Environmental Assessment

Appendix J

Section 7 Consultation

From: McWilliams, Robin <robin_mcwilliams@fws.gov>
Sent: Friday, September 24, 2021 9:33 AM
To: Rusty Yeager
Subject: SR 11 Section 7 coordination

Hi Rusty,

Scott and I had a call this morning to discuss this project. After looking at the maps and records (including the hibernacula data) it appears that formal consultation is the appropriate pathway. There is the potential to assume presence. In that scenario, we would assume the project is within a maternity colony area and evaluate "take" based on this, as well as impacts to the fall swarming/spring staging area. As in the past, we would request a 3:1 ratio of forest preservation/reforestation. You can also do a presence/absence survey. This survey would be specific to determining summer maternity presence in the area. However, even if this turned out negative, the project would still need to go formal because the hibernacula in that area are some of the most important range-wide for the Ibat with over 100K Ibats converging in this part of the state for fall swarming. In the event there are no indications of maternity use (negative mist net survey), a reduced mitigation ratio of 2:1 would be appropriate.

Let me know if you have any questions. If you assume presence, we could start at any time on the consultation (assuming you have final alignment and impact numbers).

Sincerely,
Robin

Robin McWilliams Munson
Fish and Wildlife Biologist
U.S. Fish and Wildlife Service
620 South Walker Street
Bloomington, IN 46142
812-334-4261

Mon-Tues 8-3:30p
Wed-Thurs 8:30-3p Telework

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Indiana Ecological Services Field Office
620 South Walker Street
Bloomington, IN 47403-2121
Phone: (812) 334-4261 Fax: (812) 334-4273
http://www.fws.gov/midwest/Endangered/section7/s7process/step1.html

In Reply Refer To: October 14, 2021
Consultation Code: 03E12000-2022-SLI-0117
Event Code: 03E12000-2022-E-00377
Project Name: Des 2001154; SR 11 Roadway Project; Harrison County

Subject: List of threatened and endangered species that may occur in your proposed project location or may be affected by your proposed project

To Whom It May Concern:

The attached species list identifies any federally threatened, endangered, proposed and candidate species that may occur within the boundary of your proposed project or may be affected by your proposed project. The list also includes designated critical habitat if present within your proposed project area or affected by your project. This list is provided to you as the initial step of the consultation process required under section 7(c) of the Endangered Species Act, also referred to as Section 7 Consultation.

Section 7 of the Endangered Species Act of 1973 requires that actions authorized, funded, or carried out by Federal agencies not jeopardize federally threatened or endangered species or adversely modify designated critical habitat. To fulfill this mandate, Federal agencies (or their designated non-federal representative) must consult with the Service if they determine their project "may affect" listed species or critical habitat.

Under 50 CFR 402.12(e) (the regulations that implement Section 7 of the Endangered Species Act) the accuracy of this species list should be verified after 90 days. This verification can be completed formally or informally. You may verify the list by visiting the ECOS-IPaC website http://ecos.fws.gov/ipac/ at regular intervals during project planning and implementation and completing the same process you used to receive the attached list. As an alternative, you may contact this Ecological Services Field Office for updates.

Please use the species list provided and visit the U.S. Fish and Wildlife Service's Region 3 Section 7 Technical Assistance website at - http://www.fws.gov/midwest/endangered/section7/s7process/index.html. This website contains step-by-step instructions which will help you determine if your project will have an adverse effect on listed species and will help lead you through the Section 7 process.

For all **wind energy projects** and **projects that include installing towers that use guy wires or are over 200 feet in height**, please contact this field office directly for assistance, even if no federally listed plants, animals or critical habitat are present within your proposed project or may be affected by your proposed project.

Although no longer protected under the Endangered Species Act, be aware that bald eagles are protected under the Bald and Golden Eagle Protection Act (16 U.S.C. 668 *et seq.*) and Migratory Bird Treaty Act *(*16 U.S.C. 703 *et seq*), as are golden eagles. Projects affecting these species may require measures to avoid harming eagles or may require a permit. If your project is near an eagle nest or winter roost area, see our Eagle Permits website at http://www.fws.gov/midwest/midwestbird/EaglePermits/index.html to help you determine if you can avoid impacting eagles or if a permit may be necessary.

We appreciate your concern for threatened and endangered species. Please include the Consultation Tracking Number in the header of this letter with any request for consultation or correspondence about your project that you submit to our office.

Attachment(s):

- Official Species List

Official Species List

This list is provided pursuant to Section 7 of the Endangered Species Act, and fulfills the requirement for Federal agencies to "request of the Secretary of the Interior information whether any species which is listed or proposed to be listed may be present in the area of a proposed action".

This species list is provided by:

Indiana Ecological Services Field Office
620 South Walker Street
Bloomington, IN 47403-2121
(812) 334-4261

Project Summary

Consultation Code: 03E12000-2022-SLI-0117
Event Code: Some(03E12000-2022-E-00377)
Project Name: Des 2001154; SR 11 Roadway Project; Harrison County
Project Type: TRANSPORTATION
Project Description: The Federal Highway Administration (FHWA) and Indiana Department of Transportation (INDOT) plan to proceed with a new road construction project located in Harrison County. The project is located between the State Road (SR) 135 and Watson Road junction in the west and the SR 11 and Melview Road/SR 337 junction in the east, 4.7 miles north of the existing junction between SR 135 and SR 11 and approximately 10 miles south of Corydon, Indiana along SR 135. The project involves upgrading existing county roads and building a new terrain road to create a new east-west SR 11 connection across Buck Creek. The project proposes the construction of a new bridge across Buck Creek and installation of additional culverts spanning smaller streams. The exact size of these new structures is not yet known. Once sizes are known, asset numbers will be created and used for final design. Twenty-four (24) small culverts, ranging in size from 12 inches to 5 feet in diameter, are present within the proposed study area. Adjacent land use is primarily agricultural fields and mature forests with scattered residences. The mature forests and adjacent edges of agricultural fields would be considered suitable summer habitat for the Indiana bat and northern long-eared bat. The project is anticipated to require up to 29 acres of tree clearing, including up to 9 acres within 100 feet of the existing roadway, up to 2 acres between 100 and 300 feet of the existing roadway, and up to 20 acres greater than 300 feet from the existing roadway. All tree clearing will occur during the inactive season (November 15 to March 31). Dominant species within the tree clearing areas include multiple oak species (Quercus sp.), tulip poplar (Liriodendron tulipifera), shagbark hickory (Carya ovata), American beech (Fagus grandifolia), black walnut (Juglans nigra), American elm (Ulmus americana), maples (Acer sp.), white pine (Pinus strobus), ash species (Fraxinus sp.), American sycamore (Platanus occidentalis), red cedar (Juniperus virginiana), tree of heaven (Alianthus altissima), and box elder (Acer negundo). Up to $28,062 is anticipated to be paid to the Range-wide In-lieu Fee Program, to be administered by The Conservation Fund. This amount was determined by the Habitat Block Method. The area of suitable habitat to be cleared, multiplied by the mitigation ratio for inactive season tree clearing for Harrison County, and the compensatory price per acre; 2 acres x 1.5 x $9,354.
Bat inspections for the 24 culverts were performed on April 22, 2021 and no evidence of bats was identified within any of the culverts. A review of the USFWS database by INDOT Seymour District environmental staff on May 4, 2021 did not indicate the presence of endangered bat species in or

within 0.5 mile of the project area; however, the project is located within the 10-mile MYSO hibernacula buffer. Tree removal dates for projects located within the hibernacula buffer are from November 15 to March 31 (instead of the standard October 1 to March 31) to allow for the conclusion of fall swarming around the hibernacula. No permanent or temporary lighting is anticipated for the project. It is likely that some buildings will need to be removed as part of the project; however, specific buildings have not yet been identified. Any buildings that are removed will need to be inspected for evidence of bat use prior to demolition. Please note, if bats or signs of bats are found during the inspection(s), coordination will need to occur with the appropriate INDOT District Environmental as soon as possible. Work is anticipated to begin in July 2025 and be completed by July 2028.

Project Location:

Approximate location of the project can be viewed in Google Maps: https://www.google.com/maps/@38.0848526,-86.12301182971167,14z

Counties: Harrison County, Indiana

Endangered Species Act Species

There is a total of 4 threatened, endangered, or candidate species on this species list.

Species on this list should be considered in an effects analysis for your project and could include species that exist in another geographic area. For example, certain fish may appear on the species list because a project could affect downstream species. Note that 1 of these species should be considered only under certain conditions.

IPaC does not display listed species or critical habitats under the sole jurisdiction of NOAA Fisheries[1], as USFWS does not have the authority to speak on behalf of NOAA and the Department of Commerce.

See the "Critical habitats" section below for those critical habitats that lie wholly or partially within your project area under this office's jurisdiction. Please contact the designated FWS office if you have questions.

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1. NOAA Fisheries, also known as the National Marine Fisheries Service (NMFS), is an office of the National Oceanic and Atmospheric Administration within the Department of Commerce.

Mammals

NAME	STATUS
Gray Bat *Myotis grisescens* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/6329	Endangered
Indiana Bat *Myotis sodalis* There is **final** critical habitat for this species. Your location overlaps the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/5949	Endangered
Northern Long-eared Bat *Myotis septentrionalis* No critical habitat has been designated for this species. This species only needs to be considered under the following conditions: ▪ Incidental take of the NLEB is not prohibited here. Federal agencies may consult using the 4(d) rule streamlined process. Transportation projects may consult using the programmatic process. See www.fws.gov/midwest/endangered/mammals/nleb/index.html Species profile: https://ecos.fws.gov/ecp/species/9045	Threatened

Insects

NAME	STATUS
Monarch Butterfly *Danaus plexippus* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/9743	Candidate

Critical habitats

There is 1 critical habitat wholly or partially within your project area under this office's jurisdiction.

NAME	STATUS
Indiana Bat *Myotis sodalis* https://ecos.fws.gov/ecp/species/5949#crithab	Final

INDIANA DEPARTMENT OF TRANSPORTATION

100 North Senate Avenue
Room N758-ES
Indianapolis, Indiana 46204

PHONE: (855) 463-6848

Eric Holcomb, Governor
Michael Smith, Commissioner

April 12, 2022

Robin McWilliams-Munson
U.S. Fish and Wildlife Service
Bloomington Field Office
620 South Walker Street
Bloomington, Indiana 46403

Re: Standard Informal Consultation for the Indiana Bat and Northern Long-Eared Bat
Des. No. 2001154
State Road (SR) 11 Extension, New Roadway Construction Project; SR 11, from SR 135/Watson Road to SR 11/SR 337/Melview Road Intersection in Harrison County, Indiana

Dear Ms. McWilliams-Munson:

The Indiana Department of Transportation (INDOT) is acting on behalf of Federal Highway Administration (FHWA) and submitting this letter for standard informal consultation for the Indiana bat (*Myotis sodalis*) and Northern long-eared bat (*Myotis septentrionalis*) (NLEB). Based on the project description and aerial maps (Attachment 1), the project is not within the scope of the *Programmatic Biological Opinion for Transportation Projects in the Range of the Indiana Bat and NLEB* due to the project exceeding maximum acreage cleared (generally 20 acres of suitable habitat per 5-mile section of road/rail).

Existing Project Conditions

Within the study area, Watson Road is functionally classified as a rural major collector and Melview Road is functionally classified as a local road. The typical cross section of Watson and Melview Roads consists of two 9- to 10-foot travel lanes (one lane in each direction) with no shoulder or median. Surrounding land use consists of agricultural fields, forests, and streams with scattered residences. The forests, adjacent edges of agricultural fields, and riparian areas along streams would be considered suitable summer habitat for the Indiana bat and northern long-eared bat

Proposed Improvements

The need for the SR 11 Extension, New Roadway Construction Project is to address the substandard roadway conditions of the existing SR 11 from the intersection of SR 11 / SR 337 / Melview Road to SR 135 to improve the safety and travel time along this section of the SR 11 roadway.

