopy closure for roosting, pup-rearing, feeding, and travel. A variety of tree species are recommended for planting. The species mix will include both tree species likely to be long-term roost/maternity trees and those that will host an assortment of insects on which the bats can feed.

This tree planting plan is a component part of the ELCR's Forest and Forage Plan to provide habitat benefits, water filtration, erosion mitigation, and ecological restoration to the acres surrounding the ELCR. The North Central Missouri Regional Water Commission is committed to meeting or exceeding its environmental obligations.

Areas included for planting are dispersed around the perimeter of the ELCR. Current vegetation is primarily cool-season grass, with varying levels of native forb and woody encroachment.

Site Preparation requirements

Access limitations to each individual planting area will be different, and may change between the writing of this plan and beginning of site preparation activities.

- 1) If machinery access is available:
 - a. mow rows to be planted in the fall prior to planting to eliminate tall vegetation within the future tree rows.
 - b. At or before the time of planting in the spring, spray the tree rows with a combination of glyphosate and pre-emergent herbicide (e.g. Oust).
- 2) If machinery access is unavailable:
 - a. Following planting, spray at least an 18" radius area around each sapling with a combination of glyphosate and pre-emergent herbicide (e.g. Oust).

Planting requirements

Planned species mixes are divided into two categories: bottomland and upland. The bottomland mix is planned for larger areas within the 100-year floodplain, primarily at the upper extremities of the lake. The upland mix is planned for all other areas. Planned spacing for each mix is 10' within rows and 12' between rows, for an average of 363 trees/acre.

Bottomland mix (avg. tre	nd mix (avg. trees/ac) – 40.81 acres Upland Mix (avg. trees/ac) – 442.6) – 442.61 acres
shellbark hickory	(65)	shagbark hickory	(60)
bur oak	(50)	white oak	(50)
swamp white oak	(50)	bur oak	(35)
river birch	(35)	swamp white oak	(35)
American sycamore	(25)	black oak	(35)
black walnut	(25)	northern red oak	(25)
common hackberry	(25)	shellbark hickory	(15)
black willow	(20)	common hackberry	(15)
eastern cottonwood	(20)	chinkapin oak	(10)
silver maple	(20)	post oak	(10)
bitternut hickory	(10)	mockernut hickory	(10)
buttonbush	(10)	red mulberry	(10)
silky dogwood	(10)	American basswood	(10)
		black cherry	(10)
		persimmon	(10)
		blackhaw	(5)
		eastern redbud	(5)
		common serviceberry	(5)
		green hawthorn	(5)
		hazelnut	(5)

- Substitutions/modifications of the planned species list/rates can be made based on species availability. A minimum of 15% of the total trees planted in each mix must be loose-barked hickory (shagbark or shellbark). A minimum of 25% of the total planted trees in the bottomland mix and 50% of the total planted trees in the upland mix must be oaks. Any species included in the planting must be locally native and suited for the soils and growing conditions.
- Each field to be planted shall contain a minimum of 5 tree species. Larger fields should be planted with a wider diversity of species.
- Shrubs (buttonbush and silky dogwood in the bottomland mix and blackhaw, eastern redbud, common serviceberry, green hawthorn, and hazelnut in the upland mix) shall comprise no more than 10% of the planted trees in any field.
- Bottomland areas: species with the highest tolerance for flooding should be favored for planting in the lower elevations, closer to the lake. These species include: river birch, black willow, eastern cottonwood, and silver maple.
- *Upland areas:* species typical of higher and lower site qualities should be planted accordingly. High site quality species include northern red oak, shellbark hickory, American basswood, and hazelnut. Lower site quality species include chinkapin oak, post oak, and bur oak.
- No trees should be planted within 15' of a boundary fence to allow for access around the perimeter of the NCMRWC owned lands.

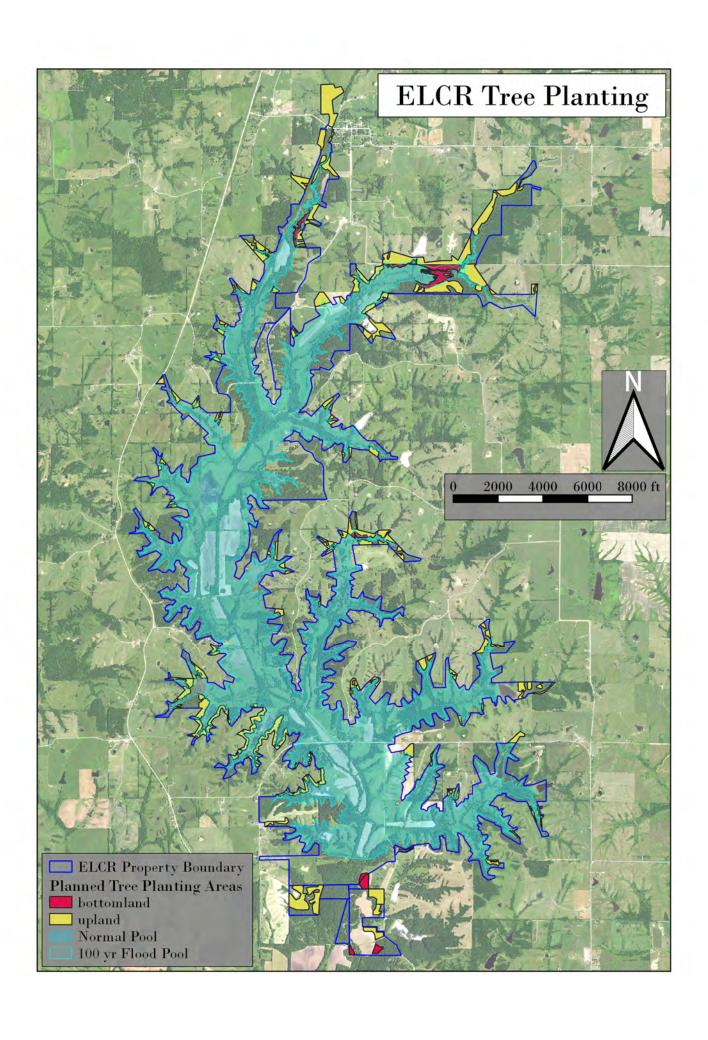
Maintenance requirements

Access limitations to each individual planting area will be different, and may change between the writing of this plan and beginning/conclusion tree maintenance activities.

- 1) If machinery access is available:
 - a. mow between rows 2x per year for 3 growing seasons following planting (year of planting plus 2 more years).
 - b. Spray tree rows (or an 18" radius around individual trees if spraying by hand) each spring/early summer with glyphosate + pre-emergent herbicide. Repeat for 4 years, beginning the year after planting (for a total of 5 years weed control).
- 2) If machinery access is unavailable:
 - a. Spray an 18" radius area around each sapling with a combination of glyphosate and preemergent herbicide (e.g. Oust). Repeat for 4 years, beginning the year after planting (for a total of 5 years weed control).

Evaluation of planting success

- Evaluate planted fields for total tree count the summer following planting (e.g. 15 months after planting).
 - O Utilize randomly located 1/20 acre sample plots (26.3' radius). Locate a minimum of 3 plots in each planted field. Each field shall have a minimum of 1 sample plot per each 5 acres.
 - Count all living trees (and planted woody shrubs) within the designated sample plot
 - Replant fields (by interplanting within existing rows) if average tree count falls below 290 trees/acre (80% of the initial planting rate).
 - If tree count failure can be isolated to only portions of a given field, the remaining areas of the field need not be replanted.
 - Utilize species/spacing requirements from the original planting specifications for replanting
- Re-evaluate any re-planted fields using the protocol in this section to determine success of replanting.



Appendix B

NCMRWC Resolutions

RESOLUTION ESTABLISHING A POLICY TO PROTECT PERENNIAL AND INTERMITTENT STREAM TRIBUTARIES TO THE EAST LOCUST CREEK RESERVOIR TO PROVIDE FOR WATER RUN-OFF FILTRATION AND BANK STABILIZATION

WHEREAS, the North Central Regional Water Commission (Commission) has established a priority to secure and maintain clean raw water in the East Locust Creek Reservoir in order to provide safe, clean water and lower treatment costs; and,

WHEREAS, Lake Authority legislation established the ability to control and address contamination and sedimentation risks in the East Locust Creek Reservoir watershed that includes a robust Source Water Protection Plan, Best Management Practices for storm water runoff, forebays, buffer strips and other physical features and policies; and

WHEREAS, the Commission established a High Impact Zone, which is generally a 500foot zone from Commission owned property necessary for the East Locust Creek Reservoir; and,

WHEREAS, the High Impact Zone is an area of heightened interest for purposes of keeping the reservoir clean and for mitigating erosion and sedimentation; and,

WHEREAS, protecting perennial and intermittent stream tributaries to the lake by establishing a protected and restricted buffer on both sides of the stream within the High Impact Zone is a Best Management Practice recommended by and favored by State and Federal regulators.

THEREFORE, BE IT RESOLVED, that the Commission establishes a policy to create a 100-foot buffer for protection and restriction on both sides of perennial and intermittent stream tributaries within the High Impact Zone in the East Locust Creek Reservoir watershed (See Attachment A); and,

BE IT FURTHER RESOLVED, that the Commission does direct the establishment of allowed and prohibited use of the riparian buffer strip and administrative protocols to enforce such measures.

ADOPTED THIS 9th day of September, 2019

CERTIFICATE OF RECORDING OFFICER

The undersigned, duly qualified and acting Secretary of the North Central Missouri Regional Water Commission, does hereby certify: That the above resolution is a true and correct copy of the resolution adopted at a legally convened meeting of the North Central Missouri Regional Water Commission held the 9th day of September, 2019; and further that such resolution has

been fully recorded in the journal of proceedings and records in my office. IN WITNESS WHEREOF, I have hereunto set my hand this 9th day of September, 2019.



Jeanna Johnson, Secretary

North Central Missouri Regional

Water Commission

RESOLUTION AFFIRMING COMMITMENT TO MEETING OBLIGATIONS TO THE UNITED STATE FISH AND WILDLIFE SERVICE AS REPRESENTED IN THE BIOLOGICAL ASSESSMENT WHICH REPRESENT THE NORTH CENTRAL MISSOURI REGIONAL WATER COMMISSIONS PLAN TO PRESERVE HABITAT IN AND AROUND THE EAST LOCUST CREEK RESERVOIR.

WHEREAS; The North Central Missouri Regional Water Commission (Commission) is charged with the mission to construct the East Locust Creek Reservoir as a regional water supply; and,

WHEREAS; The Commission has an obligation to mitigate impacts to endangered and protected species including the Indiana Bat (*Myotis* sodalist) and the Northern Long-eared Bat (*Myotis* septentrionalis), which have been found in the project footprint of the East Locust Creek Reservoir; and,

WHEREAS; This requires action to be taken by the Commission to implement mitigation features and policies that have been presented to the United States Fish and Wildlife Service (USFWS) in the Commission's Biological Assessment; and,

WHEREAS; The Commission, through this Resolution represents a public and policy commitment to adhere to the plan provide to the USFWS.

THEREFORE BE IT RESOLVED; That the Commission;

- 1. Commits to a 1:1 ratio for tree planting and/or preservation for forest impacts associated with the proposed East Locust Creek Reservoir.
 - a. 683 acres of tree preservation on NCMRWC property with a conservation easement
 - b. 553 acres of tree plantings according to Matt Arndt's tree planting plan with a conservation easement.
 - c. 79 acres of palustrine emergent wetland creation.
 - d. 25 acres of tree planting or preservation associated with wetland or stream mitigation.
 - e. Lake Authority zoning within the High Impact Zone that would preserve 50 acres of forest along the existing streams.
- 2. Commits to five years of ongoing maintenance to ensure the establishment of the tree plantings.
- 3. Commits to a permanent conservation easement on the above-mentioned tree planting and/or preservation.
- 4. Commits to a winter (November 1 March 31) hazard tree removal program. Hazardous trees or trees that may become hazardous for reservoir operation or recreational activities will be identified and removed during the winter.
- 5. Commits to winter tree clearing for commercial timber harvest, for reservoir construction activities, and for tree clearing to allow boat navigation.
- 6. Commits to signing a Missouri Department of Conservation (MDC) Conservation Assistance Program agreement and adherence to a Forest Management Plan created by a MDC forester.

RESOLUTION RECOMMENDING POLICIES TO THE LAKE AUTHORITY TO LIMIT TREE CLEARING WITHIN THE RESERVOIR WATERSHED TO THE PERIOD BETWEEN NOVEMBER 1 AND MARCH 31

WHEREAS, the North Central Missouri Regional Water Commission (Commission) is charged with the mission to construct the East Locust Creek Reservoir in compliance with all state and federal requirements including mitigating impacts on identified endangered species; and,

WHEREAS, the Indiana Bat and Northern Long-eared Bat were found to inhabit the environs of the ELCR in roosting and maternity sites for which a Bat Mitigation Plan was created in order to secure a Biological Opinion from the U.S. Fish and Wildlife Service (USFWS); and,

WHEREAS, as a part of the Bat Mitigation Plan, the Commission must adopt protection policies over which they have statutory authority and promote and recommend to the Lake Authority protection policies for its adoption; and,

WHEREAS, the two identified bat species are migratory and are not in Sullivan County between November 1 and March 31, which is the period that USFWS allows the cutting of trees; and,

WHEREAS, the Commission and subsequently the Lake Authority has an intense interest in the management and, generally, preservation of trees and forage to aid in keeping the reservoir clean with particular attention paid to what has been designated the High Impact Zone, which is generally the land 500 feet back from the Commission's property line.

THEREFORE, BE IT RESOLVED, that the Commission will strongly recommend that the Lake Authority require all clearing of deciduous trees larger than 3" DBH within the High Impact Zone be done in the inactive season, November 1 through March 31, and that they require the property owners to self-certify that they acted in compliance with this requirement before receiving any construction permit from the Lake Authority (Appropriate provisions will be included for the removal of trees that pose a safety hazard to life and property); and,

BE IT FURTHER RESOLVED, that the Commission will inform landowners in the High Impact Zone of the prevalence of protected bats and of their obligations to follow USFWS and Commission policies relating to their protection, and will encourage the Lake Authority to do likewise.

ADOPTED THIS 10th day of August, 2020

CERTIFICATE OF RECORDING OFFICER

The undersigned, duly qualified and acting Secretary of the North Central Missouri Regional Water Commission, does hereby certify: That the above resolution is a true and correct copy of the resolution adopted at a legally convened meeting of the North Central Missouri Regional Water Commission held the 10th day of August, 2020; and further, that such resolution has been fully recorded in the journal of proceedings and records in my office. IN WITNESS WHEREOF, I have hereunto set my hand this 10th day of August, 2020.



Jeanna Johnson, Secretary North Central Missouri Regional Water Commission

RESOLUTON TO REQUIRE WATER DISTRICTS PURCHASING WATER FROM THE NORTH CENTRAL MISSOURI REGIONAL WATER COMMISSION TO CONFER WITH USFWS FOR CONSTRUCTION OF-WATER TRANSMISSION LINES

WHEREAS, the North Central Missouri Regional Water Commission (Commission) is charged with the mission to construct the East Locust Creek Reservoir (ELCR) in compliance with all state and federal requirements including mitigating impacts on identified endangered species; and,

WHEREAS, the Indiana Bat and Northern Long-eared Bat were found to inhabit the environs of the ELCR in roosting and maternity sites for which a Bat Mitigation Plan was created in order to secure a Biological Opinion from the U.S. Fish and Wildlife Service (USFWS); and,

WHEREAS, as a part of the Bat Mitigation Plan, the Commission must adopt protection policies over which they have statutory authority; and,

WHEREAS, as a result of the construction of the ELCR it is anticipated that water districts and communities will join the Commission requiring the construction of water transmission line owned by them or the Commission; and,

WHEREAS, in the course of construction, trees may need to be removed that could have adverse impacts on endangered species that the USFWS and Commission are committed to mitigate.

THEREFORE, BE IT RESOLVED, that the Commission will require any entity removing trees for construction of water transmission lines for the purpose of purchasing and transmitting water from the East Locust Creek Reservoir or the NCMRWC water treatment plant to the entity's water system must confer with USFWS regarding impacts to federally listed species that could result from transmission line construction

ADOPTED THIS 10th day of August, 2020

CERTIFICATE OF RECORDING OFFICER

The undersigned, duly qualified and acting Secretary of the North Central Missouri Regional Water Commission, does hereby certify: That the above resolution is a true and correct copy of the resolution adopted at a legally convened meeting of the North Central Missouri Regional Water Commission held the 10th day of August, 2020; and further, that such resolution has been fully recorded in the journal of proceedings and records in my office. IN WITNESS WHEREOF, I have hereunto set my hand this 10th day of August, 2020.



Jeanna Johnson, Secretary North Central Missouri Regional Water Commission

Appendix C

Mead's Milkweed Study

MEAD'S MILKWEED STUDY

EAST LOCUST CREEK RESERVOIR SULLIVAN COUNTY, MISSOURI

PREPARED FOR

North Central Missouri Regional Water Commission 201 N. Market Street Milan, Missouri 63556

PREPARED BY

Olsson Associates 7301 West 133rd Street, Suite 200 Overland Park, Kansas 66213

January 2018
Olsson Associates Project No. A11-1513



List of Figures

Figure 1	Site Location Map
Figure 2	Sample Locations Map
Figure 3	Photo Locations Map
Figure 4	Native Site Y
Figure 5	Native Site 3
Figure 6	Native Site 21 and 22a

List of Appendices

Appendix A Photo Log



1.0 PROJECT DESCRIPTION

The North Central Missouri Regional Water Commission's (NCMRWC) proposed project involves the construction of a multipurpose reservoir in Sullivan County, Missouri, approximately 6 miles north-northeast of Milan, Missouri (Figure 1). The project is in Sections 5, 6, 7, and 8, Township 63 North, Range 19 West; Sections 1, 2, and 12, Township 63 North, Range 20 West; Sections 18, 19, 30, and 31, Township 64 North, Range 19 West; Sections 13, 23, 24, 25, 26, 35, and 36, Township 64 North, Range 20 West. The project center is located at -93.09912 degrees longitude and 40.28905 degrees latitude.

An earthen dam would be constructed on East Locust Creek south of Boynton and a water transmission line would be constructed from the dam to the water treatment plant in Milan. The reservoir would have a contributing drainage area of 32.7 square miles, and the 0.5-mile-long dam would impound water to a normal pool maximum depth of 56 feet. At this depth, the proposed lake would have a normal pool surface area of approximately 2,400 acres and a storage volume of 54,000 acre-foot. The project area inundated by the reservoir contains approximately 911.8 acres of grassland. The proposed reservoir would provide water supply, reduce flood damages, and provide water-based recreational opportunities.

The proposed project is within the range of the federally listed Mead's milkweed (*Asclepias meadii*). Mead's milkweed was listed as threatened under the Endangered Species Act (ESA) on September 1, 1988. The purpose of this study is to conduct a Mead's milkweed survey to determine the presence or probable absence of Mead's milkweed. No critical habitat has been designated in Sullivan County for Mead's milkweed.

The current land use is upland pastures on the steep terrain and crop fields on the flat ground. The upland pastures have typically been reseeded with tall fescue (*Schedonorus arundinaceus*) and has more than 80 percent establishment. Wooded areas consist of American elm (*Ulmus americana*), white oak (*Quercus alba*), bur oak (*Quercus macrocarpa*), black walnut (*Juglans nigra*), green ash (*Fraxinus pennsylvanica*), and shagbark hickory (*Carya ovata*).



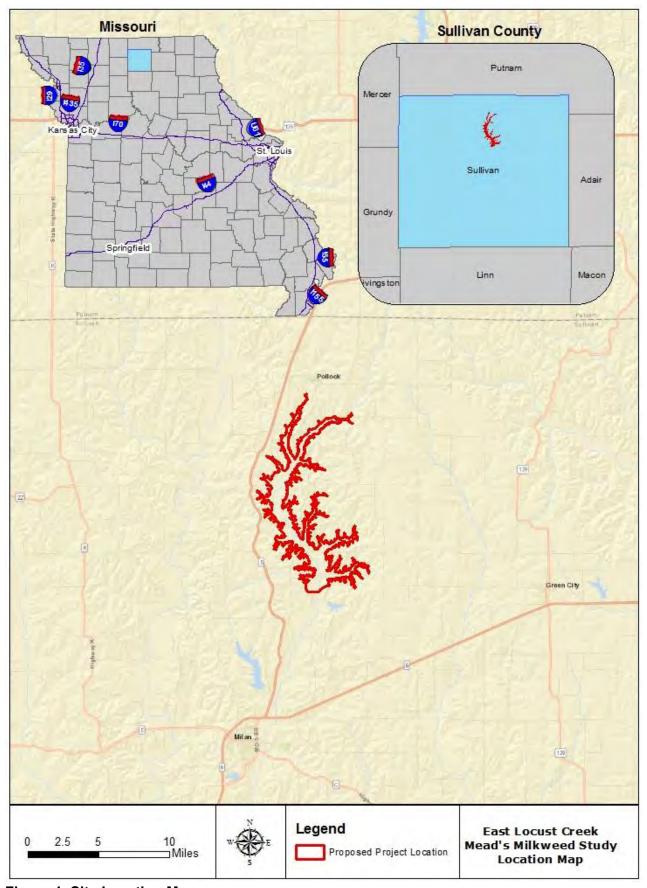


Figure 1. Site Location Map.



2.0 PERSONNEL

A field team for the Mead's milkweed survey was staffed with two Olsson Associates (Olsson) biologists, Aaron Ball and Jessica Casey. Mr. Ball is a certified professional in rangeland management.

3.0 SPECIES DESCRIPTION

Mead's milkweed was listed as threatened under the Endangered Species Act (ESA) on September 1, 1988. Declines of Mead's milkweed can be attributed to alteration of the tallgrass prairie by multiple factors including: (1) agricultural use, (2) urban growth, (3) industrial, (4) commercial development, (5) recreational use of sites, and (6) hay mowing (U.S. Fish and Wildlife Service [USFWS] 1988).

The status at the time of listing was detailed in the federal register when the species was listed as threatened. Federal Register/ Vol. 53, No. 170/Pg. 33992/Thursday, September 1, 1988/Rules and Regulations (USFWS 1988):

"Approximately 81 populations are currently known: 38 in Kansas, 3 in Illinois, 2 in Iowa, and 17 in Missouri. The plant is believed to be extirpated from Indiana and Wisconsin. It is threatened by destruction and modification of the 'tall grass' prairie due to agricultural expansion, urban growth, and agricultural practices that such as mowing and grazing, which are detrimental to the plant's reproductive cycle."

Mead's milkweed is currently known in 34 counties in Kansas, Missouri, Iowa, and Illinois at 171 sites (USFWS 2016). Sullivan County does not have a known current or extant Mead's milkweed population, but there are three extant populations in the Missouri glaciated plains physiographic region in which Sullivan County is located (USFWS 2012).

Mead's milkweed habitat includes mesic to moderately dry upland tallgrass prairies throughout the eastern tallgrass prairie, from Kansas through Missouri and Illinois and north to southern lowa and northwest Indiana. Currently the species exists only in eastern Kansas, Missouri, south-central lowa, and southern Illinois (NatureServe 2015). Mead's milkweed is found in virgin, tallgrass prairies that is managed for light grazing and hay production (USFWS 2003). USFWS 1988 cited personal communication with Ronald McGregor (University of Kansas) that he has only found Mead's milkweed in tallgrass prairies. Similarly, an unpublished report by S.W. Morgan (MDC) in 1980 stated that Mead's Milkweed in Missouri is found in unplowed bluestem prairie (USFWS 1988).

Mead's milkweed has a single, waxy coated stalk that stands 8 to 16 inches high. The leaves branch opposite each other and are approximately 2 to 3 inches long, 3/8 to 2 inches wide. The tip of the milkweed has a drooping cluster of 6 to 15 greenish to cream-colored flowers (USFWS 2005). Mead's milkweed may take 15 years or more to mature from a germinating seed to a flowering plant (USFWS 2003). The species flowers as early as late May in the south (southern Kansas and Missouri) through mid to late June in the north (Illinois) (USFWS 2005). Observations show that individual plants flower for two or three years and then rest, and in some cases, completely disappear.

4.0 METHODOLOGY

The survey consisted of two parts, a desktop review to identify grassland habitat and a follow-up field verification to determine potential Mead's milkweed habitat and species occurrence. The



desktop review identified grassland areas from aerial photographs that could contain Mead's milkweed habitat. Specifically, grassland sites were identified that have never been plowed, were not currently or previously developed and that lacked over 50 percent tree or shrub canopy cover. Woodland areas, open waters, and cropped areas (historically or present) were eliminated as these would have a low likelihood of providing suitable habitat for the species. Resources used during the desktop review include:

- Earth Sciences Resources Institute (ESRI) Aerial Imagery
- Google Earth ® Historical Aerial Photographs

Following the desktop review, a field verification survey was performed for the identified sample locations (Figure 2). Each survey area, identified as grassland through the desktop review, was walked to determine if vegetation was native or non-native to Missouri. Non-native grassland vegetation includes tall fescue, smooth brome (*Bromis inermis*), and reed canarygrass (*Phalaris arundinacea*). Multiple research documents list habitat for Mead's milkweed as virgin, tallgrass prairie (USFWS 1988), which would not include cool season grass pastures. Cool season grasses are considered undesirable prairie species consistent with a degraded prairie (Kindscher et. al. 2008).

If the vegetation was non-native, photos and GPS coordinates were taken (See Appendix A – Photo Log). If the vegetation was determined to be native, 30-minute wandering surveys of the areas were completed to look for any milkweeds. If during the field survey areas of native vegetation were found that were not identified in the desktop survey, they were surveyed for 30-minutes as well. Photos of all milkweeds were taken and identified to assess if Mead's milkweed was likely to be present or absent from the area.

5.0 RESULTS

Based on the desktop review, the dam and inundation area include approximately 452 acres of grassland that could support Mead's milkweed. The 452 acres were found in 58 unique sites and are shown in Figure 2.

Olsson conducted a field survey from June 14 – July 7, 2016. Photo points were taken for all 58 unique sites (Appendix A). The photo point locations are included in Figure 3. There were four sites identified with native vegetation: Site 3 (Figure 4), Site 21 (Figure 5), Site 22a (Figure 5), and Site Y (Figure 6). The native vegetation totaled 18.7 acres. Wandering surveys were competed for 30 minutes at each site. Other milkweeds and milkweed-like plants were recorded including common milkweed (*Asclepias syriaca*), dogbane (*Apocynum cannabinum*), and prairie milkweed (*Asclepias hirtella*). Mead's milkweed was not found. Native grass species included big bluestem, little bluestem (*Schizachyrium scoparium*), indiangrass (*Sorgastrum nutans*), and switchgrass (*Panicum virgatum*) and forb species included tall goldenrod (*Solidago altissima*), common yarrow (*Achillea millefolium*), blackeyed Susan (*Rudbeckia hirta*), white heath aster (*Symphyotrichum ericoides*) and Baldwin's ironweed (*Veronia baldwinii*).

The remaining 54 sites contained non-native species, which was primarily tall fescue, smooth brome, and reed canarygrass.



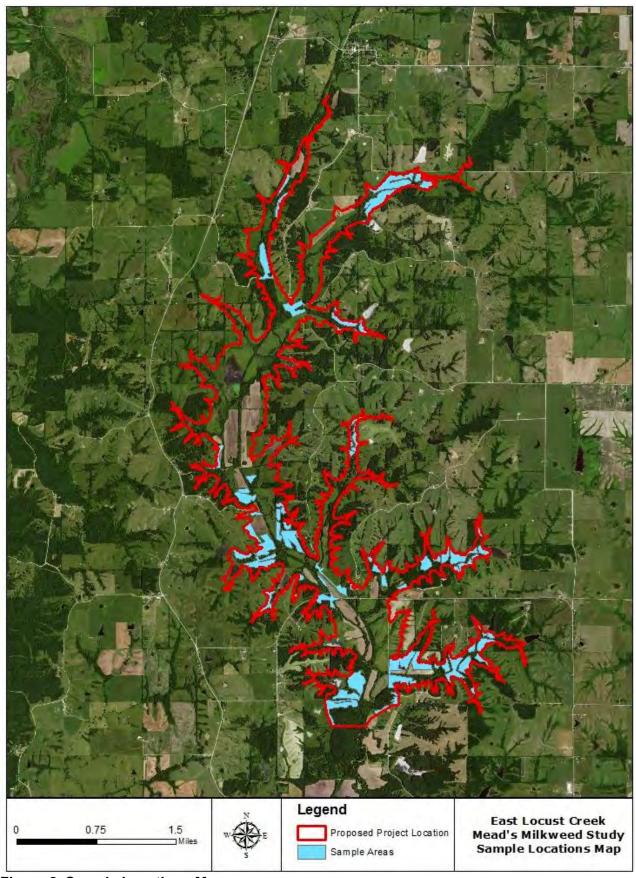


Figure 2. Sample Locations Map.



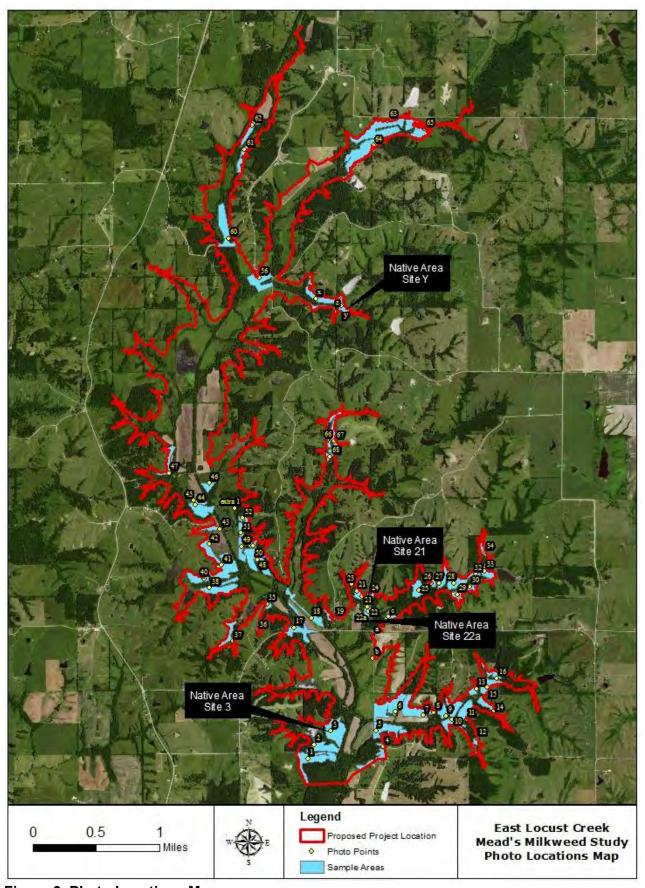


Figure 3. Photo Locations Map.



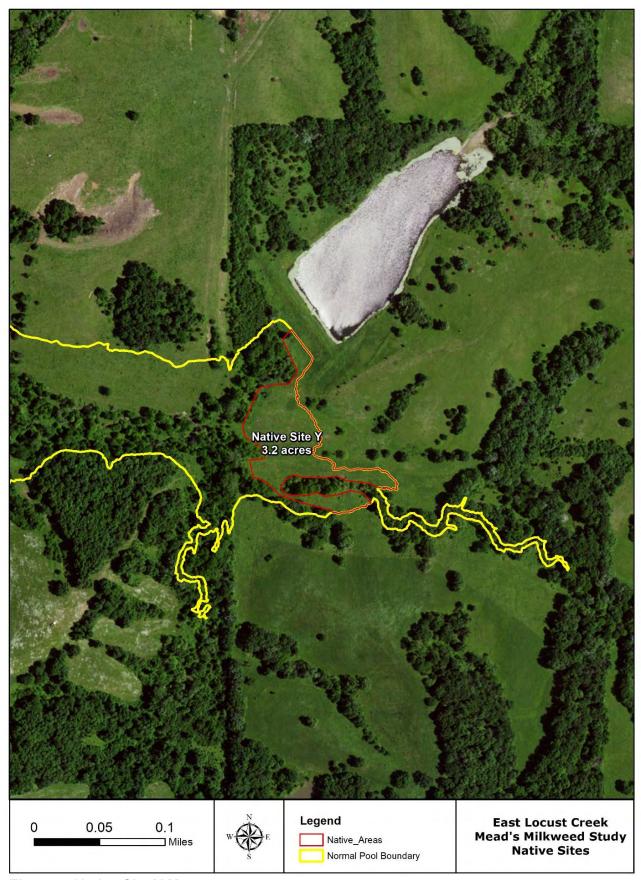


Figure 4. Native Site Y Map.





Figure 5. Native Site 3 Map.



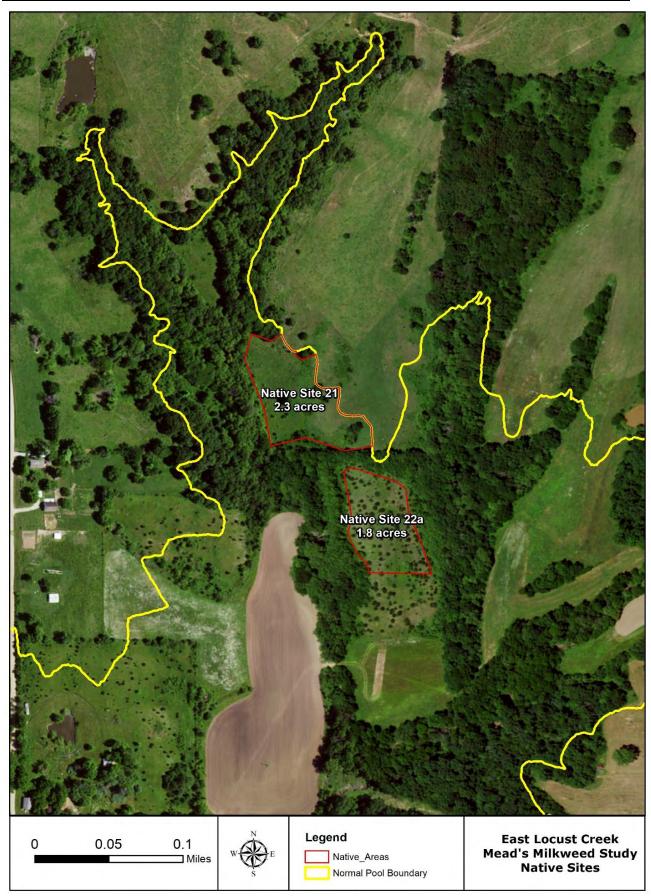


Figure 6. Native Sites 21 and 22a Map.



6.0 DISCUSSION AND CONCLUSION

The proposed project has a footprint of approximately 2,400 acres of which 452 acres are grassland areas that could provide habitat for Mead's milkweed. Grassland areas within the project footprint are primarily tall fescue, which is typical of the area. Tall fescue was planted for grazing and haying purposes and replaced the native tallgrass prairie species. Tall fescue forms dense stands and greatly reduces species diversity. Typically, native grass species including big bluestem (*Andropogon gerardi*) are completely eliminated from tall fescue pastures.

Potential Mead's milkweed habitat includes grassland areas consisting of virgin tallgrass prairie that had not been previously cultivated. Non-native cool season grasses, like tall fescue, likely do provide adequate habitat to support Mead's milkweed. Seedbed preparation for tall fescue seeding can include tillage, which could eliminate Mead's milkweed populations.

The highest potential habitat for Mead's milkweed within the project area is within the 18.7 acres in the four native sites consisting of native tallgrass prairie. The remaining 433.3 acres identified in the desktop review were non-native cool season grasses that likely do not provide suitable habitat for Mead's milkweed. The 18.7 acres of native tallgrass prairie were traversed through wandering surveys for 30 minutes per site or four hours total. Mead's milkweed was not identified.

Determining species absence is not possible within the scope of this study. However, this study does support the probable absence of the species within the project area. Additionally, there are no known current populations or extant populations within Sullivan County.

The limitations of this study are included below.

- 1. The field observer may not detect the Mead's milkweed. The field study was completed during the flowering period to aid in detection. Other milkweeds were identified and photographed when found. Common milkweed was identified during the non-flowering, early morphological stage. However, as shown in the photolog, dense vegetation was present and may make detection difficult within the wandering survey. Additionally, there may only be a few individual ramets to identify.
- 2. The Mead's milkweed seed or juveniles may be present, but the plant is not growing or visible. Detection is based on identifying a visible specimen.
- 3. Herbivory may have removed an individual from a site prior to the field survey. USFWS 2003 listed multiple Mead's milkweed populations with fewer than 3 ramets. Wildlife or livestock grazing could have removed individual ramets prior to the field survey.
- 4. Mead's milkweed may exist within the cool-season grass pastures. Based on the literature, the likelihood is low for Mead's milkweed to be found in cool-season grass pastures. Small remnant native tallgrass prairies within the cool-season grass pastures is possible, especially along forest edges. Wandering surveys were not conducted within the cool-season grass pastures.



7.0 REFERENCES

- Kindscher, Kelly, Long, Quinn, and Byczynski, Lynn. 2008. Mead's Milkweed Reintroduction Plan for Marais Des Cygnes National Wildlife Refuge. Kansas Biological Survey Open File Report Number 152. November 15, 2008.
- NatureServe Explorer. (2015). *Asclepias meadii* Torr. ex Gray Mead's Milkweed.

 <a href="http://explorer.natureserve.org/servlet/NatureServe?sourceTemplate=tabular report.wmt_aloadTemplate=species_RptComprehensive.wmt&selectedReport=RptComprehensive.wmt&summaryView=tabular_report.wmt&elKey=129673&paging=home&save=true&start_lndex=1&nextStartIndex=1&reset=false&offPageSelectedElKey=129673&offPageSelect_edElType=species&offPageYesNo=true&post_processes=&radiobutton=radiobutton&sel_ectedIndexes=129673_Accessed_August_2016.
- U.S. Fish and Wildlife Service (USFWS). 1988. Endangered and Threatened Wildlife and Plants; Determination of Threatened Status for Asclepias Meadii (Mead's Milkweed). Federal Register. Volume 53, Number 170. Rules and Regulations. September 1, 1988.
- USFWS. (2003). Mead's Milkweed (*Asclepias meadii*) Recovery Plan. U.S. Department of Interior. Great Lakes Big Rivers Region (Region 3) Fort Snelling, Minnesota.
- USFWS. 2005. Mead's Milkweed (*Asclepias meadii*). U.S. Fish and Wildlife Service. Threatened and Endangered Species. Midwest Region.

 https://www.fws.gov/midwest/Endangered/plants/pdf/meads-fs.pdf Accessed August 2016.
- USFWS. 2012. Mead's Milkweed (*Asclepias meadii*). 5-Year Review: Summary and Evaluation. USFWS Chicago, Illinois Field Office. November 2012.
- USFWS. 2016. Mead's Milkweed (Asclepias meadii). U.S. Fish and Wildlife Service. Endangered Species Midwest Region.

 https://www.fws.gov/midwest/endangered/plants/meads/index.html Accessed January 2018.



APPENDIX A PHOTO LOG







Photo No. 1 Photo Dir. North

Description: Site 1. Non-native tall fescue

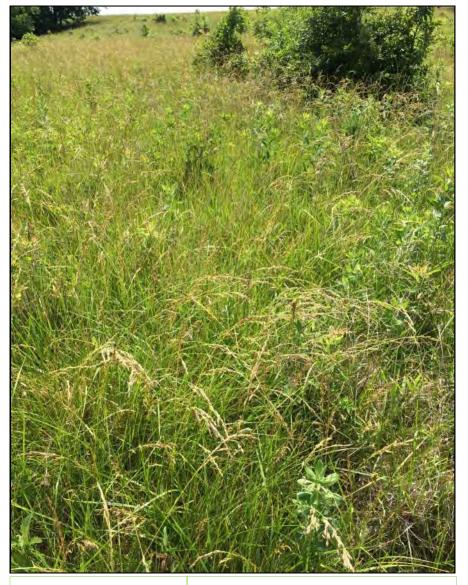


Photo No. 2 Photo Dir. South

Description: Site 1. Non-native tall fescue





Photo No. 3 Photo Dir.

Description: Site 1. Dogbane (Apocynum sp.)



Photo No. 4 Photo Dir.

Description: Site 1. Prairie milkweed (Asclepias hirtella)



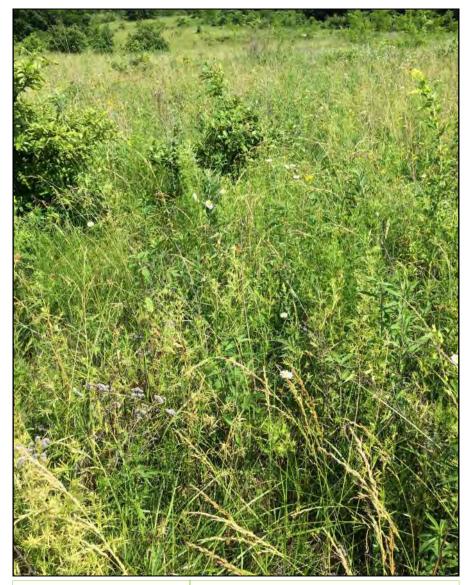


Photo No. 5 Photo Dir. East

Description: Site 2. Non-native tall fescue



Photo No. 6 Photo Dir. North

Description: Site 2. Non-native tall fescue





Photo No. 7 Photo Dir. West

Description: Site 3. Native. Searched for 49 minutes with two people.

Jessica Casey and Aaron Ball.

Photo No. 8 Photo Dir. North

Description: Site 3. Native. Searched for 49 minutes with two people.

Jessica Casey and Aaron Ball.

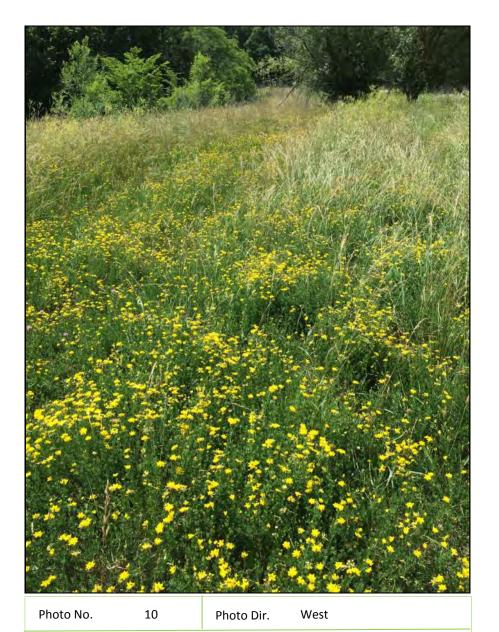




Photo Dir. Photo No. 9 West

Description: Site 3. Native. Searched for 49 minutes with two people.

Jessica Casey and Aaron Ball.