The proposed project will involve upgrading existing county roads and building a new terrain road to create a new east-west SR 11 connection across Buck Creek. The project proposes the construction of a new bridge across Buck Creek and installation of additional culverts spanning smaller streams. The exact size of these new structures is not yet known. Once they are, asset numbers will be created and used for final design.

Temporary lighting may be necessary. No permanent lighting is anticipated for the project.

Right-of-Way

This project is anticipated to require up to 45 acres of permanent right-of-way (ROW) and up to 5 acres of temporary ROW.

Construction Schedule and Maintenance of Traffic

Work is anticipated to begin in July 2025 and be completed by July 2028.

The proposed maintenance of traffic (MOT) includes closure with detour for any existing county roads that are utilized. Existing portions of SR 135 and SR 11 are expected to remain open to traffic but will require temporary lane shifting to make room for construction. Access for property owners will be maintained at all times.

Coordination Completed

Early coordination for the project was distributed October 6, 2021. The Indiana Department of Natural Resources Division of Fish and Wildlife (IDNR DFW) responded on November 10, 2021 (Attachment 3). According to the response, the Natural Heritage Program's data have been checked. The Nature Conservancy's Indiana Forest Bank is located within 0.5 mile of the study area. The Wavyrayed Lampmussel (*Lampsilis fasciola*) and Little Spectaclecase (*Villosa lienosa*), both state species of special concern, have been documented in Buck Creek within 0.5 mile of the study area. However, as long as in-stream impacts are minimized in Buck Creek and standard erosion control measures are implemented, the IDNR DFW does not foresee any impacts to these species. The response also stated that significant direct and indirect impacts may be caused by new-terrain road alignments. IDNR DFW provided recommendations regarding road fragmentation, alternative selection, crossing structures, riparian habitat, and karst features, as well as additional standard recommendations.

The official species list generated in IPaC indicated that the Indiana bat (*Myotis sodalis*) (MYSO), northern long-eared bat (*Myotis septentrionalis*), and one other species, the gray bat (*Myotis grisescens*), are present within the study area (Attachment 4). The project does not qualify for the USFWS Interim Policy due to greater than 0.5 acre of anticipated impacts to forested ROW.

On October 25, 2021 a Microsoft Teams meeting with Lochmueller Group, INDOT, and USFWS occurred to discuss the Section 7 process for this project.

Existing Bat Habitat

The portion of the study area that will have new road constructed currently consists of agricultural fields, forests, and streams with scattered residences. The forests, adjacent edges of agricultural fields, and riparian areas along streams would be considered suitable summer habitat for the Indiana bat and northern long-eared bat. The project proposes the construction of a new bridge across Buck Creek and installation of additional culverts spanning smaller streams. The exact size of these new structures is not yet known. Once sizes are known, asset numbers will be created and used for final design. Twenty-four (24) small culverts, ranging in size from 12 inches to 5 feet in diameter, are present within the proposed study area. Bat inspections for the 24 culverts were performed on April 22, 2021 and no evidence of bats was identified within any of the culverts (Attachment 2). A review of the USFWS database by INDOT Seymour District environmental staff on May 4, 2021 did not indicate the presence of endangered bat species in or within 0.5 mile of the study area; however, the project is located

within the 10-mile MYSO hibernacula buffer. Tree removal dates for projects located within the hibernacula buffer are from November 15 to March 31 (instead of the standard October 1 to March 31) to allow for the conclusion of fall swarming around the hibernacula.

Lochmueller Group performed bat habitat evaluations on April 22 and 23, 2021 and May 5-8, 2021 and roosting and foraging habitat were found to be present throughout the forested portions of the study area.

Assessment of Potential Suitable Summer Habitat

Within the study area, the forests, adjacent edges of agricultural fields, and riparian areas along streams would be considered suitable summer habitat for the Indiana bat and northern long-eared bat. Dominant species within the tree clearing areas include multiple oak species (*Quercus sp.*), tulip poplar (*Liriodendron tulipifera*), shagbark hickory (*Carya ovata*), American beech (Fagus grandifolia), black walnut (*Juglans nigra*), American elm (*Ulmus americana*), maples (*Acer sp.*), white pine (*Pinus strobus*), ash species (*Fraxinus sp.*), American sycamore (*Platanus occidentalis*), red cedar (*Juniperus virginiana*), tree of heaven (Alianthus altissima), and box elder (*Acer negundo*). Phase 1 Summer Habitat Assessments were completed for the project in April and May 2021 (Attachment 5).

Water Resources and Wetlands Present

Twelve streams (including Buck Creek and eleven unnamed tributaries to Buck Creek), six wetlands, and eight open water features are present within the study area (Attachment 1).

Impacts

Three preliminary alternatives are being investigated at this time. Tree clearing and water resource impacts will vary depending on the alternative that is selected. Up to 1,039 feet of streams, 0.087 acres of wetlands, and 0.117 acres of open water features may be impacted by the project. Up to 29 acres of tree clearing, including up to 9 acres within 100 feet of existing road, up to 2 acres greater than 100 feet but less than 300 feet from existing road, and up to 20 acres greater than 300 feet from existing road, is anticipated. No lighting is anticipated; however, noise and vibrations will be raised above existing conditions due to the project. The proposed tree clearing is shown on the aerial photographs in Attachment 1 and are summarized below.

*Table 1. Tree Clearing Summary**

Acres of trees to be cleared within 100 feet of existing road/rail	Acres of trees to be cleared more than 100 feet, but less than 300 feet from existing road/rail	Acres of trees to be cleared more than 300 feet from existing road/rail	Total Acres of Trees
Up to 9	Up to 2	Up to 20	Up to 29

*Please note that tree clearing acreages in each column include combined information for multiple alternatives. Therefore, the total acres of trees to be cleared is not equal to the sum of acres provided for each distance from the roadway.

Commitments

The following commitments are proposed as Avoidance and Minimization Measures (AMMs) to reduce potential impacts to the Indiana Bat and NLEB.

General AMM 1: Ensure all operators, employees, and contractors working in areas of known or presumed bat habitat are aware of all FHWA/FRA/FTA (Transportation Agencies) environmental commitments, including all applicable AMMs.

Tree Removal AMM 1: Modify all phases/aspects of the project (e.g., temporary work areas, alignments) to the extent practicable to avoid tree removal in excess of what is required to implement the project safely.

Tree Removal AMM 2: Apply time of year (TOY) restrictions for tree removal when bats are not likely to be present, or limit tree removal to 10 or fewer trees per project at any time of year within 100 feet of existing road/rail surface and outside of documented roosting/foraging habitat or travel corridors; visual emergence survey must be conducted with no bats observed.

Tree Removal AMM 3: Ensure tree removal is limited to that specified in project plans and ensure that contractors understand clearing limits and how they are marked in the field (e.g., install bright colored flagging/fencing prior to any tree clearing to ensure contractors stay within clearing limits).

Tree Removal AMM 4. Do not remove documented Indiana bat or NLEB roosts that are still suitable for roosting; or trees within 0.25 mile of roosts; or documented foraging habitat any time of year.

Hibernacula AMM 1: For projects located within karst areas, on-site personnel will use best management practices, secondary containment measures, or other standard spill prevention and countermeasures to avoid impacts to possible hibernacula. Where practicable, a 300 foot buffer will be employed to separate fueling areas and other major containment risk activities from caves, sinkholes, losing streams, and springs in karst topography.

Lighting AMM 1: Direct temporary lighting away from suitable habitat during the active season.

Conclusion

In consultation with USFWS, it was determined that the Proposed Action is not within the scope of the *Programmatic Biological Opinion for Transportation Projects in the Range of the Indiana Bat and NLEB* and will be processed as standard informal consultation.

Based on the presence of likely suitable summer habitat in the study area; up to 29 acres of tree clearing (a portion of which is greater than 300 feet from existing road/rail); and the application of General AMM 1, Tree Clearing AMMs 1-4, and Hibernacula AMM 1, the FHWA has determined the proposed project has an effect finding of “May Affect, Not Likely to Adversely Affect - with AMMs” for the federally endangered Indiana bat (*Myotis sodalis*) and the federally threatened northern long-eared bat (*Myotis septentrionalis*).

The FHWA is requesting USFWS concurrence with this project “May Affect, Not Likely to Adversely Affect - with AMMs” determination.

If you have any questions or require additional information, please contact Holly Hume at (812) 759-4107 or at hhume@lochgroup.com or the sponsor of this project, the INDOT-Seymour District, Project Manager, Matthew Rhoads, at (812) 524-3941 or at mrhoads@indot.in.gov. We appreciate your attention to this project.

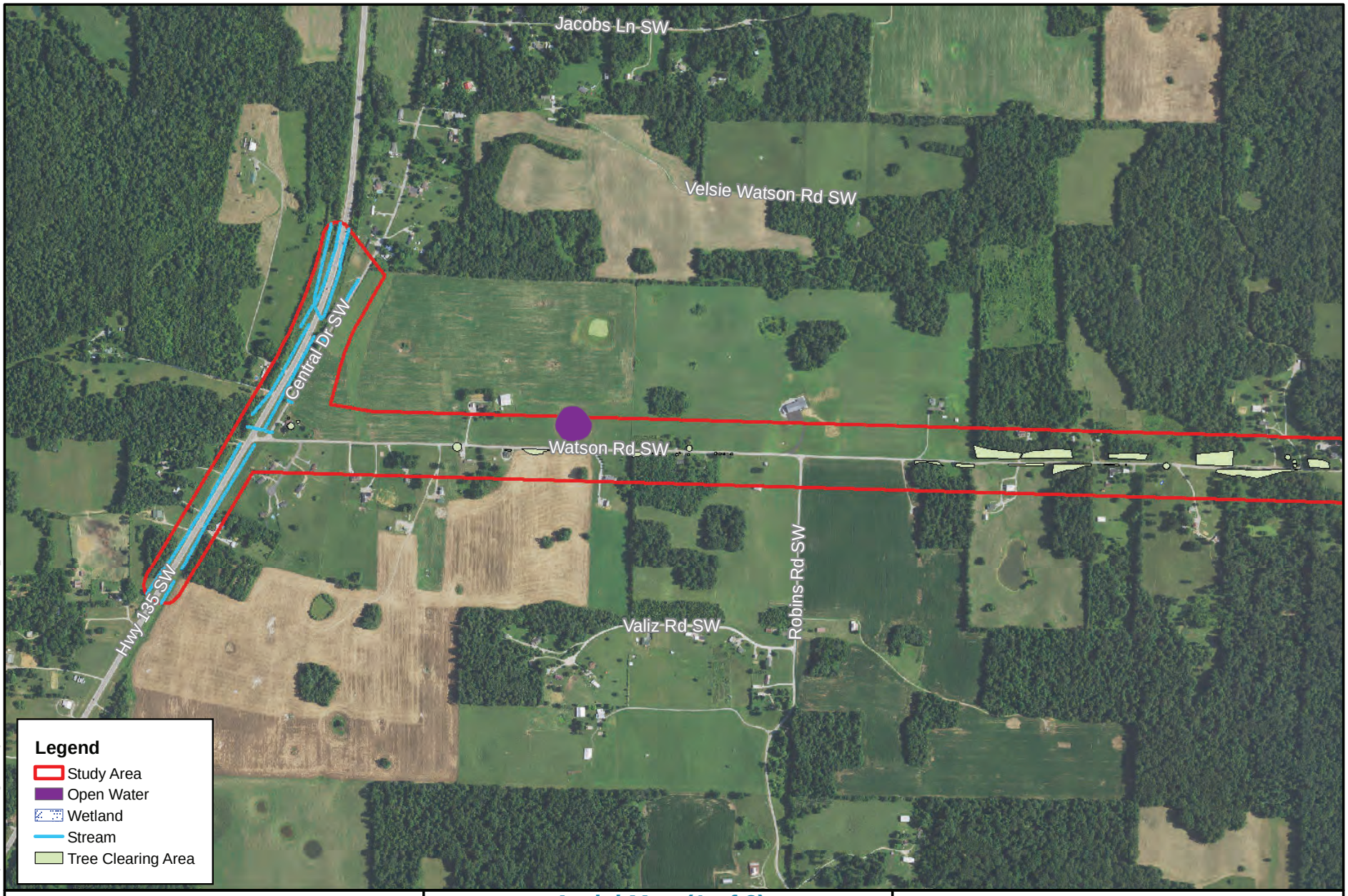
Sincerely,

Holly Hume
Environmental Specialist II
Lochmueller Group, Inc.

Attachments:

- Aerial Maps
- Structure Inspection Table
- ~~IDNR Early Coordination Response Letter~~
- ~~Official Species List~~
- Phase 1 Summer Habitat Assessments

Removed to avoid duplication



LOCHMUELLER GROUP
6200 Vogel Road
Evansville, IN 47715
Phone: (812) 479-6200
Fax: (812) 479-6262

Aerial Map (1 of 3)

Des. No. 2001154

County: Harrison
Townships: Boone & Heth

0 0.1 0.2 Miles

N

SR 11, From SR 135/Watson Rd to
SR 11/SR 337/Melview Rd Intersection
Extension, New Roadway Construction
Created: 2/17/2022, H. Hume

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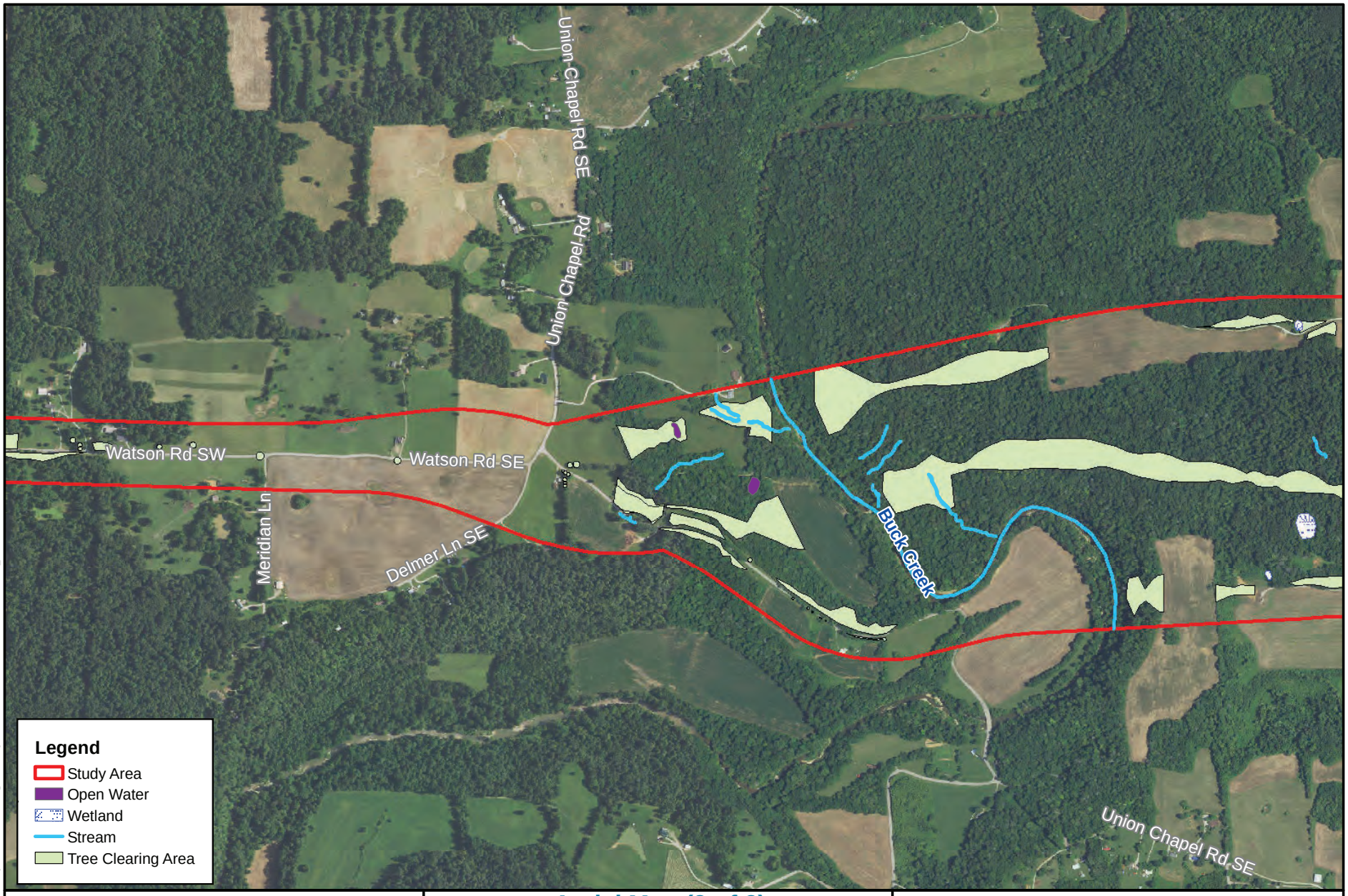

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LOCHMUELLER GROUP
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Evansville, IN 47715
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Aerial Map (2 of 3)

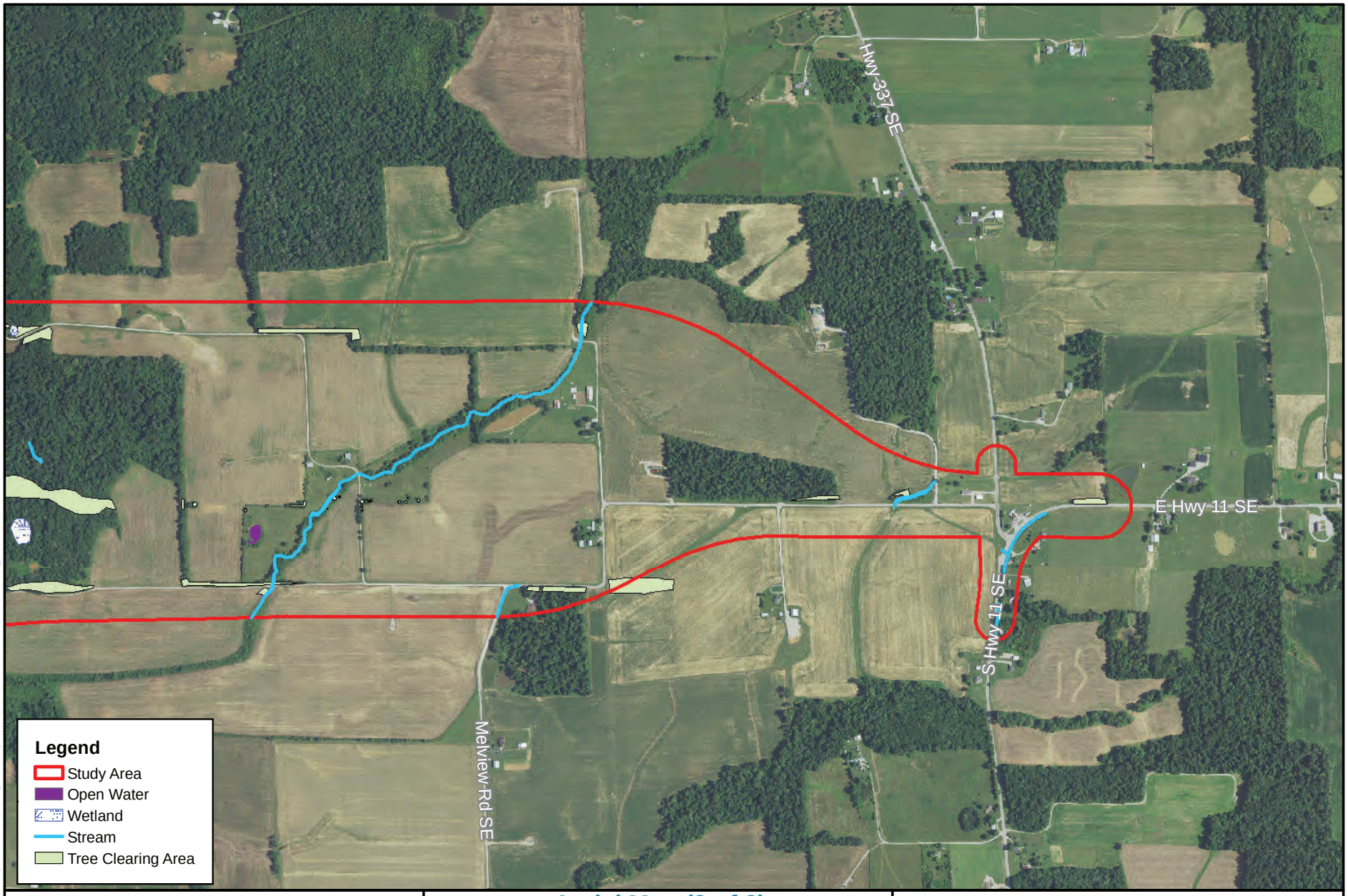
Des. No. 2001154

County: Harrison
Townships: Boone & Heth

0 0.1 0.2 Miles

N

SR 11, From SR 135/Watson Rd to SR 11/SR 337/Melview Rd Intersection Extension, New Roadway Construction
Created: 2/17/2022, H. Hume



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Aerial Map (3 of 3)

Des. No. 2001154

0 0.1 0.2 Miles

N

County: Harrison
Townships: Boone & Heth

SR 11, From SR 135/Watson Rd to
SR 11/SR 337/Melview Rd Intersection
Extension, New Roadway Construction
Created: 2/17/2022, H. Hume

Inspection Date: April 22, 2021
Inspector: Sean Langley
Des 2001154

Culvert	Description	Route/Facility Carried	Length (feet)	Latitude	Longitude	Evidence of Bats
1	24" CMP	SR 135	120	38.085565	-86.164094	No
2	12" CMP	Central Drive SW	70	38.085556	-86.164063	No
3	12" CMP	Watson Road	30	38.084641	-86.142724	No
4	18" CMP	Watson Road	30	38.084305	-86.132678	No
5	12" CMP	Watson Road	30	38.084077	-86.123898	No
6	18" CMP	Union Chapel Road	20	38.082818	-86.120899	No
7	12" CMP	Private Drive	30	38.083981	-86.122942	No
8	12" rubber	Private Drive	15	38.081177	-86.100948	No
9	12" Concrete Box Culvert	Private Drive	30	38.081283	-86.095911	No
10	12" Concrete Box Culvert	Private Drive	30	38.081283	-86.095911	No
11	18" CPP	Private Drive	15	38.018324	-86.094732	No
12	24" CMP	Private Drive	30	38.083702	-86.093408	No
13	24" CMP	Private Drive	30	38.083702	-86.093408	No
14	24" CMP	Private Drive	30	38.083702	-86.093408	No
15	12" rubber	Private Drive	15	38.084519	-86.094858	No
16	12" rubber	Private Drive	15	38.086807	-86.096015	No
17	12" rubber	Private Drive	15	38.086804	-86.098246	No
18	24" CPP	Private Drive	15	38.087044	-86.099836	No
19	24" CPP	Private Drive	25	38.081239	-86.090391	No
20	18" CMP	Private Drive	35	38.083091	-86.086936	No
21	18" CMP	Melview Road SE	30	38.082918	-86.08295	No
22	60" Metal	Melview Road SE	30	38.082849	-86.078919	No
23	12" CMP	Private Drive	50	38.082928	-86.077648	No
24	48" CMP	SR 337	40	38.08347	-86.076271	No

Attachment 2

PHASE 1 SUMMER HABITAT ASSESSMENTS

TA-HA-1

INDIANA BAT HABITAT ASSESSMENT DATASHEET

Project Name: SR 11 Extension (120-0046)			Date: April 23, 2021
Township/Range/Section:	5S/4E/16		Boone Township, Harrison County
Lat Long/UTM/Zone: 86.0699038 W 38.0455701 N	Western terminus 86.0699038 W 38.0455701 N	Eastern terminus 86.0699038 W 38.0455701 N	Surveyor: S. Langley

Brief Project Description

Four alternative routes are being considered to connect Stater Road 11 to State Road 135. Surveys of potential bat habitat and roosts trees are being conducted to assist in route selection and minimize environmental impacts.