Site 4. Non-native tall fescue Description:





Photo No. 11 Photo Dir. South

Description: Site 4. Non-native tall fescue



Photo No. 12 Photo Dir. North

Description: Site 5. Non-native tall fescue





Photo No. 13 Photo Dir. East

Description: Site 5. Non-native tall fescue

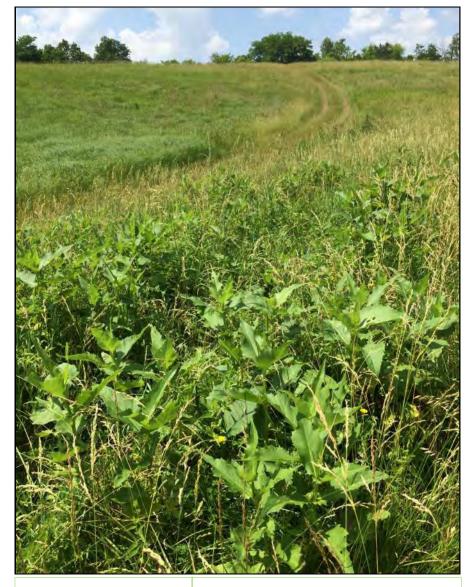


Photo No. 14 Photo Dir. North

Description: Site 6. Non-native tall fescue



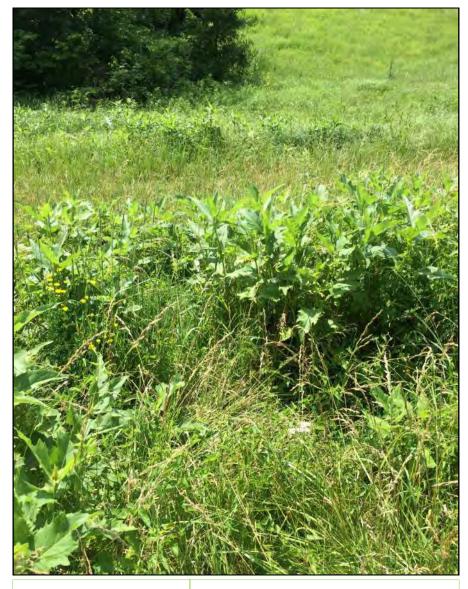


Photo No. 15 Photo Dir. West

Description: Site 6. Non-native tall fescue



Photo No. 16 Photo Dir. North

Description: Site 7. Non-native tall fescue





Photo No. 17 Photo Dir. West

Description: Site 7. Non-native tall fescue



Photo No. 18 Photo Dir. South

Description: Site 8. Non-native tall fescue



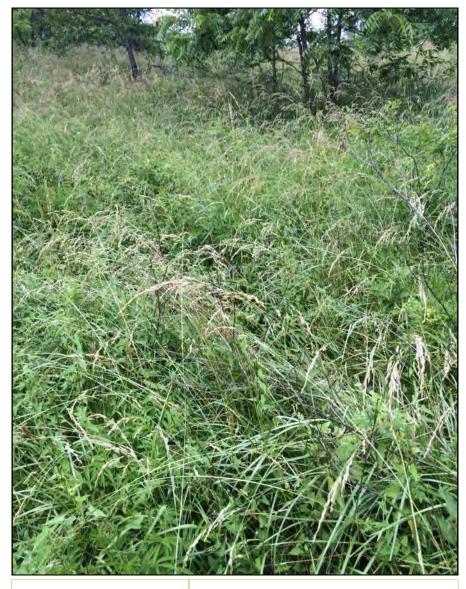


Photo No. 19 Photo Dir. North

Description: Site 8. Non-native tall fescue

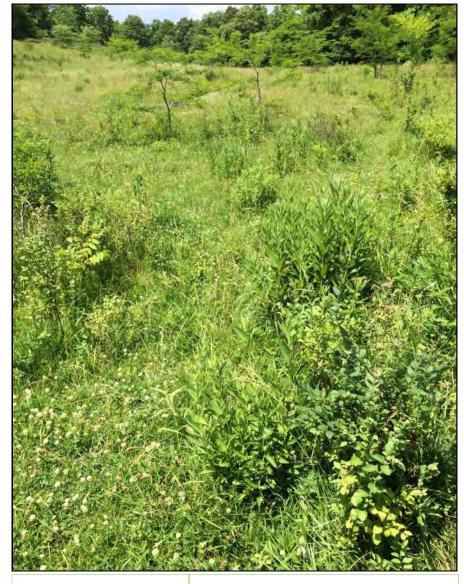


Photo No. 20 Photo Dir. North

Description: Site 9. Non-native tall fescue





Photo No. 21 Photo Dir. West

Description: Site 9. Non-native tall fescue



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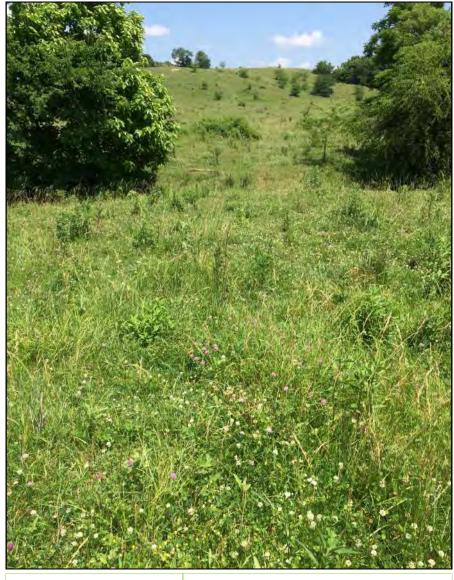


Photo No. 23 Photo Dir. North

Description: Site 10. Non-native tall fescue

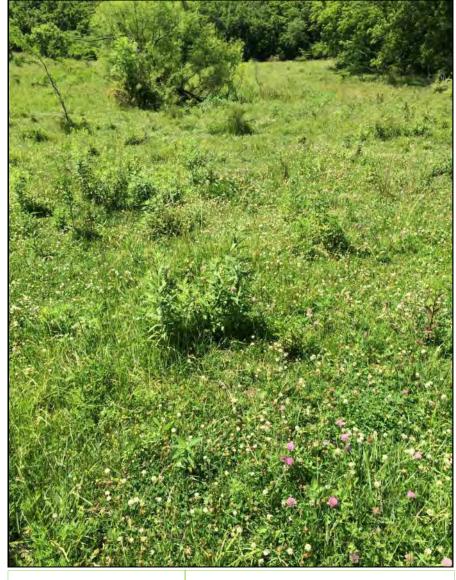


Photo No. 24 Photo Dir. West

Description: Site 10. Non-native tall fescue





Photo No. 25 Photo Dir. East

Description: Site 11. Non-native tall fescue



Photo No. 26 Photo Dir. West

Description: Site 11. Non-native tall fescue





Photo No. 27 Photo Dir. South

Description: Site 12. Non-native tall fescue



Photo No. 28 Photo Dir. North

Description: Site 12. Non-native tall fescue





Photo No. 29 Photo Dir. North

Description: Site 13. Non-native tall fescue



Photo No. 30 Photo Dir. East

Description: Site 13. Non-native tall fescue





Photo No. 31 Photo Dir. North

Description: Site 14. Non-native tall fescue



Photo No. 32 Photo Dir. South

Description: Site 14. Non-native tall fescue





Photo No. 33 Photo Dir. North

Description: Site 15. Non-native tall fescue



Photo No. 34 Photo Dir. South

Description: Site 15. Non-native tall fescue





Photo No. 35 Photo Dir. North

Description: Site 16. Non-native tall fescue

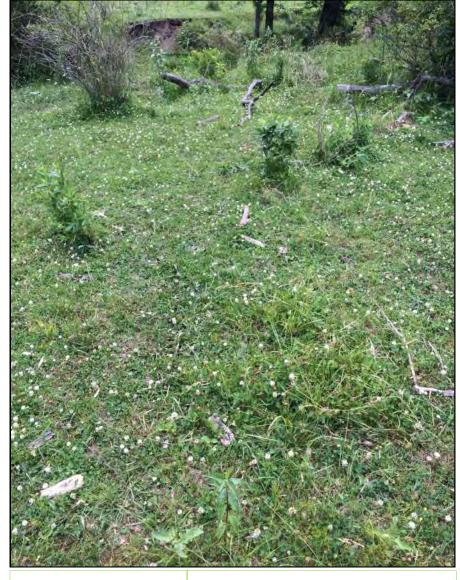


Photo No. 36 Photo Dir. South

Description: Site 16. Non-native tall fescue



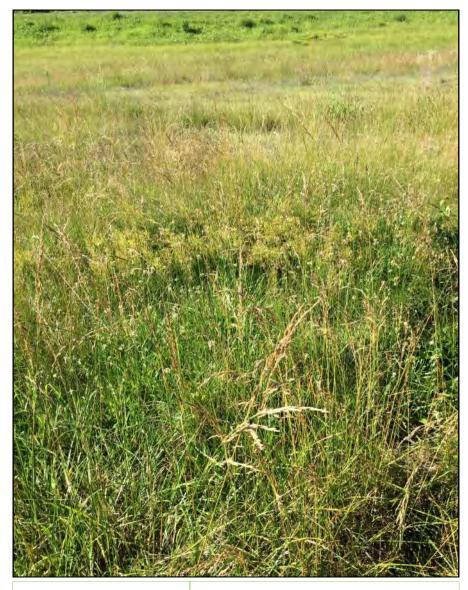


Photo No. 37 Photo Dir. South

Description: Site 17. Non-native tall fescue



Photo No. 38 Photo Dir. West

Description: Site 17. Non-native tall fescue





Photo No. 39 Photo Dir. North

Description: Site 18. Non-native tall fescue



Photo No. 40 Photo Dir. West

Description: Site 18. Non-native tall fescue





Photo No. 41 Photo Dir. West

Description: Site 19. Non-native tall fescue



Photo No. 42 Photo Dir. North

Description: Site 19. Non-native tall fescue





Photo No. 43 Photo Dir. West

Description: Site 21. Native big bluestem. 30 minute survey with two people. Aaron Ball and Jessica Casey.



Photo No. 44 Photo Dir. East

Description: Site 21. Native big bluestem. 30 minute survey with two people. Aaron Ball and Jessica Casey.





Photo No. 45 Photo Dir. East

Description: Site 21. Native big bluestem. 30 minute survey with two

people. Aaron Ball and Jessica Casey.



Photo No. 46 Photo Dir. West

Description: Site 21. Native big bluestem. 30 minute survey with two people. Aaron Ball and Jessica Casey.



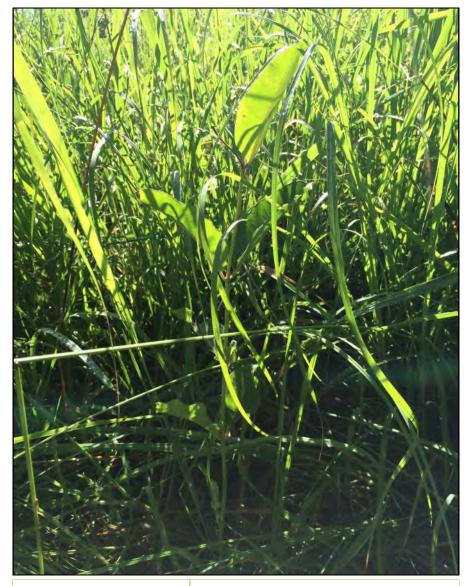


Photo No. 47 Photo Dir.

Description: Site 21. Common milkweed (Asclepias syriaca)



Photo No. 48 Photo Dir.

Description: Site 21. Common milkweed





Photo No. 49 Photo Dir.

Description: Site 21. Common milkweed



Photo No. 50 Photo Dir.

Description: Site 21. Common milkweed





Photo No. 51 Photo Dir. South

Description: Site 22. Non-native tall fescue



Photo No. 52 Photo Dir. North

Description: Site 22. Non-native tall fescue





Photo No. 53 Photo Dir. West

Description: Site 22a. Native big bluestem. 30 minute walking survey.



Photo No. 54 Photo Dir. East

Description: Site 22a. Native big bluestem. 30 minute walking survey.





Photo No. 55 Photo Dir. North

Description: Site 23. Non-native tall fescue



Photo No. 56 Photo Dir. West

Description: Site 23. Non-native tall fescue





Photo No. 57 Photo Dir. South

Description: Site 24. Non-native, mowed tall fescue



Photo No. 58 Photo Dir. East

Description: Site 24. Non-native, mowed tall fescue



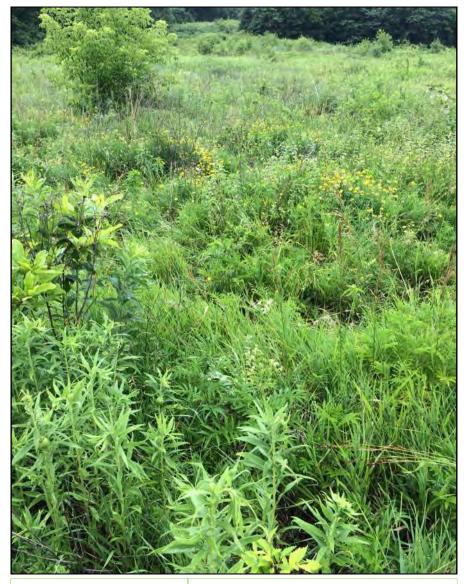


Photo No. 59 Photo Dir. North

Description: Site 25. Non-native smooth brome

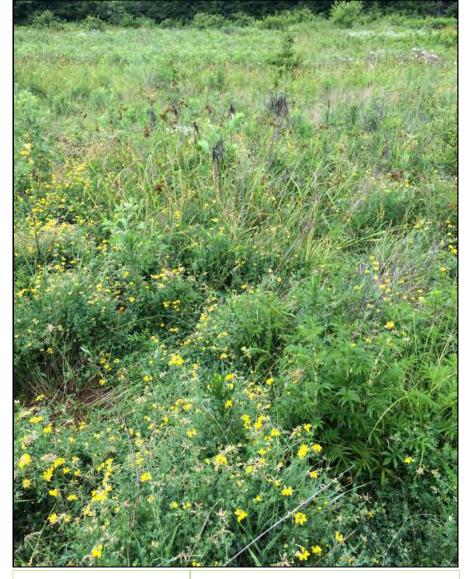


Photo No. 60 Photo Dir. West

Description: Site 25. Non-native smooth brome





Photo No. 61 Photo Dir. South

Description: Site 25. Non-native smooth brome



Photo No. 62 Photo Dir. East

Description: Site 25. Non-native smooth brome





Photo No. 63 Photo Dir. East

Description: Site 26. Non-native smooth brome

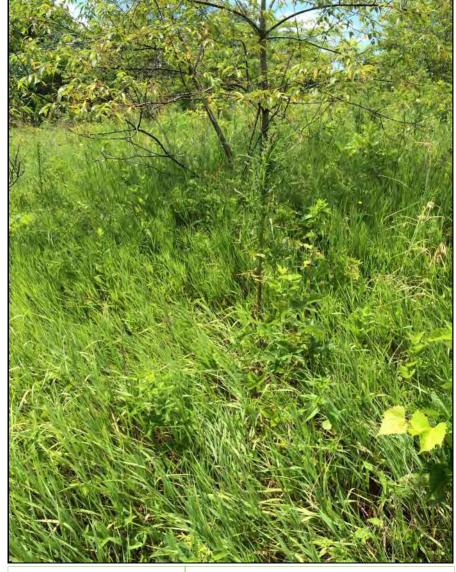


Photo No. 64 Photo Dir. West

Description: Site 26. Non-native smooth brome





Photo No. 65 Photo Dir. South

Description: Site 27. Non-native tall fescue



Photo No. 66 Photo Dir. North

Description: Site 27. Non-native tall fescue





Photo No. 67 Photo Dir. South

Description: Site 28. Non-native tall fescue

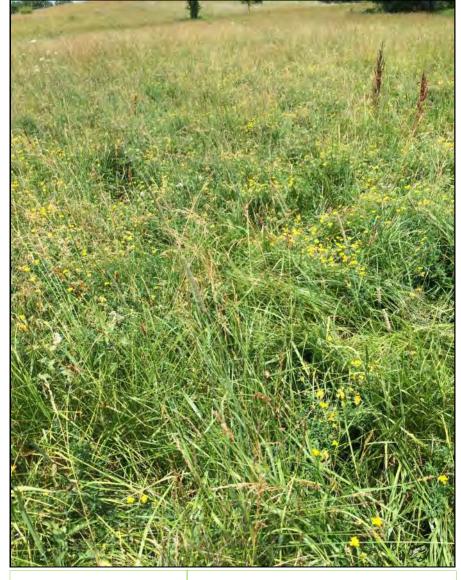


Photo No. 68 Photo Dir. North

Description: Site 28. Non-native tall fescue





Photo No. 69 Photo Dir. West

Description: Site 29. Non-native tall fescue

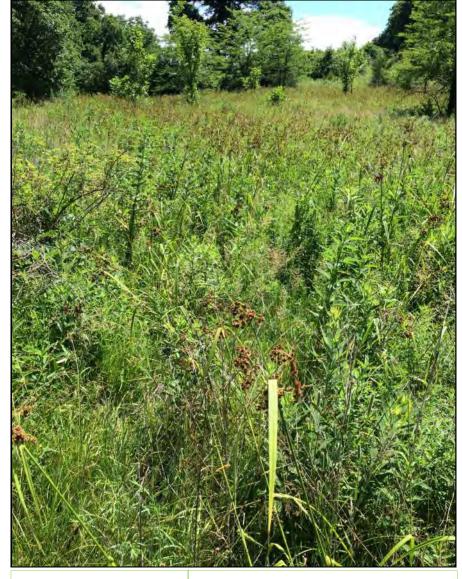


Photo No. 70 Photo Dir. East

Description: Site 29. Non-native tall fescue





Photo No. 71 Photo Dir. South

Description: Site 31. Non-native tall fescue

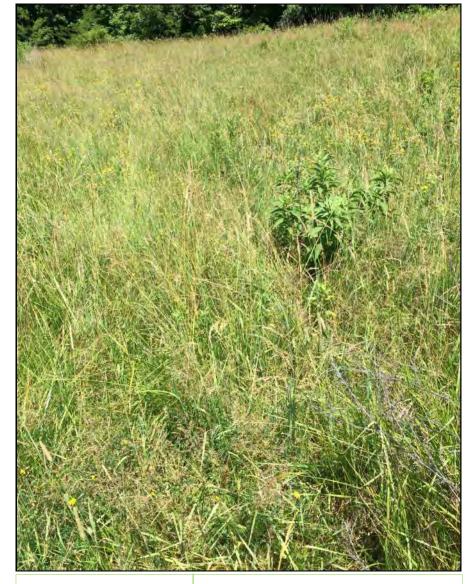


Photo No. 72 Photo Dir. North

Description: Site 31. Non-native tall fescue





Photo No. 73 Photo Dir. North

Description: Site 32. Non-native tall fescue and timothy



Photo No. 74 Photo Dir. South

Description: Site 32. Non-native tall fescue and timothy



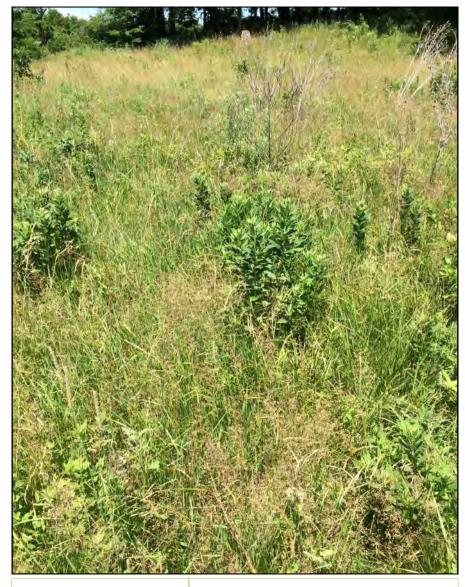


Photo No. 75 Photo Dir. North

Description: Site 33. Non-native tall fescue



Photo No. 76 Photo Dir. South

Description: Site 33. Non-native tall fescue





Photo No. 77 Photo Dir. Northwest

Description: Site 34. Non-native tall fescue



Photo No. 78 Photo Dir. Southeast

Description: Site 34. Non-native tall fescue





Photo No. 79 Photo Dir. North

Description: Site 35. Non-native tall fescue and smooth brome



Photo No. 80 Photo Dir. South

Description: Site 35. Non-native tall fescue and smooth brome





Photo No. 81 Photo Dir. North

Description: Site 36. Non-native smooth brome and tall fescue



Photo No. 82 Photo Dir. South

Description: Site 36. Non-native smooth brome and tall fescue





Photo No. 83 Photo Dir. South

Description: Site 37. Non-native smooth brome and tall fescue



Photo No. 84 Photo Dir. North

Description: Site 37. Non-native smooth brome and tall fescue





Photo No. 85 Photo Dir. East

Description: Site 38. Non-native tall fescue



Photo No. 86 Photo Dir. West

Description: Site 38. Non-native tall fescue





Photo No. 87 Photo Dir. North

Description: Site 39. Non-native tall fescue



Photo No. 88 Photo Dir. South

Description: Site 39. Non-native tall fescue





Photo No. 89 Photo Dir. East

Description: Site 40. Non-native tall fescue



Photo No. 90 Photo Dir. West

Description: Site 40. Non-native tall fescue





Photo No. 91 Photo Dir. South

Description: Site 41. Non-native tall fescue



Photo No. 92 Photo Dir. West

Description: Site 41. Non-native tall fescue





Photo No. 93 Photo Dir. West

Description: Site 42. Non-native tall fescue



Photo No. 94 Photo Dir. South

Description: Site 42. Non-native tall fescue



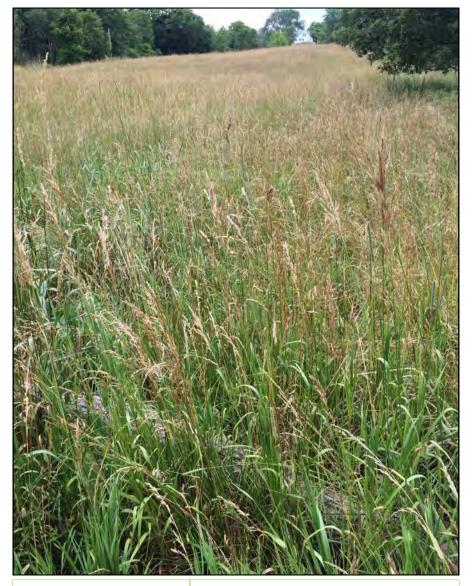


Photo No. 95 Photo Dir. West

Description: Site 43. Non-native tall fescue



Photo No. 96 Photo Dir. South

Description: Site 43. Non-native tall fescue





Photo No. 97 Photo Dir. West

Description: Site 44. Non-native tall fescue and reed canary



Photo No. 98 Photo Dir. Southeast

Description: Site 44. Non-native tall fescue and reed canary





Photo No. 99 Photo Dir. South

Description: Site 45. Non-native reed canary and timothy



Photo No. 100 Photo Dir. North

Description: Site 45. Non-native reed canary and timothy





Photo No. 101 Photo Dir. East

Description: Site 46. Non-native reed canary and wetland species



Photo No. 102 Photo Dir. West

Description: Site 46. Non-native reed canary and wetland species





Photo No. 103 Photo Dir. North

Description: Site 47. Non-native tall fescue and smooth brome

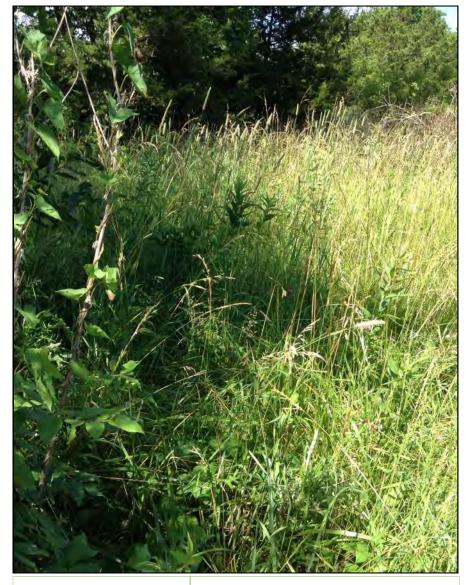


Photo No. 104 Photo Dir. South

Description: Site 47. Non-native tall fescue and smooth brome





Photo No. 105 Photo Dir. West

Description: Site 48. Non-native tall fescue



Photo No. 106 Photo Dir. East

Description: Site 48. Non-native tall fescue



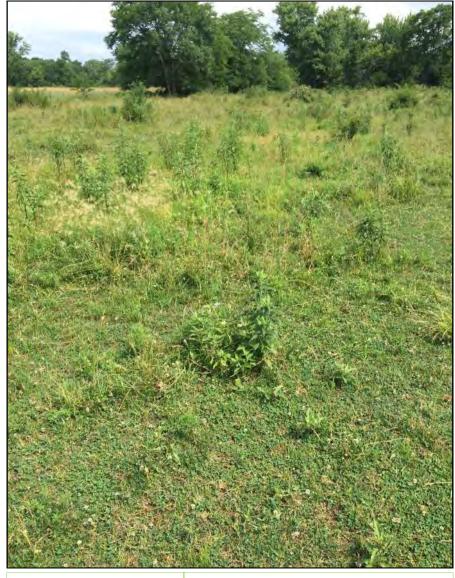


Photo No. 107 Photo Dir. North

Description: Site 49. Non-native tall fescue



Photo No. 108 Photo Dir. South

Description: Site 49. Non-native tall fescue



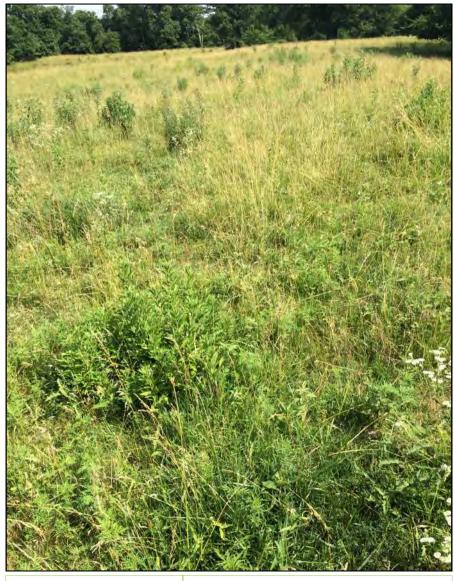


Photo No. 109 Photo Dir. North

Description: Site 50. Non-native tall fescue



Photo No. 110 Photo Dir. South

Description: Site 50. Non-native tall fescue





Photo No. 111 Photo Dir. North

Description: Site 52. Non-native tall fescue



Photo No. 112 Photo Dir. East

Description: Site 52. Non-native tall fescue





Photo No. 113 Photo Dir. South

Description: Site 56. Non-native reed canary and willows



Photo No. 114 Photo Dir. West

Description: Site 56. Non-native reed canary and willows



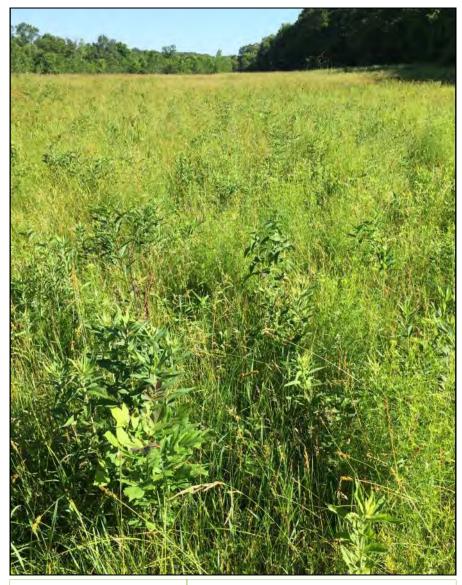


Photo No. 115 Photo Dir. North

Description: Site 60. Old crop field



Photo No. 116 Photo Dir. East

Description: Site 60. Old crop field





Photo No. 117 Photo Dir. North

Description: Site 61. Non-native reed canary and tall fescue



Photo No. 118 Photo Dir. South

Description: Site 61. Non-native reed canary and tall fescue





Photo No. 119 Photo Dir. South

Description: Site 62. Non-native reed canary



Photo No. 120 Photo Dir. North

Description: Site 62. Non-native reed canary





Photo No. 121 Photo Dir. South

Description: Site 64. Non-native tall fescue



Photo No. 122 Photo Dir. East

Description: Site 64. Non-native tall fescue





Photo No. 123 Photo Dir. North

Description: Site 64. Non-native tall fescue

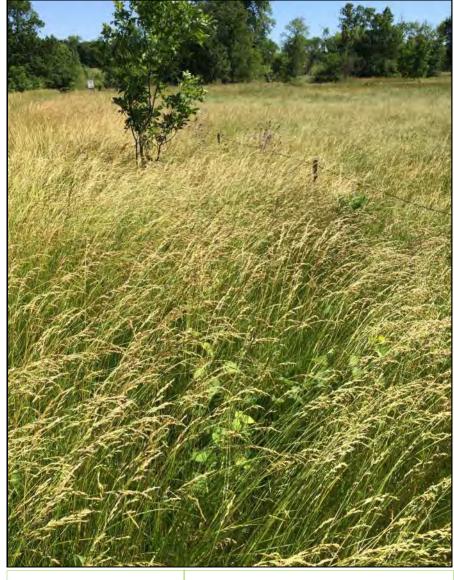


Photo No. 124 Photo Dir. West

Description: Site 64. Non-native tall fescue





Photo No. 125 Photo Dir. South

Description: Site 66. Non-native tall fescue

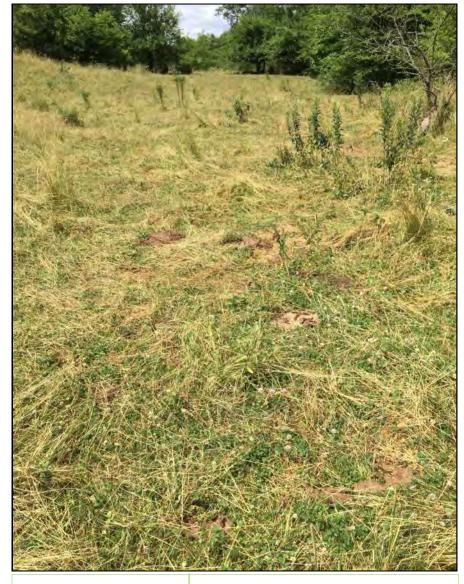


Photo No. 126 Photo Dir. North

Description: Site 66. Non-native tall fescue



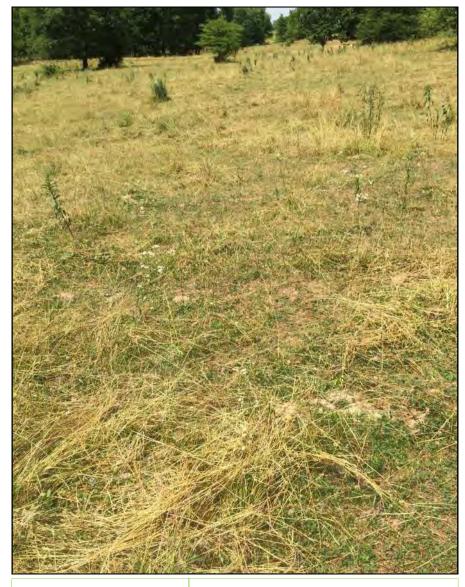


Photo No. 127 Photo Dir. North

Description: Site 67. Non-native tall fescue



Photo No. 128 Photo Dir. South

Description: Site 67. Non-native tall fescue



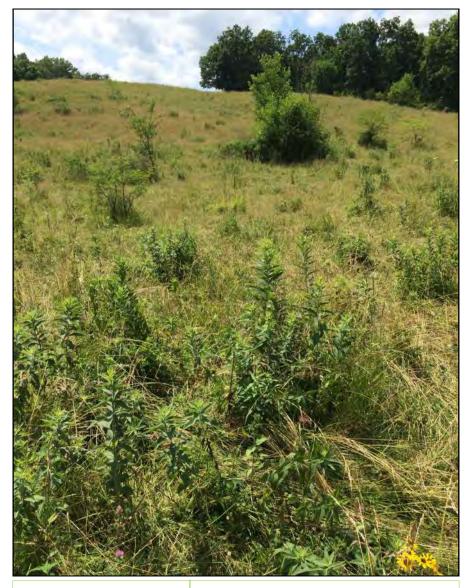


Photo No. 129 Photo Dir. North

Description: Site 68. Non-native tall fescue



Photo No. 130 Photo Dir. South

Description: Site 68. Non-native tall fescue





Photo No. 131 Photo Dir. West

Description: Site A. Non-native smooth brome

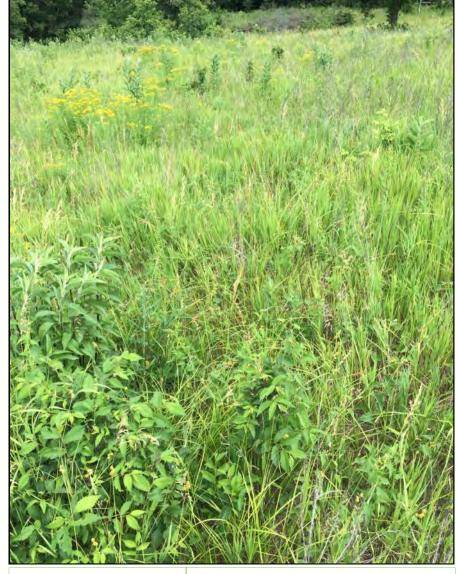


Photo No. 132 Photo Dir. North

Description: Site A. Non-native smooth brome



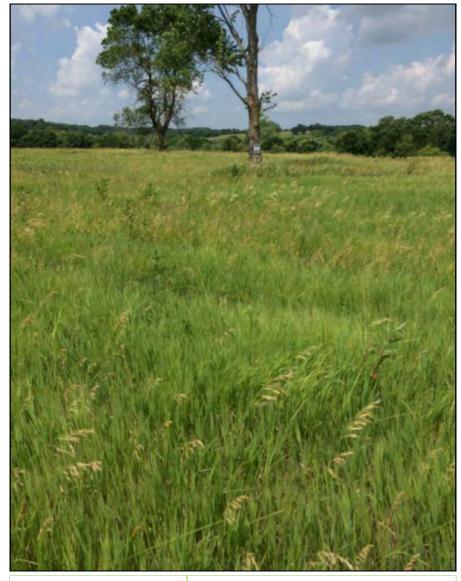


Photo No. 133 Photo Dir. West

Description: Site B. Non-native smooth brome



Photo No. 134 Photo Dir. South

Description: Site B. Non-native smooth brome





Photo No. 135 Photo Dir. East

Description: Site X. Non-native tall fescue

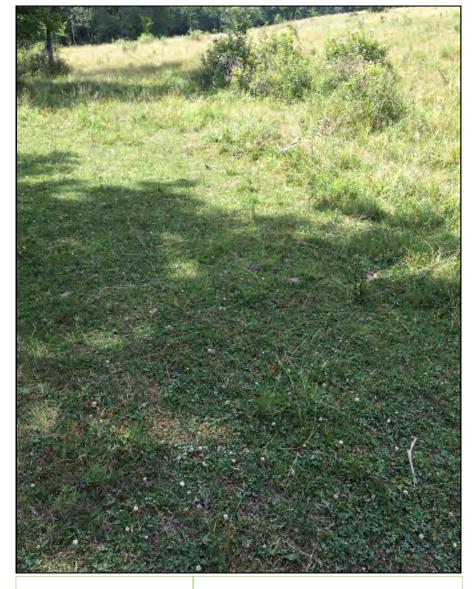


Photo No. 136 Photo Dir. West

Description: Site X. Non-native tall fescue





Photo No. 137 Photo Dir. East

Description: Site Y. Prairie cordgrass and wetland species. Performed a 10 minute survey.



Photo No. 138 Photo Dir. West

Description: Site Y. Prairie cordgrass and wetland species. Performed a 10 minute survey.





Photo No. 139 Photo Dir. South

Description: Site Z. Shrubby area with wetland species



Photo No. 140 Photo Dir. North

Description: Site Z. Shrubby area with wetland species





Photo No. 141 Photo Dir. North

Description: Site Extra. Non-native tall fescue



Photo No. 142 Photo Dir. South

Description: Site Extra. Non-native tall fescue

Appendix D

Gray, Indiana, and Northern Long-eared Bats Study

BAT SURVEY REPORT

EAST LOCUST CREEK PROJECT SULLIVAN COUNTY, MISSOURI

PREPARED BY:

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DATE PREPARED:

FEBRUARY 2017

OLSSON PROJECT No. A11-1513

Table of Contents

1.0	Introduction	
2.0	Methodology	
2.1	Acoustic Survey	2
2.2	9 ,	
2.3	, ,	
2.4	Emergence Counts	8
2.5	Bat Habitat Assessment	8
2.6	White Nose Syndrome Disinfection Protocols	8
2.7	Personnel	8
3.0	Results	9
3.1	Acoustic Surveys	9
3.2	Mist-netting Survey	12
3.3	Radio-telemetry Survey	16
3.4	Emergence Counts	19
4.0	Habitat Assessments	23
5.0	Summary	
6.0	References	25
Table	2. Acoustic Survey Locations. 3. MYSO Calls by Region. 4. MYSE Calls by Region. 5. Mist Net Locations. 6. All Bat Species Captured by Survey Region. 7. Summary Mist-netting Survey Effort. 8. Bat Reproductive Status by Region. 9. Reproductive Condition of MYSO Captured. 10. Roost Trees Identified for Tagged MYSO. 11. Emergence Counts for all Roost Trees. 12. Maternity Roost Trees.	
	13. Bat Habitat Assessment Summary.	
iable	14. MYSO Study Results.	22
	of Figures	
	e 1. Site Location Map	
	e 2. Woodlands Map	
	e 3. Nine Survey Regions.	
	e 4. Acoustic Detector Placement for the East Locust Creek Project	
•	e 5. Locations of the Mist Net Sites for the East Locust Creek Project.	
•	e 6. Roost Tree Location Map for the East Locust Creek Project	
	e 7. Decay Status of Roost Trees.	
Figure	e 8. Maternity Roost Trees Identified for the East Locust Creek Project	27

List of Appendices

Appendix A: Acoustic Survey Report by BatSense

Appendix B: Acoustic Photolog

Appendix C: Mist Net Bat Survey Datasheets

Appendix D: Mist Net Photolog
Appendix E: Tagged Bats Photolog

Appendix F: USFWS Indiana Bat Roost Datasheets

Appendix G: Roost Tree Photolog

Appendix H: USFWS Bat Emergence Survey Datasheets

Appendix I: Bat Habitat Assessments

1.0 Introduction

The North Central Missouri Regional Water Commission's (NCMRWC) proposed project involves construction of a multipurpose reservoir in Sullivan County, Missouri, north of Milan and west of Green City (Figure 1). The proposed project is located in Sections 5, 6, 7, and 8, Township 63 North, Range 19 West; Sections 1, 2, and 12, Township 63 North, Range 20 West; Sections 18, 19, 30, and 31, Township 64 North, Range 19 West; Sections 13, 23, 24, 25, 26, 35, and 36, Township 64 North, Range 20 West. The project center is located at -93.09912 degrees longitude and 40.28905 degrees latitude.

The proposed project would provide water supply, reduce flood damages, and provide water-based recreational opportunities. The multiple purposes of the East Locust Creek project are described below:

- Provide a dependable, affordable long-term water supply to meet the water demand for the 10-county region of north-central Missouri including Adair, Chariton, Grundy, Linn, Livingston, Macon, Mercer, Putnam, Schuyler, and Sullivan counties.
- Reduce flooding damages on 24 miles of East Locust Creek between Boynton and the confluence with Locust Creek.
- Provide water-based recreation to meet the unmet demand for the 10-county recreation management area including Adair, Chariton, Grundy, Linn, Livingston, Macon, Mercer, Putnam, Schuyler, and Sullivan counties.

An additional drinking water source in north-central Missouri is needed to meet the existing and future needs of water suppliers and water users in the region during a drought, as well as to provide resiliency against uncertainty in future water demands and climate change. The NCMRWC and the Missouri Department of Natural Resources (MDNR) have identified the need for an adequate, dependable, and high-quality water supply system for the rural areas and municipalities of north-central Missouri. The area to be served by the NCMRWC includes 10 counties in north-central Missouri, which are listed above.

The proposed project would include construction of an earthen dam along East Locust Creek that would inundate approximately 2,400 acres with the normal pool (project area). The project area consists of approximately 1,060 acres of woodlands (Figure 2). Tree species preferred by MYSO and MYSE include shagbark hickory, American elm, white oak, silver maple, and cottonwood, which were identified within the woodland acres. The study is intended to determine the presence or probable absence of MYSO and MYSE within the project area, which may be affected by the proposed project.

The proposed project is within the range of the federally listed Indiana bat (*Myotis sodalis*; MYSO) and the federally listed northern long-eared bat (*Myotis septentrionalis*; MYSE). The MYSO was listed as endangered under the Endangered Species Preservation Act of 1966, which preceded the current Endangered Species Act (ESA). The MYSE was listed as a threatened species under the ESA on April 2, 2015, and a final 4(d) rule was listed on January 14, 2016.

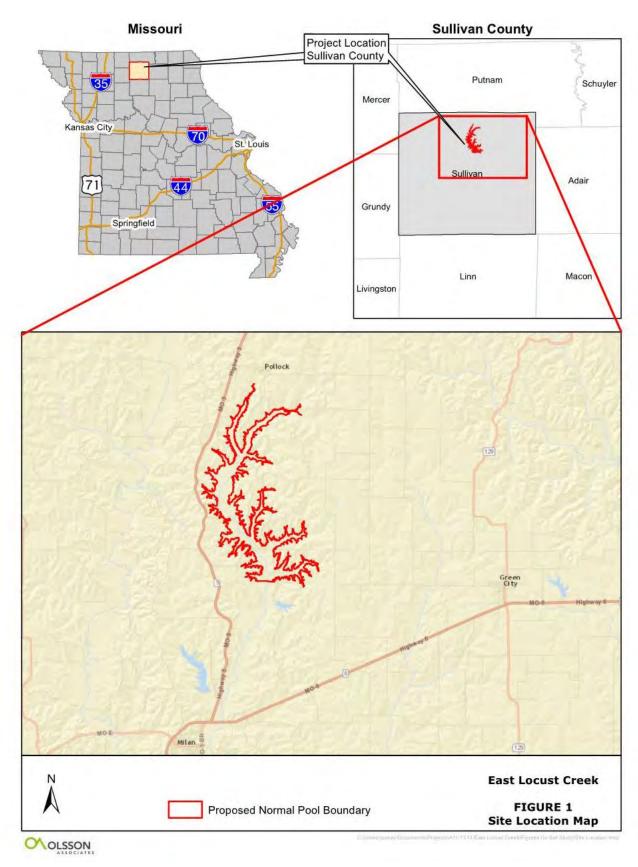


Figure 1. Site Location Map.



Figure 2. Woodlands Map.

2.0 Methodology

The survey approach followed the U.S. Fish and Wildlife Service's (USFWS) Range-wide Indiana Bat Summer Survey Guidelines (USFWS 2016). The guidelines are intended for both MYSO and MYSE summer surveys. The woodland habitat within the reservoir area was divided into nine regions; each survey region is approximately 123 acres in size per USFWS regulations. Table 1 shows the exact acreage by region, and Figure 3 shows the nine regions.

Table 1. Woodland Acreage by Region.

Pogion	Woodland	Total		
Region	Acres	Acres		
1	126.4	345.9		
2	129.3	250.2		
3	113.8	273.7		
4	104.0	321.5		
5	102.9	284.1		
6	110.6	215.2		
7	129.2	293.6		
8	114.4	213.0		
9	127.3	249.7		
TOTAL	1,057.9	2,446.9		

The regions were determined by woodland acres and not by total acres. As such, some regions are larger and contain additional farmland or grassland acres. These nine survey regions encompass the woodland acres (1,057.9 acres) of the total project area (2,446.9 acres). Bat survey methodology for the nine regions consisted of acoustic monitoring, mist netting, radio tracking, emergence counts, and bat habitat assessments. The use of multiple survey collection methods was to ensure that each region was surveyed as thoroughly as possible.

2.1 Acoustic Survey

Acoustic surveys were used to determine the presence/probable absence of bats within the project boundary. The acoustic survey was completed prior to mist netting and determined whether mist netting was needed in each of the nine regions. Acoustic surveys are an acceptable method for determining presence/probable absence of MYSO and MYSE (USFWS 2016).

Acoustic surveys were conducted during the summer (between May 15 and August 15) 2016. To comply with USFWS requirements, each survey region (Figure 3) was surveyed for at least four detector nights, including at least two detector sites spaced more than 200 meters apart, with each sampled for up to two nights. In cases where both MYSO and MYSE were identified, no further acoustic monitoring was needed.

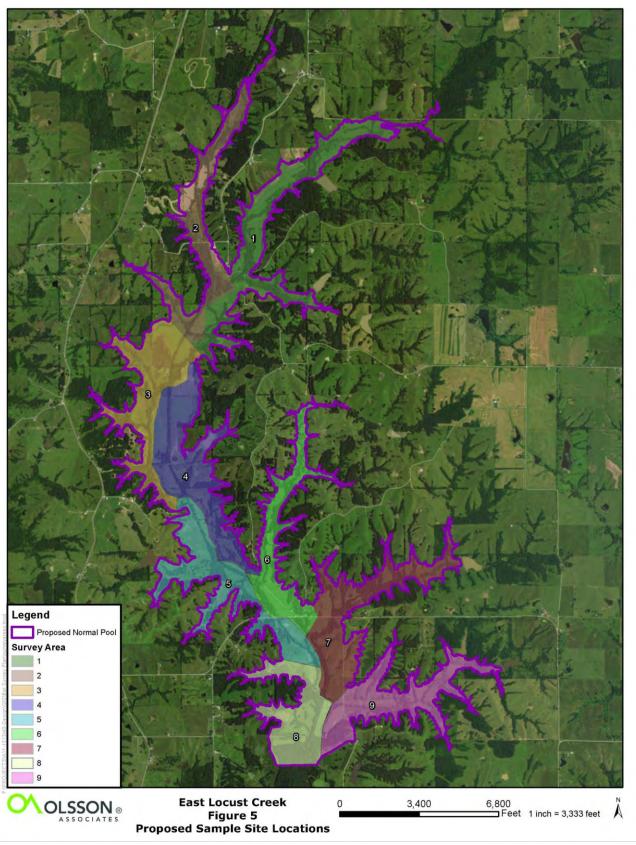


Figure 3. Nine Survey Regions.

For the acoustic survey, Olsson utilized Titley Scientific SD1/SD2, Walkabout, and/or Express detectors at appropriate locations for each survey region. The survey sites were selected in the field by a qualified biologist. Bat detector microphones were deployed in areas where qualified bat biologists believed there was the best chance of recording high-quality calls. Detector placement protocols included the following:

- At least 3 meters from any obstructions within the zone intended to be sampled
- Oriented parallel to woodland edges where present
- More than 15 meters from known or suitable MYSO roost structures
- In areas without or with minimal vegetation within 10 meters in front of the microphone
- At least 200 meters apart and distributed in appropriate habitats across the project site

Locations of microphones were plotted using the global positioning system (GPS) to verify location and spacing. Each microphone's placement and orientation was photographed to document microphone setup. Microphones were tested for sensitivity before and after deployment as well as on each occasion when data was downloaded.

Acoustic monitoring was set to record the whole period from sunset to sunrise. Weather was monitored at the Milan 1.2 Southwest National Oceanic and Atmospheric Administration (NOAA) National Weather Service Station to document compliance with required weather criteria outlined in the guidelines (USFWS 2016). A night's recording was considered successful if:

- The air temperature was at least 10 degrees Celsius (°C; 50° Fahrenheit) in the first five hours after sunset.
- Sustained wind speed did not exceed 4 meters/second for more than 30 minutes in the first five hours after sunset.
- Any precipitation that occurred was less than 30 minutes of continuous duration or continued intermittently during the first five hours of the survey period.

If these weather conditions were not met during any sample night, that sample night was repeated until appropriate weather conditions occurred.