Project Area

Project	Total Acres	Forest Acres	Open Acres
	0.61	0.61	0.0

Proposed Tree Removal (ac)	Completely cleared	Partially cleared (will leave trees)	Preserve acres-no clearing
	Unknown	Unknown	Unknown

Brief Project Description

Pre-Project	**Post-Project**
*See Project Description Above	Unknown at this time.

Brief Project Description

Flight corridors to other forested areas?

Flight corridors to neighboring forested areas are not present.

Describe Adjacent Properties (e.g. forested, grassland, commercial or residential development, water sources)

Adjacent property use is rural with agricultural and rural-residential areas.

Proximity to Public Land

What is the distance (mi.) from the project area to forested public lands (e.g., national or state forests, national or state parks, conservation areas, wildlife management areas)?

Indiana Forest Bank – Harrison is located approximately 1.99 mile west of the habitat assessment area.
Three-Way Sedge Sinkhole Swamp Nature Conservancy is located approximately 2.89 miles southwest of the habitat assessment area.
Mosquito Creek DNR Nature Preserve is located approximately 3.33 miles southeast of the habitat assessment area.
Perseverance Barrens DNR Nature Preserve is located approximately 3.39 miles northwest of the habitat assessment area.

PHASE 1 SUMMER HABITAT ASSESSMENTS

Use additional sheets to assess discrete habitat types at multiple sites in a project area
Include a map depicting locations of sample sites if assessing discrete habitats at multiple sites in a project area
A single sheet can be used for multiple sample sites if habitat is the same

Sample Site Description

Sample Site No.(s): TA-HA-1

The bat habitat assessment area is a small stand of trees lining an Unnamed Tributary (UNT) to Buck Creek. The trees area isolated by ag fields, residential property, and Melview Road. American sycamore and ash species are dominant within the canopy. Box elder and ash species are dominant within the mid-story and understory.

Water Resources at Sample Site

Stream Type (# and length)	Ephemeral	Intermittent	Perennial	Describe existing condition of water sources: An Unnamed Tributary (UNT) to Buck Creek is located within the bat habitat assessment area. The UNT to Buck Creek was flowing at the time of the survey.
	N/A	N/A	UNT to Buck Creek, 0.06 mile	
Pools/Ponds (# and size)	N/A	N/A		
		N/A		
Wetlands (approx. ac.)	N/A	N/A		
	N/A	N/A		

Forest Resources at Sample Site

Closure/Density	Canopy (>50')	Midstory (20-50')	Understory (<20')	1=1-10%, 2=11-20%, 3=21-40%, 4=41-60% 5=61-80%, 6=81-100%
	1	3	4	
Dominant Species of Mature Trees	Canopy: *Platanus occidentalis*, *Fraxinus sp.* Mid-Story: *Fraxinus sp.*, *Acer negundo* Understory: *Acer negundo*			
% Trees w/ Exfoliating Bark	0	0	0	
Size Composition of Live Trees (%)	Small (3-8 in)	Med (9-15 in)	Large (>15 in)	
	70	20	10	
No. of Suitable Snags	0	0	0	

Standing dead trees with exfoliating bark, cracks, crevices, or hollows.
Snags without these characteristics area not considered suitable.

IS THE HABITAT SUITABLE FOR INDIANA BATS?

Additional Comments:

Use of the bat habitat assessment area by Indiana, northern long-eared, or gray bats is possible, but unlikely due to the isolated nature of the area. A permanent, or at least semi-permanent, water source is available through a UNT to Buck Creek.

Attach aerial photo or project site with all forested areas labeled and a general description of the habitat

Photographic Documentation: habitat shots at edge and interior from multiple locations; Understory/midstory/canopy; examples of potential suitable snags and live trees; water sources

Attachment 5

PHASE 1 SUMMER HABITAT ASSESSMENTS

TA-HA-2

INDIANA BAT HABITAT ASSESSMENT DATASHEET

Project Name: SR 11 Extension (120-0046)			Date: April 23, 2021
Township/Range/Section:	5S/4E/9		Boone Township, Harrison County
Lat Long/UTM/Zone: 86.0781780 W 38.0904972 N	Western terminus 86.0781780 W 38.0904972 N	Eastern terminus 86.0781780 W 38.0904972 N	Surveyor: S. Langley

Brief Project Description

Four alternative routes are being considered to connect Stater Road 11 to State Road 135. Surveys of potential bat habitat and roosts trees are being conducted to assist in route selection and minimize environmental impacts.

Project Area

Project	Total Acres	Forest Acres	Open Acres
	11.78	11.78	0.00

Proposed Tree Removal (ac)	Completely cleared	Partially cleared (will leave trees)	Preserve acres-no clearing
	Unknown	Unknown	Unknown

Brief Project Description

Pre-Project	**Post-Project**
*See Project Description Above	Unknown at this time.

Brief Project Description

Flight corridors to other forested areas?

Flight corridors are not present to other forested areas.

Describe Adjacent Properties (e.g. forested, grassland, commercial or residential development, water sources)

Adjacent land use is rural, consisting of agricultural and rural-residential areas. A petroleum well is located immediately west of the bat habitat assessment area.

Proximity to Public Land

What is the distance (mi.) from the project area to forested public lands (e.g., national or state forests, national or state parks, conservation areas, wildlife management areas)?

An Indiana Forest Bank – Harrison property is located approximately 1.66 miles west of the bat habitat assessment area.
Squire Boone Caverns is located approximately 2.86 miles southwest of the bat habitat assessment area.
Three-Way Sedge Sinkhole Swamp Nature Conservancy is located approximately 2.86 miles south of the bat habitat assessment area.
Perseverance Barrens Nature Conservancy is located approximately 3.24 miles north of the bat habitat assessment area.
Mosquito Creek DNR Nature Preserve is located approximately 3.52 miles southeast of the bat habitat assessment area.
Harrison-Crawford State Forest is located approximately 6.04 miles west of the bat habitat assessment area.

PHASE 1 SUMMER HABITAT ASSESSMENTS

Use additional sheets to assess discrete habitat types at multiple sites in a project area
Include a map depicting locations of sample sites if assessing discrete habitats at multiple sites in a project area
A single sheet can be used for multiple sample sites if habitat is the same

Sample Site Description

Sample Site No.(s): TA-HA-2

The bat habitat assessment area is located in a mature, upland forest bordered by ag fields and Melview Road. Dominant species in the canopy include white oak and shagbark hickory. Dominant species within the mid-story include American beech, redbud, and sassafras. A honeysuckle species was dominant within the understory. Many of the secondary growth sassafras within the mid-story are dying back, providing potential bat roosts, especially ideal for the northern long-eared bat. This forest is isolated and no flight corridors exist to neighboring forested areas. Maintained paths and gaps in the mid-story provide internal flight corridors. No permanent source of water was identified within the bat habitat assessment area.

Water Resources at Sample Site

Stream Type (# and length)	Ephemeral	Intermittent	Perennial	Describe existing condition of water sources: No permanent water source was identified within the bat habitat assessment area. No wetlands were identified within the bat habitat assessment area.
	N/A	N/A	N/A	
Pools/Ponds (# and size)	N/A	N/A		
		N/A		
Wetlands (approx. ac.)	N/A	N/A		
	N/A	N/A		

Forest Resources at Sample Site

Closure/Density	Canopy (>50')	Midstory (20-50')	Understory (<20')	1=1-10%, 2=11-20%, 3=21-40%, 4=41-60% 5=61-80%, 6=81-100%
	4	4	4	
Dominant Species of Mature Trees	Canopy: *Quercus alba, Carya ovata* Mid-Story: *Fagus grandifolia, Cercis canadensis, Sassafra albidum* Understory: *Lonicera sp.*			
% Trees w/ Exfoliating Bark	20	20	10	
Size Composition of Live Trees (%)	Small (3-8 in)	Med (9-15 in)	Large (>15 in)	
	30	30	40	
No. of Suitable Snags	2	7	2	

Standing dead trees with exfoliating bark, cracks, crevices, or hollows.
Snags without these characteristics area not considered suitable.

IS THE HABITAT SUITABLE FOR INDIANA BATS?

Additional Comments:

The bat habitat assessment area should be considered potential foraging and roost habitat for both the Indiana and northern long-eared bat. The bat habitat assessment area should also be considered potential foraging habitat for the federally endangered gray bat, present within Harrison County. The bat habitat assessment area is not connected to neighboring forested areas; however, due to the size of the forest and the presence of potential roost trees, occupancy by bats cannot be ruled out. No permanent source of water is located within the bat habitat assessment area. Ponds and streams are located on neighboring properties. Eleven potential roost trees were identified within the bat habitat assessment area. Shagbark hickory with the area may provide additional roosting opportunities.

TA-HA-2 Potential Roost Trees

Tree ID	Species	DBH (cm)	Decomposition Stage	Roost Features
TA-1	*Sassafras albidum*	20.5	5	Cavities
TA-2	*Sassafras albidum*	32	4	Cavities, Exfoliating Bark
TA-3	Unknown	29	6	Snag, Cavities
TA-4	*Sassafras albidum*	39	2	Cavities, Fissures
TA-5	*Sassafras albidum*	19	7	Snag, Cavities
TA-6	*Sassafras albidum*	24	7	Snag, Cavities
TA-7	*Sassafras albidum*	42	2	Snag
TA-8	*Sassafras albidum*	22	2	Snag
TA-9	*Sassafras albidum*	31.5	6	Snag, Cavities
TA-10	Unknown	28.5	7	Snag, Fissures
TA-11	*Sassafras albidum*	35	5	Cavities

PHASE 1 SUMMER HABITAT ASSESSMENTS

TA-HA-3

INDIANA BAT HABITAT ASSESSMENT DATASHEET

Project Name: State Road 11 Extension			Date: May 6, 2021
Township/Range/Section:	5S/3E/11		Heth Township, Harrison County
Lat Long/UTM/Zone: 38.085562 N -86.164437 W	Western terminus 38.085308 N -86.164579 W	Eastern terminus 38.085117 N -86.164728 W	Surveyor: S. Langley

Brief Project Description

Four alternative routes are being considered to connect Stater Road 11 to State Road 135. Surveys of potential bat habitat and roosts trees are being conducted to assist in route selection and minimize environmental impacts.

Project Area

Project	Total Acres	Forest Acres	Open Acres
	0.54	0.43	0.11

Proposed Tree Removal (ac)	Completely cleared	Partially cleared (will leave trees)	Preserve acres-no clearing
	Unknown	Unknown	Unknown

Brief Project Description

Pre-Project	**Post-Project**
*See Project Description Above	Unknown at this time.

Brief Project Description

Flight corridors to other forested areas?

Yes, flight corridors to other forested areas are present.

Describe Adjacent Properties (e.g. forested, grassland, commercial or residential development, water sources)

Adjacent land use is rural, consisting of forested, agricultural, and rural-residential areas.

Proximity to Public Land

What is the distance (mi.) from the project area to forested public lands (e.g., national or state forests, national or state parks, conservation areas, wildlife management areas)?