Recorded bat calls were retrieved daily from the detectors for analysis. All bat files were coarsely screened initially for potential *Myotis* sequences, and all files from any sites containing such calls were run through currently approved versions of Bat Call Identification (BCID) and Kaleidoscope Pro bat identifiers for auto-identification of bat species. All files identified as a *Myotis* by BCID or Kaleidoscope Pro were reviewed by a bat biologist qualified according to USFWS guidelines for qualitative analysis. If findings from the acoustic survey showed the potential presence of MYSO or MYSE within any of the nine survey regions, mist nets were set within that site to confirm the potential presence.

2.2 Mist-netting Survey

Mist-netting surveys were completed for each survey region where the acoustic survey recorded potential *Myotis* sequences. The USFWS guidelines propose nine net nights per survey region. The surveys were conducted during the summer (June 15 – July 10) 2016. The net-night is a sampling unit during which a single net set is deployed during a single survey night. When two net sets are used during a survey night, the sampling effort equals two net-nights, etc. Cumulative

net hours were calculated from net-open to net-close time for each survey night. All nets for that survey night were open for the same number of hours. The number of bats captured was the total for each site during the survey effort. Areas with patchy or isolated forest cover were excluded as bat habitat for the purpose of the mist-netting survey. The same nine survey areas used in the acoustic survey were used during the mist-netting survey. (Figure 4).

When MYSO were detected via acoustic detectors in each of the survey regions, Olsson set out mist nets within that region. Mist net locations were selected based on their likelihood to capture MYSO as well as the potential for MYSO to use the area. The mist net night locations occurred throughout the nine survey regions and were determined at the discretion of the qualified bat biologist. Nets were checked approximately every 10 to 15 minutes to reduce the amount of stress to captured bats (USFWS 2016).

Sampling periods for each net began at sunset and continued for at least five hours. A maximum of three consecutive netting nights occurred at any single location. Mist nets were set perpendicular to flight paths to maximize coverage used by bats along suitable travel corridors, foraging areas, and/or drinking areas. Placement of mist nets was based on the extent of canopy cover, presence of an open flyway, and forest conditions near the sites.

Bats that were caught in mist nets were released unharmed near the point of capture. Biological and morphometric data (i.e., species, sex, age class, reproductive condition, mass, and right forearm length) were recorded on datasheets for each individual captured. In addition, the height, and the specific net location of capture was recorded for each bat. Processing of bats was completed within 30 minutes from the time the bat was removed from the net, up to 45 minutes if the bat was to have a radio transmitter attached. Capture of reproductive females or young of the year (May 15 – August 15) was used to confirm the presence of a maternity colony in the area. Any equipment that was exposed to bats was kept clean and disinfected, following white nose syndrome (WNS) protocols, to minimize the potential for disease transmission.

2.3 Radio Telemetry Survey

The following telemetry protocol was used to identify maternity colonies and roost locations. The telemetry protocol was based on the USFWS-approved East Locust Creek Bat Survey Plan.

Olsson was prepared to track up to 18 MYSO. Radio transmitters were attached to pregnant or lactating females or to appropriately sized juveniles for a better chance at locating maternity colonies and roost locations, as males and non-reproductive females may not be located in the maternity colonies. Only two MYSO were tracked per 123-acre region until the maximum number of MYSO were tracked.

The radio transmitter (i.e., Holohil LB-2X), adhesive, and any other markings weighed less than 5 percent of the pre-attachment body weight of the bat. Once a radio transmitter was attached to the bat, it was tracked until the transmitter failed, fell off, or could not be located for at least seven days. A minimum of two evening emergence counts were conducted at each identified maternity roost, and one emergence count was conducted at each secondary roost tree. A maternity roost was defined as a roost tree having more than five bats observed leaving during the emergence count. A secondary roost tree was defined as a roost tree having five or fewer bats observed leaving the roost tree. For each roost identified during the radio tracking, a USFWS Indiana Bat

Roost Datasheet was completed. Any equipment that was exposed to bats was kept clean and disinfected, following WNS protocols, to minimize the potential for disease transmission.

2.4 Emergence Counts

A minimum of two evening emergence counts was conducted at each identified maternity roost, and at least one emergence count was conducted at each secondary roost tree (i.e., trees from which five or fewer bats emerge). Emergence counts were conducted at identified roost trees from 30 minutes before sunset to one hour after sunset or until it was too dark to see emerging bats. Observers recorded the number of bats seen emerging from the tree and the timing of emergence.

2.5 Bat Habitat Assessment

Bat habitat assessments were completed to document potential habitat in each of the nine regions. The assessments followed the 2016 Indiana Bat Summer Survey Guidelines, Phase 1 Summer Habitat Assessment (USFWS 2016). A total of three bat habitat assessments were completed in each region. The three habitat assessments were geographically spaced to document the region's habitat. Each sampling site was assessed for the following items:

- Water resources
- Wetlands
- Dominant tree species
- Tree canopy closure/density, size composition of live trees (small to large)
- Preferred tree species that were present (trees larger than 9 inches diameter at breast height that were specific target tree species of shagbark hickory, cottonwood, white oak, other oak species, silver maple, American elm, and shortleaf pine)
- Suitable snags standing dead trees with sloughing bark, crevices, or holes
- Site suitability for MYSO and MYSE (low, medium, or high)

2.6 White Nose Syndrome Disinfection Protocols

WNS has not been confirmed in Sullivan County, Missouri. WNS is documented in Arkansas and Illinois and in several central and eastern counties in Missouri, but it is currently not found in north-central portions of the state (USFWS 2014). Therefore, this study followed the USFWS's National WNS Decontamination Protocol (USFWS 2012) and complied with measures to combat the potential spread of the disease among bats by washing and disinfecting all field equipment, including clothing and vehicles, at all survey locations. A wing score based on Reichard's wing-damage index (Reichard 2008) was recorded for all bats captured. If any live or dead bats were found that appeared to exhibit signs of WNS, the nearest state or federal wildlife professional would have been contacted. No bats exhibiting symptoms of WNS were identified during this project.

2.7 Personnel

Personnel from this project consisted of biologists from Olsson Associates teamed with biologists from BatSense. Ms. Vona Kucynska, of BatSense, is a qualified biologist and maintains a USFWS recovery permit for both MYSO and MYSE in Missouri. Qualified bat biologists were present for all project activities and assisted with data analysis for this report. All personnel who collected

data for each of the survey methods received training in proper data collection, data recording, and disinfection protocols.

BatSense

Vona Kucynska (Lead Biologist) Kim Livengood (Senior Biologist) Chris Corben (Acoustics Biologist) Jennifer Mulikin (Field Biologist)

Olsson Associates

Aaron Ball (Project Manager) Buck Ray (Senior Biologist) Jessica Casey (Field Biologist)

3.0 Results

3.1 Acoustic Surveys

The acoustic surveys occurred at 18 sampling sites within the nine regions. The site nomenclature is based on the region (first numeric digit) and the site within the region (alphabetic letter). If the site was shifted to improve recording, a final numeric digit was included. The single case of site x1g indicates that data was collected from an Anabat Express to measure temperature, because the main detector at the site failed to record data.

While the focus of the East Locust Creek Bat Study was on the federally threatened or endangered MYSO and MYSE, information on additional bat species was recorded. BatSense's Acoustic Bat Survey Report (Appendix A) includes information on additional species and information on bat species identification, supporting files, and notes on the sampling sites. Photographs of the acoustic detector sites are included in Appendix B. The GPS data for the 18 sites is included in Table 2 and Figure 4.

Table 2. Acoustic Survey Locations.

Sites	Latitude (degrees North)	Longitude (degrees West)	Elevation (meters)
1B	40.340272	93.076964	278.4
x1G	40.324635	93.093031	274.6
2A	40.344925	93.093703	283
2A2	40.346174	93.093194	279.1
2C	40.326575	93.099027	284.2
3E	40.301446	93.107657	279.9
4B	40.299179	93.101452	272.4
5A	40.289711	93.096536	279.6
5B	40.286148	93.093985	265.2
6B	40.286337	93.090371	268.8
7D	40.286493	93.075643	273.4
7E	40.284269	93.078461	284
8A	40.275108	93.085004	284.9
8A2	40.27401	93.080552	268.6
8B	40.26883	93.081755	264
9A1	40.277238	93.054831	284.2
9A2	40.277904	93.059894	298.6
9B	40.276464	93.073767	278.7

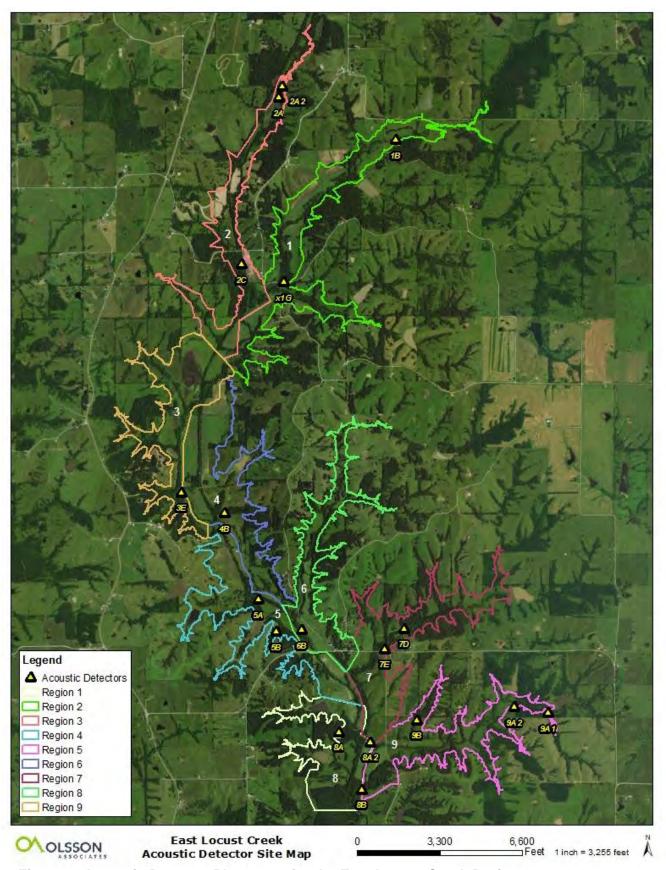


Figure 4. Acoustic Detector Placement for the East Locust Creek Project.

Weather conditions were generally acceptable for acoustic surveys over the 10-night period between June 2 to July 11, 2016. Rainfall and wind intensity was determined by the acoustic record. Wind intensity did not reduce the ability to record bat calls. Rainfall occurred from 1:00 a.m. to 2:15 a.m. on June 4, 2016. The rainfall exceeded the USFWS requirement of less than 30 minutes of rainfall within five hours of monitoring. The rain affected acoustic sites 5a, 6b, 7e, 8a2, 8b, and 9b; acoustic monitoring was repeated an additional night at those sites. The data collected from June 4, 2016, was included in the acoustic data. Temperatures ranged from 10°C to 21.5°C.

A total of 35 detector nights were completed with the number of detection nights varied based on the results of the auto identification programs. Regions 3, 4, and 6 were sampled for fewer than the required detector nights because positive identifications of MYSO and MYSE were detected prior to completion of the four detector nights. Region 9 was sampled for three additional nights because the results of the auto identification programs were inconclusive for MYSO detection. Region 7 was sampled for one additional night because there were no MYSO detections verified through manual vetting.

The acoustic surveys resulted in MYSO calls detected and identified through BCID auto identification or Kaleidoscope auto identification in all nine survey regions. Biologist verification determined that the two possible MYSO calls identified by Kaleidoscope in Region 7 could not be positively identified as MYSO. BCID did not identify any MYSO in Region 7. Region 7 is the only region without positive MYSO detection. Table 3 shows the MYSO calls identified by the three methods. Positive detection was completed by acoustics biologist Chris Corben of BatSense.

Table 3. MYSO Calls by Region.

Region	Manual Vetting	BCID	Kaleidoscope	Detection	MYSO
	(MYSO Calls	(MYSO Calls	(MYSO Calls	Nights	Detected?
	Identified)	Identified)	Identified)		
Region 1	4	26	35	4	YES
Region 2	2	10	17	4	YES
Region 3	3	12	17	2	YES
Region 4	1	3	4	2	YES
Region 5	1	1	1	4	YES
Region 6	4	7	14	3	YES
Region 7	0	0	2	5	NO
Region 8	2	13	20	4	YES
Region 9	1	6	15	7	YES
TOTAL	18	78	125	35	

The acoustic surveys resulted in MYSE calls detected and identified by BCID or Kaleidoscope in in all nine regions. Biologist verification determined that the 35 calls in Region 2 and the five calls in Region 9 could not be positively identified as MYSE. Regions 2 and 9 are the only regions without positive MYSE detection. Table 4 shows the MYSE calls identified by the three methods. Positive detection was completed by acoustics biologist Chris Corben of BatSense.

Table 4. MYSE Calls by Region.

Region	Manual Vetting	BCID	Kaleidoscope	Detection	MYSE
	(MYSE Calls	(MYSE Calls	(MYSE Calls	Nights	Detected?
	Identified)	Identified)	Identified)		
Region 1	3	10	28	4	YES
Region 2	0	11	24	4	NO
Region 3	3	8	12	2	YES
Region 4	4	5	18	2	YES
Region 5	2	0	5	4	YES
Region 6	3	9	21	3	YES
Region 7	1	0	2	5	YES
Region 8	1	2	6	4	YES
Region 9	0	0	5	7	NO
TOTAL	17	45	121	35	

3.2 Mist-netting Survey

The mist-netting survey included mist-netting at 63 sites within the eight regions that had positive MYSO identification during the acoustic survey. The mist-netting bat survey datasheets are included in Appendix C, and the mist-netting locations are included in Table 5 and Figure 5. Region 7 was not mist-netted, because the acoustic monitoring did not detect MYSO calls. The number of nets managed each night ranged from two to seven, with five nets being the most common. The number of nets varied based on the number of personnel available. A majority of the mist net sites were moved each night. Eight sites were repeated for one additional night, and five sites were repeated for two additional nights. The sites repeated for three nights were primarily in Region 3. In Region 3, two MYSO were caught on night one, but a tracking signal could not be found during the radio tracking. Two additional nights of sampling were completed in an attempt to capture and track an additional MYSO. The only other site with three net-nights was in Region 8 and was duplicated because it had a high bat-capture rate. Photographs of the mist net sites are provided as Appendix D.

Weather conditions were acceptable for the 19 mist-netting surveys over the 26-night period between June 15 and July 10, 2016. Wind conditions did not exceed 7 miles per hour and rain was not present for the surveys. Temperatures ranged from 15°C to 32°C.

A total of 85 bats representing seven bat species were caught during the 19 mist-netting surveys. The most frequently captured bats were the big brown bat (*Eptesicus fuscus*; EPFU), the red bat (*Lasiurus borealis*; LABO), and the evening bat (*Nycticeius humeralis*; NYHU). These three bats represent 76 percent of the bats caught. Also captured were the hoary bat (*Lasiurus cinereus*; LACI), the silver-haired bat (*Lasionycteris noctivagans*; LANO), and the two target species, MYSE and MYSO. Regions 3, 4, and 8 had the highest bat numbers caught. These three regions represent 72 percent of all bats caught.

Table 5. Mist Net Locations.

Region	Net	Latitude	Longitude	Region	Net	Latitude	Longitude
_	Number	(degrees N)	(degrees W)		Number	(degrees N)	(degrees W)
1	1	40.34023	93.07708	5	4	40.2864	93.0909
1	2	40.34011	93.07652	5	5	40.2858	93.0918
1	3	40.34057	93.07453	5	6	40.2855	93.0913
1	4	40.34071	93.07407	5	7	40.286	93.092
1	5	40.34039	93.0738	5	8	40.2861	93.0925
2	1	40.32711	93.09911	6	1*	40.2845	93.089
2	2	40.32658	93.09897	6	2*	40.2853	93.0896
2	3	40.32579	93.09885	6	3*	40.2867	93.091
2	4	40.32499	93.09854	6	4	40.287	93.0914
2	5	40.32487	93.09861	6	5	40.2839	93.0886
2	6	40.34303	93.09344	6	6	40.2969	93.0884
2	7	40.34251	93.09376	6	7	40.2958	93.089
2	8	40.34198	93.09422	6	8	40.2945	93.0894
2	9	40.34152	93.09428	8	1**	40.2688	93.0818
3	1**	40.30483	93.10787	8	2	40.2697	93.0813
3	2**	40.30377	93.10794	8	3	40.2707	93.0816
3	3**	40.30259	93.10796	8	5	40.268	93.0823
3	4**	40.30156	93.10761	8	6	40.2673	93.0825
3	5*	40.30139	93.10762	8	7	40.2714	93.0826
3	6	40.3019	93.1062	8	8	40.2707	93.083
3	7	40.30203	93.10613	8	9	40.2699	93.0834
4	1*	40.29169	93.09772	9	1	40.2762	93.0741
4	2*	40.29079	93.09774	9	2	40.2765	93.0738
4	5	40.2908	93.0958	9	3	40.2767	93.0737
4	6	40.29063	93.0953	9	4	40.2769	93.0734
4	8	40.29216	93.09725	9	5	40.2769	93.0732
4	9	40.29588	93.09865	9	6	40.2762	93.0545
4	10	40.29454	93.09766	9	7	40.2763	93.0544
4	11	40.29637	93.09818	9	8	40.2765	93.0546
5	1*	40.2902	93.0972	9	9	40.2773	93.055
5	2*	40.2903	93.0967	9	10	40.2776	93.0552
5	3	40.2901	93.0967				

^{*} Indicates two net-nights.

** Indicates three net-nights.

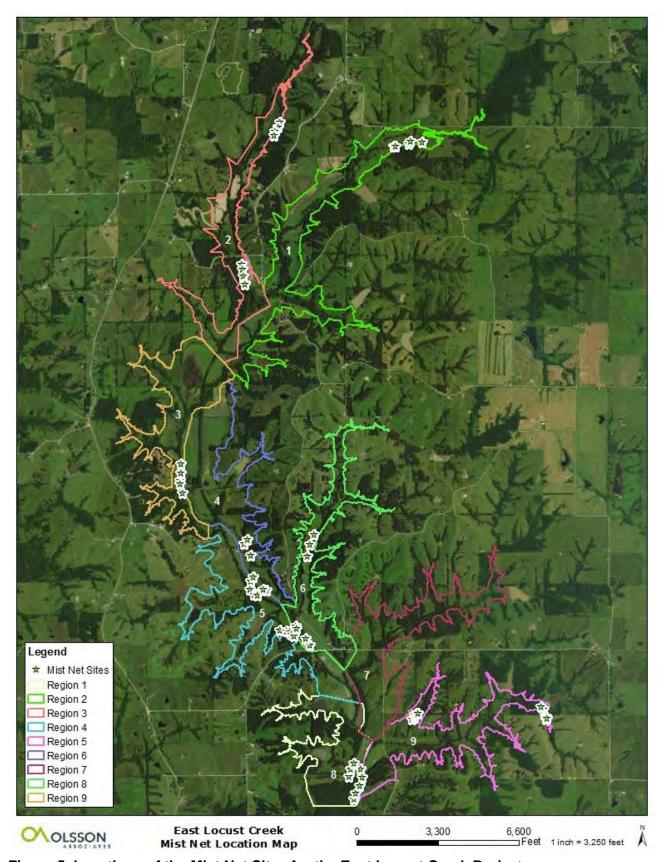


Figure 5. Locations of the Mist Net Sites for the East Locust Creek Project.

A total of 10 MYSO and six MYSE were caught during the sampling period. Sampling in five of the eight regions had MYSO caught, and four of the eight regions had MYSE caught. Only Region 9 did not have either MYSO or MYSE caught; in Regions 1 and 3, both MYSO and MYSE were caught. Table 6 summarizes the bat species caught by region.

Table 6. All Bat Species Captured by Survey Region.

Species	Survey Regions								
opedies	1	2	3	4	5	6	8	9	Total
EPFU	1	0	1	12	0	0	10	1	25
LABO	0	3	4	0	1	6	3	1	18
LACI	0	1	2	0	0	0	0	0	3
LANO	0	0	1	0	0	0	0	0	1
MYSE	1	0	3	1	1	0	0	0	6
MYSO	3	2	2	0	0	2	1	0	10
NYHU	0	1	8	9	0	0	4	0	22
TOTAL	5	7	21	22	2	8	18	2	85

The 85 bat species sampled were captured during 387 survey hours at 41 of the 81 net-nights (Table 7). The capture rate was calculated based on the percentage of bats (any species) captured per number of net-nights sampled for each survey region. Therefore, if five bats were captured during five survey nights, then the capture rate was one bat per net-night. Capture rates were highest in Regions 3, 4, and 8 and lowest in Regions 5 and 9. Region 1 was only sampled for five net-nights because three MYSO and one MYSE were caught the first night. Additional net-nights were sampled in Region 3 because the captured MYSO that received radio transmitters were not relocated the following day. Mist net datasheets are included in Appendix C.

Table 7. Summary Mist-netting Survey Effort.

Region	Number of Net-Nights	Total Mist- Netting Hours	Number of All Bats Captured	Number of MYSO Captured	Capture Rate*
1	5	7	5	3	1.00
2	9	45	7	2	0.78
3	16	80	21	2	1.31
4	10	50	22	0	2.20
5	10	50	2	0	0.20
6	11	55	8	2	0.73
8	10	50	18	1	2.00
9	10	50	2	0	0.20
Overall Results	81	387	85	10	1.07

^{*}All bats captured per net-night.

Bat reproductive status was obtained for all bats regardless of species (Table 8). Ten of the captured female bats were classified as juvenile bats (young of the year). No male juvenile bats were captured. Of the adult bats captured, 61 were female and 18 were male. Lactating adult females were the most common reproductive status (46 percent) followed by pregnant adult

female (19 percent) and juvenile female (12 percent). Only three adult female bats were not reproductive. One bat escaped the net before reproductive data could be gathered, so it is not included in Table 8.

Table 8. Bat Reproductive Status by Region.

Reproductive	Survey Regions								
Status	1	2	3	4	5	6	8	9	Total
Pregnant Adult Female	0	0	1	10	0	0	5	0	16
Lactating Adult Female	4	4	8	8	1	6	6	2	39
Non-Reproductive Adult Female	0	0	0	0	0	2	1	0	3
Non-Reproductive Adult Male	0	0	1	3	1	0	3	0	8
Testes Descended Adult Male	0	0	0	1	0	0	3	0	4
Juvenile Female	1	3	6	0	0	0	0	0	10
Juvenile Male	0	0	5	0	0	0	0	0	5
TOTAL	5	7	21	22	2	8	18	2	85

Note: One non-Myotis bat escaped the net before data collection; therefore, it is not included in the data analysis.

3.3 Radio-telemetry Survey

The target species for attaching radio telemetry tags was MYSO. Up to two adult, reproductive female MYSO in each survey region were tagged with radio telemetry tags and tracked to determine roost trees. The identified trees were then monitored for activity. The third MYSO caught in Region 1, net 1, was not tagged because it was the third bat caught in the region. The MYSO caught in Region 6, net 4, was not tagged because it was non-reproductive. Table 9 presents the reproductive status of all MYSO bats captured during the mist net survey.

Table 9. Reproductive Condition of MYSO Captured.

Net Night*	Capture Time	Age	Sex	Reproductive Status	Telemetry Tag	Telemetry ID Name
1.1	10:30 p.m.	Adult	Female	Lactating	Yes	Sushi
1.1	10:30 p.m.	Adult	Female	Lactating	Yes	Burrito
1.1	10:30 p.m.	Adult	Female	Lactating	No	None
2.7	10:30 p.m.	Adult	Female	Lactating	Yes	Wilma
2.7	10:42 p.m.	Adult	Female	Lactating	Yes	Betty
3.2	9:45 p.m.	Adult	Female	Lactating	Yes	Pistachio
3.4	1:37 a.m.	Adult	Female	Lactating	Yes	Porky
6.2	10:50 p.m.	Adult	Female	Lactating	Yes	Laela
6.4	12:12 a.m.	Adult	Female	Non-	No	None
8.8	12:20 a.m.	Adult	Female	Lactating	Yes	Elvira

^{*}The first number is the region and the second number is the net number.

Eight bats received radio tags in order to attempt to locate maternity roost trees. Bats were assigned names to help differentiate them in the field and on datasheets. Bats will be referred to by their field aliases in this report. Photographs of the tagged bats are included as Appendix E.

Roost trees were successfully located for six of the eight tagged bats. The remaining two (Pistachio and Porky) were not relocated during radio-telemetry tracking. A signal was not found after seven days of tracking. Thirteen roost trees were identified between the six tagged bats that were able to be tracked. At least one roost tree was identified for each of the six bats, although in one instance, multiple tagged bats shared a roost tree. One additional roost tree was identified near two known roost trees; however, none of the tagged bats were identified associating with that tree. The bats leaving the additional roost tree could not be identified. Table 10 shows each tagged bat and the number of maternity roost trees visited during the radio-telemetry tracking. All roost tree locations can be viewed on Figure 6. Datasheets for roost trees are included in Appendix F and photographs are included in Appendix G.

Table 10. Roost Trees Identified for Tagged MYSO.

rabio for Recot freeze facilities for ragges in Feet							
Roost Name	Tagged Bat	Latitude (degrees N)	Longitude (degrees W)				
Α	Laela (Tree 1)	40.2772	93.091				
В	Elvira (Tree 2)	40.2773	93.0911				
С	Laela (Tree 2)	40.2837	93.0989				
D	Elvira (Tree 1)	40.27153	93.08502				
E	Sushi (Tree 1)	40.3432	93.0617				
F	Sushi (Tree 2)	40.3446	93.0616				
G	Sushi (Tree 3)	40.3442	93.0617				
Н	Sushi (Tree 4)	40.3428	93.0644				
I	Burrito (Tree 1)	40.3384	93.0723				
J	Burrito (Tree 2) and Betty (Tree 1)	40.3359	93.0843				
K	Betty (Tree 2)	40.3501	93.0907				
L Wilma (Tree 1)		40.3433	93.0629				
M	Sushi (Tree 5)	40.3446	93.0619				

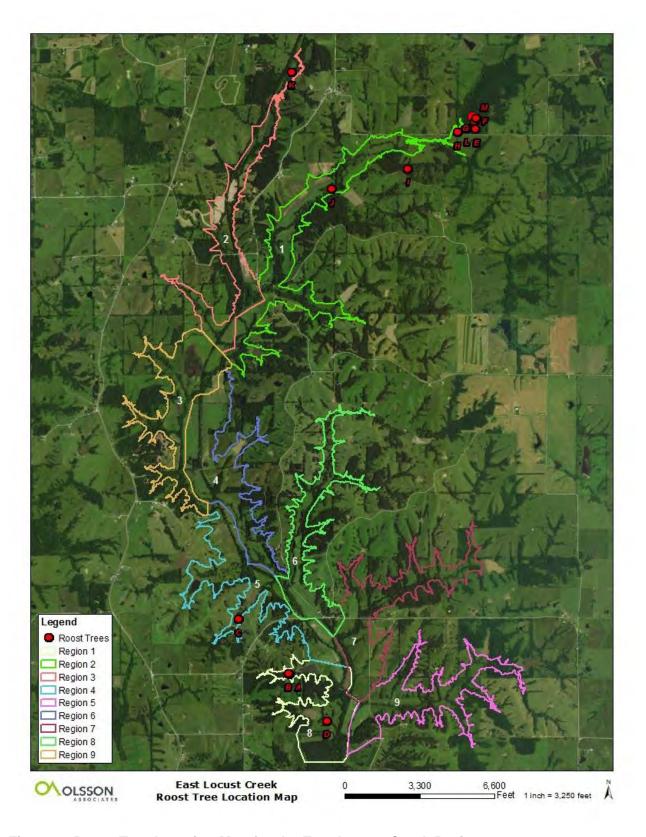


Figure 6. Roost Tree Location Map for the East Locust Creek Project.

All tagged bats had at least two maternity roost trees, with the exception of Wilma. Biologists followed Wilma's tracker to a tree and discovered the radio transmitter lying on the ground. Therefore, it was not necessary to conduct further radio tracking or emergence counts for this bat. The tracker for Sushi was also found on the ground near what was believed to be the fifth roost tree (Roost M) for that bat. Two nights of emergence counts were performed at this location with no bats observed leaving the tree before the tracker was discovered on the ground. It is probable that the tracker was on the ground during both nights of emergence counts. No bats were seen leaving that tree during either night of emergence counts. The datasheets for that tree are included with the emergence count datasheets (Appendix H).

Roost trees represented four species of trees and were classified into decay classes on a scale of 1 to 9, based on the Indiana Bat Monitoring Protocol (USFWS 2016). A majority of the trees were either shagbark hickory or American elm. The other two species represented were white oak and shingle oak. Most roosts were dead trees with sloughing bark (decay class 4); however, roosts trees included a range of decay classes (Figure 7). Only two live trees were documented (Roosts F and M). The rest of the roosts were dead, and some had sloughing bark. All of the roost trees are characteristic of typical MYSO-suitable roost trees (USFWS 2010).

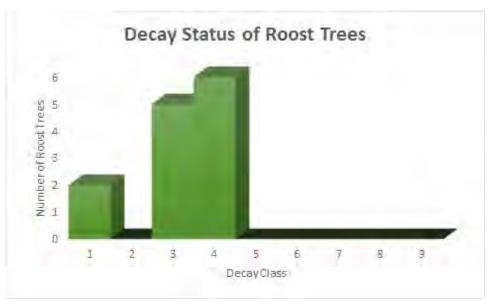


Figure 7. Decay Status of Roost Trees.

3.4 Emergence Counts

For ease of discussion and presentation, roost trees were assigned roost names in addition to their tree names. Roost names are an alphabetic letter assigned to each roost tree. Roost tree names were designated in the field and represent the tagged bat(s) associated with that particular tree. In the discussion, roost trees will be referred to by their roost names. Table 11 summarizes all the emergence counts performed for the roost trees.

Table 11. Emergence Counts for all Roost Trees.

Roost Name	Tagged Bat	Date	Species	Emergence Counts	Tagged Bat Left Tree?
Α	Laela (Tree 1)	30-Jun-16	American Elm	19	Yes
Α	Laela (Tree 1)	1-Jul-16	American Elm	31	Yes
Α	Laela (Tree 1)	3-Jul-16	American Elm	0	No
В	Elvira (Tree 2)	3-Jul-16	American Elm	2	Yes
В	Elvira (Tree 2)	4-Jul-16	American Elm	1	Yes
С	Laela (Tree 2)	4-Jul-16	Shagbark Hickory	7	Yes
С	Laela (Tree 2)	5-Jul-16	Shagbark Hickory	7	Yes
D	Elvira (Tree 1)	1-Jul-16	Shagbark Hickory	1	No
Е	Sushi (Tree 1)	6-Jul-16	Shagbark Hickory	22	Yes
Е	Sushi (Tree 1)	8-Jul-16	Shagbark Hickory	38	Yes
F	Sushi (Tree 2)	7-Jul-16	Shagbark Hickory	7	Yes
F	Sushi (Tree 2)	8-Jul-16	Shagbark Hickory	2	Yes
G	Sushi (Tree 3)	9-Jul-16	White Oak	3	Yes
G	Sushi (Tree 3)	15-Jul-16	White Oak	0	No
Н	Sushi (Tree 4)	10-Jul-16	Shingle Oak	4	Yes
Н	Sushi (Tree 4)	11-Jul-16	Shingle Oak	0	No
Н	Sushi (Tree 4)	14-Jul-16	Shingle Oak	2	No
I	Burrito (Tree 1)	6-Jul-16	American Elm	3	Yes
J	Burrito (Tree 2)	8-Jul-16	American Elm	3	Yes
J	Betty (Tree 1) Burrito (Tree 2)	13-Jul-16	American Elm	2	No
K	Betty (Tree 2)	12-Jul-16	Shagbark Hickory	2	Yes
K	Betty (Tree 2)	16-Jul-16	Shagbark Hickory	2	Yes
L	Wilma (Tree 1)	11-Jul-16	American Elm	3	Yes
L	Wilma (Tree 1)	12-Jul-16	American Elm	3	Yes
М	Sushi (Tree 5)	11-Jul-16	Shagbark Hickory	0	No
M	Sushi (Tree 5)	12-Jul-16	Shagbark Hickory	0	No

Emergence counts were performed for all identified roost trees for two nights in all cases except two. Roost D only had one night of emergence counts, because Elvira (the tagged bat associated with that tree) did not return to Roost D after the first night of emergence counts. She moved to her second roost tree (Roost B) and remained there for two additional nights of emergence counts. Roost D is considered a secondary roost tree. After the first count was performed for Roost I (Burrito [Tree 1]), it was discovered the roost was actually on private property, so a second count was not completed. Burrito was identified leaving the roost during the first count, so biologists are confident the roost was correctly identified. Because of the number of bats emerging during the first night of emergence counts, Roost I is considered a secondary roost tree. In one instance, a roost tree was shared by more than one bat. Roost J was shared by two bats (Burrito and Betty). An "incidental roost" was identified in close proximity to Roosts A and B. No tagged bats were associated with the roost; however, an emergence count was performed since bats were seen leaving the tree. A large enough number of bats were seen leaving the incidental roost; therefore, that tree is likely a maternity roost tree. Since the bats could not be identified as MYSO, information from the incidental roost is not included in the data.

Of the thirteen roost trees located, only roosts A, C, E, and F (Figure 8) had emergence counts with five more bats on at least one night and are considered maternity roost trees. All other trees had fewer than five bats leave the roost during all nights of emergence count monitoring, which designates them as secondary roost trees. Table 12 shows the maternity roost trees, and the emergence count datasheets are included as Appendix H.

Table 12. Maternity Roost Trees.

Roost Name	Tagged Bat	Date	Species	Emergence Counts
Α	Laela (Tree 1)	30-Jun-16	American Elm	19
Α	Laela (Tree 1)	1-Jul-16	American Elm	31
Α	Laela (Tree 1)	3-Jul-16	American Elm	0
С	Laela (Tree 2)	4-Jul-16	Shagbark Hickory	7
С	Laela (Tree 2)	5-Jul-16	Shagbark Hickory	7
Е	Sushi (Tree 1)	6-Jul-16	Shagbark Hickory	22
Е	Sushi (Tree 1)	8-Jul-16	Shagbark Hickory	38
F	Sushi (Tree 2)	7-Jul-16	Shagbark Hickory	7
F	Sushi (Tree 2)	8-Jul-16	Shagbark Hickory	2

Weather conditions were acceptable for all emergence surveys. All surveys noted no precipitation and generally a calm wind. The lone exception was Roost H for Sushi, tree 4, which noted windy conditions.

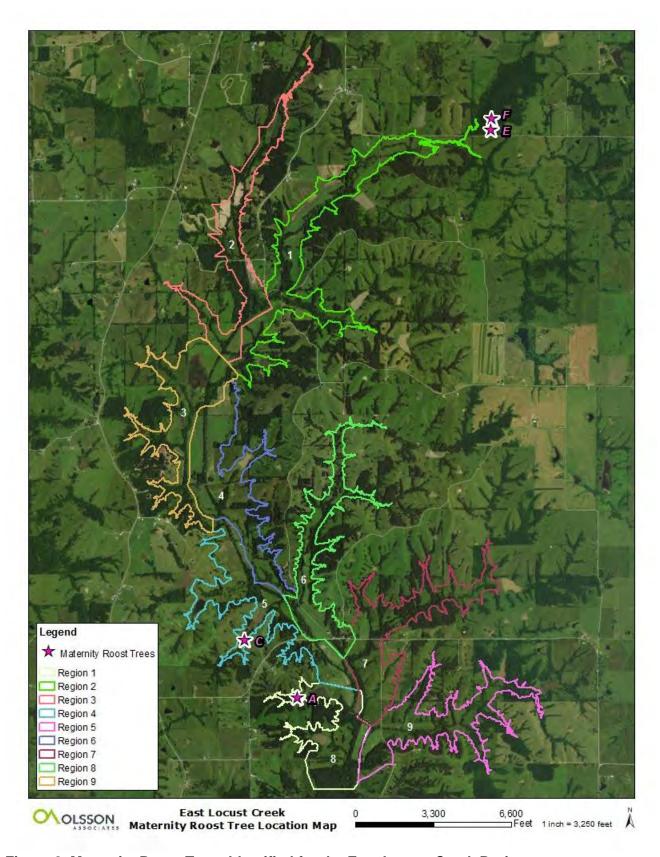


Figure 8. Maternity Roost Trees Identified for the East Locust Creek Project.

4.0 Habitat Assessments

The three habitat assessments completed for each region identified suitable habitat, the habitat rating, and snags observed at the habitat assessment location. Table 13 shows the bat habitat assessment summary. Suitable habitat was identified in 81 percent of the habitat assessments and was identified in every region. Snags were observed at 52 percent of the sampling locations and ranged from zero to seven snags observed. Region 7 was the only region without any snags observed. The habitat ratings were primarily low (56 percent) with six assessments (22 percent) recording a moderate habitat rating and one assessment (4 percent) recording a high habitat rating. The remaining five assessments (19 percent) did not record suitable habitat. Notes from the habitat assessments show suitable foraging habitat in 93 percent of the sampled sites. Appendix I contains the bat habitat assessments.

Table 13. Bat Habitat Assessment Summary.

Sample Site	Suitable MYSO	Habitat Rating	Number of Snags
Number	Habitat?	(Low, Moderate, High)	Observed
1-1	Yes	Low	1
1-2	Yes	Low	1
1-3	Yes	Moderate	3
2-1	Yes	Moderate	7
2-2	Yes	High	6
2-3	Yes	Low	0
3-1	Yes	Low	0
3-2	Yes	Moderate	3
3-3	Yes	Low	0
4-1	Yes	Low	0
4-2	No	n/a	0
4-3	Yes	Moderate	1
5-1	Yes	Low	1
5-2	Yes	Low	0
5-3	Yes	Low	0
6-1	Yes	Moderate	3
6-2	No	n/a	0
6-3	Yes	Low	0
7-1	No	n/a	0
7-2	Yes	Low	0
7-3	Yes	Low	0
8-1	No	n/a	0
8-2	Yes	Low	2
8-3	Yes	Moderate	5 2
9-1	Yes	Low	2
9-2	Yes	Low	5
9-3	No	n/a	0

5.0 Summary

The proposed project will likely affect MYSO foraging and maternity roost tree habitat. Acoustic monitoring, mist netting, radio telemetry, and emergence counts supported MYSO presence and identified maternity roost trees within the project area. The project area has approximately 1,060 acres of woodland that may provide MYSO habitat. The woodland habitat was further split into nine survey regions and individually studied for MYSO presence or probable absence. Study results for each region are included in Table 14.

Region	Acres	Bat Habitat?	Acoustic Monitoring?	Mist- Netting?	MYSO Roost Tree?	MYSO Maternity Roost Tree?
1	126.4	Yes	Yes	Yes	Yes	No
2	129.3	Yes	Yes	Yes	No	No
3	113.8	Yes	Yes	Yes	No	No
4	104.0	Yes	Yes	No	No	No
5	102.9	Yes	Yes	No	Yes	Yes
6	110.6	Yes	Yes	Yes	No	No
7	129.2	Yes	No	No	No	No
8	114.4	Yes	Yes	Yes	Yes	Yes
9	127.3	Yes	Yes	No	No	No

Table 14. MYSO Study Results.

The 2016 Range-wide Indiana Bat Summer Survey Guidelines (USFWS 2016) use bat habitat assessments, acoustic monitoring, and mist netting to determine whether a project will have potential impacts to MYSO. Bat habitat of varying quality was observed in all regions. Acoustic monitoring detected MYSO in all regions except Region 7. The bat habitat in Region 7 was low or not present for the three habitat assessments, and no snags were observed at the habitat assessment locations in that region.

During the mist-netting survey, MYSO were captured in five of the nine regions. Regions 1, 2, 3, 6, and 8 had positive MYSO detections through both acoustic monitoring and mist netting. These regions contain 594.5 acres of woodland habitat. MYSO acoustic calls were recorded in Regions 4, 5, and 9, but no MYSO were caught there during the mist-netting surveys. These three regions contain 463.4 acres of woodland habitat. While no MYSO were caught during mist-netting in Region 5, a maternity roost tree was identified within the region.

Roost trees were identified in Regions 1, 5, and 8, and maternity roost trees were identified in Regions 5 and 8. Region 1 had two maternity roost trees just east of the project boundary in a large woodland area. The large woodland area will not be affected by the proposed project. Regions 5 and 8 contain 217.3 acres of woodland habitat.

MYSE were detected through acoustic monitoring in all regions except Region 2 and Region 9. One MYSE call was biologist-verified in Region 7 where there were no MYSO calls. Mist-netting caught MYSE in Regions 1, 3, 4, and 5. Regions 1 and 3 also caught MYSO.

6.0 References

- Reichard, J.D. 2008. Wing-damage index used for characterizing wing condition of bats affected by white-nose syndrome.
- USFWS. 2010. Characteristics of Indiana Bat Summer Habitat. https://www.fws.gov/northeast/njfieldoffice/pdf/ibatsummerhab.pdf. Accessed October 2016.
- USFWS. 2012. National White-Nose Syndrome Decontamination Protocol-Version 06.25.2012. Diseases Management Working Group. www.whitenosesyndrome.org. Accessed April 2016.
- USFWS. 2014. White Nose Syndrome Fact Sheet. https://www.whitenosesyndrome.org/sites/default/files/resource/white-nose_fact_sheet_6-2014_1.pdf . Accessed October 2016.
- USFWS. 2016. Range-wide Indiana Bat Summer Survey Guidelines. April 11, 2016. U.S. Fish and Wildlife Service. Endangered Species. Midwest Region. http://www.fws.gov/midwest/endangered/mammals/inba/inbasummersurveyguidance.ht ml.

Appendix A Acoustic Survey Report BatSense

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Acoustic Bat Survey Report East Locust Creek Reservoir Sullivan County, Missouri

January 12, 2017

Prepared for:

Olsson Associates

Prepared by:

BatSense

Mr. Chris Corben

Ms. Kim Livengood

January 12, 2017

Contents

1.	INTRODUCTION	4
2.	METHODS	4
	2.1 Abbreviations Used:	4
	2.2 Sampling Strategy:	4
	2.3 Site selection:	4
	2.4 Detectors:	5
	2.5 Analysis:	6
	2.6 Species Identification:	7
3.	RESULTS	7
	3.1 The sites:	7
	3.2 The files:	8
	3.3 Identifications:	9
	3.4 Weather: 1	1
	3.5 Equipment Failures: 1	1
	3.6 Supporting Files	1
4.	DISCUSSION:	2
	4.1 Notes by Species: 1	2
	4.2 Notes by Sites: 1	2
	4.3 Comparison of Auto ID suites: 1	
	4.4 Caveat concerning detection of MYSE: 1	3
5.	LIMITATIONS	3
Арре	endix A. Species Names and Abbreviations 1	4
Арре	endix B. Notes on Species Identification: Basis and Assumptions 1	5
Арре	endix C. Supporting Files 1	8
Арре	endix D. Notes by Site 1	9
	Tables	
Table	e 1 Locations of sampling sites	7
	e 2 Sampling effort per night by region	
	e 3 Sampling status and files produced by site	
	e 4. Results of Auto ID and Manual vetting for Myotis species	

1. INTRODUCTION

Olsson Associates contracted BatSense to conduct acoustic surveys targeting Indiana Bats *Myotis sodalis* and Northern Long-eared Bats *M. septentrionalis* on the East Locust Creek Reservoir project site in Sullivan County, Missouri. BatSense collected data from June 2 to July 11 across approximately 1000 acres of habitat suitable for the target species. Data files were run through the Kaleidoscope and BCID Auto-ID programs. AutoID programs indicated that Indiana and Northern Long-eared Bats were present at multiple sites. Additionally, BatSense manually vetted *Myotis* files for the presence of Indiana and Northern Long-eared Bats. The principal investigator who performed the call identifications was Chris Corben. Our findings are detailed in Section 3 and discussed in Section 4 of this Report.

2. METHODS

2.1 Abbreviations Used:

See Appendix A – Species Names and Abbreviations

2.2 Sampling Strategy:

The acoustic sampling was conducted in accordance with the USFWS 2016 Range-wide Indiana Bat Summer Survey Guidelines. The project area had previously been divided into 9 survey regions, each containing approximately 123 acres of woodland habitat considered suitable for Indiana Bat maternity colonies.

To comply with USFWS requirements, each region was surveyed for at least 4 detector nights, including at least two detector sites spaced more than 200 metres apart, with each sampled for up to two nights. Because the objective of the sampling was to determine the presence or likely absence of the two target species in each region, sampling of a region could be curtailed if both target species were identified acoustically before the sampling was completed.

2.3 Site selection:

Each region was studied from aerial photography to determine promising survey sites. Several potential sites were chosen in each region, based on the observer's previous experience of how best to find the target species if present. From these potential sites, actual survey sites were chosen based on landowner permissions and accessibility.

Sites were chosen by preference to be within or adjacent to the largest blocks of woodland within a region. Three types of sites were chosen:

- 1. Sites at linear interfaces between the forest and adjacent agricultural land. The basis for such a choice is that MYSO, in particular, are expected to forage along habitat edges
- 2. Along the larger streams. Such habitat is usually found to be the most productive for finding a wide range of bat species and both MYSO and MYSE are well established to use such corridors
- 3. Inside old growth forest where there is plenty of open space for foraging between the tree trunks and above the ground cover, but under a closed, foliage canopy.