Harrison-Crawford State Forest is located approximately 1.63 miles west of the bat habitat assessment area.
Squire Boone Caverns is located approximately 1.80 miles southeast of the bat habitat assessment area.
An Indiana Forest Bank – Harrison property is located approximately 2.32 miles east of the bat habitat assessment area.

PHASE 1 SUMMER HABITAT ASSESSMENTS

Use additional sheets to assess discrete habitat types at multiple sites in a project area
Include a map depicting locations of sample sites if assessing discrete habitats at multiple sites in a project area
A single sheet can be used for multiple sample sites if habitat is the same

Sample Site Description

Sample Site No.(s):_____

The sample site is mature bottomland forest dominated by eastern cottonwood and American elm. Shagbark hickory and sugar maple are also present. The area features a dense canopy with relatively open mid and understories.

Water Resources at Sample Site

Stream Type (# and length)	Ephemeral	Intermittent	Perennial
	N/A	N/A	N/A
Pools/Ponds (# and size)	N/A	N/A	
		N/A	
Wetlands (approx. ac.)	N/A	N/A	
	N/A	N/A	

Describe existing condition of water sources: The nearest water source is a farm pond located approximately 0.19 mile south of the bat habitat assessment area, across SR 135.

Forest Resources at Sample Site

Closure/Density	Canopy (>50')	Midstory (20-50')	Understory (<20')

1=1-10%, 2=11-20%, 3=21-40%, 4=41-60%
5=61-80%, 6=81-100%

Dominant Species of Mature Trees	Canopy: *Populus deltoides, Ulmus americana* Mid-story: *Ulmus americana, Acer saccharum* Understory: *Ulmus americana, Acer saccharum*

% Trees w/ Exfoliating Bark	0	0	1
Size Composition of Live Trees (%)	Small (3-8 in)	Med (9-15 in)	Large (>15 in)
	20	50	30
No. of Suitable Snags	0	0	0

Standing dead trees with exfoliating bark, cracks, crevices, or hollows.
Snags without these characteristics area not considered suitable.

IS THE HABITAT SUITABLE FOR INDIANA BATS?

Additional Comments:

This habitat is suitable for Indiana and northern long-eared bats. Gray bats, which have been documented in Harrison County, may also utilize the area as foraging habitat. Flight corridors exist to the larger tangent forest. No potential roost were identified; however, shagbark hickory may provide roosts opportunities for bats in this location.

Attach aerial photo or project site with all forested areas labeled and a general description of the habitat

Photographic Documentation: habitat shots at edge and interior from multiple locations; Understory/midstory/canopy; examples of potential suitable snags and live trees; water sources

Attachment 5

PHASE 1 SUMMER HABITAT ASSESSMENTS

TA-HA-4

INDIANA BAT HABITAT ASSESSMENT DATASHEET

Project Name: State Road 11 Extension			Date: May 6, 2021
Township/Range/Section:	5S/3E/11		Heth Township, Harrison County
Lat Long/UTM/Zone: 38.085160 N -86.153320 W	Western terminus 38.085044 N -86.154112 N	Eastern terminus 38.085021 N -86.152428 W	Surveyor: S. Langley

Brief Project Description

Four alternative routes are being considered to connect Stater Road 11 to State Road 135. Surveys of potential bat habitat and roosts trees are being conducted to assist in route selection and minimize environmental impacts.

Project Area

Project	Total Acres	Forest Acres	Open Acres
	1.32	1.32* Mostly Scrub/Shrub	0.0

Proposed Tree Removal (ac)	Completely cleared	Partially cleared (will leave trees)	Preserve acres-no clearing
	Unknown	Unknown	Unknown

Brief Project Description

Pre-Project	**Post-Project**
* See project description above	Unknown at this time.

Brief Project Description

Flight corridors to other forested areas?

Flight corridors to tangent forested area are present within the bat habitat assessment area.

Describe Adjacent Properties (e.g. forested, grassland, commercial or residential development, water sources)

Adjacent land use is rural, consisting of forested, agricultural, and rural-residential areas.

Proximity to Public Land

What is the distance (mi.) from the project area to forested public lands (e.g., national or state forests, national or state parks, conservation areas, wildlife management areas)?

Squire Boone Caverns is located approximately 1.37 miles southeast of the bat habitat assessment area.
An Indiana Forest Bank – Harrison property is located approximately 1.71 miles east of the bat habitat assessment area.
Harrison-Crawford State Forest is located approximately 2.61 miles west of the bat habitat assessment area.
Perseverance Barrens Nature Conservancy is located approximately 3.75 miles northeast of the bat habitat assessment area.

PHASE 1 SUMMER HABITAT ASSESSMENTS

Use additional sheets to assess discrete habitat types at multiple sites in a project area
Include a map depicting locations of sample sites if assessing discrete habitats at multiple sites in a project area
A single sheet can be used for multiple sample sites if habitat is the same

Sample Site Description

Sample Site No.(s): TA-HA-4

The bat habitat assessment area is a successional scrub shrub forest. Two mature sugar maples and one mature black walnut are present. The majority of the assessment area is covered with young black locust and red cedar. No permanent water source is located within the assessment area; however, a large pond is located within close proximity. There are no flight corridors present; however, the open nature of the canopy would not be prohibitive to flight. Watson Road is located immediately south of the bat habitat assessment area.

Water Resources at Sample Site

Stream Type (# and length)	Ephemeral	Intermittent	Perennial	Describe existing condition of water sources: A large perennial pond is located approximately 0.06 mile west of the bat habitat assessment area. The pond was at a normal water level at the time of the survey.
	N/A	N/A	N/A	
Pools/Ponds (# and size)	N/A	N/A		
		N/A		
Wetlands (approx. ac.)	N/A	N/A		
	N/A	N/A		

Forest Resources at Sample Site

Closure/Density	Canopy (>50')	Midstory (20-50')	Understory (<20')	1=1-10%, 2=11-20%, 3=21-40%, 4=41-60% 5=61-80%, 6=81-100%
	1	1	1	
Dominant Species of Mature Trees	Canopy: *Acer saccharum, Juglans nigra* Mid-Story: *Robina pseudoacacia, Juniperus virginiana* Understory: *Robina pseudoacacia, Juniperus virginiana*			
% Trees w/ Exfoliating Bark	0	0	0	
Size Composition of Live Trees (%)	Small (3-8 in)	Med (9-15 in)	Large (>15 in)	
	90	0	10	
No. of Suitable Snags	0	0	0	

Standing dead trees with exfoliating bark, cracks, crevices, or hollows.
Snags without these characteristics area not considered suitable.

IS THE HABITAT SUITABLE FOR INDIANA BATS?

Additional Comments:

The bat habitat assessment area should be considered potential, but poor foraging habitat for the Indiana bat, northern long-eared bat, and gray bat. Roost potential for the assessment area is low. No permanent water source is located within the assessment area; however, a large pond is located within close proximity. The bat habitat assessment area is separated from nearby forested areas by Watson Road and agricultural fields. No potential roosts, shellbark hickories, shagbark hickories, or dead ash were identified within the assessment area.

Attach aerial photo or project site with all forested areas labeled and a general description of the habitat

Photographic Documentation: habitat shots at edge and interior from multiple locations; Understory/midstory/canopy; examples of potential suitable snags and live trees; water sources

Attachment 5

PHASE 1 SUMMER HABITAT ASSESSMENTS

TA-HA-5

INDIANA BAT HABITAT ASSESSMENT DATASHEET

Project Name: State Road 11 Extension			Date: May 6, 2021
Township/Range/Section:	5S/3E/13		Heth Township, Harrison County
Lat Long/UTM/Zone: 38.084919 N -86.153338 W	Western terminus 38.084930 N -86.154162 W	Eastern terminus 38.084866 N -86.151312 W	Surveyor: S. Langley

Brief Project Description

Four alternative routes are being considered to connect Stater Road 11 to State Road 135. Surveys of potential bat habitat and roosts trees are being conducted to assist in route selection and minimize environmental impacts.

Project Area

Project	Total Acres	Forest Acres	Open Acres
	1.95 (House & Yard Excluded)	1.95 (House & Yard Excluded)	0.00 (House & Yard Excluded)

Proposed Tree Removal (ac)	Completely cleared	Partially cleared (will leave trees)	Preserve acres-no clearing
	Unknown	Unknown	Unknown

Brief Project Description

Pre-Project	**Post-Project**
* See project description above.	Unknown at this time.

Brief Project Description

Flight corridors to other forested areas?

Flight corridors to tangent forested areas are limited or non-existent due to the tree density within the bat habitat assessment area.

Describe Adjacent Properties (e.g. forested, grassland, commercial or residential development, water sources)

Adjacent land use is rural, consisting of forested, agricultural, and rural-residential areas.

Proximity to Public Land

What is the distance (mi.) from the project area to forested public lands (e.g., national or state forests, national or state parks, conservation areas, wildlife management areas)?

Squire Boone Caverns is located approximately 1.36 miles southeast of the bat habitat assessment area.
An Indiana Forest Bank – Harrison property is located approximately 1.69 miles east of the bat habitat assessment area.
Harrison-Crawford State Forest is located approximately 2.61 miles west of the bat habitat assessment area.
Perseverance Barrens Nature Conservancy is located approximately 3.80 miles northeast of the bat habitat assessment area.

PHASE 1 SUMMER HABITAT ASSESSMENTS

Use additional sheets to assess discrete habitat types at multiple sites in a project area
Include a map depicting locations of sample sites if assessing discrete habitats at multiple sites in a project area
A single sheet can be used for multiple sample sites if habitat is the same

Sample Site Description

Sample Site No.(s): TA-HA-5

The bat habitat assessment area is within a secondary forest with a dense canopy and mid-story, and sparse understory. The dominant species within the canopy are young black locust and sassafras. The mid-story is dominated by sassafras and red cedar. Occasional sugar maple, black locust, sassafras, and red cedar seedlings and saplings dot the understory. Watson Road runs along the north border of the assessment area. The terrain is largely flat. No permanent water source is located within the bat habitat assessment area; however, a pond is located immediately northwest across Watson Road. The bat habitat assessment area is a portion of larger forested area, connected to additional forests by hedgerows. Flight corridors are limited to non-existence.

Water Resources at Sample Site

Stream Type (# and length)	Ephemeral	Intermittent	Perennial	Describe existing condition of water sources: A large pond is located approximately 0.06 mile northwest of the bat habitat assessment area.
	N/A	N/A	N/A	
Pools/Ponds (# and size)	N/A	N/A		
		N/A		
Wetlands (approx. ac.)	N/A	N/A		
	N/A	N/A		

Forest Resources at Sample Site

Closure/Density	Canopy (>50')	Midstory (20-50')	Understory (<20')	1=1-10%, 2=11-20%, 3=21-40%, 4=41-60% 5=61-80%, 6=81-100%
	6	6	4	
Dominant Species of Mature Trees	Canopy: *Robinia psuedoacacia, Sassafras albidum* Mid-Story: *Sassafras albidum, Juniperus virginiana* Understory: *Robinia psuedoacacia, Acer saccharum, Juniperus virginiana, Sassafras albidum*			
% Trees w/ Exfoliating Bark	0	0	0	
Size Composition of Live Trees (%)	Small (3-8 in)	Med (9-15 in)	Large (>15 in)	
	30	60	10	
No. of Suitable Snags	0	0	0	

Standing dead trees with exfoliating bark, cracks, crevices, or hollows.
Snags without these characteristics area not considered suitable.

IS THE HABITAT SUITABLE FOR INDIANA BATS?