2.4 Detectors:

Both Anabat SD1 and Anabat SD2 bat detectors were used. These were powered by rechargeable AA cells which provide power for at least two complete nights of recording (from 30 minutes before sunset to 30 minutes after sunrise). The microphones used were standard Anabat microphones, which are quite directional at *Myotis* frequencies. These were protected from rain by weatherheads consisting of 45 degree curved tubes, unmodified from the form sold by the Anabat manufacturers (Titley-Scientific).

The weatherheads were mounted on poles, usually at 3m above ground level and directed upwards at 45 degrees to the horizontal. In some cases, this mounting strategy was varied to suit local conditions and for better chances of detecting the target species. For example, a detector placed on a river bank might be mounted closer to the ground and directed horizontally to better sample the space in which the target species were likely to fly. Photographs were taken of each site at deployment to illustrate the detector placements and the nature of the surrounding vegetation.

When each detector was deployed, a GPS unit was connected to the detector and the detector set to record GPS fixes for at least 16 seconds. This ensured that a record of the position of the detector was embedded within the dataset. The sensitivity of each detector and microphone was checked in the laboratory prior to commencement of the survey to ensure proper operation, and in addition, the sensitivity was checked in the field at deployment time. At each site, the detector sensitivity was set to the maximum at which it could be operated without continuous microphone self-noise in the absence of external stimulus (eg. insects). Sensitivity was checked by rubbing fingers in front of the microphone while the detector was recording. The response from the loudspeaker of the detector gives a crude impression of sensitivity, but with sufficient experience, this is a reliable way to detect any significant loss of sensitivity.

Whenever feasible, each detector was downloaded the morning after sampling, and the batteries were replaced to minimize the possible loss of data due to any problems encountered. The sensitivity was also checked to ensure the detectors were still functioning normally.

In addition, Anabat Express detectors were placed alongside the other detectors at selected sites to monitor temperature throughout the sampling period, and to provide some level of redundancy in case of equipment failure.

2.5 Analysis:

After downloading, the results were quickly evaluated to determine:

- 1. The presence of acceptable examples of the target species, because this could reduce the need for further sampling and also help inform the need for mist-netting surveys.
- 2. The recording quality in case a site needed to be repeated or moved to provide adequate sampling.

In the above context, it was considered that an example of a target species was acceptable if it showed features considered to be typical of either species in typical hunting situations. Given that the objective was to demonstrate "presence or probable absence" the position was taken that probable absence could not possibly be demonstrated if typical calls of a species were recorded, even if those calls could not be confidently identified to a particular species.

Subsequently, the raw, complete dataset was subjected to analysis by the following Auto ID programs:

- 1) BCID version 2.7d
- 2) Kaleidoscope version 3.1.7

In BCID, the Minimum Discriminant Probability was set to 0.35.

In Kaleidoscope, the sensitivity was set to -1 (more liberal).

In addition, a special filter was developed in AnalookW to pick up any potential *Myotis* calls. This was a highly inclusive filter with a high false positive rate but expected to have a negligible false negative rate and intended to greatly reduce the number of files needing to be examined manually to check on false negatives from the two Auto ID programs. All the files passing this filter were examined manually, and all *Myotis* sequences were carefully examined and identified as far as possible. Since both Auto ID programs identify bats on a per file basis, species could be missed if present in a file containing other species.

All files identified by either BCID or Kaleidoscope as produced by any species of *Myotis* were manually vetted for correct identification. Because many sequences can be readily identified as belonging to the genus *Myotis*, but are difficult or impossible to distinguish to species level, vetting aimed to both identify any sequences considered diagnostic for a species and also to speculate on the likely composition of the *Myotis* fauna at each site based on the mix of call types observed. To illustrate this principle with a simple example, consider a case where all *Myotis* calls were consistent with both MYLU and MYSO, so none of the sequences could be identified to species. Yet an absence of calls diagnostic of MYLU could suggest that at least the majority of calls were made by MYSO, simply because at some level, it is unlikely that MYLU could be present without at least some diagnostic calls being detected. The probabilities are completely unknown, so some degree of speculation must be made, based on the vetter's experience with what these species usually produce when encountered in the field.

2.6 Species Identification:

See Appendix B - Notes on Species Identification: Basis and Assumptions

3. RESULTS

3.1 The sites:

All the 18 sampled sites are listed in Table 1, showing geographic positions and elevations (as measured with GPS). The nomenclature of sites is that the first digit specifies the region, the next character specifies the site within a region and a final digit indicates the site was shifted in an attempt to improve recording. The single case of site x1g indicates that data was collected from an Anabat Express left at the site to measure temperature, because the main detector at the site failed to record data. Photographs of all these sites are provide in the folder "Photos of project survey sites", showing the detectors and their orientations.

Site	Latitude (deg N)	Longitude (deg W)	Elevation (m)
1B	40.340272	93.076964	278.4
x1G	40.324635	93.093031	274.6
2A	40.344925	93.093703	283
2A2	40.346174	93.093194	279.1
2C	40.326575	93.099027	284.2
3E	40.301446	93.107657	279.9
4B	40.299179	93.101452	272.4
5A	40.289711	93.096536	279.6
5B	40.286148	93.093985	265.2
6B	40.286337	93.090371	268.8
7D	40.286493	93.075643	273.4
7E	40.284269	93.078461	284
8A	40.275108	93.085004	284.9
8A2	40.27401	93.080552	268.6
8B	40.26883	93.081755	264
9A1	40.277238	93.054831	284.2
9A2	40.277904	93.059894	298.6
9B	40.276464	93.073767	278.7

Table 1 Locations of sampling sites.

Table 2 shows the number of detectors deployed in each region by night, along with the minimum temperature as recorded by one or more Anabat Express deployed at one or more of the sites.

	Number of detectors collecting data									Min Temp (deg C)	
	Regions										
Night	1	2	3	4	5	6	7	8	9	Totals	
20160602								2	1	3	11.75
20160603					1	1	1	2	1	6	15.75
20160604					1		1		1	3	14.5
20160605	1	1	1	1	1	1	1			7	14.5
20160606	1	1	1	1	1	1	1			7	10
20160607	2	1					1			4	9.75
20160608		1								1	17.75
20160709									2	2	19.25
20160710									2	2	21.5
Totals	4	4	2	2	4	3	5	4	7	35	

Table 2 Sampling effort per night by region

3.2 The files:

Table 3 shows how the recorded files were distributed amongst the sampling sites. This shows the total number of nights each site was sampled and the number which failed to meet the USFWS requirements due to rain, or which failed for some other reason. The column "All files" shows the total number of files recorded, including files containing just noise and no bats. The column "Files with potential Myotis" shows how many files could possibly have contained Myotis after examination with the AnalookW filter and elimination of all files which definitely did not contain Myotis or which did not contain sequences adequate for separation of Myotis from other genera. These numbers represent the maximum numbers of files which might have had Myotis. All these files were further vetted and files which unambiguously contained Myotis were labeled with the identification as far as possible.

Site	Region	Nights	Rain	Failed	All files	Files with potential Myotis
1b	1	1			141	88
x1g	1	3			419	27
2 a	2	1			95	
2a2	2	1			193	70
2 c	2	2			68	22
3e	3	2			227	43
4b	4	2			261	40
5a	5	3	1	1	373	21
5b	5	1			18	
6b	6	3	1		1048	69
7d	7	2			251	13
7e	7	3	1		1308	
8a	8	1			36	6
8a2	8	1	1		587	2
8b	8	2	1		1257	44
9a1	9	2			1924	16
9a2	9	2			2869	50
9b	9	3	1		4443	9
Totals		35			15518	520

Table 3 Sampling status and files produced by site

3.3 Identifications:

Table 4 shows the results of automated identification by BCID and Kaleidoscope, and also for the manual vetting. In this table, most *Myotis* subjected to manual vetting remained unidentified. These were bats accepted by manual vetting as definitely *Myotis*. In total, 149 files were identified as particular species of *Myotis* by BCID and 581 files were identified as particular species of *Myotis* by Kaleidoscope. 481 files were accepted as *Myotis* by manual vetting, and 38 of those were identified to species. Note that these figures for BCID and Kaleidoscope are based on the whole dataset.

	CJC vetting					o ID		Kaleidoscope Auto ID						
Site	MYLU	MYSE	MYSO	MYsp	MYGR	MYLE	MYLU	MYSE	MYSO	MYGR	MYLE	MYLU	MYSE	MYSO
1b	2	3	3	80	1	1	3	8	23		1	32	24	26
x1g	1		1	25				2	3			7	4	9
2a												1		
2a2	1		2	64			3	7	10		1	25	20	16
2c				17				4			1	10	4	1
3e		3	3	42				8	12		1	9	12	17
4b		4	1	28			1	5	3	2		11	18	4
5a	2	2	1	13					1			20	5	1
5b												1		
6b		3	4	59			1	9	7		2	24	21	14
7d	1	1		4			2					49	2	
7e												25		2
8a				2					1			7	1	3
8a2				2								2	1	
8b	1	1	2	28	5		3	2	12	3	1	24	4	17
9a1				16			2		1			5		4
9a2	2		1	47					3	3		25	4	4
9b				8	2		2		2	3		40	1	7
Totals	10	17	18	435	8	1	17	45	78	11	7	317	121	125

Table 4. Results of Auto ID and Manual vetting for Myotis species.

This table presents the numbers of files identified with each species of *Myotis* by BCID, Kaleidoscope and by manual vetting. The manual vetting results shows the numbers of files which are thought to be most likely of each species. No MYGR or MYLE are included in manual vetting, since it was felt there was no evidence that either species was present in the dataset. The label MYsp indicates calls safely attributable to the genus *Myotis*, but not to particular species. The numbers reported here for BCID and Kaleidoscope are those reported for the entire dataset. These may be higher than the numbers of files labeled in the **Potential Myotis Labeled** supporting files, because some of these did not pass manual vetting as having any potential to really be *Myotis*.

3.4 Weather:

As shown in Table 2, the temperature easily met the USFWS requirements, only falling below 10 degrees C on the night of 7 to 8 June and then only during the period just before dawn.

Rain of any consequence is easily detected in the acoustic record. The only night showing signs of rain was the night of 3 to 4 June 2016. On this night, rain was recorded at all sites monitored from about 0100 till about 0215. This violates the USFWS requirements because the rain duration exceeded 30 minutes in the first 5 hours of monitoring. The data was still used in the analysis. Affected sites were repeated, except for those in Region 8, where both MYSO and MYSE had already been found after that night's data was downloaded.

In the absence of local wind data, it is noted that wind never showed up in the acoustic record to the extent that it would reduce the ability to record bats.

3.5 Equipment Failures:

Two equipment failures affected data collection.

- 1. At site 5a, one night was lost due to a corrupted memory card. This had no real effect, because it was also the night affected by rain.
- 2. At site 1g, the same detector failed three nights in a row. This resulted from a misdiagnosis of the nature of the problem, which turned out to be another corrupted memory card. This report considers data collected by the Anabat Express which was set up at the same site to gather temperature data. However, the region was covered anyway because both target species were recorded at site 1b in the same region.

Apart from these cases, it was noted that the detector monitoring site 9b on 3 June was inadvertently turned up to a much higher sensitivity than desirable, as a result of which the whole dataset was filled with noise. However, this did not prevent bat detections, in fact, more bats will be detected under such conditions, though reviewing the files is made more difficult. There is no reason to think this caused any problem with data collection. In any case, that night was disqualified by rain.

All the sensitivity tests showed normal behavior and there is no evidence that any detector lost sensitivity during the project.

3.6 Supporting Files

Please refer to Appendix C for folder structure and details of the supporting files.

4. **DISCUSSION**:

4.1 Notes by Species:

Both Auto ID suites identified some calls as from MYGR or MYLE.

MYLE

None of the files reported as MYLE makes a convincing case. MYLE could be very difficult to distinguish from MYSE or MYSO, but a concentration of calls showing classic MYLE features might be at least suggestive of the occurrence of that species. No such evidence is seen in this dataset. Some of the bats reported as MYLE might be correctly identified, as there is a lot of overlap in call characteristics. However, in the absence of a more compelling concentration, it seems most likely that the majority of these bats are MYSO.

MYGR

MYGR is acoustically much more distinctive as a *Myotis*, but some calls of other species can quite closer mimic MYGR calls. All of the files identified as MYGR are most likely LABO. Some individual pulses look very like MYGR calls, but they are surrounded by other pulses from LABO.

4.2 Notes by Sites:

Please refer to Appendix D for notes on site characteristics and results.

4.3 Comparison of Auto ID suites:

The results from BCID and Kaleidoscope differ quite markedly from each other. There are two points which need to be considered:

- In accordance with USFWS recommendations, BCID was effectively used at a lower sensitivity setting than Kaleidoscope (Minimum Discriminant Probability was set to 0.35). For this reason, it is to be expected that BCID reports less identifications
- Kaleidoscope seemed to be consistently reporting more MYLU compared to other
 Myotis species. Manual vetting showed that this higher proportion arose from
 misidentifications of species of other genera (eg. Lasiurus) as well as a tendency to
 identify many sequences which were ambiguous between MYLU and MYSO as MYLU.

Both Auto ID suites make it clear their identifications should not be regarded as highly accurate. Manual vetting supported that position, finding both misidentifications of other genera as

Myotis and many cases where it is considered that identifications to species was not justified based on the call sequence identified. However, it is also worth noting that at a broader level, it does seem that both suites are responding to species in a way which means something. For example, within a suite, it seemed that higher proportions of MYSO or MYSE were tending to correlate with a higher likelihood that species was present based on manual vetting. Both Auto ID suites and manual vetting are difficult to verify, except to the extent that subsequent captures could confirm true positives.

4.4 Caveat concerning detection of MYSE:

Our main caveat is that the acoustic detection of *Myotis*, especially of MYSE, MYSO and MYLE is not really well understood. That is, it is not well understood where detectors should be placed or for how long to have a reasonable chance of detecting these species, quite apart from the problems of distinguishing them from each other when there is such broad overlap in call characteristics. MYSE is widely regarded as a species which primarily hunts in cluttered situations, and will therefore be difficult to detect. As with other species which hunt in clutter, there is a high risk that most MYSE are likely to be detected, if at all, very poorly. It is possible that MYSE is hard to detect acoustically even in places where it is common, simply because a bat which keeps to clutter tends to produce quiet calls which can closely resemble calls of other species flying in clutter. Our own experience has shown convincing detections of MYSE (because some of their calls are quite distinctive) in places where other *Myotis* were common, but it is difficult to know what that means, because there is no way to know how common MYSE really were by independent means. Whether MYSE is easy or difficult to detect is likely to depend critically on how often they move out of clutter to hunt in more open situations where their calls will be more distinctive.

5. LIMITATIONS

BatSense is not responsible for any independent conclusions or recommendations made by others related to this Report. Please note that the analyses presented in this report have been prepared for the exclusive use of Olsson Associates and for submission to the US Fish and Wildlife Service. The written consent of BatSense must be obtained should anyone else wish to view, excerpt or rely on the contents of this report.

Appendix A. Species Names and Abbreviations

Northern Long-eared Bat	Myotis septentrionalis	MYSE
Indiana Bat	Myotis sodalis	MYSO
Little Brown Bat	Myotis lucifugus	MYLU
Gray Bat	Myotis grisescens	MYGR
Eastern Small-footed Bat	Myotis leibii	MYLE
Tricoloured Bat	Perimyotis subflavus	PESU
Eastern Red Bat	Lasiurus borealis	LABO
Seminole Bat	Lasiurus seminolus	LASE
Big Brown Bat	Eptesicus fuscus	EPFU
Evening Bat	Nycticeus humeralis	NYHU
Silver-haired Bat	Lasionycteris noctivagans	LANO
Hoary Bat	Lasiurus cinereus	LACI
Mexican Freetail Bat	Tadarida brasiliensis	TABR

There is no known acoustic difference between LABO and LASE and the abbreviation LABO/SE can be used to denote one or the other. However, given the location of this dataset, it is assumed that any *Lasiurus* in the frequency range of LABO and LASE will be LABO, and that LASE will be very rare or non-existent. When the abbreviation LABO is used, there is no attempt to distinguish between LABO and LASE. LASE might be present, but at this time, there is no justification for thinking that and no possibility of resolving the difference from passive acoustic recordings.

Appendix B. Notes on Species Identification: Basis and Assumptions

The following are based on observations by C. Corben over many years of encountering these bats in a wide range of situations and localities, and from recording numerous bats of all these species on release after capture. The reference set used as a basis for understanding species acoustic identification criteria was collected over many years from many sites, but mostly from within Missouri.

All the species of *Myotis* in the region of this dataset have distinctly different acoustic behaviours, yet their calls broadly overlap. This is a typical situation with *Myotis* in other parts of the world as well. Typically, their calls are most distinctive when flying in the open, since echolocation calls tend to converge upon a similar design when flying in clutter (ie close to objects producing echoes). A large problem arises, however, because many species of *Myotis* tend not to hunt in open situations where they might be presenting their most distinctive calls. Different species of *Myotis* tend to hunt in different situations, and often typically occupy situations with different degrees of clutter. As a general rule, species which typically hunt in more clutter tend to produce calls which typify higher clutter situations (ie. high frequency, short duration, steep slope, relatively linear shape), even when flying in very open situations. For this reason, it should be relatively easy to distinguish many species when they are known to be flying in very low clutter. A couple of examples should demonstrate these points.

MYLU typically hunts in quite open situations, for a *Myotis*, usually several metres away from trees and typically in the wider gaps between tree canopies. In such situations, search-phase calls of MYLU generally have a lower slope and longer duration, and a more gently curved shape, than calls given by MYSO under the same circumstances. In the extreme, these calls are easily distinguished from those of MYSO.

MYSO seems to most often hunt along forest edges, closer to vegetation than MYLU and giving calls typical of a higher clutter situation than MYLU in its typical hunting situations. However, it is likely that no calls of MYSO are diagnostic for that species — overlapping broadly with MYLU when in lower clutter and broadly with MYSE in higher clutter. All three of these species produce distinctly different calls when flying in an open situation, with MYLU producing calls typical of lower clutter situations, MYSE producing calls typical of much higher clutter situations and MYSO in between. If a bat was known to be in a very open situation, its calls could readily be distinguished between these three possibilities. Unfortunately, passively recorded datasets don't provide useful information about where a bat was flying in relation to clutter. It is important to appreciate that the degree of clutter in which a bat is flying has nothing to do with the habitat in which it is recorded, but is a function of the distance a bat is flying from objects from which it receives echoes. Thus a MYLU flying in some clutter could produce calls which don't seem to differ at all from calls of MYSO flying in the open. A MYSO flying in clutter could produce calls very similar to those of MYSE flying in less clutter. A MYSE in the open could be quite distinctive, but it is not likely to be recorded there.

Given the above situation, a critical question is how often different species hunt in atypical situations, as that will profoundly affect how easily they can be distinguished. Although bats may have their preferred hunting situations, they can be quite opportunistic, and hunt in atypical places. Presumably, they will follow their prey, and where their prey is found could be very much affected by other factors. For example, in windy conditions, insects might tend to keep closer to vegetation than usual, so a MYLU might tend to hunt closer to vegetation than usual – in which case its calls can be expected to be more like typical calls of MYSO. MYSO, and perhaps even MYSE, might venture out into much more open situations than usual to take advantage of a Mayfly hatch. Very little is known about how such variation affects the acoustic distinctiveness of these species under natural conditions.

It also seems that bats hunting in higher clutter than usual tend to produce more variable sequences than bats hunting in more typical situations. This could be a very useful clue to species identification if it was better understood. For example, it is obvious that a MYLU can hunt in a more closed situation than usual and produce calls which closely resemble (and may be identical to) calls produced by MYSO or even MYSE. The question then is how long is it likely to maintain that behaviour, before producing more distinctive MYLU calls? The answer to that could be very useful for species discrimination, but in the absence of any definitive answers, the assumption can be made that the longer a recorded sequence keeps showing the same types of calls, the more it means in terms of species identification. In the extreme, it is easy to see that brief sequences can be very misleading across a wide range of Chiropteran taxa. In the case of these *Myotis*, it seems equally clear that identification is more likely to be successful when the sequence is extended in time (ie. over at least several seconds) and shows consistent call types with a regular spacing between pulses.

In the cases of these *Myotis*, extended sequences of similar calls are also important for distinguishing *Myotis* from other bats. PESU and NYHU can produce very *Myotis*-like sequences, but the biggest problem comes from LABO, which can closely duplicate *Myotis* calls for several seconds.

In summary, for the five *Myotis* species considered here, the following seems to hold:

MYGR usually produce diagnostically distinctive sequences, though they are also capable of producing much less distinctive sequences when in high clutter. MYGR can usually be distinguished from all other species by frequency in combination with call shape, though confusion with PESU in high clutter may be a problem.

MYLU can produce very distinctive calls, but the most distinctive are not seen very often and most of their calls could be duplicated by MYSO in very open situations. When in higher clutter, they can produce calls similar to MYSO or MYSE in higher clutter, but tend not to maintain that situation for long.

MYSO probably don't produce any truly diagnostic sequences. Their most common calls are of higher slope than typical MYLU calls, but lower slope than typical MYSE calls. When in open

situations, they can produce sequences which are very similar to typical MYLU calls, but this is not common. They often produce calls in high clutter which can look very similar to calls of MYSE in high clutter, but they tend not to do this for long.

MYSE can produce very distinctive calls, but these are not often recorded. Most of their calls are well within the range of MYSO in higher clutter, but tend to show more consistency. In low clutter they can produce calls which closely match typical MYSO calls and even overlap with MYLU calls, but these are rare.

MYLE in the open can give calls very similar to many MYSO calls, while in clutter they can resemble MYSE calls. MYLE calls are quite variable in frequency and are often higher in frequency than similar calls of MYSO, MYSE or MYLU. Some calls may be distinctive in showing more of a hooked shape at a higher frequency than seen in other species, where such frequencies are associated with higher clutter and a more drooped ending. A high prevalence of such calls could be a strong indicator of the presence of MYLE, but may not be commonly encountered.

Appendix C. Supporting Files

The following folders of files are included to hold the data required by the USFWS.

The folder **Photos of project survey sites** contains all photos of the project survey sites.

The folder **Original Files** contains the raw data files as collected by the detectors.

The folder **Potential Myotis labeled** contains all the files deemed by manual vetting to have contained *Myotis* or bat files which might be *Myotis*. These files are labeled in the locality field by the site in which they were recorded and in the species field according to the following convention:

A prefix is a lower case letter preceding the species abbreviation, which is in upper case.

All labels with the prefix "a" were labeled by manual examination of the file.

All labels with the prefix "b" were labeled as such by BCID.

All labels with the prefix "k" were labeled as such by Kaleidoscope.

In addition, when a file was labeled by Kaleidoscope, a shortened entry is included which is derived from the Kaleidoscope labelling process. This entry shows the Kaleidoscope Margin. According to Kaleidoscope Help, this is an "uncalibrated confidence score" where "higher values are more confident than lower values".

This folder also contains a special Sorted.anl file which is an AnalookW list file allowing all the files in the base folder to be viewed as if they are in one place. This file also contains special fields for species across all ID methods. All labels are additionally presented without the lower case prefix, so the files labeled aMYSO, bMYSO and kMYSO will also appear under MYSO.

The folder **BCID outputs** contains the _BCIDout_5.xls output files produce by BCID for both the original dataset and for the dataset containing only the files which manual vetting considered to be potential *Myotis*.

The folder **Kaleidoscope outputs** contains the id.csv and idsummary.csv output files produced by Kaleidoscope for both the original dataset and for the dataset containing only the files which manual vetting considered to be potential *Myotis*.

Appendix D. Notes by Site

Comments are included on the nature of the sampling and what it found, along with any comments specific to the site.

Guesses are made at the relative abundances of the three local species of *Myotis*, based on the types of calls recorded. This assumes that most of the *Myotis* recorded were behaving in ways typical for their species and that this gives some insight into the mix of species present. The accuracy of this approach is unknown, as it is not known how much variation in gross hunting behavior results from physical differences between sites as well as other factors such as insect hatches.

Site 1b

Site 1b was at the edge of the river, directed out over the water. It was at a site which looked excellent for bats, with substantial adjacent forest area and woodland also fringing the river banks. The site also looked across the river at a substantial break in the riparian strip, providing ready access to agricultural fields and forest edge.

Surveyed for one night on 7 June. Both target species were recorded that night so it was not repeated.

This was the best site for *Myotis*, with three species identifiable there. Overall, the types of calls recorded suggest that MYSO was the dominant species, as found by BCID. Kaleidoscope reported more MYLU, but the impression from looking at several datasets is that Kaleidoscope is substantially over-reporting MYLU. BCID also reported one each of MYGR and MYLE and Kaleidoscope reported one MYLE.

Site x1g

Site x1g was placed on a river flat between the river and the road, and along a flyway formed by a disused track running parallel to the river. There were quite large trees along the river and the immediate site was under the canopy but very open for bats.

Surveyed on 5, 6 and 7 June. In each case, the main detector failed to collect any data, and the comments here are based on recordings from the Anabat Express. The Express was using an omnidirectional microphone, as opposed to the Anabat SD1/SD2 which used standard Anabat microphones which are much more directional at *Myotis* frequencies.

This site produced small numbers of *Myotis*, with both MYLU and MYSO accepted by manual vetting. The impression is that most of the calls were likely to be MYLU. Both BCID and Kaleidoscope reported MYSO and MYSE, with Kaleidoscope also reporting MYLU. Manual vetting did not support the occurrence of MYSE.

Site 2a

Site 2a was in the open at the edge of an agricultural field beside an extensive tract of riverine forest

Surveyed for one night on 7 June, then moved to site 2a2.

Recorded very few bats, and no Myotis.

Site 2a2

Site 2a2 was surveyed for one night after the detector was moved from site 2a. The site was overlooking a river at a point where the canopy was quite open, giving some connection to nearby grazing fields. The flyway along the river was substantially blocked by a log jam below the detector, which would have meant that bats flying along the river bed would have had to fly up over the logs close to the detector.

Surveyed for one night on 8 June.

A productive site for *Myotis*, with MYLU and MYSO accepted by manual vetting. However, many of the sequences were quite ambiguous between MYSO and MYLU. No compelling evidence of MYSE, despite being reported by both BCID and Kaleidoscope. Most so labeled are more likely to be MYSO in clutter. Kaleidoscope also reported one MYLE.

Site 2c

This site was situated in riverine forest adjacent to agriculture from which it was separated by a narrow road under the canopy. The detector was placed in an opening in the forest which was connected to the roadway.

Surveyed for two nights, 5 and 6 June. The detector was re-oriented for the second night in the hope of increasing its effectiveness, but this night was cooler than the previous nights and activity was markedly reduced.

Myotis activity consisted of high clutter calls which are ambiguous between MYSO and MYSE. Both BCID and Kaleidoscope reported MYSE, while Kaleidoscope reported mostly MYLU and one MYSO and one MYLE. None of the sequences looks at all convincing for MYLU. From the call types recorded, either or both MYSO and MYSE are likely to account for most of the sequences.

Site 3e

Site 3e was situated in a river bed beside a ford and adjacent to agricultural fields. The vicinity was quite open, with trees mainly along the river and a mostly open canopy exposing the river to the sky. The microphone was directed horizontally along the stream bed.

Surveyed on 5 and 6 June.

Manual vetting accepted both MYSE and MYSO and both these species were also reported by BCID and Kaleidoscope. Kaleidoscope also reported a few MYLU and one MYLE. The call types seen show a lot of high clutter sequences and a lot of ambiguity.

Site 4b

Site 4b was situated in a narrow gap connecting two fields, otherwise separated by forest on both sides of the gap.

Surveyed on 5 and 6 June.

Both BCID and Kaleidoscope reported MYSO, MYSE and MYLU, with MYSE dominating and Kaleidoscope reporting a greater preponderance of MYLU and 2 MYGR. Manual vetting found 4 MYSE and one MYSO. Most of the sequences are ambiguous between MYSO and MYSE, but MYLU could also be there.

Site 5a

Site 5a was situated at the end of a field where it connected though to a substantial area of forest along an old roadway. In effect, the field tapered into the forest along the road.

Surveyed on 3, 4 and 5 June. The detector failed to record anything on 3 June, but that night was also lost to rain.

Only 13 *Myotis* files were detected, but they represent a varied set of calls and manual vetting accepted MYLU, MYSE and MYSO. BCID only identified one MYSO, but Kaleidoscope identified all three species, with most being MYLU. Most of the MYLU identified by Kaleidoscope were calls which are ambiguous between MYLU and MYSO.

Site 5b

Site 5b was situated near the edge of a field in an open space surrounded by forest.

It was surveyed only on 6 June.

It recorded very few bats and no Myotis.

Site 6b

Site 6b was placed at the edge of the river which had open fields on one side and woodland with a roadway on the other.

It was surveyed on 3, 5 and 6 June, being removed on 4 June from fear of the water rising after rain which was forecast but didn't eventuate. On 3 June the microphone was oriented across the river towards an opening in the trees at the edge of the field. That night was lost to rain. On 5 and 6 June it was directed down the river bed.

Manual vetting accepted both MYSE and MYSO. Both BCID and Kaleidoscope reported those species plus MYLU, but Kaleidoscope also reported one MYLE and a much higher proportion of MYLU than BCID. Most of the calls were from bats in high clutter and ambiguous between MYSO and MYSE, but the overall impression is that MYSO was dominant.

Site 7d

Site 7d was situated at the side of a ford over a narrow stream. The ford was connecting two fields. The creek was heavily lined with trees, mainly willows.

Surveyed on 6 and 7 June.

Only a few *Myotis* were recorded, with one each of MYLU and MYSE accepted by manual vetting. BCID reported only MYLU, and Kaleidoscope identified both MYLU and MYSE, but with the vast preponderance being MYLU. Most of these were misidentified bats of other genera.

Site 7e

Site 7e was inside well-developed forest of large trees with a complete canopy. The area around the detector was very open, providing plenty of space for bats to fly.

Surveyed for three nights, 3, 4 and 5 June. The night of 3 June was lost due to rain.

No *Myotis* were accepted by manual vetting, and none were reported by BCID. Kaleidoscope reported 2 MYSO and 25 MYLU. These were at least mostly misidentifications of LABO. There is no evidence of any *Myotis* at this site and the two MYSO reported by Kaleidoscope are definitely not that species – they are either LABO or NYHU.

Site 8a

Site 8a was inside forest with a complete canopy but quite open underneath, providing plenty of room for bats to fly.

Surveyed only on 2 June, then moved to 8a2.

A small number of *Myotis* was recorded, but all the calls were given in high clutter and manual vetting considered none identifiable to species. BCID reported one MYSO and Kaleidoscope reported MYLU, MYSE and MYSO but mostly MYLU.

Site 8a2

Site 8a2 was situated at the edge of a large agricultural field, beside woodland on the bank of the river. The area immediately around the detector was very open. The detector was oriented along the edge of the larger trees on the river bank.

Surveyed only on 3 June after moving from 8a. The night was lost to rain but not repeated because both target species were already found within the region.

BCID reported no *Myotis* and Kaleidoscope reported both MYSE and MYLU. Manual vetting found two *Myotis* sequences, neither considered identifiable, though one suggests MYLU and the other is of a bat in high clutter.

Site 8b

Site 8b was placed in the river bed at a point where there was a high but fragmented canopy. This was adjacent to a large block of forest on one side of the river and there were fields on the other side, separated from the river by a strip of woodland.

Surveyed on 2 and 3 June. The night of 3 June was lost due to rain, but both target species were recorded so the site was not repeated.

BCID and Kaleidoscope both reported MYLU, MYSE and MYSO, but with BCID reporting mostly MYSO while Kaleidoscope reported mostly MYLU. Both also reported MYGR and Kaleidoscope also reported MYLE. Manual vetting accepted MYLU, MYSE and MYSO and the call types recorded suggest that MYSO and MYLU accounted for most sequences.

Site 9A1

Site 9a1 was situated at the edge of a small stream surrounded by forest but close to fields. The immediate vicinity consisted of an opening in the forest around the stream, dominated by regrowth.

Surveyed on 9 and 10 July. Site 9a1 was run simultaneously with 9a2 for logistical reasons.

BCID and Kaleidoscope both identified a few MYLU and MYSO. Manual vetting showed mainly high clutter calls with a lot of ambiguity and none considered identifiable to species. The sequences are highly varied and don't suggest any species was dominant.

Site 9A2

Site 9a2 was placed at the edge of a small field of herbage, adjacent to a flyway through the forest bordering the field to a more open area along the river.

Surveyed on 9 and 10 July. Site 9a2 was run simultaneously with 9a1 for logistical reasons.

A good number of *Myotis* were recorded, but most were of bats in high clutter or only short sequences, and thus not considered identifiable. Manual vetting did accept MYLU and MYSO. BCID reported MYSO, while Kaleidoscope reported MYLU, MYSE, MYSO and 3 MYGR, with most being MYLU. The call types seen do suggest that MYLU was likely dominant.

Site 9b

Site 9b was placed at one corner of a large field and close to a small, overgrown creek. The adjacent sides of the field were bordered by an extensive forest block and by the riparian trees

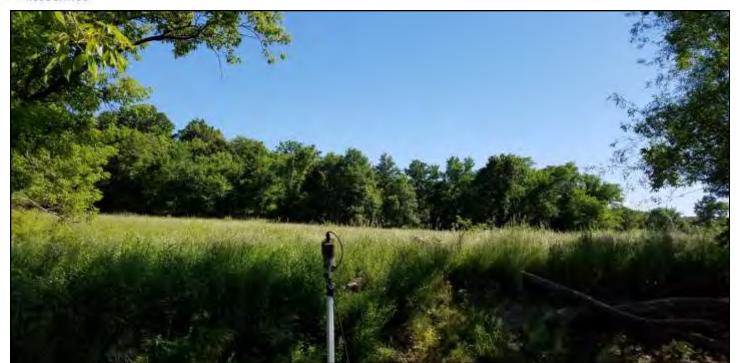
along the creek. The detector was in a gap in the riparian strip, connecting the field through to the creek.

Surveyed on 2, 3 and 4 June. The night of 3 June was lost due to rain, but the data collected is used anyway.

Manual vetting showed 8 *Myotis* sequences, with none identifiable to species. BCID and Kaleidoscope both identified MYSO and MYLU with Kaleidoscope showing a much higher proportion of MYLU. Kaleidoscope also identified MYSE and both also identified MYGR.

Appendix B Acoustic Photolog





1

Site:

Acousti Site 1b



Photo No.

2

Site:

Acousti Site 1b





3

Site:

Acousti Site 1g



Photo No.

1

Site:

Acousti Site 1g





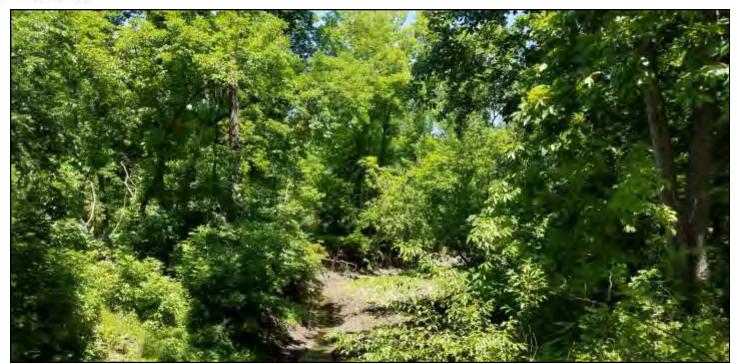
Site: Acousti Site 2a



Photo No. 6

Site: Acousti Site 2a





7

Site:

Acousti Site 2a2



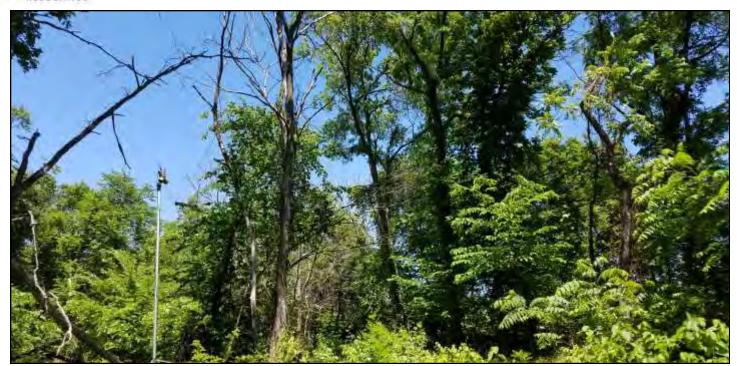
Photo No.

8

Site:

Acousti Site 2a2





9

Site:

Acousti Site 2c



Photo No.

10

Site:

Acousti Site 2c





Site: Acousti Site 3e



Photo No. 12

Site: Acousti Site 3e





13

Site:

Acousti Site 4b



Photo No.

14

Site:

Acousti Site 4b





Site: Acousti Site 5a

15



Photo No. 16

Site: Acousti Site 5a





Site: Acousti Site 5b

17



Photo No. 18

Site: Acousti Site 5b





19

Site: Acousti Site 6b



Photo No.

20

Site:

Acousti Site 6b





21

Site:

Acousti Site 7d



Photo No.

22

Site:

Acousti Site 7d





23

Site: Acousti Site 7e



Photo No.

24

Site:

Acousti Site 7e





25

Site:

Acousti Site 8a



Photo No.

26

Site:

Acousti Site 8a





Site: Acousti Site 8a2

27



Photo No. 28

Site: Acousti Site 8a2





29

Site: Acousti Site 8b



Photo No.

30

Site:

Acousti Site 8b





31

Site:

Acousti Site 9a1



Photo No.

32

Site:

Acousti Site 9a1





33

Site:

Acousti Site 9a2



Photo No.

34

Site:

Acousti Site 9a2





35

Site: Acousti Site 9b



Photo No.

36

Site:

Acousti Site 9b

Appendix C Mist Net Bat Survey Datasheets

riigineeiiig, iir	ing, inc.				,								
1	Site 8 6)			Project	East L	locust	Cree	y		Date C	une	June 15, 20,	18
[]	st Locust												
County Su	Sullivan		State	00	Quad				Quadrant	†			0
Lat/Long (DMS):N	Ä	() () () () () () () () () ()		8			Zone		Surveyors	S X	SP	30	HIS
# Time	Species	Age	Sex	Repro.	RFA (mm) Mass (g)	Mass (g)	Net/	Wing	Moon Phase	Toon Phase	2	% & W	
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29:20	e venino J	A	נד	٢	<u>ဖ</u>	11	1/2	4	Moon	1:4	4:16pm	2:	2:54 gm
34:48	bid brown	A	3	NN	40	17.5	T/3	0	Sun	5 your	am	14:8	11 pm
1h:b t	7	A	3	ONT SEE		10	1/2	29					
3h: b 5	big brown	A	3	T		18	1/2	G	Time	Temp	Sky	Wind #	# of bats
6 9:48		A	M	10	96	81	1/2	0	848	78	12	0	0
34:48	mada bid	R	π	7	hh	23	1/2	4	2hb	ナチ	1	Ö	4
8 10:15	6	A	9	0	49	26	1/2	1	1048	ht	2	C	C
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11 10:48	Like .	D	T	+	3	18	1/3	0	148		بمنيه		
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	e red bad	Δ	ጎ	٢	44	14	1/2	0	1		Few	Few Clouds	
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17									3	0	Cloudy	Cloudy or Overcast	ast
18									4		Smol	Smoke or Fog	
19									5	C	rizzle o	Drizzle or Light Rain	lain
20									6		Thun	Thunderstorm	3
21								* 10.15.3				1000	the second
22		1	m 1		1	***		14	×	Beau	ford W	Beauford Wind Code	6
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24						346		701	3.41	Li	ght Wi	Light Wind (1-3 mph)	ηph)
25								8	2	Lig	ht Bree	Light Breeze (4-7 mph)	mph)
26							1	-	ű	Gen	tle Bre	Gentle Breeze (8-12 mph)	mph)
*Reproductive Condition:(P)Pregnant:(I)Lactating:(PI)Post-Lactating:(NR)Non-Reproductive:(TD)Testes Descended					/-	1							

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entered JC

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Engineering, Inc.

Bat Survey Data Sheet

Net Site Diagram			Land St. Co.	
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14		/	Pond	
11.	7		Road Rut	
TO STATE OF THE PERSON AND PERSON			Corridor	
	10	15	Cave/Mine	
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- . Moon well ut but not illuminating nots they are concecled by leg.
- . Arthrapods very active Period with 11:15 pm
- . Will mak not 2 to 3 closer to Not 1 tomomer.



- 1					_1		,			-	
Location				rioject	1807	Comet Creek	Creek	ľ		Date 6-1	31.91.
County Sullivan	RT		State	30	Quad				Quadrant	7	
Lat/Long (DMS):N	:Z			W			Zone		Surveyors 37	SBR YK	
# Time	Species	Age	Sex	Repro.	RFA (mm) Mass (g)	Mass (g)	Net/	Wing	Moon Phase	hase	%
1 928	a Red	3	3	8	8	16	K	4		Rise	Set
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4 2:02	Bis Barr	A	2	AM	47	71	イ	0			
5	C				10 mm				Time	Temp Sky	Wind # of bats
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8									111	68.7 0	0
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10											
11									220	0 829	0
12											
13										Sky	Sky Code
14									0		Clear
15									1	Fe	Few Clouds
16									2	Pai	Partly Cloudy
17									3	Cloud	Cloudy or Overcast
18		Ŧ							4	Sm	Smoke or Fog
19									. 5	Drizzle	Drizzle or Light Rain
20									6	Thu	Thunderstorm
21											
22										Beauford \	Beauford Wind Code
23									0	Cal	Calm (0 mph)
24									1	Light W	Light Wind (1-3 mph)
25									2	Light Br	Light Breeze (4-7 mph)
36									3	Gentle Br	Gentle Breeze (8-12 mph)

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Engineering, Inc.

Bat Survey Data Sheet

Net Site Diagram	3		5	3	50000	100				Domi	Dominant Vegetation	tion	0
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Comments													
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# Time	Species	Age	Sex	Repro.	RFA (mm) Mass (g	Mass (g)	Net/	Wing	Moon Phase	hase
1 9,30	hy 43	2	4		62	500	2/2	0		Rise
2 9:25	SIFU	A	The	۲.	24	Ĉ _@	1/2	0	Moon	
3 9:25	EPFU		3	3	ti	53-30	1/2	3	Sun	
4 950	EPRO	4	7	7	36	19	1/2	0		
5950	04/3	D.	T	۴	てか	7.3	112	9	Time	Temp Sky
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8 12:37	Red But - Recapture						3/2	j	200	697 (
9							1		1146	69.1 C
10								7 (5)	126	65.2 C
11									74	63.7 C
12										
13										Sky Code
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15		.0)							1	
16	* E								2	Partly Cloudy
17		-							3	Cloudy or Overcast
18									4	Smoke or Fog
19									5	Drizzle or Light Rain
20									6	Thunderstorm
21			100	60	3		51		E	
22										Beauford Wind Code
23									0	Calm (0 mph)
24						-	,		1	Light Wind (1-3 mph)
									2	Light Breeze (4-7 mph)
25									₃	Gentle Breeze (8-12 mph)

entered WI/BR



Net Site Diagram	- Habirata	A NAME OF	
	Dominant	Dominant Vegetation	
	1 harkbonn		
	2 " Slade, Walnut		
	3 black locusi	7	F
	4 shadbarle h	hillery	7
	1 C	by of	7
	A TITLE	Som	gov.
	Net Sites	Net Sites by Habitat	
	Habitat 18 1 B 9	1 C 3 D/4	
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Comments			
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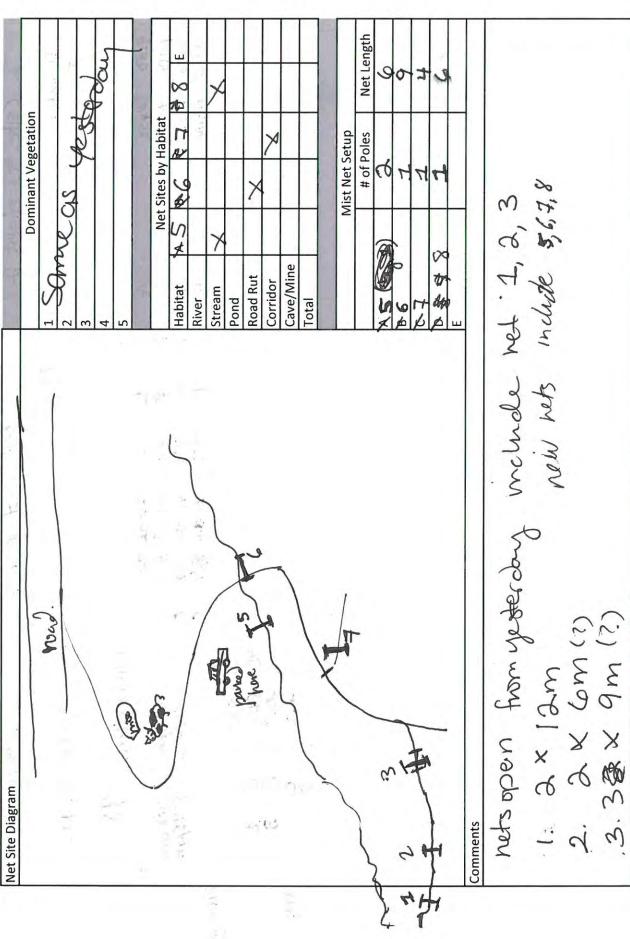


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Site No.	(site 4) night	9		Project East		Locust Re	Rexervoir	,	Ц	Date 6	6/18/	16		ш
Location	,													_
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00	N:()		×	W			Zone	1	Surveyors	rs VK	SR	CC	T.	
# Time	Species	Age	Sex	Repro. Cond.*	RFA (mm)	Mass (g)	Net/	Wing Score	Moon I	Moon Phase	snag	86 %	8	
1 9,50	MYSE	P	A	r	35	276-20	1/2	0		Rise	e		Set	
2)0:15	MHYIN	A	ħ	4	34	43-29	5/2	00	Moon	705pm	pm	4:	4:38 am	
3 10:15	NYHW	A	T	P	37	47-31	5/2	0	Sun	5:4	5:42am	99	8:45pm	
4 10:25	MAKA	A	T	P	37	45-22	8/1	0						
5						No.			Time -	Temp	Sky	Wind	# of bats	humol
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7	36.4						1	1 m	986	1.68	0	0	12	
8								1		73.4	0	0	w	
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25									2	Lig	ght Bre	eze (4-	Light Breeze (4-7 mph)	
26									3	Ger	tle Bre	eze (8-	Gentle Breeze (8-12 mph)	
*Reproductive C	*Reproductive Condition:(P)Pregnant;(L)Lactating;(PL)Post-Lactating;(NR)Non-Reproductive;(TD)Testes Descended	ıg;(PL)Post-Lac	ctating;(N	IR)Non-Rep	productive;(TD)Testes D	escended		4	Mode	rate Br	eeze (1	Moderate Breeze (13-18 mph)	

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Engineering, Inc.

Bat Survey Data Sheet





18 19 20 21 22 23 23 24	18 19 20 21 22 23 24	18 19 20 21 21 22 23	18 19 20 21 21	18 19 20 21	18 19 20	18	18	1/	17	16	15	14	13 1	12 1	11 !	10.	9 - 10	8/18	7 10	6 8	5 9	4 9	39	29	19	#	Lat/Lon	County	Location	Site No.	1
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tle Bree	Light Breeze (4-7 mph)	Light Wind (1-3 mph)	Calm	Beauford Wind Code		Thunc	Drizzle or Light Rain	Smok	Cloudy or Overcast	Partly	Few	0	Sky Code				0	0	0	>	Sky V		M	ma	е	%	200			-19-1	
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9	SUS APP	1		W		0	Zone	50	Surveyors	rs VK	BR	7	
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5					1	-0.		- Indian	Time	Temp	Sky	Wind #	# of bats
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7										70.3	W	25	0
8	× ×			The state of					1050	55.2	1	£=	ages
9				-40 M					150	1.10	2	ti-rapa.	0
10				CF			j	0.0					
11						,	135	1					
12						7							1
13											Sky Code	1	388
14		-							0		_	Clear	
15	Del	x 51							1		Few	Few Clouds	
16	4	7							2		Part	Partly Cloudy	ly
17 40	Ly	le:							3		Cloudy	Cloudy or Overcast	cast
18	-	V							4		Smo	Smoke or Fog	B
19									5		rizzle (Drizzle or Light Rain	Rain
20									6		Thun	Thunderstorm	m
21	-2												
22										Beau	ford W	Beauford Wind Code	le
23									0		Calm	Calm (0 mph)	1)
24									1	Li	ght Wi	Light Wind (1-3 mph)	mph)
									2	Lig	ht Bre	Light Breeze (4-7 mph)	mph)
25									3	Gen	tle Bre	eze (8-	Gentle Breeze (8-12 mph)

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	9.2		N					250	2001	E		×								Net Length	9m	12	6m	6mg	4m		
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	Then !	Dominant Vegetation				,	1K	5	Net Sites by Habitat	С					X				Mist Net Setup	# of Poles	7	b	2	7	_		
	W.	Dominan	N.W.	DOG.	ash	Dank	Re oa		Net Site	В									Mist I	#							
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et		,	1	2 6	3	4	2		\	Habitat	River	Stream	Pond	Road Rut	Corridor	Cave/Mine	Total				A N,	B 2	C 3	ba	E S		
She			文は					-	77				1		100	12	/										
Jata			12)		7	7		1	1	-	4	2	180g	O										
'ey [見った							ci.		_	1	1															
Bat Survey Data Sheet	Charles .							58-85	きるん	12		+															
Bat	1000			#Y2	9			63	2									g	2								
					7)		o	0	Ctor	١.	L					5										
					V	1	77			9	2.		00	3120	1	120											
				17	7.15	3	330		200	7	1	1	10	0.4	1	N. Carrie							ì				
ng, Inc.	- 5			7		5	Py ton	-	P.	1	3	1	12	4	1	-	~	_	9			2		-			
gineerir	Jiagram			5		(2	-	0.14	073	/		_	17					٠	mester	1	302				S	
Engineering, Inc.	Net Site Diagram						4	-	14	100			A .	0			\	\	_	1	9		_	_	_	Comments	
	2												0.	000												<u> </u>	
K.)																											



							-				100	1	11
Location Location	PANT 2 (MANTAN)			Project	East Loc	OCUST CI	Creek			Date 0	2	00.10 01/ 00/0	200
County Sullivan			State Mo	0	Quad				Quadrant	7			
00	•	()		V			Zone		Surveyors	's VK	BR,	JC	
# Time	Species	Age	Sex	Repro.	RFA (mm) Mass (g)	Mass (g)	Net/	Wing	Moon Phase	hase	%	0	
17										Rise	rD.		Set
2)								Moon				
3	() > (Sun				
4	. 10	/											
5	5	15							Time	Temp	Sky V	Wind #	# of bats
6		()	\bigcap						- 7	75.1	@ 2	0	O
7			10	Tela) /			*	24:42	745	۷.	0	0
8	ž			7.1.	7			*	12401	74.0	1	0	0
9				(7				1145	734	0	0	0
10									12451	74.3	0	0	C
11									145				
12					1								
13											Sky Code	de	
14									0		C	Clear	
15									1		Few	Few Clouds	
16									2		Partly	Partly Cloudy	,
17									3	0	Cloudy or Overcast	r Over	cast
18									4		Smok	Smoke or Fog	υq
19									5	0	Drizzle or Light Rain	r Light I	Rain
20									6		Thunc	Thunderstorm	n
21													
22										Beau	Beauford Wind Code	nd Cod	rib
23									0		Calm	Calm (0 mph))
24									1	Li	Light Wind (1-3 mph)	d (1-3 r	nph)
25									2	Lig	Light Breeze (4-7 mph)	ze (4-7	mph)
36									3	Gen	Gentle Breeze (8-12 mph)	ze (8-1	2 mph)

of the sound of the N-NN a few times aray. No thinch sounds just lightening & a cloud over which received around 11:00pm.



Strange Action I planta folders 2 Lingte colders 3 Character and Colders 3 Character and Colders 4 & Lallian Net Sites by Habitat River Stream Net Strup River Corridor Corridor Road Rut Corridor Corridor Road Rut Road Rut Corridor Corridor Road Rut Road Rut Road Rut Road Rut Road Rut Road Rut Corridor Corridor Road Rut Road	Net Site Diagram	E 34 - 187 - 18 - 18			SCIVIL S		THE P	
1 huner locuest 2 shingle and the second of				Dor	minant Veg	etation		
Stream Stream			1.6	honer la	15	0.5		
3 chapbark hickory 4 a bullan 5 & Stallan Net Sites by Habitat Net Sites by Habitat River Stream Road Rut Corridor Corridor Total Total Mist Net Setup # of Poles # of Pole				shingle				
Stream Stream				chapl	hickon	77		
Stream St				1,01		8		
Met Sites by Habitat Net Sites by Habitat Habitat A B C D River Stream Stream Road Rut Corridor Cave/Mine Total Mist Net Setup # of Poles B A A A A A A A A A A A A				*				
Musseq condo								
Habitat A B C D River Stream S				Ne	t Sites by H	labitat		
Stream X X X Pond Pond Road Rut Corridor X Corridor X Pond Road Rut Corridor X Pond Road Rut Corridor X Pond Pond Road Rut Corridor X Pond Road Rut Ro								111
Stream Stream X X X Pond Pond Road Rut Corridor X Corridor X Cave/Mine Total Mist Net Setup # of Poles # of Po				River				/
Strom Strom Corridor X Cave/Mine Total Mist Net Setup # of Poles C C C C C C C C C C C C C				Stream	×	X	×	×
Mist Net Setup Mosteg condin	12.			Pond				
Corridor X Cave/Mine Total Mist Net Setup A A A A A A A A A A A A A A A A A A A	TY2 8 0			Road Rut				
Description of the constraint	8 S	Stran	_				4:	
Mist Net Setup Mist Net Setup # of Poles C C D E E	18:0	A.E.	_	Cave/Mine				
Mist Net Setup Mist Net Setup # of Poles # of Poles C			, /	Total				
Mist Net Setup # of Poles We shed cornoin E Mist Net Setup # of Poles # of Poles # of Poles # description # des	5-1	\$						
Musteg condon	1	70	/		Mist Net Se	tup		
Wester condo		5	_		# of P	oles	Net Le	ngth
Wester consider		\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\	*	A	ef		hma	
1) C 2 2 D J E E D D D D D D D D D D D D D D D D	1000		1-	В	7		Am	
E E E	when con!			C	7		4m	
E E	180			D	/		4m	
				E	8		6m	
	ents						,	

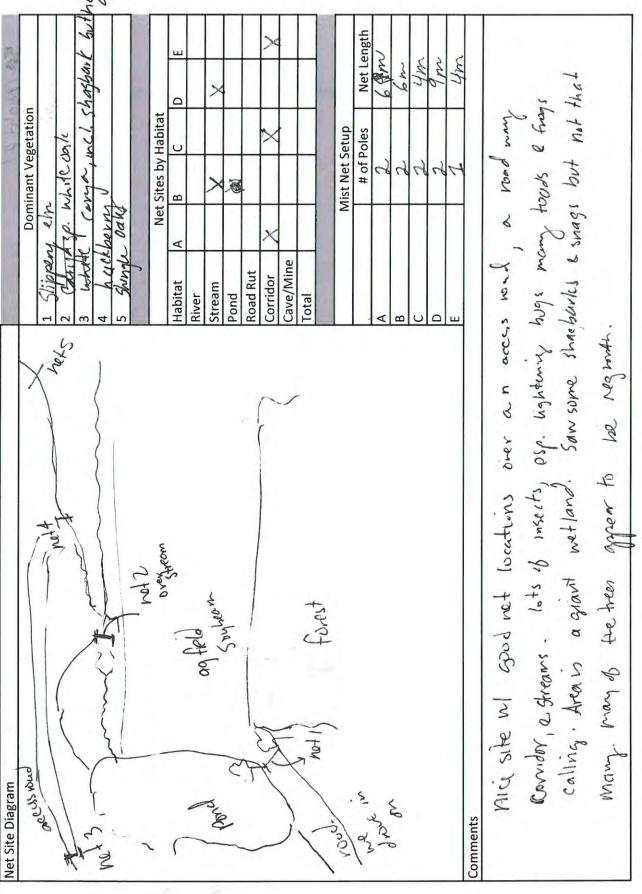
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Engineering, Inc.		שני		1						de		
Site No. 50 (Night	ght 2)		roject	Project East lucust	st creek	K			Date 6	1231	2011	
County Sullings	25	State Mp		Quad				Quadrant	7			100
00					<i>,</i>	Zone		Surveyors	rs V/L	B10	20	49
- A TONOS	The state of the s											1
# Time	Species	Sex	Repro. Cond.*	RFA (mm)	Mass (g)	Net/ Ht	Wing	Moon Phase	hase		%	
1									Rise	е	S	Set
2								Moon				
3								Sun				
4								,				
5								Time	Temp	Sky	Wind #	# of bats
6	8								44	23	0	0
7								546	76.2	2	0	0
8	*							10/5	34.8	2	0	0
9								11 45			,	
10								1240		+5		ż
11								145				
12												
13										Sky Code	ode	
14								0			Clear	
15	Ь							1		Few	Few Clouds	
16								2		Partl	Partly Cloudy	
17	k-y-							3		Cloudy	Cloudy or Overcast	ast
18	(+,?							4		Smol	Smoke or Fog	
19								5		rizzle o	Drizzle or Light Rain	ain
20	1/1							6		Thun	Thunderstorm	
21	The same of the sa		-					No. of Lot,		K	1,11,1	
22)	Beau	ford W	Beauford Wind Code	X .
23	AND AND AND							/0)	Calm	Calm (0 mph)	
24				7				7	11	ght Wir	Light Wind (1-3 mph)	ph)
25								2	Lig	ht Bree	Light Breeze (4-7 mph)	nph)
26								ω	.Gen	tle Bre	Gentle Breeze (8-12 mph)	mph)

Bytond I







Engineering, Inc.	ng, Inc.	ָּבֶּ	35 00	-	7 720	2 0116	(
Site No. (N	Night 1			Project	East Loca	ocust cr	reck			Date (623	23/16
sa3	Socust (reek											
IN			State 1	77	Quad			0	Quadrant	t		
00				8			Zone	10	Surveyors	SX.	BR 17	SC
# Time	Species	Age	Sex	Repro.	RFA (mm)	Mass (g)	Net/ Ht	Wing Score	Moon Phase	hase		%
1										Rise	е	Set
2									Moon			
3									Sun			
4												
5				*					Time	Temp	Sky .	Wind # of bats
6									853	73.1	0	0 0
7							101			72.2	0,	00
8										68.8	0	0 0
9									1153	63.1	0	00
10									_	13	0	0
11								1	153	61.3	0	9
12												
13											Sky Code	ode
14	344								0			Clear
15								11	1		Fev	Few Clouds
16									2	-	Part	Partly Cloudy
17									ω		Cloudy	Cloudy or Overcast
18									4		Smo	Smoke or Fog
19									5)rizzle (Drizzle or Light Rain
20									6		Thun	Thunderstorm
21							+					
22										Beau	ford W	Beauford Wind Code
23									0		Calm	Calm (0 mph)
24									1	- 6	ght Wi	Light Wind (1-3 mph)
25									2	Lig	ht Bre	Light Breeze (4-7 mph)
26			1						3	Gen	tle Bre	Gentle Breeze (8-12 mph)
*Reproductive Con	*Reproductive Condition:(P)Pregnant;(L)Lactating;(PL)Post-Lactating;(NR)Non-Reproductive;(TD)Testes Descended	;(PL)Post-La	ctating;(N	IR)Non-Re	productive;(TD)Testes Do	escendec		4	Mode	rate Br	Moderate Breeze (13-18 mph)

entered 50



Engineering, Inc.

Bat Survey Data Sheet

Engineering, inc	g, inc.				7		2000			- 1) <u>^</u> !.	
Site No. Kegion	6 (Night)			Project	COURT DO	DONS	CRECK	7		Date (0100	
County Cya Minay	7 22.3	2	State Y	3	Quad				Quadrant	Ħ.			
9	Escalabol Vi	4		×			Zone		Surveyors	SVK	82	30	
	THE COLF	20		Repro.			Net/	Wing	Moon Phase	Phase	. 9	%	
	130		,	Cond.		1		Score	DIAMAN	IN CASE	MOJEM	Cat	
1 8:45	LABO	R	7	3	42	36-215	2/2	C	Ġ	, KISE	100		•
	CA80	P	π	1	4/	40-23	7	0	Moon	38 am:	3.	231 pm	1
1	LABO	×	η	٦	39 %	44.30	1/2	6	Sun	5:59am	am	8:49pm	
04:1	CABO	D	7	٢		45-30	2/2	0			0		
						1			Time	Temp	Sky \	Wind # of bats	S
6				17/		E I			8:45	72.		0 0	
7				-					9:45	66.4	-	0 /	12
∞							T v		1045	8.50	-	0	
9				í					1145	61.5	0	0	loo
10									rus				
11									145	60.3	0	0	
12													
13											Sky Code	de	
14	20	Flori							0		0	Clear	
15		M							1		Few	Few Clouds	
16		0.7							2	ľ	Parth	Partly Cloudy	
17	W	÷				,			3	0	loudy o	Cloudy or Overcast	
18									4		Smok	Smoke or Fog	
19									5	D	rizzle o	Drizzle or Light Rain	
20									6		Thung	Thunderstorm	
21													
22										Beau	ford W	Beauford Wind Code	
23									8		Calm	Calm (0 mph)	
24			1						→		ght Wir	Light Wind (1-3 mph)	
									2	Lig	ht Bree	Light Breeze (4-7 mph)	
25			1						w	Gen	tle Bree	Gentle Breeze (8-12 mph)	_

enter of the

Engineering, Inc.

Saine La Alegal	7.14	2 Alack Lateriat	3 Chitc Oak 4 American Flor	5 Hickory	Net Sites by Habitat	Habitat K p/ 2 g 3 x67 E	Stream	Pond	Road Rut	Cave/Mine	Total	Mist Net Setup	# of Poles Net Length	2	n	7 6				
Net Site Diagram		most 60 the second		The transfer of the second of	The state of the s	N 22 0 10 20 21 21 21 22 22 22 22 22 22 22 22 22 22	700	10.00									Comments			

Site No. Site 6	near (B)	Night 3		Project	Project East lacust Creek	ust Cr	Creek			Date 6/2	12016	110
	**											
County Sullivan	Van	The same	State	Mo	Quad				Quadrant		1	_
100	.N	, Cillian		×			Zone	S	Surveyors	VK BK	JUCA	MB, ta
# Time	Species	Age	Sex	Repro. Cond.*	RFA (mm) Mass (g)	Mass (g)	Net/ Ht	Wing Score	Moon Phase	hase	%	
1 10:40	CA50	P	7	1	Pr. 39	97-33	1/5	0		Rise		Set
2/0,40	CA 60	A	7	7	11	46 -33	5/3	0	Moon			
340:50	MYVSO	A	TI	,	36	39-28	2/2	C	Sun			
11:11	05 FW	D	7	70	38	36-30	1/4	1				
			3	2.	-				Time	Temp Sky	Wind	# of bats
6									,	70.2 2	0	0
7									846	191 2	0	0
8										67.2 2	0	2
9			j	ý	=17			100	9 8411	4.0	0	1
10					w.c			(Carrie	1248	64.0 2	0	1
11					8				148	628 2	0	0
12					e ²	4	ايو	- C + C	To the same of the	1	•	
13						Ģ,		y	V	Sky	Sky Code	
14	1	Lip Lip				**	1		0	- 277	Clear	
15						7			1	F	Few Clouds	S
16		je.			×				(2)	Pa	Partly Cloudy	dγ
17		4							 	Cloud	Cloudy or Overcast	rcast
18							4		4	Sn	Smoke or Fog	og g
19									5	Drizzl	Drizzle or Light Rain	Rain
20	2.4								9	Τh	Thunderstorm	m
21	1.42				- 11				1000	STACK S	2011	STATE OF
22										Beauford Wind Code	Wind Co	de
23	200		4.7		0	Y	10.00	10.33	0.	Ca	Calm (0 mph)	h)
24									1	Light \	Light Wind (1-3 mph)	mph)
25							100		2	Light Breeze	reeze (4-	(4-7 mph)
26									ω	Gentle B	Gentle Breeze (8-12 mph)	12 mph)

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Bat Survey Data Sheet	Dominant Vegetation	1 honey (00,005+		 E	+1	Habitat 🔼	ron in		het not 5 Road Rut	\ \ \ -	Cave/Mine	Total	John Sox Mist Net Setup	# of Poles Net Length	N N	G. 42 2	4 × ×	E 5 3 4m		using sites from Moswia except pulled down not & where	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
Engineering, Inc.	The Die Diegister	一个 好 一 一 女	**					13	to to				AST.	1	(6.3)	Poo.	T - 4		Comments	Revsing sites from	we cargut barr



Bat Survey Data Sheet /48.2209

				•								
Site No. Kea ISM & Mid M 3)			Project	1 K v	60 test Cro	Heal			Date 6	130	JOK	Б
Location Exist Locust Corele												
County Sullivern		State //	0	Quad				Quadrant	ē			
Lat/Long (DMS):N			W			Zone		Surveyors	rs YK,	BE T		-
# Time Species	Age	Sex	Repro.	RFA (mm)	Mass (g)	Net/	Wing	Moon Phase	hase		%	
DANIO MUCO	7	П	1	39-33	42-2/0	1/8	1	ali	Rise	ē		Set
2						1		Moon				
Δ.								Sun				
4												
5								Time	Temp	Sky	Wind	# of bats
6	1						1	12:20	59.2	-	P	5
7										S	cu	- 4
8								ST.	190		-	¥_1
9							/		0), 1	75.7	E
10							7			C		ĺ
11								100		C	7	-
12												
13										Sky Code	ode	
14					*			0			Clear	
15				-				1		Fev	Few Clouds	0,
16								2		Part	Partly Cloudy	¥
17								ω		Cloudy	Cloudy or Overcast	cast
18								4		Smo	Smoke or Fog	g
19								5	_	Orizzle	Drizzle or Light Rain	Rain
20								6		Thur	Thunderstorm	Э
21												
22									Beau	ford W	Beauford Wind Code	le
73								0		Caln	Calm (0 mph)	2)
23								1	L	ight Wi	Light Wind (1-3 mph)	mph)
24								2	Lig	ght Bre	Light Breeze (4-7 mph)	mph)
24								,	000	-	Contle Brooze (9 17 mph)	

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J. S. C. Park	3 3	Domi	Dominant Vegetation	getation		
J. J. Crosk	3					
John S. J.	3					
Ly Crosh	3					
Legister 1						
July Charle	4					4
	2				K.	
1000						
6.7		Net	Net Sites by Habitat	Habitat		
	Habitat	A 5/5	B 5.6	CSJ	D 5.8	E 5.9
5.6	River					
2 dist	Stream	×	×	狗	7	
	Pond					
	Road Rut					
	Corridor			X	X	\times
	Cave/Mine					
	Total					
t Sox						
		Σ	Mist Net Setup	etup		
C			# of Poles	oles	Net L	Net Length
1	N S V		8		21	
ctol	B 5.6		-6		6	
Mycs	C S.7		d		0	
3.50	8.2 Q		co		72	
Section Cont	E 5.9		R		8	



Site No. 5168	~			Project	East locust Greeks	ust Cre	els			Date (6-30-2016	2016	
3	-			0		ŀ							
county (DMS):N	MONITOR		State	1	Kuan		Zono		Chadian	5			
0													
# Time	Species	Age	Sex	Repro. Cond.*	RFA (mm) Mass (g)	Mass (g)	Net/	Wing	Moon Phase	hase		%	
1 9:25	Myhu	A	17	-	34	41-28	1-2			Rise	е		Set
2 9:30	Nyhu	A	7	7	37	4-29	1-3		Moon				
3 11:30	Nuhu	A	7	2	36	45-33	2-2		Sun				
4	. 1												
5									Time	Temp	Sky	Wind #	# of bats
6													
7													
8	•												
9													
10													
11													
12	4												
13											Sky Code	ode	
14									0			Clear	
15									1		Fev	Few Clouds	
16								·y	2		Part	Partly Cloudy	γ
17									3		Cloudy	Cloudy or Overcast	cast
18									4		Smo	Smoke or Fog	ga
19									5	1)rizzle (Drizzle or Light Rain	Rain
20									6		Thun	Thunderstorm	n
21													
22										Beau	ford W	Beauford Wind Code	е
23									0		Calm	Calm (0 mph))
24									1	LI LI	ght Wi	Light Wind (1-3 mph)	nph)
25		M							2	Lig	ht Bre	Light Breeze (4-7 mph)	mph)
26									3	Gen	tle Bre	Gentle Breeze (8-12 mph)	2 mph)
The state of the s	***************************************	arifBI \Bact I a		יייייייייייייייייייייייייייייייייייייי	T)	H	L		,	nando.	nto Dr	112	Moderate Breeze (13-18 mph)

entered JC



Net Site Diagram - 58 64	No. 7 - 7 - 7 - 7 - 7 - 7 - 7 - 7 - 7 - 7	947
		Dominant Vegetation
	1	and the sales
3	3 8	
	5	
	7 04	A SEP
	7 7 1	Net Sites by Habitat
	7	at A B C D E
	Stream	E
		1
	Road Rut	Rut
	Corridor	dor
	Cave/	Cave/Mine
	Total	
		Mist Net Setup
		# of Poles Net Length
	A	
	В	
	U	
	Q	
***************************************	<u>B</u>	
comments		
-2		
		,



,	Moderate Breeze (13-18 mph)	rate Bre	Mode	4		scended	Testes De	oductive:(TD	Non-Repr	tating:(NE	(PI)Post-Lac	*Reproductive Condition:(P)Pregnant:(1)Lactating:(PL)Post-Lactating:(NR)Non-Reproductive:(TD)Testes Descended	ctive Conditi	Reprodu
	Gentle Breeze (8-12 mph)	ntle Bree	Gei	3										26
	Light Breeze (4-7 mph)	ght Bree	Li	2										25
	Light Wind (1-3 mph)	ight Wir		1										24
	Calm (0 mph)	Calm		0										23
	Beauford Wind Code	uford W	Beau										1	22
													-	21
_	Thunderstorm	Thun		6										20
	Drizzle or Light Rain	Drizzle c		5									1	19
_	Smoke or Fog	Smok		4							7			18
_	Cloudy or Overcast	Cloudy		ω					_	MO	15:42	rats clused		17
	Partly Cloudy	Parti		2							7 -	N	3	16
	Few Clouds	Few		ы								一神 アイ	5.	15
	Clear			0	٦								(deposite to the second	14
_	ode	Sky Code												13
				3						,	burrita	48. 4190	#4 1	12
									10					11
				- 1							sush:	48-5205	7年91	10
			78.6	-	17				70			5230		9 /
			80.4		1									8
_			82.2		14			1						/
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7	Wind # of bats	Sky	Temp	Time	C	3/2	528-23 3		NR	77	ā	ASKIN BEAT	38	5 10
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Engineering, Inc.

Bat Survey Data Sheet

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2 9145	muso (pistachio)	A	7	7	38	00	1/2	0	Moon				
3 11:25	י האאת	4;	M	NA	35 5	6 3h	4/2	0	Sun				
4 1:37	MYSO (PORLY)	A	7		48		4/2						
5 1:46	MYSE M	為了	M	ろろ	33	35-32	1/3	0	Time	Temp	Sky	Wind #	# of bats
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17 😓	1000	1.1							3	0	Cloudy	Cloudy or Overcast	cast
18									4		Smol	Smoke or Fog	00
19									5	0	rizzle c	Drizzle or Light Rain	Rain
20									6		Thun	Thunderstorm	m
21													
22									9	Beau	ford W	Beauford Wind Code	е
23									0)		Calm	Calm (0 mph))
24									1	Li	ght Wir	Light Wind (1-3 mph)	mph)
25									2	Lig	ht Bree	Light Breeze (4-7 mph)	mph)
26									ω	Gen	tle Bree	Gentle Breeze (8-12 mph)	2 mp

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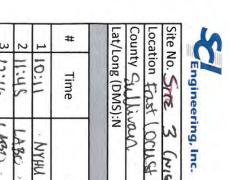
Engineering, Inc.

Bat Survey Data Sheet

FIDEL & CO. DISC.

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4 1040	NYHU	P	П	۲.	3	S18-8	4/2	0					
5 1115	LABO	7	Ū	• 7	7	118-94	6/2	0	Time	Temp	Sky	Wind	# of bats
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Size No. Size Angel State Angel Sex Cond.** Size Sex S		Moderate Breeze (13-18 mph)	Breez	Moderate	4 1		cended)Testes Des	roductive;(TD	IR)Non-Rep	ctating;(N	PL)Post-La	*Reproductive Condition:(P)Pregnant;(L)Lactating:(PL)Post-Lactating:(NR)Non-Reproductive;(TD)Testes Descended	ndition:(P)Preg	oductive Cor	Repr
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SITE 2 CNIGHT 1) Project Sor Louist Classic Date	_			- 1				- 1	- 1.						-	ocat
		6	9-16	1.75	D		JOSEN .	_		Project			MT)	2	S	ite N





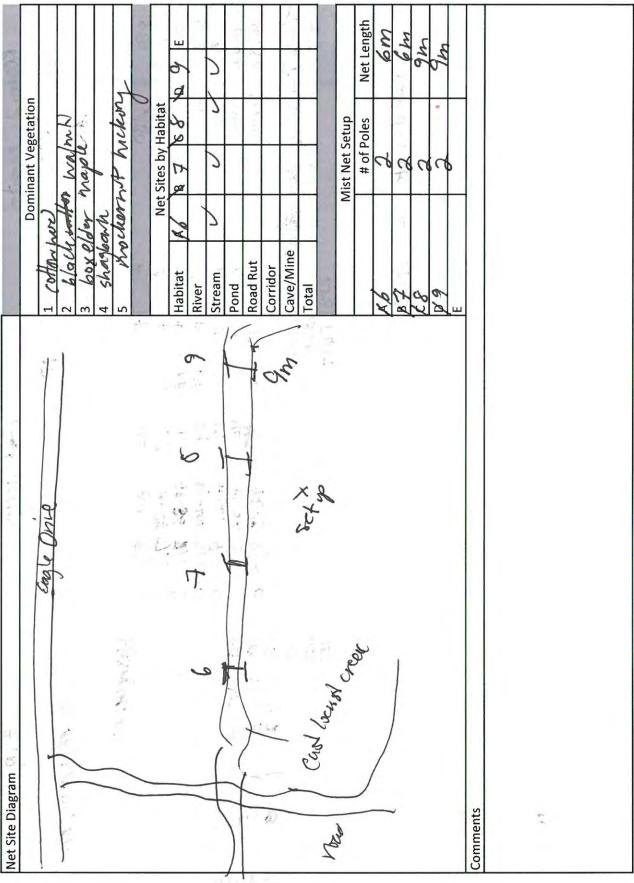


Time Species Age Sex Repro. RFA (mm) Mass (g) Ht Score May 10:30 Mag 10:30 M	,	-													-		1
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State M Quad Quadrant Quadrant	Rain	or Light	Drizzle		5												19
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State Mo Quad Quadrant	# of bats	_		Temp		0	- 1	0-27,3			7	A		150	M	10:30	3
State M Quad Quadrant Q						0	1/1	17.22		27	4	ч		1	LAN	10:30	4
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		-	1//1	Date				CMOD	CHENIN	Project			<u> </u>	None	mo	_	cat









Appendix D Mist Net Photolog





Site: Mist Net Site 1-1



Photo No. 2

Site: Mist Net Site 1-2





3

Site:

Mist Net Site 1-3



Photo No.

1

Site:

Mist Net Site 1-4





5

Site:

Mist Net Site 1-5



Photo No.

6

Site:

Mist Net Site 2-1





Site: Mist Net Site 2-2



Photo No. 8

Site: Mist Net Site 2-3





a

Site:

Mist Net Site 2-4



Photo No.

10

Site:

Mist Net Site 2-6





11

Site:

Mist Net Site 2-8



Photo No.

12

Site:

Mist Net Site 2-9





Site: Mist Net Site 3-1



Photo No. 14

Site: Mist Net Site 3-2





Site: Mist Net Site 3-3

15



Photo No. 16

Site: Mist Net Site 3-4





Site: Mist Net Site 3-5



Photo No. 18

Site: Mist Net Site 4-1





19

Site:

Mist Net Site 4-2



Photo No.

20

Site:

Mist Net Site 4-3





21

Site:

Mist Net Site 4-6



Photo No.

22

Site:

Mist Net Site 4-7





23

Site:

Mist Net Site 4-8



Photo No.

24

Site:

Mist Net Site 4-9





25

Site: Mist Net Site 4-10



Photo No.

26

Site:

Mist Net Site 4-11





Site: Mist Net Site 5-1



Photo No. 28

Site: Mist Net Site 5-2





29

Site:

Mist Net Site 5-3

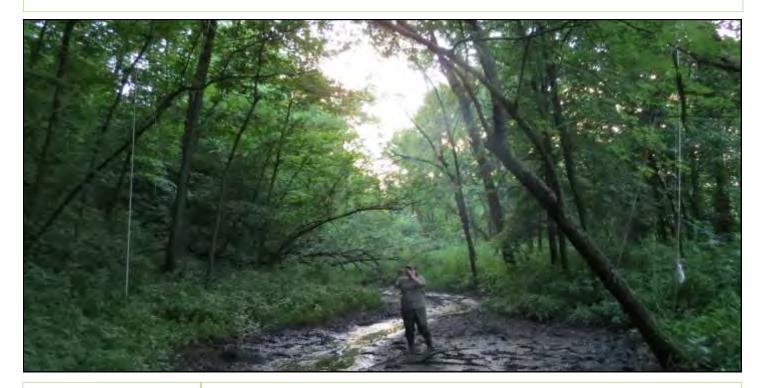


Photo No.

30

Site:

Mist Net Site 5-4





31

Site:

Mist Net Site 5-5



Photo No.

32

Site:

Mist Net Site 6-1





33

Site:

Mist Net Site 6-2



Photo No.

34

Site:

Mist Net Site 6-3





35

Site:

Mist Net Site 6-4



Photo No.

36

Site:

Mist Net Site 6-5





37

Site:

Mist Net Site 8-1



Photo No.

38

Site:

Mist Net Site 8-2





39

Site:

Mist Net Site 8-3



Photo No.

40

Site:

Mist Net Site 8-4





Site: Mist Net Site 8-5



Photo No. 42

Site: Mist Net Site 8-8





43

Site:

Mist Net Site 8-9



Photo No.

44

Site:

Mist Net Site 9-2





Site: Mist Net Site 9-3

45



Photo No. 46

Site: Mist Net Site 9-4





Site: Mist Net Site 9-5

47



Photo No. 48

Site: Mist Net Site 9-6

Appendix E Tagged Bats Photolog





Site: MYSO tagged bat 'Be y'

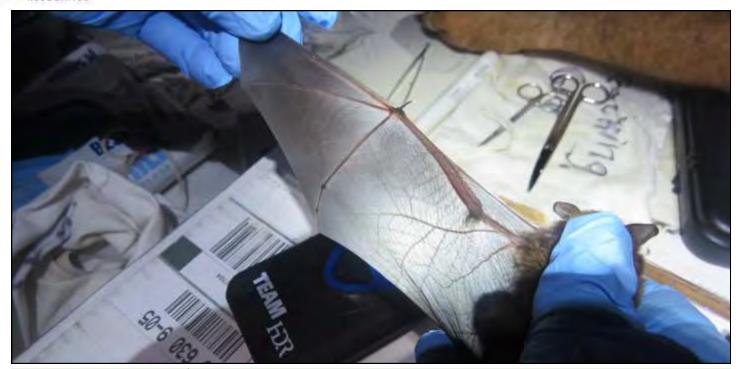
1



Photo No. 2

Site: MYSO tagged bat 'Be y'





Site: MYSO tagged bat 'Be y'



Photo No. 4

Site: MYSO tagged bat 'Be y'





Site: MYSO tagged bat 'Burrito'

5



Photo No. 6

Site: MYSO tagged bat 'Burrito'





7

Site:

MYSO tagged bat 'Burrito'



Photo No.

8

Site:

MYSO tagged bat 'Burrito'





Site: MYSO tagged bat 'Elvira'



Photo No. 10

Site: MYSO tagged bat 'Elvira'





11

Site:

MYSO tagged bat 'Elvira'



Photo No.

12

Site:

MYSO tagged bat 'Elvira'





13

Site: MYSO tagged bat 'Laela'



Photo No.

14

Site:

MYSO tagged bat 'Laela'





Site: MYSO tagged bat 'Laela'

15



Photo No. 16

Site: MYSO tagged bat 'Laela'





Site: MYSO tagged bat 'Pistachio'



Photo No. 18

Site: MYSO tagged bat 'Pistachio'





19

Site:

MYSO tagged bat 'Porky'



Photo No.

20

Site:

MYSO tagged bat 'Porky'





21

Site:

MYSO tagged bat 'Sushi'



Photo No.

22

Site:

MYSO tagged bat 'Sushi'





23

Site:

MYSO tagged bat 'Wilma'



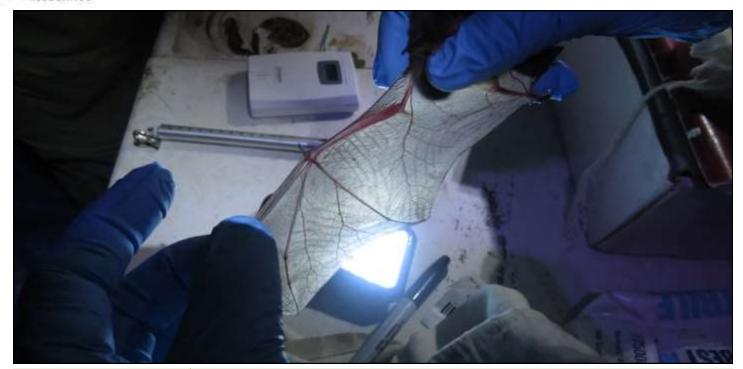
Photo No.

24

Site:

MYSO tagged bat 'Wilma'





Site: MYSO tagged bat 'Wilma'

25



Photo No. 26

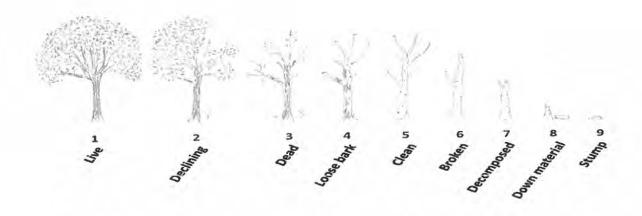
Site: MYSO tagged bat 'Wilma'

Appendix F USFWS Indiana Bat Roost Datasheets

USFWS INDIANA BAT ROOST DATASHEET

Biologists (Full Name): Chris Orben Date: 3 July 2016	_
UTM: Zone Easting Northing On	R
LAT 40.272 LONG -93.091 (same as A-1) very c	lose together)
Property Owner:Phone#	
State Missouri County Sullivan Site#	
Roost # A-3 Roost Name: Incidental tree	_
Roost Tree Data	
Species: American Elm Live Snag X Other	lu-
(if other, explain)	_
DBH (in or cm) 10" Total Height (ft or m) 16.0 m	
Height of roost area (if known) 9 m Dist. from capture site	
Roost position aspect (deg)	
Exfoliating bark on bole (%) 30° o Describe: sloughing platy_tight	_
Cavities present? If so, describe:	_

Roost Decay State: 1 2 3 4 5 6 7 8 9 Other



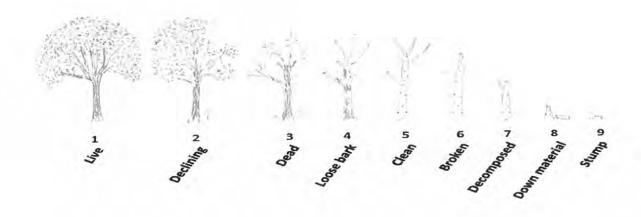
Roost tree or snag canopy position: Dominant _ Co-Dominant \(\sum \) Suppressed _

Surrounding Habitat Condition	
Canopy closure at roost (%) 10 0	<u>-</u>
Approximate woodlot size (ac or ha)	Distance to non-forest (ft or m) 20 m
Describe forest/woodlot current condition (m	nature, partially cut-over, burned, insect damage, etc.)
Additional Comments	
The data from the	is sheet is inferred from
was determined to	be a maternity roost tree.

USFWS INDIANA BAT ROOST DATASHEET

Biologists (Full Name): C) Corben		
UTM: Zone Easting	Northing	OR
LAT 40. 2772 LONG -93.091	_	
LAT 40. 2772 LONG -93.091 Property Owner: North Central Regional Water	r (oma Phone#	
State Missouri County SU	ullivan Site	# Roost A
Roost # A-l Roost Name:	_aela Treel	
Roost Tree Data Species: American Elm	Live Sn	ag √ Other _
(if other, explain)		
DBH (in or cm) 10.0" Total F	leight (ft or m)	.0 m
Height of roost area (if known) 9 m	_Dist. from capture si	te
Roost position aspect (deg) SW		
Exfoliating bark on bole (%) 30°10 I	Accribe cloughing	nlaty tight
Extoliating bark on bole (%) 30 10	rescribe. sloughing -	platy_ tight_

Roost Decay State: 1 2 3 4 5 6 7 8 9 Other



Roost tree or snag canopy position: Dominant __ Co-Dominant _ Suppressed __

Surrounding Habitat Condition

Canopy closure at roost (%) __ | D ° / o __

Approximate woodlot size (ac or ha) ___ Distance to non-forest (ft or m) __ & O m __

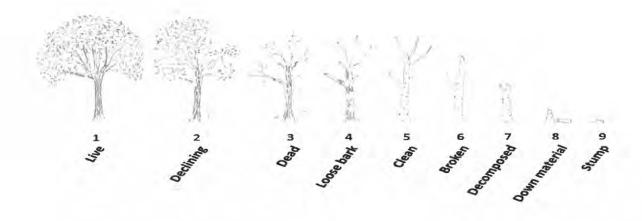
Describe forest/woodlot current condition (mature, partially cut-over, burned, insect damage, etc.)

Additional Comments _____

USFWS INDIANA BAT ROOST DATASHEET

	Chris Corben	Date: 5	July 2010	
UTM: ZoneE	asting	Northing		OR
LAT_40.2837I	ONG -93.0936	_		
Property Owner:		Phone#		
State Mi SSOuri	County So	ullivan	Site #	
Roost #	Roost Name:	Laela Tr	ee 2	
Species: Shagbar (if other, explain)				
DBH (In or cm)	I Utai II	eight (it or m)	10 111	
Height of roost area (if k				

Roost Decay State: 1 2 3 4 5 6 7 8 9 Other



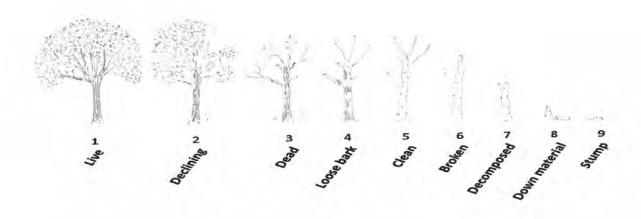
Roost tree or snag canopy position: Dominant $_$ Co-Dominant $\underline{\times}$ Suppressed $_$

Surrounding Habitat Condition Canopy closure at roost (%)	*
Approximate woodlot size (ac or ha)	Distance to non-forest (ft or m)
Describe forest/woodlot current condition (ma	ature, partially cut-over, burned, insect damage, etc.)
Additional Comments	

USFWS INDIANA BAT ROOST DATASHEET

	Date: 4 July 2016
UTM: Zone Easting	Northing OR
LAT 40. 27153 LONG -93.	08502
Property Owner:	Phone#
State Missouri Cour	nty Sullivan Site # Elvira Tree 1
Roost # Roost Na	me:
Roost Tree Data	
Species: Shagbark Hickor	ULive Snag ✓ Other
(if other, explain)	
DBH (in or cm) 10.2"	Total Height (ft or m) 16.5 m
Height of roost area (if known)) 1.5	Dist. from capture site
Roost position aspect (deg) NE	
	O Describe: sloughing \(\sqrt{platy_ tight} \)

Roost Decay State: 1 2 3 4 5 6 7 8 9 Other



Roost tree or snag canopy position: Dominant __ Co-Dominant __ Suppressed __

Surrounding Habitat Condition

Canopy closure at roost (%) __ _ O ^ { O }

Approximate woodlot size (ac or ha) ___ Distance to non-forest (ft or m) __ Q O M __

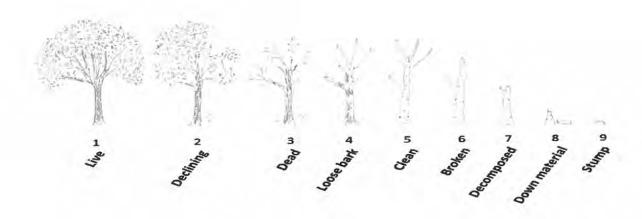
Describe forest/woodlot current condition (mature, partially cut-over, burned, insect damage, etc.)