Additional Comments:

The bat habitat assessment area is possible, but not ideal foraging habitat for the Indiana bat, northern long-eared bat, and gray bat due to the density of the young black locust, red cedar, and sassafras. No potential roosts were identified. Roost potential in the bat habitat assessment area is low due to the young age of the forest; however, it should be noted that the secondary growth is essential in providing future roost habitat, especially in regards to the northern long-eared bat. As the primary growth of the forest takes over, the secondary growth begins to decline and die back. Fissures, cavities, and hollow snags formed by decaying black locust and sassafras often make ideal roost habitats for northern long-eared bat maternity colonies. No permanent water source is located within the bat habitat assessment area, but a large pond is located northwest across Watson Road, within close proximity.

Attach aerial photo or project site with all forested areas labeled and a general description of the habitat

Photographic Documentation: habitat shots at edge and interior from multiple locations; Understory/midstory/canopy; examples of potential suitable snags and live trees; water sources

Attachment 5

PHASE 1 SUMMER HABITAT ASSESSMENTS

TA-HA-6

INDIANA BAT HABITAT ASSESSMENT DATASHEET

Project Name: State Road 11 Extension			Date: May 6, 2021
Township/Range/Section:	5S/3E/13		Heth Township, Harrison County
Lat Long/UTM/Zone: 38.084665 N -86.145786 W	Western terminus 38.08468 N -86.146542 N	Eastern terminus 38.084583 N -86.144866 W	Surveyor: S. Langley

Brief Project Description

Four alternative routes are being considered to connect State Road 11 to State Road 135. Surveys of potential bat habitat and roosts trees are being conducted to assist in route selection and minimize environmental impacts.

Project Area

Project	Total Acres	Forest Acres	Open Acres
	1.47	1.12	0.35

Proposed Tree Removal (ac)	Completely cleared	Partially cleared (will leave trees)	Preserve acres-no clearing
	Unknown	Unknown	Unknown

Brief Project Description

Pre-Project	**Post-Project**
*See project description above.	Unknown at this time.

Brief Project Description

Flight corridors to other forested areas?

Flight corridors to tangent forested area are present within the bat habitat assessment area.

Describe Adjacent Properties (e.g. forested, grassland, commercial or residential development, water sources)

Adjacent land use is rural, consisting of forested, agricultural, and rural-residential areas.

Proximity to Public Land

What is the distance (mi.) from the project area to forested public lands (e.g., national or state forests, national or state parks, conservation areas, wildlife management areas)?

An Indiana Forest Bank – Harrison property is located approximately 1.25 miles west of the bat habitat assessment area.

PHASE 1 SUMMER HABITAT ASSESSMENTS

Use additional sheets to assess discrete habitat types at multiple sites in a project area
Include a map depicting locations of sample sites if assessing discrete habitats at multiple sites in a project area
A single sheet can be used for multiple sample sites if habitat is the same

Sample Site Description

Sample Site No.(s):TA-HA-6

The bat habitat site is within a mature upland forest dominated by tulip poplar and mockernut hickory. The intermediate stage sassafras trees have begun dying back, providing ideal roost habitat for the northern long-eared bat. Undergrowth is fairly sparse. The bat habitat assessment area is a portion of a larger 6.28 acre forest. The forest is connected to surrounding forested areas by a narrow hedgerow, which is unlikely to contain a quality flight corridor; however, the proximity of surrounding forested areas may preclude the need for a strong flight corridor.

Water Resources at Sample Site

Stream Type (# and length)	Ephemeral	Intermittent	Perennial	Describe existing condition of water sources: No water source is located within the bat habitat assessment area. A pond is located approximately 0.10 mile southeast of the bat habitat inspection area.
	N/A	N/A	N/A	
Pools/Ponds (# and size)	N/A	N/A		
		N/A		
Wetlands (approx. ac.)	N/A	N/A		
	N/A	N/A		

Forest Resources at Sample Site

Closure/Density	Canopy (>50')	Midstory (20-50')	Understory (<20')	1=1-10%, 2=11-20%, 3=21-40%, 4=41-60% 5=61-80%, 6=81-100%
	4	4	3	
Dominant Species of Mature Trees	Canopy: *Liriodendron tulipifera, Carya tomentosa* Mid-Story: *Juniperus virginiana, Cornus florida, Sassfras albidum, Acer saccharum, Fagus grandifolia* Understory: *Cornus florida, Fagus grandifolia*			
% Trees w/ Exfoliating Bark	0	1	3	
Size Composition of Live Trees (%)	Small (3-8 in)	Med (9-15 in)	Large (>15 in)	
	30	30	40	
No. of Suitable Snags	2	3	1	

Standing dead trees with exfoliating bark, cracks, crevices, or hollows.
Snags without these characteristics area not considered suitable.

IS THE HABITAT SUITABLE FOR INDIANA BATS?

Additional Comments:

The bat habitat assessment area should be considered suitable roost and foraging habitat for the Indiana and northern long-eared bat. The bat habitat assessment area should also be considered potential foraging habitat for the federally endangered gray bat, present in Harrison County. A permanent water source is not located within the bat habitat assessment area; however, there is a large pond located 0.10 southeast of the location. Gaps in the canopy and the mid-story, along with the open understory may serve as flight corridors to the larger forest tangent to the bat habitat assessment area. Flight corridors to nearby forested areas may be limited or non-existent; however, the proximity of nearby forested areas to the bat habitat assessment area may mitigate the need for flight corridors. Six trees with high bat roost potential were identified within the bat habitat assessment area.

Potential Roost Trees

Species	DBH (cm)	Decomposition Stage	Roost Features
Liridodendron tulipifera	33	7	Snag, Cavities
Carya sp.	49.5	7	Snag, Cavities, Exfoliating Bark
Unknown	21.5	6	Snag, Cavities
Sassafras albidum	27.5	6	Snag, Cavities
Sassafras albidum	21	7	Fissures, Cavities
Sassafras albidum	24	6	Snag, Cavities

Attach aerial photo or project site with all forested areas labeled and a general description of the habitat

Photographic Documentation: habitat shots at edge and interior from multiple locations; Understory/midstory/canopy; examples of potential suitable snags and live trees; water sources

PHASE 1 SUMMER HABITAT ASSESSMENTS

TA-HA-7

INDIANA BAT HABITAT ASSESSMENT DATASHEET

Project Name: State Road 11 Extension			Date: May 6, 2021
Township/Range/Section:	5S/3E/12		Heth Township, Harrison County
Lat Long/UTM/Zone: 38.08517 N -86.14331 W	Western terminus 38.084703 N -86.144788 N	Eastern terminus 38.084677 N -86.14187 W	Surveyor: S. Langley

Brief Project Description

Four alternative routes are being considered to connect Stater Road 11 to State Road 135. Surveys of potential bat habitat and roosts trees are being conducted to assist in route selection and minimize environmental impacts.

Project Area

Project	Total Acres	Forest Acres	Open Acres
	2.49	2.49	2.49

Proposed Tree Removal (ac)	Completely cleared	Partially cleared (will leave trees)	Preserve acres-no clearing
	Unknown	Unknown	Unknown

Brief Project Description

Pre-Project	**Post-Project**
*See Project Description Above	Unknown at this time.

Brief Project Description

Flight corridors to other forested areas?

Flight corridors to tangent forested area are present within the bat habitat assessment area.

Describe Adjacent Properties (e.g. forested, grassland, commercial or residential development, water sources)

Adjacent land use is rural, consisting of forested, agricultural, and rural-residential areas.

Proximity to Public Land

What is the distance (mi.) from the project area to forested public lands (e.g., national or state forests, national or state parks, conservation areas, wildlife management areas)?

An Indiana Forest Bank – Harrison property is located approximately 1.08 miles east of the bat habitat assessment area.
Squire Boone Caverns is located approximately 1.38 miles south of the bat habitat assessment area.
Harrison – Crawford State Forest is located approximately 2.78 miles west of the bat habitat assessment area.
Perseverance Barrens Nature Conservancy is located approximately 3.47 miles northeast of the bat habitat assessment area.

Attachment 5

PHASE 1 SUMMER HABITAT ASSESSMENTS

Use additional sheets to assess discrete habitat types at multiple sites in a project area
Include a map depicting locations of sample sites if assessing discrete habitats at multiple sites in a project area
A single sheet can be used for multiple sample sites if habitat is the same

Sample Site Description

Sample Site No.(s): TA-HA-7

The bat habitat assessment area is with a mature upland forest. The canopy is dominated by black oak, with a significant presence of red oak. The mid-story is dense, predominantly consisting of flowering dogwood and red cedar. Woody vegetation in the understory is sparse, featuring the occasional flowering dogwood. Sapling ash are also present within the understory. The bat habitat assessment area is the southern portion of a 15.91 acre forest. No permanent water sources were identified within the bat habitat assessment area. A large, man-made pond is located approximately 0.11 mile south of the bat habitat assessment area. Openings in the canopy and driveways transecting the forest serve as corridors to tangent forested areas. A dead ash was documented on the western edge of the bat habitat assessment area. Potential bat roosts are prevalent within the area in the form of dying, dead, and decaying oaks. Residential areas are located immediately north, east, and south of the bat habitat assessment area. Buildings on these properties may provide additional roost opportunities for bats.

Water Resources at Sample Site

Stream Type (# and length)	Ephemeral	Intermittent	Perennial	Describe existing condition of water sources: No permanent water source is located within the bat habitat assessment area. A pond is located approximately 0.11 mile south of the bat habitat assessment area.
	N/A	N/A	N/A	
Pools/Ponds (# and size)	N/A	N/A		
		N/A		
Wetlands (approx. ac.)	N/A	N/A		
	N/A	N/A		

Forest Resources at Sample Site

Closure/Density	Canopy (>50')	Midstory (20-50')	Understory (<20')	1=1-10%, 2=11-20%, 3=21-40%, 4=41-60% 5=61-80%, 6=81-100%
	4	6	4	
Dominant Species of Mature Trees	Canopy: *Quercus velutina, Quercus rubra* Mid-Story: *Cornus florida, Juniperus virginiana* Understory: *Cornus florida*			
% Trees w/ Exfoliating Bark	1	1	2	
Size Composition of Live Trees (%)	Small (3-8 in)	Med (9-15 in)	Large (>15 in)	
	25	25	50	
No. of Suitable Snags	0	0	6	

Standing dead trees with exfoliating bark, cracks, crevices, or hollows.
Snags without these characteristics area not considered suitable.

IS THE HABITAT SUITABLE FOR INDIANA BATS?

Additional Comments:

The bat habitat assessment area should be considered potential foraging and roost habitat for both the Indiana and northern long-eared bat. The bat habitat assessment area should also be considered potential foraging habitat for the federally endangered gray bat, present in Harrison County. No permanent source of water was observed within the bat habitat assessment area; however, a large pond is located 0.11 mile south. Flight corridors and canopy space connect the bat habitat assessment area with the tangent forest to the north, which in turn is connected to nearby forests by hedgerows. Six trees considered to exhibit high roost potential were identified within the bat habitat assessment area. One dead ash tree was identified on the west edge of the bat habitat assessment area. The ash tree does not yet exhibit ideal roost qualities; however, exfoliating bark, cavities, and snags will likely become present as decay progresses.

Potential Roost Trees

Species	DBH (cm)	Decomposition Stage	Roost Features
Quercus rubra	41	3	Exfoliating Bark
Quercus velutina	56	3	Snags, Exfoliating Bark
Quercus sp.	70	6	Cavities
Quercus velutina	63.5	3	Snags, Cavities, Exfoliating Bark
Quercus alba	35	6	Fissures, Cavities, Exfoliating Bark
Quercus velutina	73	6	Cavities, Exfoliating Bark

Attach aerial photo or project site with all forested areas labeled and a general description of the habitat

Photographic Documentation: habitat shots at edge and interior from multiple locations; Understory/midstory/canopy; examples of potential suitable snags and live trees; water sources

Attachment 5

PHASE 1 SUMMER HABITAT ASSESSMENTS

TA-HA-8

INDIANA BAT HABITAT ASSESSMENT DATASHEET

Project Name: State Road 11 Extension			Date: May 6, 2021
Township/Range/Section:	5S/3E/13		Heth Township, Harrison County
Lat Long/UTM/Zone: 38.084567 N -86.142082 W	Western terminus 38.084585 N -86.142758 N	Eastern terminus 38.084553 N -86.141479 W	Surveyor: S. Langley

Brief Project Description

Four alternative routes are being considered to connect Stater Road 11 to State Road 135. Surveys of potential bat habitat and roosts trees are being conducted to assist in route selection and minimize environmental impacts.