Additional Comments ____

USFWS INDIANA BAT ROOST DATASHEET

Biologists (Full Name): <u>C</u> UTM: Zone Eas				
LAT 40.2773 LO				
Property Owner:		Phone#_		
State Missouri	County_Su	llivan	Site #	
Roost #	Roost Name: El	vira Tree	a	
Roost Tree Data	The	Live	s Snag ✓ O	ther
Species: <u>American</u> (if other, explain)				
Species: American	Total H	eight (ft or m)	11e.0 m	
Species: American (if other, explain) DBH (in or cm) 10	Total H own) 9 m Sw	eight (ft or m)_ _Dist. from ca	(e . () m pture site	

Roost Decay State: 1 2 3 (4) 5 6 7 8 9 Other



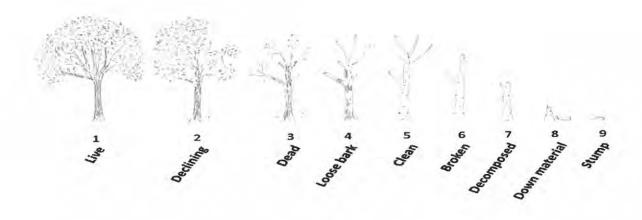
Roost tree or snag canopy position: Dominant __ Co-Dominant ≠ Suppressed __

(ft or m) 20 m
ed, insect damage, etc.)
_

USFWS INDIANA BAT ROOST DATASHEET

UTM: Zone Easting	Northing OR
LAT 40.3384 LONG -93.0	0723
Property Owner:	Phone#
State Missouri Coun	aty <u>Sullivan</u> Site#
Roost # Roost Nam	me: Burrito Tree
Roost Tree Data Species: American Elm	Live Snag \(\subseteq \) Other _
Species: American Elm	Live Snag \(\subseteq \) Other _
Species: American Elm (if other, explain)	
Species: American Elm (if other, explain) DBH (in or cm)	
Species: American Elm (if other, explain) DBH (in or cm)	Total Height (ft or m) (5 m
Species: American Elm (if other, explain) DBH (in or cm) Height of roost area (if known) Roost position aspect (deg)	Total Height (ft or m) (5 m

Roost Decay State: 1 2(3)4 5 6 7 8 9 Other



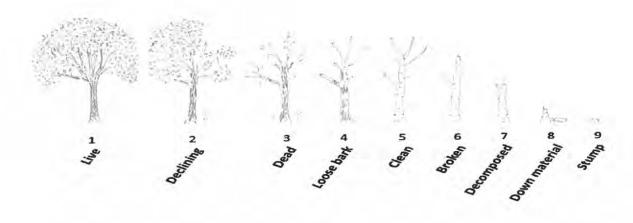
Roost tree or snag canopy position: Dominant __ Co-Dominant __ Suppressed __

Canopy closure at roost (%) Do Distance to non-forest (ft or m) Describe forest/woodlot current condition (mature, partially cut-over, burned, insect damage,	etc.)
mature- oak, hickory walnut, American Elm Lprimarily shagbark, white oak)	
Additional Comments	<u> </u>

USFWS INDIANA BAT ROOST DATASHEET

UTM: Zone	_ Easting	Northing_	
LAT 40.3359	LONG13.08	4 3	
Property Owner:			
State Missouri	County	Sullivan	Site #
Roost #	Roost Name	: Burrito Tr	ee 2
Species: America	an tlm	Live	_ Snag \ Oth
Species: <u>America</u>			
(if other, explain)	5 in To	otal Height (ft or m)_	18 m
(if other, explain) DBH (in or cm)	. <u>5 i n</u> To (if known) <u>'</u>	otal Height (ft or m)_	18 m
(if other, explain) DBH (in or cm) Height of roost area ((if known)	otal Height (ft or m)_ Dist. from cap	18 m oture site

Roost Decay State: 1 2 (3) 4 5 6 7 8 9 Other



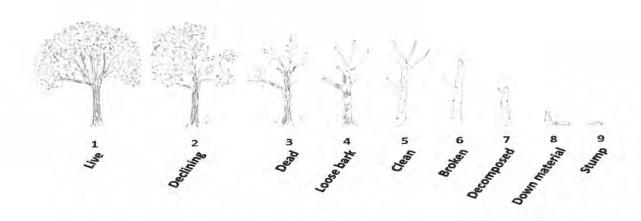
Roost tree or snag canopy position: Dominant __ Co-Dominant _X Suppressed __

Approximate woodlot size (ac or ha)	
	Distance to non-forest (ft or m)
Describe forest/woodlot current condition (matu	ure, partially cut-over, burned, insect damage, etc.)
hickories. Area mostly	enian elms, cotto nwoods, and in a wetland. The roost
tree is near a tributary	late .
Additional Comments	

USFWS INDIANA BAT ROOST DATASHEET

UTM: Zone F	Easting	Northing		_ OR
LAT 40.3432	LONG -93.0617	<u>i</u>		
Property Owner:		Phone#		
State Missouri	County SU	llivan	Site #	
Roost #	Roost Name: S	bushi Tree		
Roost Tree Data Species: Shagba (if other, explain)		Live	_ Snag X Of	ther _
				-
Species: Shagha (if other, explain)	n Total H	leight (ft or m)_	14 m	
Species: Shagba (if other, explain) DBH (in or cm) 1 1	Total H	leight (ft or m)_ _Dist. from cap	14 m ture site	

Roost Decay State: 1 2 3 4 5 6 7 8 9 Other



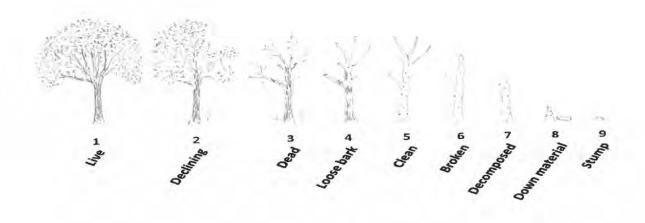
Roost tree or snag canopy position: Dominant __ Co-Dominant X Suppressed __

Canopy closui	Habitat Condition re at roost (%) woodlot size (ac or h		D	istance to non-fore	st (ft or m)	
Approximate woodlot size (ac or ha) Describe forest/woodlot current condition (matu						
open	canopy	ava	ìΛ	forested	location	
dditional Co	mments					

USFWS INDIANA BAT ROOST DATASHEET

UTM: Zone	Easting	Northing	OR
LAT 40.3446	LONG - 93.0610	<u>o</u>	
Property Owner:		Phone#	
State Missoun	County 5	ullivanSite#	
Roost #	Roost Name:	sushi Tree a	
Roost Tree Data			
Species: Shagh	bark hickory	Live X Snag Oth	ner _
Species: Shack (if other, explain) DBH (in or cm)	CM Total H		

Roost Decay State: 1 2 3 4 5 6 7 8 9 Other



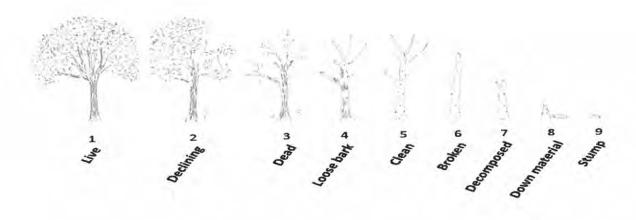
Roost tree or snag canopy position: Dominant _ Co-Dominant ∠ Suppressed _

Approximate woodlot size (ac or ha)			Distance to non-forest (ft or m)			
	forest/woodlot curren					
live	shagbark	hickory	next	to	Several	snag
dditiona	al Comments					

USFWS INDIANA BAT ROOST DATASHEET

UTM: Zone	Easting	Northing	OR
LAT	LONG	_	
Property Owner:			
State Missouri	County_	Sullivan Site #_	
Roost #	Roost Name:	Sushi tree 3	
Roost Tree Data			V Other
Species: White			
Species: White (if other, explain) DBH (in or cm) 11.	l in Tota	al Height (ft or m) 15.5	m
Species: White (if other, explain) DBH (in or cm) 11.	l in Tota		m

Roost Decay State: 1 2 3 4 5 6 7 8 9 Other



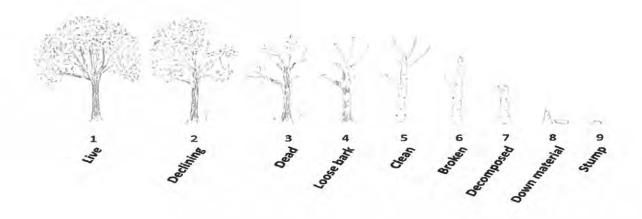
Roost tree or snag canopy position: Dominant \(\cdot \) Co-Dominant \(\subset \) Suppressed \(\subset \)

Surrounding Habitat Condition	
Canopy closure at roost (%) 45	
Approximate woodlot size (ac or ha)	Distance to non-forest (ft or m)
Describe forest/woodlot current condition (mat	ture, partially cut-over, burned, insect damage, etc.)
semi mature out hickory	forest
dense midstory at thee	but canopy is open at top
Shagbark white bak m. tim understory - Coral berry, b Additional Comments	I. Am. Chestnut lackbery, woodland sedge, cleaver
Suitable snogs within	vicinity

USFWS INDIANA BAT ROOST DATASHEET

Biologists (Full Name)	: Vona K.: Jenny	Mulkin Date:	7/10/2016		
UTM: Zone	Easting	Northing_		OR	
LAT40. 34 28	LONG -93.06	,44			
Property Owner:		Phone#_			
State MISSOUri	County_	Sulli van	Site #		
Roost #	Roost Name:	sushi tree	4		
Roost Tree Data					
Species: Shingle	oak	Live	_ Snag X Otl	her	
(if other, explain) $r = 9$ DBH (in or cm) $72 = 1$	i. din Tz=7.4in pSin Tota	al Height (ft or m)_	15.5 m		
Height of roost area (if Roost position aspect (known) <u>3-4 m</u> deg) <u>Facing</u> SW, C	Dist. from cap open to ground	ture site	sloug hing	bark was
Exfoliating bark on bo	le (%) 45°10	_ Describe: sloughi	ing <u>×</u> platy_ ti	ght_ \(\tau\)	JA 13
Cavities present?	If so, describe:		r	oost location	71

Roost Decay State: 1 2 (3) 4 5 6 7 8 9 Other



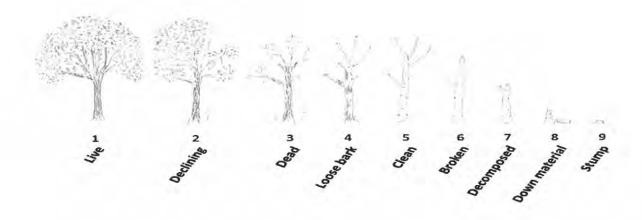
Roost tree or snag canopy position: Dominant _ Co-Dominant × Suppressed _

Surrounding Habitat Condition	
Canopy closure at roost (%)	
Approximate woodlot size (ac or ha)	Distance to non-forest (ft or m)
Describe forest/woodlot current condition	(mature, partially cut-over, burned, insect damage, etc.)
Semi mature oak/nickony	forest
large Clearing east of the in canopy midstory possibline. many snags; sna	tree and west side has open span oly selectively cleared area at one ghalk hickories near tree
Additional Comments	
inderstory - jewel weed b Shagnary hickory, white	elackberry, wood nextle
<i>J</i>	
	8

USFWS INDIANA BAT ROOST DATASHEET

Biologists (Full Name	Easting	Northing	OR
LAT 40,3446			
Property Owner:		Phone#	
State Mi SSOUri	County	Sullivan Site	#
Roost #	Roost Name	: Sushi tree 5	
Roost Tree Data			
Species: Swuy w		Live X Sn:	
Species: Sway was (if other, explain) DBH (in or cm) 11.5	To To		m

Roost Decay State: (1) 2 3 4 5 6 7 8 9 Other



Roost tree or snag canopy position: Dominant _ Co-Dominant \(\times \) Suppressed _

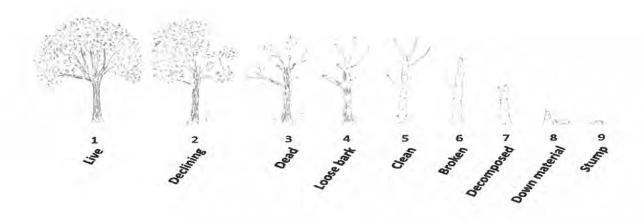
Surrounding Habitat Condition	
Canopy closure at roost (%) 50 %	
Approximate woodlot size (ac or ha)	Distance to non-forest (ft or m)
Describe forest/woodlot current condition (ma Mature oak hickory brest -	iture, partially cut-over, burned, insect damage, etc.) Covered in Shaq bark everywhere
white oak, hackberry, bu	ack halnut, American Elm-
all present in large	numbers
J	
Additional Comments	

X

USFWS INDIANA BAT ROOST DATASHEET

	(asey Date: 7/12/2016 Northing
LAT 40.3501 LONG -93	3.0907
Property Owner:	Phone#
State Missouri Cour	nty Sullivan Site#
Roost # Roost Na	me: Betty Tree a
Roost Tree Data	
Species: Shagbark hicko	Live Snag / Othe
Species: Shagbark hicko	
Species: Shag bark hicko (if other, explain) DBH (in or cm) 10 in	
Species: Shag bark hicko (if other, explain) DBH (in or cm) 10 in	Total Height (ft or m) 30 f+
Species: Shaq bark hick of (if other, explain) DBH (in or cm) Height of roost area (if known) Roost position aspect (deg)	Total Height (ft or m) 30 f+

Roost Decay State: 1 2 3 4 5 6 7 8 9 Other



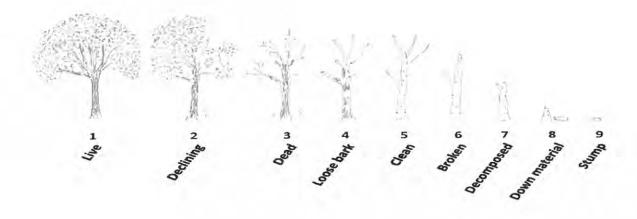
Roost tree or snag canopy position: Dominant __ Co-Dominant × Suppressed __

Approximate wood	roost (%) 10%			to non-forest (ft or m)_ ut-over, burned, insect	
		the	area.	understory	
Additional Comme	nts				

USFWS INDIANA BAT ROOST DATASHEET

UTM: Zone	Easting	Northing	OR
LAT 40.3433	LONG93.0629		
Property Owner:		Phone#	
State Missouri	County Su	livan sit	e #
Roost #	Roost Name:	ilma tree	- (
Roost Tree Data	FI	***	V ou
Species: <u>Omen</u>	ican Elm		nag X₄ Other _
Species:			
Species: <u>Qmen</u> (if other, explain) <u> </u>		ight (ft or m)	f m
Species: <u>Qmen</u> (if other, explain) <u> </u>	Total He (if known)	ight (ft or m)	f m
Species: _Qmen (if other, explain) DBH (in or cm) _U Height of roost area (Roost position aspect	Total He (if known)	ight (ft or m)\	f msite

Roost Decay State: 1 2 (3) 4 5 6 7 8 9 Other



Roost tree or snag canopy position: Dominant _ Co-Dominant \(\subseteq \) Suppressed _

	Distance to non-forest (ft or m) nature, partially cut-over, burned, insect damage, etc.)
Shagbark hickory, Ameri mature forest, 5-10	can elm, Hackberry snags in the area
Additional Comments	

Appendix G Roost Trees Photolog



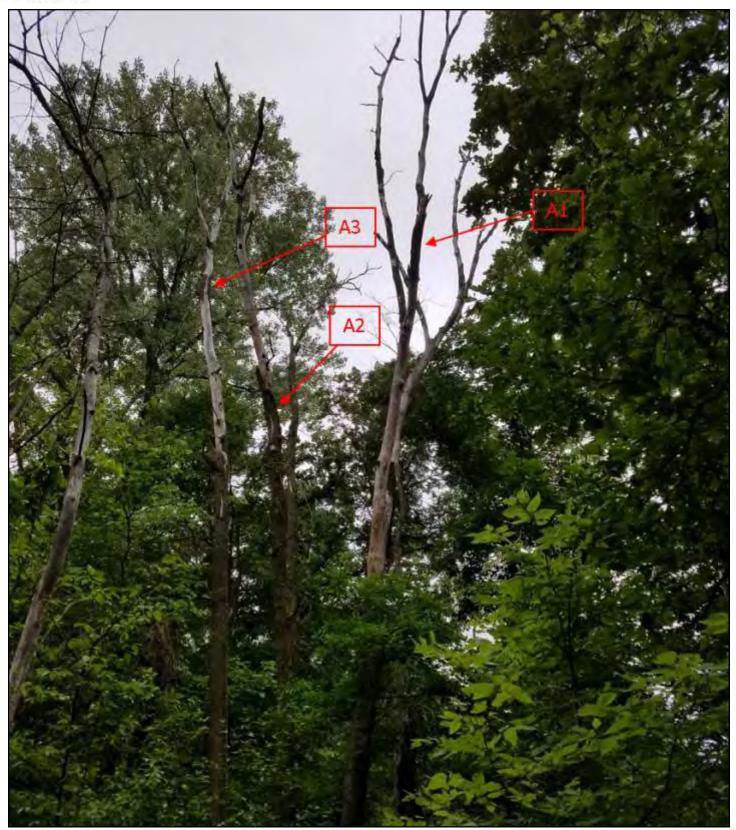


Photo No.	1	
Site:	Roost trees	A (A1; Laela Tree 1)
		B (A2; Elvira Tree 2)
		A3, Incidental Tree determined not to be a roost tree.





Site: Roost tree: C (Laela Tree 2)





Site: Roost tree: D (Elvira Tree 1)





Site: Roost tree: E (Sushi Tree 1)

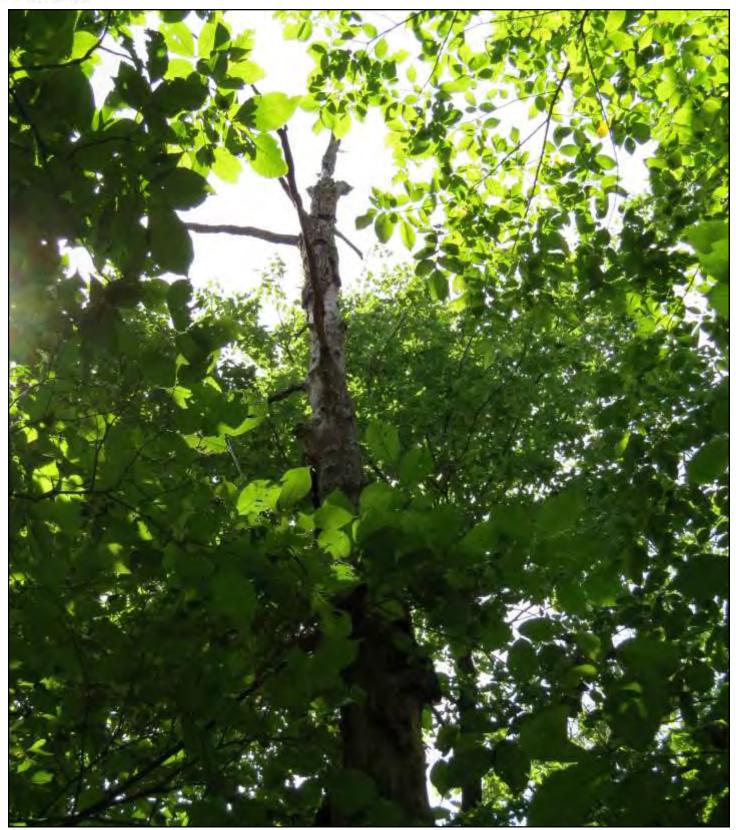




Photo No. 5 F (Sushi Tree 2)

Site: Roost tree:





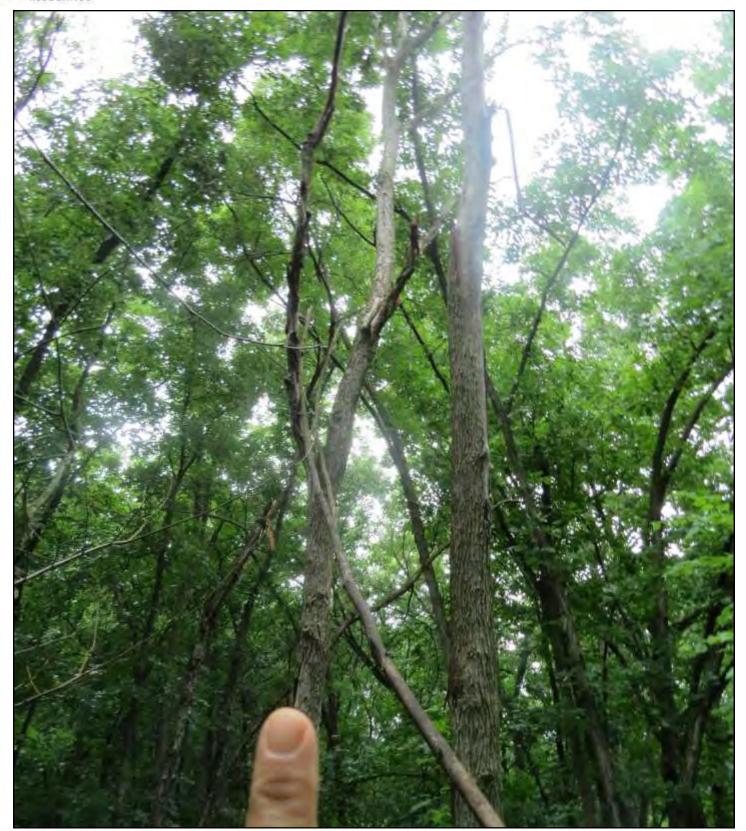
Site: Roost tree: G (Sushi Tree 3)





Site: Roost tree: H (Sushi Tree 4)





Site: Roost tree: I (Burrito Tree 1)





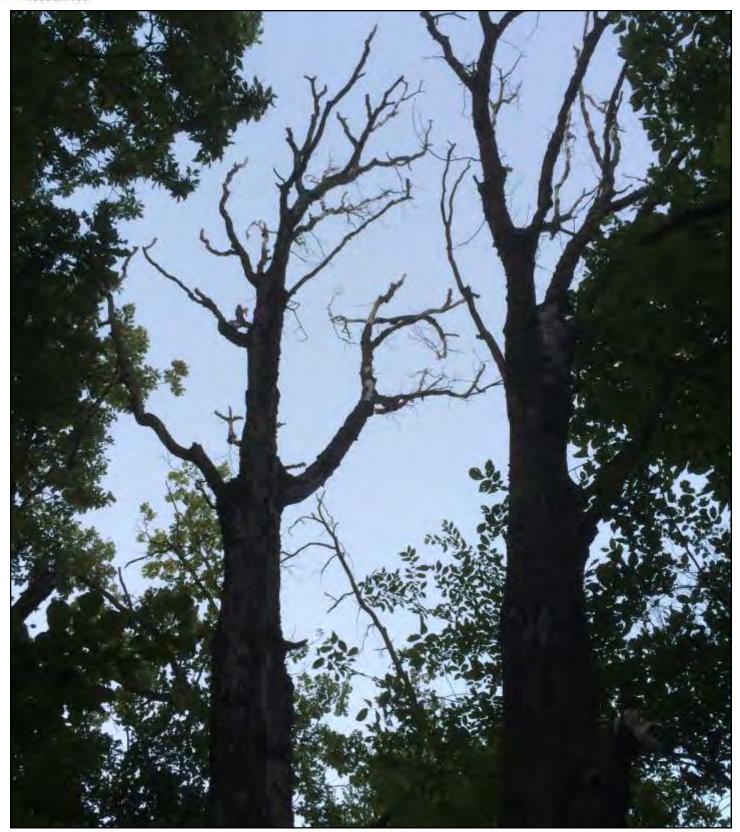
Site: Roost tree: J (Burrito Tree 2, Be y Tree 1)





K (Bett Tree 2) Site: Roost tree:





Site: Roost tree: L (Wilma Tree 1)

Appendix H USFWS Bat Emergence Survey Datasheets

APPENDIX E PHASE 4 EMERGENCE SURVEYS

USFWS BAT EMERGENCE SURVEY DATASHEET

Date: 30 June	2016 Surve	vor(s) Full Name: Buck	Ray, Jessica Casey,	Chris Corbe
State: MO Count	v: Sulliv	an Project Nam	e: East locust Cree	ek
Site Name/#: A	,	Roost Name/#	Bat #	: Laela (1)
Lat/Long or UTM o	f Roost: 40	. 2772 - 93.09	11	
Description of Roos	t/Habitat Fea			
Bat Species Known	to be using th	nis Roost/Feature (if not k	nown, leave blank):	
Other Suspected Ba	t Species (exp	olain):		
Weather Conditions	s during Surv	ey (temperature, precipita	ation, wind speed):	
Survey Start Time:	8:30	Time of Sunset:	Survey End Time:	9:30
NOTE: Emergence of the wise too dark to so be silhouetted against to or as natural breaks in lexiting/returning bats, lead on not make unnecessarecord data, if necessare	surveys should ee emerging bat he sky as they e bat activity allo- but not close en ry noise and/or y). Do not shin om emerging.	begin ½ hour before sunset and its. The surveyor(s) should post exit the roost. Tallies of emerging we Please ensure that surveyor ough to influence emergence (conversation, and minimize use a light on the roost tree crev	d continue for a minimum of 1 h sition him or herself so that emer ging bats should be recorded ever (i.e., do not stand directly beneat se of lights other than a small flatice/cave/mine entrance itself as d, night vision, or thermal-imagi	reging bats will ry few minutes to observe all the roost and ashlight to this may

Time	Number of Bats Leaving Roost*	Comments / Notes
8:50	19	19 hats including tagged but left

APPENDIX E PHASE 4 EMERGENCE SURVEYS

USFWS BAT EMERGENCE SURVEY DATASHEET

	ns (orner)
Date: 1 July 2016 Surveyor(s) Full Name: Ch State: MO County: Sulivan Project Nam	ne: Fact Crust Creek
Site Name/#: Roost Name/# A	-\ Bat #: (\$-1) (aeld
Lat/Long or UTM of Roost: 40. 2772 -9:	3.09/
Description of Roost/Habitat Feature Surveyed: <u>AMOR</u>	ican elm trees
Bat Species Known to be using this Roost/Feature (if not k	nown, leave blank):
Other Suspected Bat Species (explain):	
Weather Conditions during Survey (temperature, precipit	ation, wind speed):
Survey Start Time: 8:32 Time of Sunset:	Survey End Time: 9:25

Time	Number of Bats Leaving Roost*	Comments / Notes
8:53	31	including tagged bat
		3 71

APPENDIX E PHASE 4 EMERGENCE SURVEYS

USFWS BAT EMERGENCE SURVEY DATASHEET

Date: 3 Ju	Ly 2016 Survey	vor(s) Full Name: Chris Carpen
State: MO	County: SWING	W Project Name: Fast Dust Cicle
Site Name/#:	A	Project Name: FOST DUIST CYCEK Roost Name/# A- Bat #: (1) Alla
Lat/Long or l	UTM of Roost:	40.2772 -93.09/
<u>Am</u>	elm tre	9
Bat Species K	Malana	s Roost/Feature (if not known, leave blank):
Other Suspec	ted Bat Species (expl	ain):
Weather Con	ditions during Surve	y (temperature, precipitation, wind speed):
Survey Start	Time: 8.25	Time of Sunset: Survey End Time: 935
otherwise too da be silhouetted a or as natural bre exiting/returning do not make una record data, if n prevent or delay	gainst the sky as they exeaks in bat activity allow g bats, but not close eno- necessary noise and/or c ecessary). Do not shine bats from emerging. If	egin ½ hour before sunset and continue for a minimum of 1 hour or until it is. The surveyor(s) should position him or herself so that emerging bats will it the roost. Tallies of emerging bats should be recorded every few minutes. Please ensure that surveyor(s) are close enough to the roost to observe all ugh to influence emergence (i.e., do not stand directly beneath the roost and onversation, and minimize use of lights other than a small flashlight to a light on the roost tree crevice/cave/mine entrance itself as this may available, use of an infra-red, night vision, or thermal-imaging video nic bat detector are strongly recommended but not required.
Time	Number of Bats Leaving Roost*	Comments / Notes
9:00	Ø	i hat flew in 18 pleu)
	/	out

USFWS BAT EMERGENCE SURVEY DATASHEET 7010 Surveyor(s) Full Name:_ State: MO County: Project Name: -Roost Name/# A-Bat #: Site Name/#: Lat/Long or UTM of Roost: Description of Roost/Habitat Feature Surveyed: Bat Species Known to be using this Roost/Feature (if not known, leave blank): Other Suspected Bat Species (explain): Weather Conditions during Survey (temperature, precipitation, wind speed): Time of Sunset: Survey End Time: Survey Start Time: NOTE: Emergence surveys should begin ½ hour before sunset and continue for a minimum of 1 hour or until it is otherwise too dark to see emerging bats. The surveyor(s) should position him or herself so that emerging bats will be silhouetted against the sky as they exit the roost. Tallies of emerging bats should be recorded every few minutes or as natural breaks in bat activity allow. Please ensure that surveyor(s) are close enough to the roost to observe all exiting/returning bats, but not close enough to influence emergence (i.e., do not stand directly beneath the roost and do not make unnecessary noise and/or conversation, and minimize use of lights other than a small flashlight to record data, if necessary). Do not shine a light on the roost tree crevice/cave/mine entrance itself as this may prevent or delay bats from emerging. If available, use of an infra-red, night vision, or thermal-imaging video camera or spotting scope and an ultrasonic bat detector are strongly recommended but not required.

Time	Number of Bats Leaving Roost*	Comments / Notes
3:50	9	incidental that these
		buts were seen, came
		out of tree near
		A-19A-2.

Date: 4 July 701/ Surveyor(s) Full Name:	heis Coeben
State: MO County: SILLIVAN Project Na	me: Fast Toust Mille
Site Name/#: [Clapla Tree 2 Roost Name/#_	C-1 Bat #: 1 Call
Lat/Long or UTM of Roost: 40.2837 -93.	0936
Description of Roost/Habitat Feature Surveyed:S\u00a700	groant hickory
Bat Species Known to be using this Roost/Feature (if not	known, leave blank):
Other Suspected Bat Species (explain):	
Weather Conditions during Survey (temperature, precip	itation, wind speed):
Survey Start Time: 8.30 Time of Sunset:	Survey End Time: 9:30
NOTE: Emergence surveys should begin ½ hour before sunset otherwise too dark to see emerging bats. The surveyor(s) should p be silhouetted against the sky as they exit the roost. Tallies of emergence or as natural breaks in bat activity allow. Please ensure that survey exiting/returning bats, but not close enough to influence emergence do not make unnecessary noise and/or conversation, and minimize record data, if necessary). Do not shine a light on the roost tree creprevent or delay bats from emerging. If available, use of an infractionarca or spotting scope and an ultrasonic bat detector are strongly	position him or herself so that emerging bats will erging bats should be recorded every few minutes ever(s) are close enough to the roost to observe all e (i.e., do not stand directly beneath the roost and use of lights other than a small flashlight to evice/cave/mine entrance itself as this may red, night vision, or thermal-imaging video

Time	Number of Bats Leaving Roost*	Comments / Notes		
8:20		including tagged but		

Time	Number of Bats Leaving Roost*	Comments / Notes
3:48	7	including tagged best
		J 00

Date: 141, 2016 Surve			Livengood	=
State: MO County: Sulliva Site Name/#: Elviva Tree Lat/Long or UTM of Roost: 4	Roost Name/#			Elvina
Description of Roost/Habitat Fea	ture Surveyed: Sh	agbark sno	g	
Bat Species Known to be using th	is Roost/Feature (if not	known, leave blan	k):	
Other Suspected Bat Species (exp	olain):			
Weather Conditions during Surv	ey (temperature, precipi	tation, wind speed	I):	
Survey Start Time: 8:3	Time of Sunset:	Survey I	End Time: 9:2	.8
NOTE: Emergence surveys should be otherwise too dark to see emerging bate be silhouetted against the sky as they ever as natural breaks in bat activity allow exiting/returning bats, but not close end do not make unnecessary noise and/or record data, if necessary). Do not shim prevent or delay bats from emerging.	begin ½ hour before sunset a s. The surveyor(s) should po- xit the roost. Tallies of eme w. Please ensure that survey ough to influence emergence conversation, and minimize e a light on the roost tree cre	and continue for a min osition him or herself rging bats should be or(s) are close enoug e (i.e., do not stand di use of lights other that evice/cave/mine entra	nimum of 1 hour or uf so that emerging bat recorded every few ments to obse rectly beneath the rocan a small flashlight the notes itself as this may	ntil it is s will ninutes rve all ost and

Time	Number of Bats Leaving Roost*	Comments / Notes		
8:45	1	1 bat left tree		
		t ne		
i uid	sa liitz ma	See V Verje e 1800/W		

Site Name/#:		Roos	t Name/#:		
10000	revil will i	Leval		Vila C	Intak
iviTime	Number of Bats Leaving Roost*	8	Comments &	NS.	om
	wak Shay		82172.00		
		latis	ज्ये योगमा		
9:28			16	8:3	
	30 710	josed i	ooi	-1	zy:8
Fotal Number of Bats Observed Emerging from the Roost/Feature During the Survey:					
Describe Emerg	gence: Did bats emerge a radio-tagged bat was i	simultaneous	sly, fly off in the same of tree, at what time did	direction, loiter it emerge?	
when	to dark	1	. Tracker s	7111 ble	ping

prevent or dela	ing scope and an ultrasonic ba	at detector are strongly recommended but not required.
otherwise too d be silhouetted a or as natural br- exiting/returnin do not make un	lark to see emerging bats. The against the sky as they exit the eaks in bat activity allow. Ple ag bats, but not close enough to mecessary noise and/or convenecessary). Do not shine a lighty bats from emerging. If avail	hour before sunset and continue for a minimum of 1 hour or until it is a surveyor(s) should position him or herself so that emerging bats will roost. Tallies of emerging bats should be recorded every few minutes have ensure that surveyor(s) are close enough to the roost to observe all to influence emergence (i.e., do not stand directly beneath the roost and resation, and minimize use of lights other than a small flashlight to the nother roost tree crevice/cave/mine entrance itself as this may lable, use of an infra-red, night vision, or thermal-imaging video
		emperature, precipitation, wind speed): ne of Sunset: Survey End Time:
Other Suspec	cted Bat Species (explain):	
Bat Species I	Known to be using this Ro	ost/Feature (if not known, leave blank):
		encan Elm
	UTM of Roost: 40. 2	
Site Name/#:	A	Roost Name/# 1 - 2 Elvina Tree 2 Bat #: # L Elvina
Date: JO	why 20/10 Surveyor(s)	Full Name: Cheis Copben Project Name: Fast Laust Creek
Date: 3 1	1 4 6	Olo Olic Carlona

Time	Number of Bats Leaving Roost*	Comments / Notes
8:45	2	including tagged but
		J

Site Name/#:	y: Sulliv	vor(s) Full Name: Kim ON Project Name Roost Name/# El 0. 2773 - 93.09 ture Surveyed: Amen	e: Fast (ocust cre vira tree2 Bat#:	ek #2 Fluira
Bat Species Known	to be using th	is Roost/Feature (if not kn	nown, leave blank):	
Other Suspected Ba	t Species (exp	lain):		
Weather Conditions	during Surv	ey (temperature, precipita	ation, wind speed):	
Survey Start Time:	8:20	Time of Sunset:	Survey End Time:	9:38
NOTE: Emergence otherwise too dark to so be silhouetted against to as natural breaks in exiting/returning bats, do not make unnecessarecord data, if necessare	surveys should be emerging bat he sky as they e bat activity allow but not close energy noise and/or by). Do not shing a marging	begin ½ hour before sunset and s. The surveyor(s) should post xit the roost. Tallies of emerg w. Please ensure that surveyor ough to influence emergence (conversation, and minimize use a light on the roost tree crevits available, use of an infra-reconstruction.	d continue for a minimum of 1 has sition him or herself so that emerging bats should be recorded ever r(s) are close enough to the roost (i.e., do not stand directly beneath se of lights other than a small flastice/cave/mine entrance itself as the d, night vision, or thermal-imaging recommended but not required.	ging bats will y few minutes to observe all the roost and shlight to his may

Time	Number of Bats Leaving Roost*	Comments / Notes
8:45	1	tagged bat
- V ₁	25 PY 10WY	

Site Name/#: _	Roost Name/#:			
	horacores i	1074	5	
ASS 13 IF Time	Number of Bats Leaving Roost*	MV/3	Comments / Notes	THE
	mid n	319014	i i i di i di e	
		21.5	type officers	
28:0			12:8	
	2-1-	d been	**************************************	au.
		7	4	
Total Number of Bats Observed Emerging from the Roost/Feature During the Survey:				
* If any bats return to Describe Emerger	nce: Did bats emerge	simultaneously, fly	off in the same direction, loid that time did it emerge?	
goina	off in	the dis-	tance.	repe

Date: () July 2016 Surveyor(s) Full Name: ()	iris Corben
Date: 6 July 2016 Surveyor(s) Full Name: 6 State: MC County: Sullivan Project Nam	ne: -East Lows Creek
Site Name/#: Roost Name/#	ushi Tree Bat #: # 3 Sush
Lat/Long or UTM of Roost: 40.3432 -93. 061	7
Description of Roost/Habitat Feature Surveyed:S\u00eda	ghark hickory
Bat Species Known to be using this Roost/Feature (if not k	known, leave blank):
Other Suspected Bat Species (explain):	
Weather Conditions during Survey (temperature, precipit	ation, wind speed):
Survey Start Time: 8:25 Time of Sunset:	Survey End Time: 928
NOTE: Emergence surveys should begin ½ hour before sunset an otherwise too dark to see emerging bats. The surveyor(s) should possible silhouetted against the sky as they exit the roost. Tallies of emergor as natural breaks in bat activity allow. Please ensure that surveyor exiting/returning bats, but not close enough to influence emergence do not make unnecessary noise and/or conversation, and minimize us record data, if necessary). Do not shine a light on the roost tree crew prevent or delay bats from emerging. If available, use of an infra-recamera or spotting scope and an ultrasonic bat detector are strongly	sition him or herself so that emerging bats will ging bats should be recorded every few minutes or(s) are close enough to the roost to observe all (i.e., do not stand directly beneath the roost and use of lights other than a small flashlight to vice/cave/mine entrance itself as this may d, night vision, or thermal-imaging video

Time	Number of Bats Leaving Roost*	Comments / Notes
3:42	22	including tagged bat
		J ,
	,	

Date: 8 July 7016 Surve	vor(s) Full Name:	in's Corber)
State: County:	Project Nam	e: tast luu	St Creek
Site Name/#:	Roost Name/#	reel	_ Bat #: #3 Sush
Lat/Long or UTM of Roost: 4	0. 3432 -93.	.0617	
Description of Roost/Habitat Fea	ture Surveyed: Shag	bark hickon)
Bat Species Known to be using the	nis Roost/Feature (if not ki	nown, leave blank):	
Other Suspected Bat Species (exp	olain):		
Weather Conditions during Surv	ey (temperature, precipita	ation, wind speed):	
Survey Start Time: 8:27	Time of Sunset:	Survey End	Time: 9:25
NOTE: Emergence surveys should otherwise too dark to see emerging bat be silhouetted against the sky as they e or as natural breaks in bat activity allow exiting/returning bats, but not close end on not make unnecessary noise and/or record data, if necessary). Do not shin prevent or delay bats from emerging. It camera or spotting scope and an ultrase	s. The surveyor(s) should post at the roost. Tallies of emerg w. Please ensure that surveyor ough to influence emergence (conversation, and minimize use a light on the roost tree crevits available, use of an infra-red	cition him or herself so ging bats should be records) are close enough to i.e., do not stand direct se of lights other than a ice/cave/mine entrance I, night vision, or therm	that emerging bats will orded every few minutes of the roost to observe all ally beneath the roost and a small flashlight to itself as this may nal-imaging video

Time	Number of Bats Leaving Roost*	Comments / Notes
8:46	38	including tagged but

Date: 7 July 2010 Sur State: MO County: SU Site Name/#:	veyor(s) Full Name: Chr	eis Corben, lennifer Muliki
State: MO County: SW	Wan Project Name	e: East Locust Chek
Site Name/#:	Roost Name/#	reea Bat #: 3 (SUShi)
Lat/Long or UTM of Roost:		
Description of Roost/Habitat F	eature Surveyed: Shac	gbark hickory
Bat Species Known to be using	this Roost/Feature (if not ki	nown, leave blank):
Other Suspected Bat Species (explain):	
Weather Conditions during Su	rvey (temperature, precipita	ntion, wind speed):
Survey Start Time: 8:29	Time of Sunset:	Survey End Time: 9:27
otherwise too dark to see emerging be silhouetted against the sky as the or as natural breaks in bat activity a exiting/returning bats, but not close do not make unnecessary noise and record data, if necessary). Do not si	bats. The surveyor(s) should pos- ey exit the roost. Tallies of emerg llow. Please ensure that surveyor enough to influence emergence (solve conversation, and minimize us hine a light on the roost tree creving. If available, use of an infra-red	d continue for a minimum of 1 hour or until it is ition him or herself so that emerging bats will ging bats should be recorded every few minutes r(s) are close enough to the roost to observe all i.e., do not stand directly beneath the roost and se of lights other than a small flashlight to ice/cave/mine entrance itself as this may 1, night vision, or thermal-imaging video

Time	Number of Bats Leaving Roost*	Comments / Notes
8:42	7	including tagged but

USFWS BAT EMERGENCE SURVEY DATASHEET

Date: 7/8/16 Surv	veyor(s) Full Name: Jenn	ifer Mullikin
State: Mo County: Sulli	Van Project Name:	East Locust (Reek
Site Name/#:	Roost Name/# Sushi	Tree 2 Bat #: 3 (SUShi
Lat/Long or UTM of Roost:	10.3446 -93.0616	
Description of Roost/Habitat Fe		rya ovata
Bat Species Known to be using	this Roost/Feature (if not know	n, leave blank):
Other Suspected Bat Species (ex	rplain):	
Weather Conditions during Sur		
Survey Start Time: 8.25	Time of Sunset: 8:43	Survey End Time:9'. 29
otherwise too dark to see emerging b be silhouetted against the sky as they or as natural breaks in bat activity all exiting/returning bats, but not close e	ats. The surveyor(s) should position exit the roost. Tallies of emerging ow. Please ensure that surveyor(s) a mough to influence emergence (i.e., or conversation, and minimize use of	ntinue for a minimum of 1 hour or until it is a him or herself so that emerging bats will bats should be recorded every few minutes are close enough to the roost to observe all do not stand directly beneath the roost and lights other than a small flashlight to ave/mine entrance itself as this may

prevent or delay bats from emerging. If available, use of an infra-red, night vision, or thermal-imaging video

camera or spotting scope and an ultrasonic bat detector are strongly recommended but not required.

Time	Number of Bats Leaving Roost*	Comments / Notes
8:48		Sushi left
8.56		Sushi came back
9:11		
9:21		sushi left
9:29	End	sushi left too dark to see

Site Name/#: _		Roost Name/#	#:	
	Control of			
	Number of Bats Leaving Roost*	Maug	Comments / Notes	Mo Mo
	ya everla	क्षा करा । कार्यक्षा का	40. sq	
	zi,o bo	e akayin		
4:23		girts basq	5 MICH 2 19 9	755Y 3
	Anni s	Sushi left	,	
Fotal Number of Bats Observed		-Pal West	i	12:12
Emerging from the Roost/Feature During the Survey:	852	ni dinah na	h 1973	9 (1.19
Describe Emerg	gence: Did bats emer	e survey, then they should be ge simultaneously, fly of as roosting in the tree, at v	f in the same direction,	loiter, circle,

USFWS BAT EMERGENCE SURVEY DATASHEET
Date: 7/9/16 Surveyor(s) Full Name: Jennifer Mullikin & Jessica Cas
State: MD County: Sullivan Project Name: Fast Louist (Reck
Site Name/#: Roost Name/# Sushi Tree 3 Bat #: 3 (SUShi)
1 4/1 TUTM of Doorts 116 2447 - 93 0417
Description of Roost/Habitat Feature Surveyed: Shag has next to live
Bat Species Known to be using this Roost/Feature (if not known, leave blank): My015 500015
Other Suspected Bat Species (explain):
Weather Conditions during Survey (temperature, precipitation, wind speed):
Survey Start Time: 8.40 Time of Sunset: 8:44 Survey End Time: 9:41
NOTE: Emergence surveys should begin ½ hour before sunset and continue for a minimum of 1 hour or until it is otherwise too dark to see emerging bats. The surveyor(s) should position him or herself so that emerging bats will be silhouetted against the sky as they exit the roost. Tallies of emerging bats should be recorded every few minutes or as natural breaks in bat activity allow. Please ensure that surveyor(s) are close enough to the roost to observe all exiting/returning bats, but not close enough to influence emergence (i.e., do not stand directly beneath the roost and do not make unnecessary noise and/or conversation, and minimize use of lights other than a small flashlight to record data, if necessary). Do not shine a light on the roost tree crevice/cave/mine entrance itself as this may prevent or delay bats from emerging. If available, use of an infra-red, night vision, or thermal-imaging video camera or spotting scope and an ultrasonic bat detector are strongly recommended but not required.

Time	Number of Bats Leaving Roost*	Comments / Notes		
9:03	1	Sushi left tree		
9:13	1	bat left tree on south facing piece of bark last bat left		
年至	李	piece of bark		
9:21		last bat left		

	Roost Name/#:		
Dec Mart	1. 49:		All a t
Number of Bats	et il		o.M
Wat of	Apport History	in y	mdar.(2
	eliatos sito	Ųπ	
	ina jayan si		- 1 1
337:	Hal Inland		51.
	Mir Main baca		£1.3
	Por legi		
	Number of Bats Leaving Roost*	Leaving Roost* Comments	Number of Bats Leaving Roost* Comments / Notes

Date: 7/15/16 Surveyor(s) Full Name: Jessica (asey
State: MO County: Sullivan Project Name: East LOCUST Creek
Site Name/#: Roost Name/# Sushi Tree#3 Bat #: 3 (Sushi)
Lat/Long or UTM of Roost: 40. 3442 -93.067
Description of Roost/Habitat Feature Surveyed: white oak, next to Suitable snag
Bat Species Known to be using this Roost/Feature (if not known, leave blank):
Other Suspected Bat Species (explain):
Weather Conditions during Survey (temperature, precipitation, wind speed): Precip / Wind, 79 of Survey Start Time: 8:29 Time of Sunset: 8:41 Survey End Time: 9:45
NOTE: Emergence surveys should begin ½ hour before sunset and continue for a minimum of 1 hour or until it is otherwise too dark to see emerging bats. The surveyor(s) should position him or herself so that emerging bats will be silhouetted against the sky as they exit the roost. Tallies of emerging bats should be recorded every few minutes or as natural breaks in bat activity allow. Please ensure that surveyor(s) are close enough to the roost to observe all exiting/returning bats, but not close enough to influence emergence (i.e., do not stand directly beneath the roost and do not make unnecessary noise and/or conversation, and minimize use of lights other than a small flashlight to record data, if necessary). Do not shine a light on the roost tree crevice/cave/mine entrance itself as this may prevent or delay bats from emerging. If available, use of an infra-red, night vision, or thermal-imaging video camera or spotting scope and an ultrasonic bat detector are strongly recommended but not required.

Time	Number of Bats Leaving Roost*	Comments / Notes
	Ø	No bats left the free
	/	
		several bats were seen
		flying around trees but did not come from the
		Roost tree

Site Name/#:	Roost Name/#:	

Time	Number of Bats Leaving Roost*	Comments / Notes
		1100.85 - 21.00 . 30
	7	
otal Number of ats Observed merging from the cost/Feature uring the Survey:	Ø	

^{*} If any bats return to the roost during the survey, then they should be subtracted from the tally.

Describe Emergence	Did bats emerge simultaneously, fly off in the same direction, loiter, circle,
disperse, etc. If a radi	o-tagged bat was roosting in the tree, at what time did it emerge?

JA		
4/.		

USFWS BAT EMERGENCE SURVEY DATASHEET

Date: 7/10/16 Surveyor(s) Full Name: Jennifer Mullikin
State: MO County: Sullivan Project Name: Fast Doust Cleek
Site Name/#: Roost Name/# Sushi Tree 4 Bat #: 3 (Cushi
Lat/Long or UTM of Roost: 40.3428 -93.0644
Description of Roost/Habitat Feature Surveyed: Shag (Shingle Oak)
Bat Species Known to be using this Roost/Feature (if not known, leave blank):
Other Suspected Bat Species (explain):
Weather Conditions during Survey (temperature, precipitation, wind speed):
Survey Start Time: 8:40 Time of Sunset: 8:44 Survey End Time: 9:40
NOTE: Emergence surveys should begin ½ hour before sunset and continue for a minimum of 1 hour or until it is otherwise too dark to see emerging bats. The surveyor(s) should position him or herself so that emerging bats will be silhouetted against the sky as they exit the roost. Tallies of emerging bats should be recorded every few minutes or as natural breaks in bat activity allow. Please ensure that surveyor(s) are close enough to the roost to observe all exiting/returning bats, but not close enough to influence emergence (i.e., do not stand directly beneath the roost and

NOTE: Emergence surveys should begin ½ hour before sunset and continue for a minimum of 1 hour or until it is otherwise too dark to see emerging bats. The surveyor(s) should position him or herself so that emerging bats will be silhouetted against the sky as they exit the roost. Tallies of emerging bats should be recorded every few minutes or as natural breaks in bat activity allow. Please ensure that surveyor(s) are close enough to the roost to observe all exiting/returning bats, but not close enough to influence emergence (i.e., do not stand directly beneath the roost and do not make unnecessary noise and/or conversation, and minimize use of lights other than a small flashlight to record data, if necessary). Do not shine a light on the roost tree crevice/cave/mine entrance itself as this may prevent or delay bats from emerging. If available, use of an infra-red, night vision, or thermal-imaging video camera or spotting scope and an ultrasonic bat detector are strongly recommended but not required.

Time	Number of Bats Leaving Roost*	Comments / Notes
8:53	1	Sushi left roost.
8:58	1	same roost spot as sushi
9:10	1	different roost spot, same tree
9:13	1	same tree, different spot
111	100 1 100	
and Mark		35 N 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
9:10 -	9:20 lots	of activity in clearing to to
east	of the ro	ost tree and flew in corricl
to th	he west	of the tree. None seen
flying	into t	ree from my anale.
, ,		
9.40	Stop	

4.400	Number of Bats Leaving Roost*	MW)	Comments / Not	es	174
	the sp. 1/10	Carlo Carlo	J. 1945		
		225	alayn,		
= 1116	1.1	ing 5 lim	ur buq	30-14	
- ', interior	51.	१८५ मेर्स अल	₩. •\$		85.3
Total Number of Sats Observed Emerging from the Roost/Feature During the Survey:	4	2 from tree, tw	tagged	bat's	location cent lo

Date: 7/11/16 Surveyor(s) Full Name: Jennifer Mullikin
State: MO County: Sullivan Project Name: East Ocust Creek
Site Name/#: Roost Name/# Sushi TRee 4 Bat #: 3 (Sushi)
Lat/Long or UTM of Roost: 40. 3428 -73.0644
Description of Roost/Habitat Feature Surveyed: Snag w/ Sloughing bark or Multiple branches
Bat Species Known to be using this Roost/Feature (if not known, leave blank):
Other Suspected Bat Species (explain):
Weather Conditions during Survey (temperature, precipitation, wind speed):
Survey Start Time: 8.25 Time of Sunset: 8.43 Survey End Time: 9:33
NOTE: Emergence surveys should begin ½ hour before sunset and continue for a minimum of 1 hour or until it is otherwise too dark to see emerging bats. The surveyor(s) should position him or herself so that emerging bats will be silhouetted against the sky as they exit the roost. Tallies of emerging bats should be recorded every few minutes or as natural breaks in bat activity allow. Please ensure that surveyor(s) are close enough to the roost to observe all exiting/returning bats, but not close enough to influence emergence (i.e., do not stand directly beneath the roost and do not make unnecessary noise and/or conversation, and minimize use of lights other than a small flashlight to record data, if necessary). Do not shine a light on the roost tree crevice/cave/mine entrance itself as this may brevent or delay bats from emerging. If available, use of an infra-red night vision or thermal-imaging video

Time	Number of Bats Leaving Roost*	Comments / Notes
		none seen leaving tree
		very windy
5/8/27	, j +, '	-s-vie vjenje, e
G: (1/D		lain 19 1 1 1 1 1 1
9:06		bird left top of tree
7.04		Cleaning to the west of t
		tree tree
9:10		2
	, -,	bats seen foraging in
	15.1	12 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

Site Name/#:		Roost Name/#:
	WANT THE	MAN.
Time	Number of Bats Leaving Roost*	Comments / Notes
	Autoria in	33.90.82 - 8.88.08
150 67	Mary - W	This so the state of the second
	,	Production States
	-	TACAGE AGE, TOTAL TOTAL
55.0		i predip industri utinci
-una - T		

Total Number of
Bats Observed
Emerging from the
Roost/Feature

Windy - top Or
SWaying

During the Survey:

visibly

* If any bats return to the roost during the survey, then they should be subtracted from the tally.

Describe Emergence: Did bats emerge simultaneously, fly off in the same direction, loiter, circle, disperse, etc. If a radio-tagged bat was roosting in the tree, at what time did it emerge?

N/A - no bats seen emerging

Date: 714/2016 Surveyor(s) Full Name: Jessica (asev
State: MO County: Sullivan Project Name: Fast Locust creek
Site Name/#: Roost Name/# Sushi Tree # 4 Bat #: Sushi (3
Lat/Long or UTM of Roost: 40. 3428 - 93. 0644
Description of Roost/Habitat Feature Surveyed: Shaq w/ Sloughing bark on multiple branches. Shingle oak
Bat Species Known to be using this Roost/Feature (if not known, leave blank):
Other Suspected Bat Species (explain):
Weather Conditions during Survey (temperature, precipitation, wind speed):
Survey Start Time: 8:28 Time of Sunset: 8:42 Survey End Time: 9:39
NOTE: Emergence surveys should begin ½ hour before sunset and continue for a minimum of 1 hour or until it is otherwise too dark to see emerging bats. The surveyor(s) should position him or herself so that emerging bats will be silhouetted against the sky as they exit the roost. Tallies of emerging bats should be recorded every few minutes or as natural breaks in bat activity allow. Please ensure that surveyor(s) are close enough to the roost to observe all exiting/returning bats, but not close enough to influence emergence (i.e., do not stand directly beneath the roost and do not make unnecessary noise and/or conversation, and minimize use of lights other than a small flashlight to record data, if necessary). Do not shine a light on the roost tree crevice/cave/mine entrance itself as this may

Time	Number of Bats Leaving Roost*	Comments / Notes
9:17	1	First but emerged
9:19		First but emerged Last but emerged
		2 bats left the tree

Site Name/#:	Roost Name/#:	
--------------	---------------	--

Time	Number of Bats Leaving Roost*	Comments / Notes
	- 4	10. 3428 - 75.069
	/	
Total Number of		
Bats Observed	N	I had hee
Emerging from the	2	both from the tree
Roost/Feature During the Survey:		130.117

^{*} If any bats return to the roost during the survey, then they should be subtracted from the tally.

Describe Emergence:	Did bats emerge simultaneously, fly off in the same dire	ection, loiter, circle,
disperse, etc. If a radio	o-tagged bat was roosting in the tree, at what time did it e	emerge?
the property of the property		\triangle I

hid	not emerge simultaneously, fleu	2
טוע	THE ETTERS	
in	different directions.	_

Date: 7/11/2016 Surveyor(s) Full Name: Vona K, agron Ball	
State: MO County: Sullivan Project Name: East Cocust Creek	_
Site Name/#: Roost Name/# Sushi Tree 5 Bat #: 3 (So	1151:
Lat/Long or UTM of Roost: 40. 3446 -93.0619	ASPIL,
Description of Roost/Habitat Feature Surveyed: Shagbark hickory	=
Bat Species Known to be using this Roost/Feature (if not known, leave blank):	
Other Suspected Bat Species (explain): NA	_
Weather Conditions during Survey (temperature, precipitation, wind speed): 82°F, no rain, no wind Survey Start Time: 8:15 pm Time of Sunset: 8:43 pm Survey End Time: 9:45pm	-
Survey Start Time: 8:15 pm Time of Sunset: 8:43 pm Survey End Time: 9:45	n
NOTE: Emergence surveys should begin ½ hour before sunset and continue for a minimum of 1 hour or until it otherwise too dark to see emerging bats. The surveyor(s) should position him or herself so that emerging bats will be silhouetted against the sky as they exit the roost. Tallies of emerging bats should be recorded every few minute or as natural breaks in bat activity allow. Please ensure that surveyor(s) are close enough to the roost to observe all exiting/returning bats, but not close enough to influence emergence (i.e., do not stand directly beneath the roost and not make unnecessary noise and/or conversation, and minimize use of lights other than a small flashlight to be ecord data, if necessary). Do not shine a light on the roost tree crevice/cave/mine entrance itself as this may be or event or delay bats from emerging. If available, use of an infra-red, night vision, or thermal-imaging video ammera or spotting scope and an ultrasonic bat detector are strongly recommended but not required.	is s

Time	Number of Bats Leaving Roost*	Comments / Notes			
		no bats seen leaving Sushi did not leave the tree			

	TO
Site Name/#:	Roost Name/#:

Time	Number of Bats Leaving Roost*	Comments / Notes
	(°) a)	ं. इंस्पूर्व - इंड. ए
otal Number of		
ts Observed		
nerging from the	X	
oost/Feature uring the Survey		

^{*} If any bats return to the roost during the survey, then they should be subtracted from the tally.

Describe Emergence: Did bats emerge simultaneously, fly off in the same direction, loiter, circle, disperse, etc. If a radio-tagged bat was roosting in the tree, at what time did it emerge?

2 or more bats were flying near tree icircling for about 3 minutes. I did not see where they came from and neither did taron. The bats were very high up in tree where there has a 46 lot of vegetation covering the top of shagbark we were watching.

Date: 7/12/2016 Survey	yor(s) Full Name:	Kim	Livengood	
State: MO County: Sulliv	an Proje	ct Name: {	ast locust a	reek
Site Name/#:	Roost Name	# Sushi	Tree & Ba	t#: 3 (SUShi)
Lat/Long or UTM of Roost: 4	and the second second	93.061		- Cansilly
Description of Roost/Habitat Feat	ture Surveyed:	Shagbar	k hickory	
Bat Species Known to be using thi	is Roost/Feature (i Spd alis	f not known	, leave blank):	
Other Suspected Bat Species (expl				
Weather Conditions during Surve	y (temperature, p	recipitation,	wind speed):	
Survey Start Time: 8:40	Time of Sunset:	8:43	Survey End Time	: 9:25
NOTE: Emergence surveys should be otherwise too dark to see emerging bats be silhouetted against the sky as they exper as natural breaks in bat activity allow exiting/returning bats, but not close enough on the make unnecessary noise and/or creecord data, if necessary). Do not shine prevent or delay bats from emerging. If the camera or spotting scope and an ultrasor	egin ½ hour before su. The surveyor(s) shout the roost. Tallies of Please ensure that sugh to influence emeronversation, and minimalight on the roost travailable, use of an i	unset and controlled position has build position has burveyor(s) are rgence (i.e., do imize use of linee crevice/cavnfra-red, night	inue for a minimum of tim or herself so that en ts should be recorded e c close enough to the ro- o not stand directly bene- ghts other than a small re/mine entrance itself at t vision, or thermal-ima	1 hour or until it is nerging bats will very few minutes ost to observe all eath the roost and flashlight to s this may ging video

Time	Number of Bats Leaving Roost*	Comments / Notes
8:55	Ø	I hat seen leaving a most above
9:00	8	I bat seen leaving a roost above I bat seen leaving an unknown
7-3	,	above trees. These bats cannot be
		attributed to this roost being so
		J
		No bats were seen to leave roos
		trainsmitter may have come Off ?
		bat and was still transmittering
		end of sampling period.
		7. 9

APPENDIX E

Site Name/#: _		Roost Name/#:
Time	Number of Bats Leaving Roost*	Comments / Notes
		45.3446 -73.06
	proporty year	a cont
Fotal Number of Bats Observed Emerging from the Roost/Feature		
During the Survey:		
* If any bats retu	rn to the roost during the	survey, then they should be subtracted from the tally.

Bats Observed Emerging from the Roost/Feature During the Survey:	
Describe Emergence:	Did bats emerge simultaneously, fly off in the same direction, loiter, circle, tagged bat was roosting in the tree, at what time did it emerge?
	46

Date: 7/(0/16) Surveyor(s) Full	Name: Buck 2	ou & lession C	asal
Date: 7/6/16 Surveyor(s) Full State: PO County: Sullivan	Project Name:	East Locust (P)	eek
Site Name/#: Roos	t Name/# BURR	ito Tree Bat #	#: 4 (Burrito)
Lat/Long or UTM of Roost: 40. 3384	-93.0723		(0000)
Description of Roost/Habitat Feature Survey	ved: snag (American Flm	.)
Bat Species Known to be using this Roost/Fer	ature (if not know	n, leave blank):	
Other Suspected Bat Species (explain):			
Weather Conditions during Survey (tempera	nture, precipitation	n, wind speed):	
Survey Start Time: 8:35 Time of S	unset: 8:45	Survey End Time:	9:20
NOTE: Emergence surveys should begin ½ hour to otherwise too dark to see emerging bats. The survey	before sunset and cor or(s) should position	ntinue for a minimum of 1 h	our or until it is

Time	Number of Bats Leaving Roost*	Comments / Notes
8:51	1	First bat
8:55	1	Tagged bat left area (Burrito)
Buck	3 Bats	
Jessica	4 Bats	

5,953	Number of Bats	P	ments / Notes	0,70
m.Time	Leaving Roost*	8384 -43.02 ENERT		
	I maingrin		7.47	
(11)	1200, 129111			
	4	23, 37,	S. Strottin	
05.16		ZD:3	22.3	
				13.8
7.		pod texti		
20.000	18 × 12 5 × 3.6	The two company	•	49.00
Total Number of Bats Observed				
Emerging from the Roost/Feature			3 10 15	3510
Dooct/Locture		1	No.	*******

Date: 7/8/2016 Surveyor(s	(s) Full Name: Jessica Casey
State: MO County: Sullivar	
Site Name/#:	Roost Name /# Burrito Tree 2 Bat #: 4 (BURREIT
Lat/Long or UTM of Roost: 40. 3	3359 -93.0F43
Description of Roost/Habitat Feature S	Surveyed: <u>Snag</u> (American elm)
	oost/Feature (if not known, leave blank):
Other Suspected Bat Species (explain):):
1 - 1 - 1	emperature, precipitation, wind speed):
Survey Start Time: 8:05 Tin	me of Sunset: 8:44 Survey End Time: 9: 32
otherwise too dark to see emerging bats. The be silhouetted against the sky as they exit the or as natural breaks in bat activity allow. Plea exiting/returning bats, but not close enough to do not make unnecessary noise and/or conver record data, if necessary). Do not shine a light prevent or delay bats from emerging. If avail-	hour before sunset and continue for a minimum of 1 hour or until it is not surveyor(s) should position him or herself so that emerging bats will be roost. Tallies of emerging bats should be recorded every few minutes ease ensure that surveyor(s) are close enough to the roost to observe all to influence emergence (i.e., do not stand directly beneath the roost and ersation, and minimize use of lights other than a small flashlight to ght on the roost tree crevice/cave/mine entrance itself as this may ilable, use of an infra-red, night vision, or thermal-imaging video but detector are strongly recommended but not required.

Time	Number of Bats Leaving Roost*	Comments / Notes
9:07	1	First bat left
9:15	2	1 was Burrito
		Burrito continued to fly in and out of the area, but never returned to the tree
7 400	AL ALIMAN	I THE SALE SALE SALE TO
7.8	Dec letter	THE WAY THE WAY THE

Site Name/#:	Roost Name/#:	

Time	Number of Bats Leaving Roost*		Comme	nts / Notes	
		30.65	पार्ट, इक्ष्टल		
V. 340-	LEADI ANTEL	Ford			
		il rilad	altopii.		
~ 0 +6		nun		UNIC	7 1 7
- 5.11				301	
1					
	113	150	testi i		7 m (L)
	o'iau		¥ 14	74.A	G is f
Total Number of Bats Observed Emerging from the Roost/Feature	ii berm	in serior	Suite H		

^{*} If any bats return to the roost during the survey, then they should be subtracted from the tally.

Describe Emergence: Did bats emerge simultaneously, fly off in the same direction, loiter, circle, disperse, etc. If a radio-tagged bat was roosting in the tree, at what time did it emerge?

2 bats left simultaneously, did not fly off in the same direction. Burrito loitered around the area. Burrito emerged at 9:15pm.

Date: 7/11/Z016 Surve	yor(s) Full Name: Jessic	a Casey
State: mo County: Sulliu	Project Name: E	east locust Creek
Site Name/#:	Roost Name/# Wilm	a Tree 1 Bat #: 7 (Wilm
Lat/Long or UTM of Roost: 40	. 3433 -93.062	9
Description of Roost/Habitat Feat	ture Surveyed: American	
Bat Species Known to be using th	Roost/Feature (if not know) Otis Sodalis	n, leave blank):
Other Suspected Bat Species (exp		
Weather Conditions during Survey humid, 90°F, 1-3	ey (temperature, precipitation mph wind	, wind speed):
Survey Start Time: 8.20	Time of Sunset: 8:43	Survey End Time: 9:33
otherwise too dark to see emerging bats be silhouetted against the sky as they ex or as natural breaks in bat activity allow	the surveyor(s) should position but the roost. Tallies of emerging but. Please ensure that surveyor(s) arough to influence emergence (i.e., donversation, and minimize use of labels a light on the roost tree crevice/car	ve/mine entrance itself as this may

Time	Number of Bats Leaving Roost*	Comments / Notes
1:03	DEALER OF	First bat left tree
:06	T.	tagged but left (Wilma)
7:15	1	last bat left tree before
		too dark to see

Site Name/#:	Roost Name/#:
Site Name/#:	Roost Name/#:

Time	Number of Bats Leaving Roost*	Comments / Notes
	P - P	10.89- 8888 CF
	2	
		A
Total Number of		
Bats Observed Emerging from the	N N	
Roost/Feature During the Survey:		
		e survey, then they should be subtracted from the tally.

Date: 7 12 2016 Surv	veyor(s) Full Name: Vova	2 K
State: Mo County: Sulliv	Ion Project Name:	East LDCust Creek
Site Name/#:	Roost Name/# W/i/w	natree Bat #: 7 (Wilma)
Lat/Long or UTM of Roost: 4	0.343) -93.0629	(night 2)
Description of Roost/Habitat Fe		(American e(m)
Bat Species Known to be using t	this Roost/Feature (if not know	vn, leave blank):
Other Suspected Bat Species (ex		
Weather Conditions during Sur 84°F, no rain,	vey (temperature, precipitatio	
Survey Start Time: 8:35	Time of Sunset: 8:43	Survey End Time: 9:35 pm
NOTE: Emergence surveys should otherwise too dark to see emerging babe silhouetted against the sky as they or as natural breaks in bat activity allow exiting/returning bats, but not close en	begin ½ hour before sunset and courts. The surveyor(s) should position exit the roost. Tallies of emerging to we. Please ensure that surveyor(s) arough to influence emergence (i.e., conversation, and minimize use of the a light on the roost tree crevice/c If available, use of an infra-red, nig	ntinue for a minimum of 1 hour or until it is in him or herself so that emerging bats will bats should be recorded every few minutes are close enough to the roost to observe all do not stand directly beneath the roost and flights other than a small flashlight to eave/mine entrance itself as this may ght vision, or thermal-imaging video

Time	Number of Bats Leaving Roost*	Comments / Notes
8:59	2	
8:59 9:04	1	tagged bat

Site Name/#: Roost Name	e/#:
-------------------------	------

Time	Number of Bats Leaving Roost*	Comments / Notes
		40. 3423 - 43. cm 2. 7
LINNE	American	
	+	
		1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1
Total Number of		
Bats Observed Emerging from the		
Roost/Feature	2	
During the Survey:		

^{*} If any bats return to the roost during the survey, then they should be subtracted from the tally.

Describe Emergence: Did bats emerge simultaneously, fly off in the same direction, loiter, circle, disperse, etc. If a radio-tagged bat was roosting in the tree, at what time did it emerge?

Bats emerged. I after the other; flew in same direction quickly away from tree.

	cyor(s) I un Maine. Jes	sica Casey	
State: Mo County: Sulliv	an Project Nan	ne: East locust (ree	k
Site Name/#:	Roost Name/# Be	Utu Tree 2 Ba	it #: 8 - Beth
Lat/Long or UTM of Roost:	40.3501 -93.0	907	Long
Description of Roost/Habitat Fe			ag
Bat Species Known to be using t	his Roost/Feature (if not b	known, leave blank):	
Other Suspected Bat Species (ex	plain):		
Weather Conditions during Survey	vey (temperature, precipit	ation, wind speed):	
- 0011011	CUP, IOUI WING		
Survey Start Time: 8:15	eciρ, low win 0 _ Time of Sunset:	Survey End Time	9:30

Time	Number of Bats Leaving Roost*	Comments / Notes
9:00	1	first bat left
9:21	1	Second but left (Betty)
	see 6 de	
124	W.V.	d bats the not as Iwa s
		direction.

	Number of Bats		Sullivan	own wife
Fime	Leaving Roost*	प्रस्थित प्रसिध	Comments / Notes	
		1370.49	10gs - 22 L	
20	ks hower-	110000000		
		31,	myotis sodal	
				
		brid	*F, o'Frecip, law	टे हैं
0:30			GI. D	
		123) 100	1 1-15	0015
	(. 112 8) Light	tow to		19:21
	1,31,34	7.5.4		
Total Number of Bats Observed Emerging from the Roost/Feature				
During the Survey:				
			ey should be subtracted from the tall	
Describe Eme disperse, etc.	ergence: Did bats emo	erge simultaneou vas roosting in th	sly, fly off in the same direction, e tree, at what time did it emerge	loiter, circle,
2 6	ats left n	ot at	the same H	m, or
disact				,

USFWS BAT EMERGENCE SURVEY DATASHEET

Date: 7 1 3 2010 Surve	yor(s) Full Name: \ SS(C)	a Casey
State: Mo County: Sulliv	Jan Project Name:	East Louist creek
Site Name/#:	Roost Name/# Betly	Tree Bat #: # 8 Beth
Lat/Long or UTM of Roost: 4		
Description of Roost/Habitat Feat	ture Surveyed: American	Elm 15070
Bat Species Known to be using th	is Roost/Feature (if not known MYOtis Sodalis	ı, leave blank):
Other Suspected Bat Species (exp	lain):	
Weather Conditions during Surve	wind	
Survey Start Time: 8.25		
be silhouetted against the sky as they ex or as natural breaks in bat activity allow	s. The surveyor(s) should position have the roost. Tallies of emerging bars. Please ensure that surveyor(s) are pugh to influence emergence (i.e., do conversation, and minimize use of lies a light on the roost tree crevice/cay of available, use of an infra-red, night	ve/mine entrance itself as this may

Time	Number of Bats Leaving Roost*	Comments / Notes
9:05 9:24	I I	First hat to emerge from tree
9:24	1	First but to emerge from tree

Site Name/#:	Roost Name/#:	
Site Name/#:	Roost Name/#.	

Time	Number of Bats Leaving Roost*	Betty	Comments / Notes
		1.065 55	iate aff
	is your and water		
tal Number of ts Observed nerging from the	2	both	from roost tree
ost/Feature tring the Survey:	1		4-00

^{*} If any bats return to the roost during the survey, then they should be subtracted from the tally.

Describe Emergence: Did bats emerge simultaneously, fly off in the same direction, loiter, circle, disperse, etc. If a radio-tagged bat was roosting in the tree, at what time did it emerge?

2	bats	left	at	Seper	ate	time	s, both left
in	the	west	di	rection	No	bats	s, both left returned
	the +						

USFWS BAT EMERGENCE SURVEY DATASHEET

Date: //16/16 Survey	or(s) Full Name:	lessi	ca lasey	
State: MO County: Sullive	w Proje	ct Name: E	ust locust C	reek
Site Name/#:	Roost Name	# Bethi.	Tree #2 Bat #	#: 8 - Both
Lat/Long or UTM of Roost:		7		
Description of Roost/Habitat Featu	ire Surveyed:	shagbarl	e Hickory sn	ag
Bat Species Known to be using this	Roost/Feature (i	if not known,	leave blank):	
Other Suspected Bat Species (expla				
Weather Conditions during Survey 83 °F / 12 Precip / 10 Survey Start Time: 8:25	(temperature, p	recipitation,	wind speed):	
Survey Start Time: 8:25	Time of Sunset:	8:41 pm	Survey End Time:	9:39
NOTE: Emergence surveys should be otherwise too dark to see emerging bats, be silhouetted against the sky as they exit or as natural breaks in bat activity allow, exiting/returning bats, but not close enouged not make unnecessary noise and/or correcord data, if necessary). Do not shine a prevent or delay bats from emerging. If a camera or spotting scope and an ultrasonic	gin ½ hour before so The surveyor(s) she to the roost. Tallies of Please ensure that so gh to influence eme inversation, and min a light on the roost to available, use of an i	unset and continuould position his of emerging bat surveyor(s) are rgence (i.e., do imize use of ligree crevice/cave infra-red, night	mue for a minimum of 1 h m or herself so that emer is should be recorded ever close enough to the roost not stand directly beneat this other than a small flate/mine entrance itself as t vision, or thermal-imagin	our or until it is ging bats will ry few minutes to observe all h the roost and shlight to his may

Time	Number of Bats Leaving Roost*	Comments / Notes
9:15	1	First but emerged
9:17	1	First bat emerged the gged bat (Betty) emerge

Site Name/#:	Roost Name/#:

Time	Number of Bats Leaving Roost*	Comments / Notes
_		
tal Number of		
ts Observed nerging from the ost/Feature	2	

^{*} If any bats return to the roost during the survey, then they should be subtracted from the tally.

Describe Emergence: Did bats emerge simultaneously, fly off in the same direction, loiter, circle, disperse, etc. If a radio-tagged bat was roosting in the tree, at what time did it emerge?

The boats left two minutes apart. Did not fly in the same direction. They both circled around the tree, but never went back in the roost.

46

Appendix I Bat Habitat Assessments

rater nesourc	Comment of the comment	Site Stream Typ		Wetlands	s:		
Number &	Ephemeral > LODD	Intermittent	Perennial	Name Land	Permanei	nt !	Seasonal
Length				Approx. Acreage			802
		Number & S	ize Ponds/Poo	ls		Ope	n & Accessi to bats?
/	A					Yes	No
Closure/Densi		2= 11-20%, 3=		Onwood Size Composition	Travio		
Understory	Mid-story		,	Small (4-8)	Medium (9	- 65	Large (>1
4	3	3		60%	307		10%
eferred Tree S	pecies≥9 in d onwood, White Am. t	e Oak & other o	oak species, Ma Oak	S. maple	COHONUS	-,	leaf Pine) Ni'Ckon
	% 2				/		

General desc	ription:					
				tucky Road	1	
90	20 35.63	359 -9	3.03 5	4.4214		
Vater Resour	ces at Sample	Site Stream Typ	e & Length:	Wetlands:		
	Ephemeral	Intermittent	Perennial		Permanent	Seasonal
Number & Length	>1,000			Approx. Acreage		30%
		Number & S	ize Ponds/Poo	ls	0	pen & Accessib to bats?
	N/A				Y	es No
open c	phemeral hannel			3		
Open c Dominant S Black w Closure/Den	Species of Maillow, East	ature Trees: ern Cottonwo	ood, Silver 1	naple, honey	locust, ; blac	ck walnut
Open c Dominant S Black w Closure/Den	Species of Maillow, Easter sity (1=1-10%; 61-80%, 6=8	ature Trees: ern Cottonwo , 2=11-20%, 3: 1-100%)	ood, Silver,	naple, honey		ck walnut nches)
Dominant S Black w Closure/Den 41-60%, 5=	Species of Maillow, Easter sity (1=1-10%; 61-80%, 6=8	ature Trees: ern Cottonwo , 2=11-20%, 3: 1-100%)	ood, Silver,	naple, honey Size Compositio	locust, je blad n of Live Trees (in	ck walnut nches)
Open of Dominant Stack with Closure/Den 41-60%, 5=	Species of Marillow, Eastern Section 11-1-10%: 61-80%, 6=8 Mid-storn 5 Species ≥ 9 in	ature Trees: ern Coffonwo , 2=11-20%, 3: 1-100%) y Canop 5	2000, Silver 1 = 21-40%,	Size Compositio	n of Live Trees (in Medium (9-1:	ck walnut nches) 5) Large (>15
Open continuant Stack with the Closure/Den 41-60%, 5= Understory Continuate State of the Chagbark, Continuate Species:	Species of Maillow, Eastern Sity (1=1-10%) 61-80%, 6=8 Mid-storn 5 Species ≥ 9 in ttonwood, Wh	ature Trees: ern Coffonwo , 2= 11-20%, 3: 1-100%) y Canop 5 dbh ite Oak & other	2000, Silver 1 = 21-40%,	Size Compositio	n of Live Trees (in Medium (9-1:	ck walnut nches) 5) Large (>15
Open c Dominant S Black w Closure/Den 41-60%, 5= Understory (o referred Tree Shagbark, Co Species: Trees w/≥	Species of Marillow, Eastern Section 11-10%	ature Trees: ern Coffonwo , 2= 11-20%, 3: 1-100%) y Canop 5 dbh ite Oak & other	e 21-40%, oak species, M	Size Compositio Small (4-8) (, 5 % aple (Silver Maple),	n of Live Trees (in Medium (9-1: 30 %)	ck walnut nches) 5) Large (>15 5 % nortleaf Pine)
Dominant S Black w Closure/Den 41-60%, 5= Understory (p referred Tree Shagbark, Co Species: 6 Trees w/ ≥ exfoliating b	Species of Mailow, Eash sity (1=1-10% 61-80%, 6=8 Mid-stor Species ≥ 9 in ttonwood, Wh will 30% ark C itable Snags (ature Trees: ern Coffonwo , 2= 11-20%, 3: 1-100%) y Canop 5 dbh ite Oak & other	oak species, M 20% trees with slo	Size Compositio Small (4-8) (5 % aple (Silver Maple), maple 10 % ughing bark, ≥ cre	n of Live Trees (in Medium (9-1: 30 %) American Elm, Sh	ck walnut nches) 5) Large (>15 5 % nortleaf Pine) Walnut

Comments: that foraging habitat, roost habitat near by outside the property boundary.

Moderate

High

Sample Site			142.9840		
	Stream Type	& Length:	Wetlands:		
emeral In	termittent	Perennial		Permanent	Seasonal
,000			Approx. Acreage		25%
Nu	ımber & Si	ze Ponds/Poo	ls	Op	oen & Accessib to bats?
A				Ye	es No
			flow open	comido	r.
311 301	7. 0000	0000101	11000 2 0101	7	
0%, 6= 81-100)%)			n of Live Trees (inc	ches)
			Small (4-8)	Medium (9-15)	
2	9		10%	55%	45°/0
es ≥ 9 in dbh ood, White Oa	k & other oa	ak species, Ma	aple (Silver Maple),	American Elm, Sho	ortleaf Pine)
	0.77	ak species, Ma	nple (Silver Maple), Mickory	American Elm, Sho	ortleaf Pine)
ood, White Oa	od m				ortleaf Pine)
Cottonuo 30%	od m	aple 0°/o	Nickory 60°/0	birch 10%	ortleaf Pine)
Cattonuc 30%	od m	aple 0°/o	Nickory 60°/0	birch 10%	ortleaf Pine)
Cottonuo 30%	o I	aple 0°/o	Nickory 60°/0 Ighing bark, ≥ crevisuitable.	birch 10%	ortleaf Pine)
	stream es of Mature Cotton k hick = 1-10%, 2=1	Number & Sin A g condition of water so Stream. Low es of Mature Trees: Cottonwood, h K hickory, r = 1-10%, 2=11-20%, 3=10%, 6=81-100%) Mid-story Canopy	Number & Size Ponds/Poor A g condition of water sources: Stream. Low water es of Mature Trees: Cottonwood, honey lo k hickory, river b =1-10%, 2=11-20%, 3=21-40%, 0%, 6=81-100%) Mid-story Canopy	Number & Size Ponds/Pools A g condition of water sources: Stream. Low water flow. Open es of Mature Trees: Cottonwood, honey locust, Silver k hickory, river birch = 1-10%, 2=11-20%, 3=21-40%, 0%, 6=81-100%) Size Composition Mid-story Canopy Small (4-8)	Number & Size Ponds/Pools A Ye g condition of water sources: Stream. Low water flow Open Comido es of Mature Trees: Cottonwood, honey locust, silver maple, K hickory, river birch = 1-10%, 2= 11-20%, 3= 21-40%, 0%, 6= 81-100%) Size Composition of Live Trees (incomid-story Canopy Small (4-8) Medium (9-15)

Comments: open corridors for MYSE. A few suitable snags. Good foraging habitat

General descri	ption: forest	east c	x East lo	cust Cree	k. 01d	rai	lway
Corrido	or runs	N; S	through	forest.			
Water Resource	es at Sample Si	ite Stream Type	e & Length:	Wetlands:	9		
	Ephemeral	Intermittent	Perennial		Permanen	nt :	Seasonal
Number & Length	NA			Approx. Acreage			75%
		Number & Siz	ze Ponds/Pools			Ope	n & Accessib to bats?
N	IA					Yes	No [
Dominant Sp	ecies of Mat	ure Trees:	1 , 5				
BOX el	der, bl y (1=1-10%, 2	ack wa		unus (cl			
BOX el Closure/Densit 41-60%, 5=6: Understory	der, bl y (1=1-10%, 2	ack wa	21-40%,			(inche	es)
BOX el Closure/Densit 41-60%, 5=6:	der, bl y (1=1-10%, 2 1-80%, 6=81-	ack wa 2=11-20%, 3=2 100%)	21-40%,	Size Composition	of Live Trees	(inche	es)
Closure/Densit 41-60%, 5= 6: Understory	der, bl y (1=1-10%, 2 1-80%, 6=81-3 Mid-story 3 Decies ≥ 9 in db nwood, White	2=11-20%, 3=2 100%) Canopy 5 Oak & other oa	21-40%,	Size Composition Small (4-8) 40 %	Medium (9-	(inche	es) Large (>15) 5 %

comments: MANY suitable snags and good foraging habitat. No water resources adjacent to the site besides East Locust Creek to the west.

Nater Resourc	es at Sample Si	te Stream T	ype & Length:	Wetlands:		
	Ephemeral	Intermitte	nt Perennial		Permanent	Seasonal
Number & Length			>1,000	Approx. Acreage		70°/0
		Number &	Size Ponds/Pools		C	pen & Accessib to bats?
			st Creek & F ately 0.50		west	es X No
	sting condition		Fast Wcu	St creek		
Dominant Sp					poxelder,	Cottonwood
MOC		ure Trees: \iCkOry 2=11-20%,	shagbark 1			
MOC	ty (1=1-10%,	ure Trees: \iCkOry 2=11-20%,	shagbark 3=21-40%,	hickory, k		nches)
Closure/Densi	ty (1= 1-10%, 51-80%, 6= 81-	ure Trees: \iCkOry 2=11-20%, 100%)	shagbark 3=21-40%,	Nickory , k	of Live Trees (in	nches)
Closure/Densi 41-60%, 5=6 Understory	ty (1= 1-10%, 1: 1-80%, 6= 81- Mid-story Z Species ≥ 9 in diagram on wood, White	ure Trees: \iCkOry 2=11-20%, 100%) Cand 5 oh Oak & othe	shagbark 3=21-40%,	Size Composition Small (4-8) 3090	Medium (9-1:	15 %

comments: Numerous snags, open midstory. Close proximity to water.

Water Resource	es at Sample	Site Stream Type	e & Length:	Wetlands:		
	Ephemeral	Intermittent	Perennial		Permanent	Seasonal
Number & Length	>1,000			Approx. Acreage		60%
		Number & Si	ze Ponds/Pools		C	pen & Accessib to bats?
1	pond	< 0.5	acre		3	es No
Describe exi	isting condit	tion of water so	nurces:			
				nan 11,00	of to	the we
S THE WAY		3.7.2				
Dominant S Shiral	pecies of Ma	ature Trees:	()	(a) a	blac	k
J 91	e bak,	WHITE	bak, Cho	kecherry	, , will	.000
	sity (1= 1-10%	, 2= 11-20%, 3=		ske Cherry Size Composition		
Closure/Dens	61-80%, 6= 8	, 2= 11-20%, 3= 1-100%)	21-40%,		of Live Trees (i	nches)
Closure/Dens 41-60%, 5=	61-80%, 6= 8	, 2= 11-20%, 3= 1-100%)	21-40%,	Size Composition	of Live Trees (i	nches)
Closure/Dens = 41-60%, 5= Understory 3	ity (1= 1-10%) 61-80%, 6= 8 Mid-stor 3 Species ≥ 9 in	, 2= 11-20%, 3= 1-100%) y Canopy	21-40%,	Size Composition	Medium (9-1	15) Large (>15)
Closure/Dens : 41-60%, 5= Understory 3	ity (1= 1-10%) 61-80%, 6= 8 Mid-stor 3 Species ≥ 9 in	, 2= 11-20%, 3= 1-100%) y Canopy	21-40%,	Size Composition Small (4-8)	Medium (9-1	15) Large (>15)
Closure/Dens 41-60%, 5= Understory 3 referred Tree Shagbark, Cott	ity (1= 1-10%) 61-80%, 6= 8 Mid-stor 3 Species ≥ 9 in tonwood, White North	, 2= 11-20%, 3= 1-100%) y Canopy	21-40%,	Size Composition Small (4-8)	Medium (9-1	15) Large (>15)
Closure/Dens 41-60%, 5= Understory 3 referred Tree Shagbark, Cott Species: Trees w/≥3 exfoliating ba umber of Suit	ity (1= 1-10%) 61-80%, 6= 8 Mid-stor 3 Species ≥ 9 in tonwood, White tonwood, White table Snags (stable Snags)	, 2= 11-20%, 3= 1-100%) y Canopy 2 dbh ite Oak & other o	z1-40%, ak species, Map	Size Composition Small (4-8) (e 0 % o le (Silver Maple), e thing bark, ≥ crev	Medium (9-1	15) Large (>15)
Closure/Dens 41-60%, 5= Understory 3 referred Tree Shagbark, Cott Species: Trees w/≥3 exfoliating ba umber of Suit les. Snags w	ity (1= 1-10%) 61-80%, 6= 8 Mid-stor 3 Species ≥ 9 in tonwood, White tonwood, White table Snags (stable Snags)	te Oak & other of the features are not features are not features are not features.	z1-40%, ak species, Map	Size Composition Small (4-8) (e 0 % o le (Silver Maple), e thing bark, ≥ crev	Medium (9-1	15) Large (>15)

comments: no suitable shags. Good foraging as its near water.