Project Area

Project	Total Acres	Forest Acres	Open Acres
	1.15	1.15	1.15

Proposed Tree Removal (ac)	Completely cleared	Partially cleared (will leave trees)	Preserve acres-no clearing
	Unknown	Unknown	Unknown

Brief Project Description

Pre-Project	**Post-Project**
*See Project Description Above	Unknown at this time.

Brief Project Description

Flight corridors to other forested areas?

Flight corridors to tangent forested area are present within the bat habitat assessment area.

Describe Adjacent Properties (e.g. forested, grassland, commercial or residential development, water sources)

Adjacent land use is rural, consisting of forested, agricultural, and rural-residential areas.

Proximity to Public Land

What is the distance (mi.) from the project area to forested public lands (e.g., national or state forests, national or state parks, conservation areas, wildlife management areas)?

An Indiana Forest Bank – Harrison property is located approximately 1.07 miles east of the bat habitat assessment area.
Squire Boone Caverns is located approximately 1.20 miles south of the bat habitat assessment area.
Harrison-Crawford State Forest is located approximately 2.90 miles west of the bat habitat assessment area.
Perseverance Barrens Nature Conservancy is located approximately 3.41 miles northeast of the bat habitat assessment area.

PHASE 1 SUMMER HABITAT ASSESSMENTS

Use additional sheets to assess discrete habitat types at multiple sites in a project area
Include a map depicting locations of sample sites if assessing discrete habitats at multiple sites in a project area
A single sheet can be used for multiple sample sites if habitat is the same

Sample Site Description

Sample Site No.(s): TA-HA-8

The bat habitat assessment site is within a mature upland forest. The dominant canopy species is white oak. The mid-story is diverse, predominantly consisting of sassafras, black cherry, and sugar maple. Red cedar is also present within the mid-story. The understory exhibits fairly low density and is composed predominantly of flowering dogwood and sassafras. The bat habitat assessment area is the northernmost portion of an extensive forested area extending southward from Watson Road. Flight corridors to tangent forested areas existed in the form of maintained paths. No permanent water source was observed within the bat habitat assessment area.

Water Resources at Sample Site

Stream Type (# and length)	Ephemeral	Intermittent	Perennial	Describe existing condition of water sources: No permanent water sources were observed within the bat habitat assessment area. A pond is located approximately 0.10 mile southwest of the bat habitat assessment area.
	N/A	N/A	N/A	
Pools/Ponds (# and size)	N/A	N/A		
		N/A		
Wetlands (approx. ac.)	N/A	N/A		
	N/A	N/A		

Forest Resources at Sample Site

Closure/Density	Canopy (>50')	Midstory (20-50')	Understory (<20')	1=1-10%, 2=11-20%, 3=21-40%, 4=41-60% 5=61-80%, 6=81-100%
	4	4	3	
Dominant Species of Mature Trees	Canopy: *Quercus alba* Mid-Story: *Sassafras albidum, Prunus serotina, Acer saccharum* Understory: *Cornus florida, Sassafras albidum*			
% Trees w/ Exfoliating Bark	0	0	0	
Size Composition of Live Trees (%)	Small (3-8 in)	Med (9-15 in)	Large (>15 in)	
	10	30	60	
No. of Suitable Snags	0	1	1	

Standing dead trees with exfoliating bark, cracks, crevices, or hollows.
Snags without these characteristics area not considered suitable.

IS THE HABITAT SUITABLE FOR INDIANA BATS?

Additional Comments:

The bat habitat assessment area should be considered ideal forage and roost habitat for both the Indiana and northern long-eared bat. The bat habitat assessment area should also be considered potential foraging habitat for the federally endangered bat, present in Harrison County. Flight corridors to tangent forested areas are present in the form of maintained paths and canopy gaps. No permanent water source was observed within the bat habitat assessment area; however, a pond is located approximately 0.10 mile southwest, providing a stable source of water for the area. The forest within the bat habitat assessment area is connected to a series of much larger forested areas. Potential for bat presence should be considered high. Two trees exhibiting high roost potential were identified within the bat habitat assessment area.

Potential Roost Trees

Species	DBH (cm)	Decomposition Stage	Roost Features
Sassafras albidum	39	2	Snag, Cavities
Prunus serotina	32	2	Snag, Cavities

Attach aerial photo or project site with all forested areas labeled and a general description of the habitat

Photographic Documentation: habitat shots at edge and interior from multiple locations; Understory/midstory/canopy; examples of potential suitable snags and live trees; water sources

PHASE 1 SUMMER HABITAT ASSESSMENTS

TA-HA-9

INDIANA BAT HABITAT ASSESSMENT DATASHEET

Project Name: State Road 11 Extension			Date: May 6, 2021
Township/Range/Section:	5S/3E/12		Heth Township, Harrison County
Lat Long/UTM/Zone: 38.084667 N -86.140438 W	Western terminus 38.084667 N -86.141189 N	Eastern terminus 38.084651 N -86.139674 W	Surveyor: S. Langley

Brief Project Description

Four alternative routes are being considered to connect Stater Road 11 to State Road 135. Surveys of potential bat habitat and roosts trees are being conducted to assist in route selection and minimize environmental impacts.

Project Area

Project	Total Acres	Forest Acres	Open Acres
	1.03	1.03	1.03

Proposed Tree Removal (ac)	Completely cleared	Partially cleared (will leave trees)	Preserve acres-no clearing
	Unknown	Unknown	Unknown

Brief Project Description

Pre-Project	**Post-Project**
*See the Project Description Above	Unknown at this time.

Brief Project Description

Flight corridors to other forested areas?

Flight corridors to tangent forested area are present within the bat habitat assessment area.

Describe Adjacent Properties (e.g. forested, grassland, commercial or residential development, water sources)

Adjacent land use is rural, consisting of forested, agricultural, and rural-residential areas.

Proximity to Public Land

What is the distance (mi.) from the project area to forested public lands (e.g., national or state forests, national or state parks, conservation areas, wildlife management areas)?

An Indiana Forest Bank – Harrison property is located approximately 0.87 mile from the bat habitat assessment area.
Squire Boone Caverns is located approximately 1.20 miles south of the bat habitat assessment area.
Harrison-Crawford State Forest is located approximately 3.11 miles west of the bat habitat assessment area.
Perseverance Barrens Nature Conservancy is located approximately 3.30 miles north of the bat habitat assessment area.

PHASE 1 SUMMER HABITAT ASSESSMENTS

Use additional sheets to assess discrete habitat types at multiple sites in a project area
Include a map depicting locations of sample sites if assessing discrete habitats at multiple sites in a project area
A single sheet can be used for multiple sample sites if habitat is the same

Sample Site Description

Sample Site No.(s): TA-HA-9

The bat habitat assessment area is within an intermediate forest. Dominant canopy and mid-story species are black locust and black cherry. Virtually no woody vegetation occupies the understory. The bat habitat area is part of a small intermediate forest, isolated from other nearby forested areas by ag fields, residential areas, and Watson Road. Overall forest density is thin and conducive to foraging. Flight corridors are present in the form of maintained trails. No permanent water source was observed in the bat habitat assessment area.

Water Resources at Sample Site

Stream Type (# and length)	Ephemeral	Intermittent	Perennial	Describe existing condition of water sources: No permanent water source was identified within the bat habitat assessment area. A pond is located approximately 0.10 mile southeast of the bat habitat assessment area.
	N/A	N/A	N/A	
Pools/Ponds (# and size)	N/A	N/A		
		N/A		
Wetlands (approx. ac.)	N/A	N/A		
	N/A	N/A		

Forest Resources at Sample Site

Closure/Density	Canopy (>50')	Midstory (20-50')	Understory (<20')	1=1-10%, 2=11-20%, 3=21-40%, 4=41-60% 5=61-80%, 6=81-100%
	1	2	2	
Dominant Species of Mature Trees	Canopy: *Robinia psuedoacacia, Prunus serotina* Mid-Story: *Robinia psuedoacacia, Prunus serotina* Understory: N/A			
% Trees w/ Exfoliating Bark	0	0	0	
Size Composition of Live Trees (%)	Small (3-8 in)	Med (9-15 in)	Large (>15 in)	
	45	45	10	
No. of Suitable Snags	0	0	0	

Standing dead trees with exfoliating bark, cracks, crevices, or hollows.
Snags without these characteristics area not considered suitable.

IS THE HABITAT SUITABLE FOR INDIANA BATS?

Additional Comments:

The bat habitat assessment area should be considered potential foraging habitat for both the northern long-eared and Indiana bat. The area is unlikely to provide roost habitat due to the age of trees; however, as the forest matures and the secondary black locust dies back, roosts ideal for northern long-eared bat would form in the black locust. The bat habitat assessment area should also be considered potential foraging habitat for the federally endangered gray bat, which occurs in Harrison County. No permanent water source was observed within the bat habitat assessment area; however, a pond serves as a ready source of water approximately 0.11 miles southeast. No trees exhibiting roost potential qualities were identified within the project area.

Attach aerial photo or project site with all forested areas labeled and a general description of the habitat

Photographic Documentation: habitat shots at edge and interior from multiple locations; Understory/midstory/canopy; examples of potential suitable snags and live trees; water sources

PHASE 1 SUMMER HABITAT ASSESSMENTS

TA-HA-10

INDIANA BAT HABITAT ASSESSMENT DATASHEET

Project Name: State Road 11 Extension			Date: May 6, 2021
Township/Range/Section:	5S/3E/12		Heth Township, Harrison County
Lat Long/UTM/Zone: 38.084547 N -86.138220 W	Western terminus 38.084593 N -86.138818 N	Eastern terminus 38.084512 N -86.137438 W	Surveyor: S. Langley

Brief Project Description

Four alternative routes are being considered to connect Stater Road 11 to State Road 135. Surveys of potential bat habitat and roosts trees are being conducted to assist in route selection and minimize environmental impacts.

Project Area

Project	Total Acres	Forest Acres	Open Acres
	0.75	0.75	0.75

Proposed Tree Removal (ac)	Completely cleared	Partially cleared (will leave trees)	Preserve acres-no clearing
	Unknown	Unknown	Unknown

Brief Project Description

Pre-Project	**Post-Project**
*See Project Description Above	Unknown at this time.

Brief Project Description

Flight corridors to other forested areas?

Flight corridors to tangent forested area are present within the bat habitat assessment area.

Describe Adjacent Properties (e.g. forested, grassland, commercial or residential development, water sources)

Adjacent land use is rural, consisting of forested, agricultural, and rural-residential areas.

Proximity to Public Land

What is the distance (mi.) from the project area to forested public lands (e.g., national or state forests, national or state parks, conservation areas, wildlife management areas)?

An Indiana Forest Bank – Harrison property is located approximately 0.70 mile east of the bat habitat assessment area.
Squire Boone Caverns is located approximately 1.18 miles south of the bat habitat assessment area.
Harrison-Crawford Forest is located approximately 3.29 miles west of the bat habitat assessment area.
Perseverance Barrens Nature Conservancy is located approximately 3.23 miles north of the bat habitat assessment area.