	10. 3-1					
General desc				,		
Ripar	ian to	rest alo	ing East	Locust C	reek.	
40.18	313.5	382 93	3° 06 ' 28.	2454		
Water Resour	ces at Sample	Site Stream Type	e & Length:	Wetlands:		
	Ephemeral	Intermittent	Perennial		Permanent	Seasonal
Number & Length			>1,000	Approx. Acreage		50%
		Number & Si	ze Ponds/Pools		0	pen & Accessib to bats?
Pools	along E	East louis	t creek		Y	es No [
Describe ex East LOU	isting condit	ion of water so Cruns th	ources: wough the	site hume	rous pools	s is Stand
		ature Trees: -		est 1 box eld	ler, black	ualnut
	1 (1 (5 (4) US (1) (1) (1 () () ()	, 2=11-20%, 3=		Siza Composition	of Live Trees (in	chas)
= 41-60%, 5=	61-80%, 6= 8	1-100%)	21-40%,	Size Composition		
	61-80%, 6= 8	1-100%)	21-40%,	Size Composition Small (4-8) 35	Medium (9-15	
Understory 5 referred Tree	61-80%, 6= 8: Mid-story 3 Species ≥ 9 in	1-100%) y Canopy 3	21-40%,	Small (4-8)	Medium (9-15	i) Large (>15
Understory 5 referred Tree Shagbark, Cot Species:	61-80%, 6= 8: Mid-story 3 Species ≥ 9 in ttonwood, Whi	1-100%) y Canopy 3	21-40%,	Small (4-8) 35	Medium (9-15	i) Large (>15
Understory 5 referred Tree Shagbark, Cot	61-80%, 6= 8: Mid-story 3 Species ≥ 9 in ttonwood, Whi	1-100%) y Canopy 3 dbh te Oak & other o	21-40%,	Small (4-8) 35	Medium (9-15	i) Large (>15
Understory Understory Species: Trees w/≥3 exfoliating ba	Mid-story Species ≥ 9 in ttonwood, White the Species (stable	1-100%) Canopy Canopy Standing dead t	21-40%,	Small (4-8) 35 le (Silver Maple), i	Medium (9-15	i) Large (>15
E 41-60%, 5= Understory 5 referred Tree Shagbark, Cot Species: 6 Trees w/ ≥ 3 exfoliating back umber of Suboles. Snags v	Mid-story Species ≥ 9 in ttonwood, White the Species (stable	Canopy Ca	21-40%, pak species, Map	Small (4-8) 35 le (Silver Maple), i	Medium (9-15	i) Large (>15

comments: Good foraging habitat; access to water. lots of insects. No snags or roost trees.

vater Kesourt	es at Sample :	Site Stream Type	& Length:	Wetlands:		
	Ephemeral	Intermittent	Perennial		Permanent	Seasonal
Number & Length	>1,000			Approx. Acreage		70%
		Number & Siz	ze Ponds/Pools			Open & Accessible to bats?
	. / 4					Yes No
J	V/A					
Describe ex	isting condit	tion of water so	ources:			
East Lo	cust Cree	k is per	ennial st	ream just	to the	east of
	21101	74X 12 14 14 14 14 14 14 14 14 14 14 14 14 14	T IUW)			
Dominant S	pecies of Ma	ature Trees:		1 Annaire	a El	
Sningle	oak, u	illas, co	Honwood	, America	yı tıvı	
Classica (Dan	-i /1- 1 100/	2-11 209/ 2-	21 40%			
Closure/Den = 41-60%, 5=		5, 2=11-20%, 3= 31-100%)	21-40%,	Size Composition	n of Live Trees	(inches)
	61-80%, 6= 8	31-100%)		Size Composition	n of Live Trees Medium (9-	
= 41-60%, 5=	61-80%, 6= 8	31-100%)				-15) Large (>15
= 41-60%, 5= Understory	61-80%, 6= 8	31-100%) ry Canopy		Small (4-8)	Medium (9-	-15) Large (>15
= 41-60%, 5= Understory 5 Preferred Tree	61-80%, 6=8 Mid-stor Species ≥ 9 in	1-100%) Ty Canopy 3		Small (4-8) (↓○⁰/○	Medium (9-	Large (>15) Large (>15) 25%
Understory 5 Preferred Tree (Shagbark, Co	Mid-stor Graph Species ≥ 9 in ttonwood, Wh	1-100%) Ty Canopy 3		Small (4-8)	Medium (9-	Large (>15) Large (>15) 25%
Understory Understory Species:	Mid-stor Graph of the story o	1-100%) Ty Canopy 3		Small (4-8) (↓○⁰/○	Medium (9-	Large (>15) Large (>15) 25%
Understory Understory Species: % Trees w/ ≥	Mid-stor Species ≥ 9 in ttonwood, Wh	Canopy 3 a dbh hite Oak & other o		Small (4-8) (↓○⁰/○	Medium (9-	Large (>15) Large (>15) 25%
Understory Understory Species: Trees w/ ≥ exfoliating b	Mid-stor Species ≥ 9 in ttonwood, What 30% ark	S1-100%) Ty Canopy 3 The dbh shite Oak & other of the Oak & other o	oak species, Map	Small (4-8)	Medium (9-	Large (>15) Large (>15) 25%
Understory Understory Species: % Trees w/ ≥ exfoliating b	Mid-stor Species ≥ 9 intronwood, What was ark itable Snags	Canopy Canopy 3 A dbh nite Oak & other of the color o	pak species, Map	Small (4-8) (↓○%) ole (Silver Maple), ghing bark, ≥ cre	Medium (9-	Large (>15) Large (>15) 25%
Understory Understory Species: % Trees w/ ≥ exfoliating b	Mid-stor Species ≥ 9 intronwood, What was ark itable Snags	S1-100%) Ty Canopy 3 The dbh shite Oak & other of the Oak & other o	pak species, Map	Small (4-8) (↓○%) ole (Silver Maple), ghing bark, ≥ cre	Medium (9-	Large (>15) 25% Shortleaf Pine)
Understory Understory Species: % Trees w/ ≥ exfoliating b	Mid-stor Species ≥ 9 in ttonwood, What without these without these	Canopy Canopy 3 Abh Aite Oak & other of the Coak & other of th	pak species, Map	Small (4-8) (() () () ole (Silver Maple), ghing bark, ≥ cresuitable.	Medium (9-	Large (>15) 25% Shortleaf Pine)
Understory Understory Understory Species: % Trees w/ ≥ exfoliating b Sumber of Sumble of Sumble site sui	Mid-stor Species ≥ 9 in ttonwood, What without these without these table for India	Canopy Canopy 3 Abh Aite Oak & other of the color of	oak species, Map trees with slou ot considered s	Small (4-8) (() () () ole (Silver Maple), ghing bark, ≥ cresuitable.	Medium (9-	Large (>15) 25% Shortleaf Pine)
Understory Understory Understory Species: % Trees w/ ≥ exfoliating b Sumber of Sumbers of Sumb	Mid-stor Species ≥ 9 intronwood, What without these without these moderates without these moderates without these moderates without these moderates moderates.	Canopy Canopy 3 Abh Aite Oak & other of the color of	trees with sloug ot considered s	Small (4-8) (Medium (9-	Large (>15) 25% Shortleaf Pine)

Water Resources	at Sample Site S	Stream Type &	& Length:	Wetlands:			
E	ohemeral Int	termittent	Perennial		Permanent	Seas	sonal
Number & Length			71,000	Approx. Acreage			25%
	Nı	umber & Size	e Ponds/Pools				Accessible bats?
\(\big(\bigA\) Describe exist	ing condition	of water sou	irces:	r/ /2		Yes _	No [
Perennial Sife. (East Loca	ust Cre	ek 21,00	off to	The east	01	7100
6 Closure/Densit	v (1= 1-10%, 2=	: 11-20%, 3= 2	21-40%,		No. of the		
6 Closure/Densit 4= 41-60%, 5= 6:	y (1= 1-10%, 2= 1-80%, 6= 81-10	00%)	_	Size Composition	T		
	y (1= 1-10%, 2=		_	Size Composition Small (4-8)	Medium (9-		
Understory 5 Preferred Tree Si	y (1=1-10%, 2= 1-80%, 6=81-10 Mid-story 3 pecies ≥ 9 in dbl pnwood, White 0	Canopy 3 Dak & other o		Small (4-8)	Medium (9-	15)	Large (>15) 20%
Understory 5 Preferred Tree S (Shagbark, Cotto) Species: % Trees w/ ≥ 30 exfoliating bar	y (1=1-10%, 2= 1-80%, 6=81-10 Mid-story 3 pecies ≥ 9 in dbh onwood, White 0 Am.t	Canopy 3 Canopy 1 Canopy	ak species, Mar	Small (4-8) (0 ° (0	Medium (9- 20 % American Elm,	15)	Large (>15) 20%

General desc	o. 4-1						
Riparian			to 🛱 East	Locust Cr	eek sur	rour	ided by
Water Resour	ces at Sample	Site Stream T	ype & Length:	Wetlands:			
	Ephemeral	Intermitter	nt Perennial		Permanei	nt	Seasonal
Number & Length			NA	Approx. Acreage	Ø		Ø
		Number &	Size Ponds/Pools			Ope	n & Accessibl
N/A						Yes	No [
Dominant S			to the wes	37 01 37			
Silver			ash red c	ak			
Closure/Dens		green ()ak Size Composition	of Live Trees	i (inch	es)
Closure/Dens	maple ity (1=1-10%, 51-80%, 6=81 Mid-story	9/cen (2=11-20%, 3-100%)	3= 21-40%,	Size Composition	of Live Trees Medium (9		es) Large (>15)
Closure/Dens 41-60%, 5=	maple ity (1=1-10%, 61-80%, 6=81	green (2=11-20%, s -100%)	3= 21-40%,	Size Composition			
Closure/Dens 41-60%, 5= Understory	maple ity (1=1-10%, 61-80%, 6=81 Mid-story 3 Species ≥ 9 in conwood, White	9/een (2=11-20%, 3-100%) Cano	3= 21-40%,	Size Composition Small (4-8) 25	Medium (9	9-15)	Large (>15)

comments: good foraging habitat. No suitable shags

	ription:			10.00		
upland	1 torest	east of	East Lou	ust creek		
40°17'	23.5000	-93°0	5 33. 22	10		
		Site Stream Type		Wetlands:	1	
	Ephemeral	Intermittent	Perennial		Permanent	Seasonal
Number & Length	N/A			Approx. Acreage	NA	
		Number & Si	ze Ponds/Pools		O	pen & Accessib
٨	M				Ye	es No [
Describe evi	sting conditi	on of water so	Hrose.			
Approxim	nately 50	of the east	of East	locust cre	ek. Just	north of
unna	ned tr	ib utary			, 0.43 86 51	. 01
Dominant Si	pecies of Mar	ture Trees				
			in plan	black w	alnut	
	0002	1 04110116	ar arri	MINICK W	All IVE	
Closure/Done	14 4 4 400	And any or the second second				
41-60%, 5= 6		2=11-20%, 3=2 -100%)		Size Composition	of Live Trees (inc	ches)
		-100%)		Size Composition		
41-60%, 5= 6	51-80%, 6= 81	-100%)			Medium (9-15)	Large (>15)
41-60%, 5= 6 Understory	61-80%, 6= 81 Mid-story	-100%) Canopy 2		Small (4-8)		
Understory (g) eferred Tree S	61-80%, 6= 81 Mid-story ↓ pecies ≥ 9 in d	-100%) Canopy Z		Small (4-8)	Medium (9-15)	Large (>15
Understory O eferred Tree S shagbark, Cotto	Mid-story Grecies ≥ 9 in dependent of the control	Canopy Canopy Chanopy Chano		Small (4-8)	Medium (9-15)	Large (>15
Understory (g) eferred Tree S hagbark, Cotto Species:	Mid-story Grecies ≥ 9 in dependency White	Canopy Z bh e Oak & other oa		Small (4-8)	Medium (9-15)	Large (>15
Understory (g referred Tree S Shagbark, Cotto	Mid-story U pecies ≥ 9 in d pnwood, White	Canopy Canopy Chanopy Chano		Small (4-8)	Medium (9-15)	Large (>15
Understory © referred Tree S Shagbark, Cotto Species: Trees w/≥ 30 exfoliating bar	Mid-story Grecies ≥ 9 in deprivation wood, White	Canopy Z bh Coak & other oa Coak	ak species, Maple	Small (4-8) US % e (Silver Maple), A	Medium (9-15)	Large (>15
Understory © referred Tree S Shagbark, Cotto Species: Trees w/ ≥ 30 exfoliating bard mber of Suita	Mid-story Grecies ≥ 9 in dependent on White W. O. White Able Snags (st	Canopy Canopy Chh Oak & other oa A A A A A A A A A A A A A	ak species, Maple	Small (4-8) U5 % e (Silver Maple), A	Medium (9-15)	Large (>15
Understory © referred Tree S chagbark, Cotto Species: Trees w/ ≥ 30 exfoliating bard mber of Suita les. Snags wi	Mid-story Pecies ≥ 9 in donwood, White W. O She Shags (st. thout these for	Canopy Canopy	ees with slough	Small (4-8) U5 % e (Silver Maple), A	Medium (9-15)	Large (>15
Understory © referred Tree S Shagbark, Cotto Species: Trees w/ ≥ 30 exfoliating bard mber of Suital les. Snags wi the site suital	Mid-story Pecies ≥ 9 in dependence of the Story Able Snags (stathout these for Indian	Canopy Canopy	ak species, Maple	Small (4-8) U5 % e (Silver Maple), A	Medium (9-15)	Large (>15
Understory © deferred Tree Schagbark, Cotto Species: Trees w/ ≥ 30 exfoliating bard mber of Suital les. Snags wi the site suital ow	Mid-story Pecies ≥ 9 in donwood, White W. O Able Snags (st. thout these for Indian Moderate	Canopy Canopy	ees with slough considered su	Small (4-8) US % e (Silver Maple), A ning bark, ≥ crevi itable.	Medium (9-15)	Large (>15
Understory © referred Tree S Shagbark, Cotto Species: Trees w/ ≥ 30 exfoliating bard mber of Suital les. Snags wi the site suital ow	Mid-story Pecies ≥ 9 in donwood, White W. O Able Snags (st. thout these for Indian Moderate	Canopy Canopy Canopy Canopy Canopy A color of the co	ees with slough considered su	Small (4-8) US % e (Silver Maple), A ning bark, ≥ crevi itable.	Medium (9-15)	Large (>15
eferred Tree Sihagbark, Cotton Species: Trees w/ ≥ 30 exfoliating bard mber of Suitation the site suitation the site suitation the site suitation	Mid-story Pecies ≥ 9 in donwood, White W. O Able Snags (st. thout these for Indian Moderate	Canopy Canopy	ees with slough considered su	Small (4-8) US % e (Silver Maple), A ning bark, ≥ crevi itable.	Medium (9-15)	Large (>15

easy flight /foraging corniclors

40° 17	56.9971	-93	3°0	6'09.	2485			
	ces at Sample S				Wetland	s:		
	Ephemeral	Intermit	ttent	Perennial		Permar	nent	Seasonal
Number & Length	>1000				Approx. Acreage	9	5	Ø
		Number	& Siz	ze Ponds/Po	ools		Op	en & Accessible
N/	A						Yes	
Describe exi UNNAM WEST	isting conditioned trib	on of war	ter so	urces: Hhroug	n site. Eas	it laws	t cr	rek 21000
maple	pecies of Ma			J	k hickory			
Closure/Dens	ity (1= 1-10%, 61-80%, 6= 81		%, 3= 2	21-40%,	Size Compositi	on of Live Tre	es (incl	nes)
Closure/Dens	ity (1= 1-10%,	-100%)	%, 3= 2 anopy	21-40%,	Size Compositi	on of Live Tre	10000	
Closure/Dens 41-60%, 5=	ity (1= 1-10%, 61-80%, 6= 81	-100%)		21-40%,			(9-15)	Large (>15)
Closure/Dens 41-60%, 5=0 Understory 5	ity (1= 1-10%, 61-80%, 6= 81 Mid-story Z Species ≥ 9 in d	-100%) Ca	anopy		Small (4-8)	Medium 20%	(9-15)	Large (>15)
Closure/Dens 41-60%, 5=0 Understory 5	ity (1= 1-10%, 61-80%, 6= 81 Mid-story 2 Species ≥ 9 in donwood, White	-100%) Ca	anopy her oa		Small (4-8)	Medium 20%	(9-15)	Large (>15)
Closure/Dens 41-60%, 5= Understory 5 eferred Tree S hagbark, Cott	ity (1= 1-10%, 61-80%, 6= 81 Mid-story 2 Species ≥ 9 in donwood, White Shay	-100%) Ca 4 bh e Oak & ot	her oa	ık species, N	Small (4-8) 50% Maple (Silver Maple)	Medium 20%	(9-15)	Large (>15)
Closure/Dens 41-60%, 5= Understory Seferred Tree Series: Trees w/≥30 xfoliating bar mber of Suita	ity (1= 1-10%, 61-80%, 6= 81 Mid-story 2 Species ≥ 9 in donwood, White Shag % k 9(bh e Oak & ot bark	her oa	ple 0%	Small (4-8) 50% Maple (Silver Maple) W. OUK 5% Doughing bark, ≥ creen	Medium 20 % , American Eli	(9-15)	Large (>15)

comments: Open foraging habitat: multiple trees with extoliating bark

			ricutural		a along	111151016
vater Kesour		Site Stream Typ	2 22 22 22 22 22	Wetlands:		
Number &	Ephemeral	Intermittent	Perennial		Permanent	Seasonal
Length		>1000ft		Approx. Acreage		90%
		Number & Si	ize Ponds/Pools		0	pen & Accessil to bats?
1 - ap	prox 1/4	acres.	South of	net si	He Y	es No [
riacicies	ity (1= 1-10%,	gle oak 2=11-20%, 3=				
41-60%, 5= 0 Understory	61-80%, 6= 81 Mid-story				of Live Trees (in	
41-60%, 5=				Small (4-8)	Medium (9-15	
Understory Understory Seferred Tree Shagbark, Cott	Mid-story 4 Species ≥ 9 in conwood, White	Canopy Shh e Oak & other o	ak species, Maple	Small (4-8) 20 %	Medium (9-15 50 %) Large (>15
Understory 5 eferred Tree Shagbark, Cott	Mid-story 4 Species ≥ 9 in conwood, White	Canopy S S S S S S S S S S S S S	ak species, Maple	Small (4-8) 20 %	Medium (9-15 50 %) Large (>15

forest	ription: ed are	a next	to old	roa du	vay	
Water Resourc	ces at Sample	Site Stream Type	e & Length:	Wetlands:		
	Ephemeral	Intermittent	Perennial		Permanent	Seasonal
Number & Length	A	>1000		Approx. Acreage		50%
		Number & Si	ze Ponds/Pools		Oj	oen & Accessib
1 P	ond 4	1.0 ac	ire		Ye	s No
Dominant Si AMENCA	pecies of Ma an Elm		plack wa locust, n		nd dam nag bark .k	
41-60%, 5= 6	51-80%, 6= 81	-100%)	are the second	Size Composition	of Live Trees (inc	hes)
Hadaustan	B 41 1 .	Canopy		0 11 / 0 01		
Understory 2	Mid-story 5	3		Small (4-8)	Medium (9-15) 20 76	
2 eferred Tree S	5 Species ≥ 9 in donwood, White Shaa	3 bh	sk species, Maple	60%		Large (>15) 20 % rtleaf Pine)

comments: Good foraging. no suitable snags. near water

General descr	ription:					
Forested	area	next to	111000000	led tribut		1
Okaak	Tacilo	such such	urmarr	led tribut	ary tast	Locust
CIEER.	eust W	cust cre	ck abou	14 25047	to the	east.
Nater Resource		Site Stream Type	e & Length:	Wetlands:		
	Ephemeral	Intermittent	Perennial		Permanent	Seasonal
Number & Length	>1000			Approx. Acreage		70%
		Number & Siz	ze Ponds/Pools	5	Oı	oen & Accessil
l p	ond	~ 0.5	acre		Ye	s No [
Dominant Sp いけんい	pecies of Ma	ture Trees: L	white o	ak, shing	le oak,	black
Closure/Densi				oumen ca	n elm	
41-60%, 5= 6	ty (1= 1-10%, 51-80%, 6= 81	2= 11-20%, 3= 2 -100%)			n elm	
	ty (1= 1-10%, 1-80%, 6= 81 Mid-story	2= 11-20%, 3= 2 -100%)			. In Color wa	hes)
41-60%, 5= 6	ty (1= 1-10%, 51-80%, 6= 81	2= 11-20%, 3= 2 -100%)		Size Composition	of Live Trees (inc	hes)
41-60%, 5= 6 Understory	ty (1= 1-10%, 11-80%, 6= 81 Mid-story 3 pecies ≥ 9 in donwood, White	2= 11-20%, 3= 2 -100%) Canopy 3 Ibh e Oak & other oa	21-40%,	Size Composition	of Live Trees (inc Medium (9-15)	hes) Large (>15 / 5 %
eferred Tree S hagbark, Cotto	ty (1= 1-10%, 1-80%, 6= 81 Mid-story 3 pecies ≥ 9 in donwood, White	2= 11-20%, 3= 2 -100%) Canopy 3 Ibh e Oak & other oa	21-40%,	Size Composition Small (4-8)	of Live Trees (inc Medium (9-15)	hes) Large (>15 / 5 %
eferred Tree S hagbark, Cotto Species: Trees w/ ≥ 30 exfoliating bark	ty (1= 1-10%, 1-80%, 6= 81 Mid-story 3 pecies ≥ 9 in donwood, White Am. % 5 ble Snags (st	2= 11-20%, 3= 2 -100%) Canopy 3 Ibh e Oak & other oa Elm 0 6	ees with sloug	Size Composition Small (4-8) 7 5 0/0 le (Silver Maple), A	Medium (9-15)	hes) Large (>15 / 5 %
eferred Tree S hagbark, Cotto Species: Trees w/ ≥ 30 exfoliating bark	ty (1= 1-10%, i1-80%, 6= 81 Mid-story 3 pecies ≥ 9 in donwood, White Am. ble Snags (st	2= 11-20%, 3= 2 -100%) Canopy 3 Ibh e Oak & other oa Ob anding dead tree eatures are not	ees with sloug	Size Composition Small (4-8) 7 5 0/0 le (Silver Maple), A	Medium (9-15)	hes) Large (>15 / 5 %
eferred Tree S hagbark, Cotto Species: Trees w/ ≥ 30 exfoliating bark mber of Suita es. Snags with	ty (1= 1-10%, 1-80%, 6= 81 Mid-story 3 pecies ≥ 9 in donwood, White Am. ble Snags (st thout these for Indian Moderate	2= 11-20%, 3= 2 -100%) Canopy 3 Ibh e Oak & other oa Ob anding dead tree eatures are not	ees with sloug considered so	Size Composition Small (4-8) 7 5 % le (Silver Maple), A thing bark, ≥ creviuitable.	Medium (9-15)	hes) Large (>15 %

comments: Near Water. no suitable Snags: Cluttered Canopy

matu	an forest	st along	tributa	ry to Ea	st locus	st C	reek.
Water Resour	ces at Sample	Site Stream Type	e & Length:	Wetlands			
	Ephemeral	Intermittent	Perennial		Permanei	nt :	Seasonal
Number & Length		>1000		Approx. Acreage	Ø		50
		Number & Siz	ze Ponds/Pools			Ope	n & Accessibl
NA						Yes	No [
no fla	ary to Educing wa	uter of pa	creek flo	tonwood 15			
	ity (1= 1-10%, 61-80%, 6= 81	2= 11-20%, 3= 2 -100%)	21-40%,	Size Composition	n of Live Trees	(inche	es)
41-60%, 5= Understory	61-80%, 6= 81 Mid-story	-100%) Canopy	21-40%,	Size Composition	n of Live Trees Medium (9		es) Large (>15)
41-60%, 5=	61-80%, 6= 81	-100%)	21-40%,				
Understory 3 referred Tree 9	Mid-story 4 Species ≥ 9 in donwood, White Shag	-100%) Canopy 4		Small (4-8)	Medium (9	-15)	Large (>15)

comments: Good foraging habitat : travel cornidor few snags > 9" W/exfoliating bark

Water Resource	es at Sample	Site Stream Typ	e & Length:	Wetland	s:		
	Ephemeral	Intermittent	Perennial		Permane	nt Seaso	onal
Number & Length			71000	Approx. Acreage	Ø	4	20
		Number & Si	ze Ponds/Pool	s		Open & /	Accessib ats?
pond	approx	imately	500 m	west	of site	Yes 🔀	No [
		ion of water so reek fl		through	a site		
Dominant S		THE PIECE	VIIVE II		IUCKPYVII	17 11	CICOL
		2=11-20%, 3=		naple, A , Amen	can elr	n	
6 Closure/Densi = 41-60%, 5= 6	ity (1= 1-10%, 51-80%, 6= 81	2= 11-20%, 3= -100%)	21-40%,	Size Composition	on of Live Trees	(inches)	
Closure/Densi	ity (1= 1-10%,	2= 11-20%, 3= -100%)	21-40%,		on of Live Trees	(inches)	rge (>15)
Closure/Densi = 41-60%, 5= 6 Understory 3	ity (1= 1-10%, 51-80%, 6= 81 Mid-story 2 species ≥ 9 in c	2= 11-20%, 3= -100%) Canopy	21-40%,	Size Composition	Medium (9	(inches)	rge (>15)
Closure/Densi = 41-60%, 5= 6 Understory ろ referred Tree S	ity (1= 1-10%, 51-80%, 6= 81 Mid-story 2 species ≥ 9 in conwood, White	2= 11-20%, 3= -100%) Canopy	21-40%,	Size Composition Small (4-8)	Medium (9	(inches)	rge (>15)
Closure/Densi = 41-60%, 5= 6 Understory Closure/Densi = 41-60%, 5= 6 Understory Species: Species: Trees w/ ≥ 30 exfoliating bard umber of Suita	ity (1= 1-10%, 61-80%, 6= 81 Mid-story 2 Species ≥ 9 in conwood, White White Able Snags (statement of the statement of	2=11-20%, 3= -100%) Canopy 3 Ibh e Oak & other of anding dead treatures are no	21-40%, ak species, Mar	Size Composition Small (4-8) 10 % ole (Silver Maple) shing bark, ≥ cre	Medium (9 30 %	(inches)	rge (>15)
Closure/Densi = 41-60%, 5= 6 Understory Closure/Densi = 41-60%, 5= 6 Understory Species: Species: Trees w/ ≥ 30 exfoliating bard umber of Suitables. Snags with	ity (1= 1-10%, 61-80%, 6= 81 Mid-story 2 Species ≥ 9 in conwood, White White Able Snags (statement of the statement of	2=11-20%, 3= -100%) Canopy 3 Ibh e Oak & other of anding dead treatures are no	ees with sloug	Size Composition Small (4-8) 10 2 ole (Silver Maple) ghing bark, ≥ crequitable.	Medium (9 30 %	(inches)	rge (>15)

Water Resource			40°17′16 190°47′16	Wetlands:		
	Ephemeral	Intermitten	t Perennial		Permanent	Seasonal
Number & Length		>1000	≥1000	Approx. Acreage		60%
		Number &	Size Ponds/Pools		(Open & Access to bats?
N	A				3	es No
Oak , Ed	ry (1= 1-10%,	2= 11-20%, 3	= 21-40%,	Size Composition	of the Trace /	
41-60%, 5= 6	1-80%, 6= 81.	100/01			i of Live Trees (ir	iches)
41-60%, 5= 6 Understory	Mid-story	Canop		Small (4-8)	Medium (9-1	
Understory 3	Mid-story 4	Canop				
Understory 3 eferred Tree Sp	Mid-story 4 Decies ≥ 9 in d nwood, White	Canop		Small (4-8)	Medium (9-1:	5) Large (>1 Z0°/6

Sample Site N	10. 7-1						
General desc uplar	nd fore	St N. 0	of Hwy	N : For 42. 2526	rum Ro	ad	
water Kesour	Ephemeral	Site Stream Type		Wetlands:			
Number & Length	NA	intermittent	Perennial	Approx. Acreage	Permanent	Seasonal	
		Number & Siz	ze Ponds/Pools	s	0	pen & Accessibl	e
NA					Y	es No	
Describe ex	isting conditi	on of water so	urces:				
COSHCY 6 Closure/Dens	n cott	2=11-20%, 3=2		Size Composition	of Live Trees (in		
Understory	Mid-story	Canopy		Small (4-8)	Medium (9-15		
2	4	3		50 %	15 %	35 %	
	Species ≥ 9 in d onwood, White		k species, Map	ole (Silver Maple), A	American Elm, Sho	ortleaf Pine)	
Species: % Trees w/ ≥ 30	shag	bark w.	oak				
oles. Snags w	able Snags (st	eatures are not	ees with sloug considered s	thing bark, ≥ crev uitable.	ices, or	<u> </u>	
the site suita	ble for <u>Indian</u> Moderate	a bats? High	Yes	□ No □			
the site suita	ble for <u>northe</u> Moderate	ern long-eared	<u>bats</u> ? Yes	□ No □		÷	

comments: Forest very cluttered. NO snags. few roost trees with extoliating bark

water Kesour	A	Site Stream Type		Wetlands:		
Number & Length	Ephemeral	Intermittent	Perennial	Approx. Acreage	Permanent	Seasonal 90 %
		Number & Size	e Ponds/Pools		0	pen & Accessil
		north (es No [
Describe ex LOUS: Cattle	isting condition	ion of water south	sw th	named nrough	thb to site. O.	of acre
Dominant S AMCr	Species of Ma	1 app ture Trees: B Elm, ea	lack stern c	willow	ood	oak,
	sity (1= 1-10%, 61-80%, 6= 81	2= 11-20%, 3= 2 -100%)		Size Composition	of Live Trees (in	ches)
Understory	Mid-story	Canopy		Small (4-8)	Medium (9-15	1 7
5	3	12		60%	30%	107.
	will will	low An	k species, Maple n. Em	e (Silver Maple), A	merican Elm, Sh	ortleaf Pine)
				ing bark, ≥ crev	ices, or	
Trees w/≥3 exfoliating ba umber of Sui		tanding dead tre features are not				

Vater Resource	s at Sample Site	Stream Type & Length:	Wetlands:		
	Ephemeral II	ntermittent Perennial		Permanent	Seasonal
Number & Length	>1000		Approx. Acreage		40%
	N	umber & Size Ponds/Poo	ls	0	pen & Accessil to bats?
1 Pon	d < 0	os acre		Y	es No [
		of water sources: Fributary	low wa	ter	
The second secon	ecies of Matur	, lastern c	ottonwood	sd how	rev loc
Closure/Densit	y (1= 1-10%, 2=	11-20%, 3= 21-40%,	Dicks JAS		
Closure/Densit		11-20%, 3= 21-40%,	Size Composition	of Live Trees (in	ches)
Closure/Densit 41-60%, 5= 6:	y (1= 1-10%, 2= 1-80%, 6= 81-10	11-20%, 3= 21-40%, 00%)	Dicks JAS		ches)
Closure/Densite 41-60%, 5= 6: Understory	y (1= 1-10%, 2= 1-80%, 6= 81-10 Mid-story 3 Decies ≥ 9 in dbh nwood, White O	11-20%, 3= 21-40%, 90%) Canopy 2 Oak & other oak species, Mark	Size Composition Small (4-8)	Medium (9-15	ches) Large (>15

Sample Site No	0 1					
General descr		Charle	. '00		,	
EUSI	LUMST	Creek	-npa	rian to	prest	
Vater Resourc	es at Sample	Site Stream Type	e & Length:	Wetlands:		
	Ephemeral	Intermittent	Perennial		Permanent	Seasonal
Number & Length			>1000	Approx. Acreage	0	D
		Number & Si	ze Ponds/Pools		Ol	oen & Accessibl to bats?
NA					Ye	s No
Describe exi	sting condition	ion of water so Creek - l	ources:	iw, 20°	Bed	
black Closure/Dens	willo	2= 11-20%, 3=	21-40%,		noney la	
Understory	Mid-story	Canopy		Small (4-8)	Medium (9-15)	Large (>15)
3	1	3		10%	40%	50%
	0%	te Oak & other o	ak species, Maplo	e (Silver Maple), A	American Elm, Sho	ortleaf Pine)
umber of Suit les. Snags w the site suita	able Snags (s ithout these ble for <u>India</u>	features are no	rees with slough t considered su Yes	ning bark, ≥ crev itable.	ices, or	
ow	Moderate	High				
the site suits	ble for north	ern long-eared	hats? Vec	No X		
the site suita	ble for <u>north</u> Moderate	ern long-eared High	bats? Yes	□ No 🛚		

comments: suitable foraging habitat wide comidor

Water Resource	es at Sample S	Site Stream Type	e & Length:	Wetlands:		
	Ephemeral	Intermittent	Perennial		Permanent	Seasonal
Number & Length	NA			Approx. Acreage	Ø	B
		Number & Si	ize Ponds/Pools		Ol	pen & Accessib to bats?
NA					Ye	es No
Dominant Sp	ty (1= 1-10%,	ture Trees: 2=11-20%, 3=	21-40%,	oak, p		
	1-80%, 6= 81	-100%)		Size Composition	of Live Trees (in	ches)
4= 41-60%, 5= 6 Understory	Mid-story	Canopy	/	Small (4-8)	Medium (9-15) Large (>15
Understory	3	5		Small (4-8) Z0%	Medium (9-15 40 %) Large (>15
Understory () Preferred Tree S	pecies ≥ 9 in onwood, White	dbh te Oak & other o			40%	40%

ater Resource	es at Sample	Site Stream Typ	e & Length:	Wetlands:			
Number &	Ephemeral	Intermittent	Perennial	A-22-22	Permanen	it Se	easonal
Length	NA			Approx. Acreage	10%		
		Number & S	ize Ponds/Pools	1			& Accessible to bats?
1- PU	ond a	pprox	> 5 ac	res		Yes [No [
Describe exi	sting condit	ion of water so	ources:				
		Pono		*			
				to bist	201 6	net	houn
			shaa ha	VI MILK	DAV VI	INIK	
Dominant Sp	pecies of Ma	ture Trees: 5	shag bai	Kemut 1	ory, 11	UCK	Derry
Dominant Si White	oecies of Ma	ture Trees: 3	shag bar Y lama	chemus)	ory, M	UCK	Derry
	T AT COLUMN		U	k hick	ory , VI	ack	Derig
Closure/Densi	T AT COLUMN	2= 11-20%, 3=	U	Size Composition			
losure/Densi	ity (1= 1-10%,	2= 11-20%, 3= 1-100%)	: 21-40%,			(inche	s)
Closure/Densi 41-60%, 5= 6	ity (1= 1-10%, 51-80%, 6= 81	2= 11-20%, 3= 1-100%)	: 21-40%,	Size Composition	of Live Trees	(inche	
closure/Densi 41-60%, 5= 6	ity (1= 1-10%, 51-80%, 6= 81 Mid-story	2= 11-20%, 3= 1-100%)	: 21-40%,	Size Composition	of Live Trees	(inche	s)
Closure/Densi 41-60%, 5= 6 Understory 5	ity (1= 1-10%, 51-80%, 6= 81 Mid-story 2 Species ≥ 9 in	2= 11-20%, 3= 1-100%) Canopy	21-40%,	Size Composition Small (4-8)	of Live Trees Medium (9	(inche:	s) Large (>15)
Closure/Densi 41-60%, 5= 6 Understory	ity (1= 1-10%, 51-80%, 6= 81 Mid-story 2 Species ≥ 9 in	2= 11-20%, 3= 1-100%) Canopy	21-40%,	Size Composition	of Live Trees Medium (9	(inche:	s) Large (>15)
Closure/Densi 41-60%, 5= 6 Understory	Mid-story Species ≥ 9 in onwood, White	2= 11-20%, 3= 1-100%) Canopy	pak species, Maj	Size Composition Small (4-8)	of Live Trees Medium (9	(inche:	s) Large (>15)
Closure/Densi 41-60%, 5=6 Understory Species:	Mid-story 2 Species ≥ 9 in onwood, White	2= 11-20%, 3= 1-100%) Canopy dbh te Oak & other o	pak species, Maj	Size Composition Small (4-8)	of Live Trees Medium (9	(inche:	s) Large (>15)
Closure/Densi 41-60%, 5=6 Understory Seferred Tree Stagbark, Cotton Species: Trees w/≥30	ity (1= 1-10%, 51-80%, 6= 83 Mid-story 2 Species ≥ 9 in onwood, White	2= 11-20%, 3= 1-100%) Canopy	pak species, Maj	Size Composition Small (4-8)	of Live Trees Medium (9	(inche:	s) Large (>15)
Closure/Densi 41-60%, 5=6 Understory Seferred Tree S hagbark, Cotte Species: Trees w/≥30 xfoliating bar	ity (1= 1-10%, 61-80%, 6= 81 Mid-story 2_ Species ≥ 9 in onwood, White Shall	2= 11-20%, 3= 1-100%) Canopy d dbh te Oak & other of	21-40%, pak species, Maj	Size Composition Small (4-8) / O ple (Silver Maple), A	Medium (9	(inche:	s) Large (>15)
Closure/Densi 41-60%, 5=6 Understory Seferred Tree Stagbark, Cotton Species: Trees w/≥30 xfoliating bar mber of Suita	ity (1= 1-10%, 61-80%, 6= 83 Mid-story 2 Species ≥ 9 in conwood, White Shall Sha	2=11-20%, 3= 1-100%) Canopy dbh te Oak & other of 1/6 tanding dead t	cak species, Maj	Size Composition Small (4-8) (C) Dole (Silver Maple), A	Medium (9	(inche:	s) Large (>15)
Closure/Densi 41-60%, 5=6 Understory Seferred Tree Shagbark, Cotton Species: Trees w/≥30 xfoliating bar	ity (1= 1-10%, 61-80%, 6= 83 Mid-story 2 Species ≥ 9 in conwood, White Shall Sha	2=11-20%, 3= 1-100%) Canopy dbh te Oak & other of 1/6 tanding dead t	21-40%, pak species, Maj	Size Composition Small (4-8) (C) Dole (Silver Maple), A	Medium (9	(inche:	s) Large (>15)
Closure/Densi 41-60%, 5=6 Understory Seferred Tree Shagbark, Cotton Species: Trees w/≥30 xfoliating bar mber of Suita	ity (1= 1-10%, 61-80%, 6= 83 Mid-story 2 Species ≥ 9 in conwood, White Shall Sha	2=11-20%, 3= 1-100%) Canopy dbh te Oak & other of tanding dead to features are no	cak species, Maj	Size Composition Small (4-8) (C) Dole (Silver Maple), A ghing bark, ≥ creviouitable.	Medium (9	(inche:	s) Large (>15)
Closure/Densi 41-60%, 5=6 Understory Seferred Tree Shagbark, Cotto Species: Trees w/≥30 xfoliating bar mber of Suita es. Snags withe site suita	Mid-story Species ≥ 9 in conwood, White Shape Shape Shape Shape Sithout these ble for India.	2=11-20%, 3= 1-100%) Canopy dbh te Oak & other of tanding dead to features are no	coak species, Major Solo of considered s	Size Composition Small (4-8) (C) Dole (Silver Maple), A ghing bark, ≥ creviouitable.	Medium (9	(inche:	s) Large (>15)
Closure/Densi 41-60%, 5=6 Understory Seferred Tree Stagbark, Cotton Species: Trees w/≥30 xfoliating bar mber of Suita es. Snags with	Mid-story Species ≥ 9 in onwood, White Shade Snags (sithout these ble for India Moderate	2=11-20%, 3= 1-100%) Canopy dbh te Oak & other of tanding dead to features are no	cak species, Major Coak Solo % trees with slougot considered solo Yes	Size Composition Small (4-8) (C) Dole (Silver Maple), A ghing bark, ≥ crevisuitable.	Medium (9	(inche:	s) Large (>15)
Closure/Densi 41-60%, 5=6 Understory Seferred Tree Shagbark, Cotton Species: Trees w/≥30 xfoliating bar mber of Suita es. Snags with	Mid-story Species ≥ 9 in onwood, White Shade Snags (sithout these ble for India Moderate	2=11-20%, 3= 1-100%) Canopy dbh te Oak & other of tanding dead to features are no na bats? High tern long-eare	cak species, Major Coak Solo % trees with slougot considered solo Yes	Size Composition Small (4-8) (C) Dole (Silver Maple), A ghing bark, ≥ creviouitable.	Medium (9	(inche:	s) Large (>15)

General desc	ription:						
		+ top	of th	e ride	ge		
Vater Resour	ces at Sample	Site Stream Type	e & Length:	Wetlands:			
	Ephemeral	Intermittent	Perennial		Permanen	it S	easonal
Number & Length	1-5001f			Approx. Acreage			75%
		Number & Si	ze Ponds/Pools				& Accessible
M	4					Yes	No
Describe ex Tribut	isting condition	ion of water so	ources: St into	East C	louist	Cr.	eek
oak,	White	ture Trees:	JOHNY 1	10000	Lury	10	ringle
		2= 11-20%, 3=	21-40%,	Size Composition	75.21 Jan 1		a la
	sity (1= 1-10%, 61-80%, 6= 81	2= 11-20%, 3= 1-100%)	21-40%,	Size Composition	of Live Trees	(inche	es)
41-60%, 5=	sity (1= 1-10%, 61-80%, 6= 81	2= 11-20%, 3= 1-100%)	21-40%,		75.21 Jan 1	(inche	es)
= 41-60%, 5= Understory Z referred Tree	sity (1= 1-10%, 61-80%, 6= 81 Mid-story 3 Species ≥ 9 in a tonwood, White	2= 11-20%, 3= 1-100%) Canopy	21-40%,	Size Composition Small (4-8)	Medium (9	(inche	Large (>15)

comments: foraging habitat. Few snags for roost trees 29 dbh. lots of shagbark hickory that are living, not snags

Water Resource		ite Stream Type		Wetlands:		
Number &	Ephemeral	Intermittent	Perennial	A	Permanent	Seasonal
Length	2/000			Approx. Acreage		10%
		Number & Si	ze Ponds/Pools		Oj	oen & Accessib
1	VA				Ye	es No [
		on of water so				
Trib	utary	to Ea.	st Locus	St Cree	et (flow	s South
			paclass	Cotton	1.1000	chinal
Dominant S	pecies of Mat	ture Trees:	eustern,	COHOTIL	wood.	sningie
	ninnv	1 - // /////	116 116	14 11/1		
CUK,	BIACK	W) 110V	us, wh	ITE OUR		
Closure/Dens	sity (1= 1-10%,	2= 11-20%, 3=	211.77			
Closure/Dens 41-60%, 5=	ity (1= 1-10%, 61-80%, 6= 81	2= 11-20%, 3= -100%)	21-40%,		of Live Trees (inc	
Closure/Dens 41-60%, 5= Understory	ity (1= 1-10%, 61-80%, 6= 81 Mid-story	2= 11-20%, 3= -100%)	21-40%,	Size Composition	of Live Trees (inc Medium (9-15	ches) Large (>15
Closure/Dens 41-60%, 5=	ity (1= 1-10%, 61-80%, 6= 81	2= 11-20%, 3= -100%)	21-40%,	Size Composition	of Live Trees (inc	ches)
Closure/Dens 41-60%, 5= Understory 5	ity (1= 1-10%, 61-80%, 6= 81 Mid-story 3	2= 11-20%, 3= -100%) Canopy	21-40%,	Size Composition Small (4-8) 50	Medium (9-15	ches) Large (>15 20
Closure/Dens 41-60%, 5= Understory 5	ity (1= 1-10%, 61-80%, 6= 81 Mid-story 3	2= 11-20%, 3= -100%) Canopy	21-40%,	Size Composition	Medium (9-15	ches) Large (>15 20
Closure/Dens 41-60%, 5= Understory 5	Mid-story Species ≥ 9 in conwood, White	2= 11-20%, 3= -100%) Canopy Hibh e Oak & other o	21-40%,	Size Composition Small (4-8) 50	Medium (9-15	ches) Large (>15 20
Closure/Dens 41-60%, 5= Understory Seferred Tree Shagbark, Cott Species: Trees w/≥3	Species ≥ 9 in conwood, White	2= 11-20%, 3= -100%) Canopy	21-40%,	Size Composition Small (4-8) 50	Medium (9-15	ches) Large (>15 20
Closure/Dens 41-60%, 5= Understory Seferred Tree Shagbark, Cott Species: Trees w/≥3	Species ≥ 9 in conwood, White	2= 11-20%, 3= -100%) Canopy Hibh e Oak & other o	21-40%,	Size Composition Small (4-8) 50	Medium (9-15	ches) Large (>15 20
Closure/Dens 41-60%, 5= Understory 5 referred Tree Shagbark, Cott Species: 6 Trees w/ ≥ 3 exfoliating ba	ity (1= 1-10%, 61-80%, 6= 81 Mid-story 3 Species ≥ 9 in conwood, White Shad ork 3 Shad table Snags (st	2= 11-20%, 3= -100%) Canopy 4 Ibh e Oak & other of the control	21-40%, Pak species, Map	Size Composition Small (4-8) 50 le (Silver Maple), A	Medium (9-15 30 American Elm, Sho	ches) Large (>15 20
Closure/Density 41-60%, 5= Understory Seferred Tree Shagbark, Cott Species: Trees w/≥3 exfoliating ba	ity (1= 1-10%, 61-80%, 6= 81 Mid-story 3 Species ≥ 9 in conwood, White Shad ork 3 Shad table Snags (st	2= 11-20%, 3= -100%) Canopy 4 Ibh e Oak & other of the control	21-40%,	Size Composition Small (4-8) 50 le (Silver Maple), A	Medium (9-15 30 American Elm, Sho	ches) Large (>15 20
Closure/Denside 41-60%, 5= Understory Seferred Tree shagbark, Cotton Species: Trees w/≥3 exfoliating base amber of Suitles. Snags were series and suitles. Snags were series and suitles. Snags were series and suitles.	ity (1= 1-10%, 61-80%, 6= 81 Mid-story 3 Species ≥ 9 in conwood, White Shad ork 3 Shad table Snags (st	2=11-20%, 3= -100%) Canopy 4 Ibh e Oak & other of the control o	21-40%, Pak species, Map	Size Composition Small (4-8) 50 le (Silver Maple), A	Medium (9-15 30 American Elm, Sho	ches) Large (>15 20
Closure/Dens = 41-60%, 5= Understory Sereferred Tree Shagbark, Cott Species: 6 Trees w/≥ 3 exfoliating base umber of Suitables. Snags we the site suitables.	Species ≥ 9 in conwood, White Shad of the	2= 11-20%, 3= -100%) Canopy He has a star of the control of the	z1-40%, bak species, Map rees with sloug of considered s	Size Composition Small (4-8) 50 le (Silver Maple), in thing bark, ≥ crevuitable.	Medium (9-15 30 American Elm, Sho	ches) Large (>1
Closure/Dens = 41-60%, 5= Understory Seferred Tree Shagbark, Cott Species: Trees w/≥ 3 exfoliating bate umber of Suitables. Snags we the site suitable the site suitable	Species ≥ 9 in of tonwood, White Shade Snags (stricthout these fable for Indian Moderate	2=11-20%, 3= -100%) Canopy 4 Ibh e Oak & other of the control o	z1-40%, rak species, Map rees with sloug of considered so Yes	Size Composition Small (4-8) 50 le (Silver Maple), in thing bank, ≥ crevuitable.	Medium (9-15 30 American Elm, Sho	ches) Large (>15 20

comments: good foraging habitat. few suitable roost trees = 9 dbh

Water Resource	s at Sample Si	te Stream Type & Length:	Wetlands:		
	Ephemeral	Intermittent Perennial	3,000	Permanent	Seasonal
Number & Length		>1000	Approx. Acreage	Ø	Ø
		Number & Size Ponds/Pools		Ор	en & Accessi to bats?
^		th of habit			s 🖾 No
East la	WST C	on of water sources: in Viek. Not f	lowing.	ent Th	10. t
Dominant Sp.	ecies of Mat	ure Trees: Shingle Black Willu	oak, h	oney loc	cust,
,	-				
	y (1= 1-10%, 2	2= 11-20%, 3= 21-40%,		of Live Trees (inc	
Closure/Densit	y (1= 1-10%, 2	2= 11-20%, 3= 21-40%, 100%)			hes)
Closure/Densit = 41-60%, 5= 63	y (1= 1-10%, 2 1-80%, 6= 81-	2= 11-20%, 3= 21-40%, 100%)	Size Composition	of Live Trees (inc	hes)
Closure/Densit = 41-60%, 5= 63 Understory 2	y (1= 1-10%, 2 1-80%, 6= 81- Mid-story 3 Decies ≥ 9 in di nwood, White	2= 11-20%, 3= 21-40%, 100%) Canopy	Size Composition Small (4-8)	Medium (9-15)	Large (>1
Closure/Densite 41-60%, 5= 6: Understory Z referred Tree Sp. Shagbark, Cotto Species:	y (1= 1-10%, 2 1-80%, 6= 81- Mid-story 3 Decies ≥ 9 in di nwood, White	2= 11-20%, 3= 21-40%, 100%) Canopy 5	Size Composition Small (4-8)	Medium (9-15)	Large (>1
Closure/Densite 41-60%, 5= 65 Understory Z referred Tree Sp Shagbark, Cotto Species: 6 Trees w/ ≥ 305 exfoliating bark umber of Suita	y (1= 1-10%, 2 1-80%, 6= 81- Mid-story 3 Decies ≥ 9 in di nwood, White Shap 50	2= 11-20%, 3= 21-40%, 100%) Canopy 5	Size Composition Small (4-8) 3 () le (Silver Maple), A	Medium (9-15)	Large (>1
Closure/Densite 41-60%, 5= 65 Understory Z referred Tree Sp. Shagbark, Cotto Species: 6 Trees w/ ≥ 305 exfoliating bark umber of Suitables. Snags with the site suitables.	y (1= 1-10%, 2 1-80%, 6= 81- Mid-story 3 Decies ≥ 9 in di nwood, White Shy 50 ble Snags (state	Canopy Canopy Canopy S Canopy Canopy S Canopy Canopy S Canopy Canopy S Canopy S Canopy S Canopy Canopy S Canopy Cano	Size Composition Small (4-8) 3 () le (Silver Maple), A thing bark, ≥ crevuitable.	Medium (9-15)	Large (>1