PHASE 1 SUMMER HABITAT ASSESSMENTS

Use additional sheets to assess discrete habitat types at multiple sites in a project area
Include a map depicting locations of sample sites if assessing discrete habitats at multiple sites in a project area
A single sheet can be used for multiple sample sites if habitat is the same

Sample Site Description

Sample Site No.(s): TA-HA-10

The bat habitat assessment area is within a mature upland forest. Dominant species within the canopy include black oak, black cherry, sugar maple, and red cedar. Scattered tulip poplar were also present within the canopy. Dominant species within the mid-story consists of red cedar and sugar maple. The understory is dominated by sugar maple saplings. The bat habitat assessment area is the southernmost portion of a large forest extending northwards from Watson Road. Another large forest located immediately south of the bat habitat assessment and Watson Road, extends south to Buck Creek. No permanent water source was observed in the bat habitat assessment area. A pond is located 0.11 mile southeast of the bat habitat assessment area. A dead ash was located on the west end of the bat habitat assessment area. Flight corridors were present to tangent forested areas.

Water Resources at Sample Site

Stream Type (# and length)	Ephemeral	Intermittent	Perennial
	N/A	N/A	N/A
Pools/Ponds (# and size)	N/A	N/A	
		N/A	
Wetlands (approx. ac.)	N/A	N/A	
	N/A	N/A	

Describe existing condition of water sources: No permanent water source was observed within the bat habitat assessment area. A pond is located approximately 0.11 mile southeast of the bat habitat assessment area. Buck Creek is located approximately 0.65 mile southeast of the bat habitat assessment area.

Forest Resources at Sample Site

Closure/Density	Canopy (>50')	Midstory (20-50')	Understory (<20')
	5	5	5

1=1-10%, 2=11-20%, 3=21-40%, 4=41-60%
5=61-80%, 6=81-100%

Dominant Species of Mature Trees	Canopy: *Quercus velutina, Prunus serotina, Acer saccharum, Juniperus virginiana* Mid-Story: *Juniperus virginiana, Acer saccharum* Understory: *Acer saccharum*

% Trees w/ Exfoliating Bark	0	0	0
Size Composition of Live Trees (%)	Small (3-8 in)	Med (9-15 in)	Large (>15 in)
	60	10	30
No. of Suitable Snags	0	0	0

Standing dead trees with exfoliating bark, cracks, crevices, or hollows.
Snags without these characteristics area not considered suitable.

IS THE HABITAT SUITABLE FOR INDIANA BATS?

Additional Comments:

The bat habitat assessment area should be considered foraging habitat for both the Indiana and northern long-eared bat. The bat habitat assessment area should also be considered potential foraging habitat for the federally endangered gray bat, which has been documented in Harrison County. No trees exhibiting high roost potential were observed in the bat habitat assessment area; however, potential bat roosts are likely to exist in the extensive forest immediately north. A dead ash was identified on the western end of the bat habitat assessment area. The dead ash did not currently exhibit features conducive to bat roosting, but will likely develop exfoliating bark, snags, and cavities as decay progresses. Flight corridors to tangent forested areas are present. No permanent water source was identified within the bat habitat assessment area; however, a pond located approximately 0.11 mile provides a ready water source.

Attach aerial photo or project site with all forested areas labeled and a general description of the habitat

Photographic Documentation: habitat shots at edge and interior from multiple locations; Understory/midstory/canopy; examples of potential suitable snags and live trees; water sources

PHASE 1 SUMMER HABITAT ASSESSMENTS

TA-HA-11

INDIANA BAT HABITAT ASSESSMENT DATASHEET

Project Name: State Road 11 Extension			Date: May 6, 2021
Township/Range/Section:	5S/3E/13		Heth Township, Harrison County
Lat Long/UTM/Zone: 38.084381 N -86.1369849 W	Western terminus 38.08443 N -86.138182 W	Eastern terminus 38.084352 N -86.135371 W	Surveyor: S. Langley

Brief Project Description

Four alternative routes are being considered to connect Stater Road 11 to State Road 135. Surveys of potential bat habitat and roosts trees are being conducted to assist in route selection and minimize environmental impacts.

Project Area

Project	Total Acres	Forest Acres	Open Acres
	2.60	2.51	0.09

Proposed Tree Removal (ac)	Completely cleared	Partially cleared (will leave trees)	Preserve acres-no clearing
	Unknown	Unknown	Unknown

Brief Project Description

Pre-Project	**Post-Project**
*See Project Description Above	Unknown at this time.

Brief Project Description

Flight corridors to other forested areas?

Flight corridors to tangent forested area are present within the bat habitat assessment area.

Describe Adjacent Properties (e.g. forested, grassland, commercial or residential development, water sources)

Adjacent land use is rural, consisting of forested, agricultural, and rural-residential areas.

Proximity to Public Land

What is the distance (mi.) from the project area to forested public lands (e.g., national or state forests, national or state parks, conservation areas, wildlife management areas)?

An Indiana Forest Bank – Harrison property is located approximately 0.70 mile east of the bat habitat assessment area.
Squire Boone Caverns is located approximately 1.18 miles south of the bat habitat assessment area.
Harrison-Crawford Forest is located approximately 3.29 miles west of the bat habitat assessment area.
Perseverance Barrens Nature Conservancy is located approximately 3.23 miles north of the bat habitat assessment area.

PHASE 1 SUMMER HABITAT ASSESSMENTS

Use additional sheets to assess discrete habitat types at multiple sites in a project area
Include a map depicting locations of sample sites if assessing discrete habitats at multiple sites in a project area
A single sheet can be used for multiple sample sites if habitat is the same

Sample Site Description

Sample Site No.(s): TA-HA-11

The bat habitat assessment area is within a mature upland forest. The dominant canopy species are white oak and tulip poplar. Red cedar is dominant within the mid-story strata. Autumn olive and sugar maple saplings are dominant within the understory. Spicebush and sycamore saplings are also present within the understory. The bat habitat assessment area is the northernmost part of a large, contiguous extending south from Watson Road to the banks of Buck Creek. No permanent source of water was observed in the bat habitat assessment area; however, a pond is located 0.05 mile south within a connected forest. Several beehives and a clover field are located immediately south of the bat habitat area. A maintained driveway provides a strong flight corridor.

Water Resources at Sample Site

Stream Type (# and length)	Ephemeral	Intermittent	Perennial
	N/A	N/A	N/A
Pools/Ponds (# and size)	N/A	N/A	
		N/A	
Wetlands (approx. ac.)	N/A	PEM1C, 031 acre	
	N/A	N/A	

Describe existing condition of water sources: No permanent water source was observed within the bat habitat assessment area. A PEM1C wetland is located on the eastern edge of the area. A pond is located approximately 0.05 mile south of the bat habitat assessment area. Buck Creek is located approximately 0.57 mile southeast of the bat habitat assessment area.

Forest Resources at Sample Site

Closure/Density	Canopy (>50')	Midstory (20-50')	Understory (<20')
	4	5	6

1=1-10%, 2=11-20%, 3=21-40%, 4=41-60%
5=61-80%, 6=81-100%

Dominant Species of Mature Trees	Canopy: *Quercus alba, Liriodendron tulipifera* Mid-Story: *Juniperus virginiana,* Understory: *Acer saccharum, Elaeagnus umbellata*		
% Trees w/ Exfoliating Bark	0	0	1
Size Composition of Live Trees (%)	Small (3-8 in)	Med (9-15 in)	Large (>15 in)
	10	20	70
No. of Suitable Snags	0	0	1

Standing dead trees with exfoliating bark, cracks, crevices, or hollows.
Snags without these characteristics area not considered suitable.

IS THE HABITAT SUITABLE FOR INDIANA BATS?

Additional Comments:

The bat habitat assessment area should be considered ideal forage and roost habitat for both the Indiana and northern long-eared bat. The bat habitat assessment area should also be considered potential foraging habitat for the federally endangered gray bat, present in Harrison County. A maintained driveway provides a strong flight corridor to tangent forested areas. No permanent water source was identified within the bat habitat assessment area; however, a small pond and buck creek are located in the immediate vicinity. A PEM1C wetland is mapped within the area. One oak with features conducive to bat use was identified within the bat habitat assessment area.

Potential Roost Tree			
Species	**DBH (cm)**	**Decomposition Stage**	**Roost Features**
Quercus velutina	60	3	Snags, Cavities, Exfoliating Bark

Attach aerial photo or project site with all forested areas labeled and a general description of the habitat

Photographic Documentation: habitat shots at edge and interior from multiple locations; Understory/midstory/canopy; examples of potential suitable snags and live trees; water sources

Attachment 5

PHASE 1 SUMMER HABITAT ASSESSMENTS

TA-HA-12

INDIANA BAT HABITAT ASSESSMENT DATASHEET

Project Name: State Road 11 Extension			Date: May 7, 2021
Township/Range/Section:	5S/3E/12		Heth Township, Harrison County
Lat Long/UTM/Zone: 38.084432 N -86.133916 W	Western terminus 38.084481 N -86.135802 N	Eastern terminus 38.084415 N -86.133226 W	Surveyor: S. Langley

Brief Project Description

Four alternative routes are being considered to connect Stater Road 11 to State Road 135. Surveys of potential bat habitat and roosts trees are being conducted to assist in route selection and minimize environmental impacts.

Project Area

Project	Total Acres	Forest Acres	Open Acres
	1.26	1.26*House Yard Excluded	0.00*House and Yard Excluded

Proposed Tree Removal (ac)	Completely cleared	Partially cleared (will leave trees)	Preserve acres-no clearing
	Unknown	Unknown	Unknown

Brief Project Description

Pre-Project	**Post-Project**
*See Project Description Above	Unknown at this time.

Brief Project Description

Flight corridors to other forested areas?

Flight corridors to tangent forested area are present within the bat habitat assessment area.

Describe Adjacent Properties (e.g. forested, grassland, commercial or residential development, water sources)

Adjacent land use is rural, consisting of forested, agricultural, and rural-residential areas.

Proximity to Public Land

What is the distance (mi.) from the project area to forested public lands (e.g., national or state forests, national or state parks, conservation areas, wildlife management areas)?

An Indiana Forest Bank – Harrison Property is located approximately 0.72 mile east of the bat habitat assessment area.
Squire Boone Caverns is located approximately 1.16 miles south of the bat habitat assessment area.
Perseverance Barrens Nature Conservancy is located approximately 3.24 miles north of the bat habitat assessment area.
Harrison-Crawford State Forest is located approximately 3.31 miles west of the bat habitat assessment area.

PHASE 1 SUMMER HABITAT ASSESSMENTS

Use additional sheets to assess discrete habitat types at multiple sites in a project area
Include a map depicting locations of sample sites if assessing discrete habitats at multiple sites in a project area
A single sheet can be used for multiple sample sites if habitat is the same

Sample Site Description

Sample Site No.(s):TA-HA-12

The bat habitat assessment area is within a mature upland forest. The canopy consists predominantly of tulip poplar and oak species. The mid-story consists predominantly of ash species. The understory is largely compromised of American sycamore saplings. The bat habitat assessment area is the southernmost portion of a large forest extending north from Watson road for nearly one mile. Flight corridors to tangent forested areas are present in the form of maintained trails and canopy gaps. No permanent water source was observed within the bat habitat area; however, a pond is located approximately 0.09 mile to the northwest. Two additional ponds are located approximately 0.07 and 0.08 mile south of the bat habitat assessment area.

Water Resources at Sample Site

Stream Type (# and length)	Ephemeral	Intermittent	Perennial	Describe existing condition of water sources: No permanent water source was identified within the bat habitat assessment area. The nearest permanent water source is located approximately 0.07 mile to the south.
	N/A	N/A	N/A	
Pools/Ponds (# and size)	N/A	N/A		
		N/A		
Wetlands (approx. ac.)	N/A	N/A		
	N/A	N/A		

Forest Resources at Sample Site

Closure/Density	Canopy (>50')	Midstory (20-50')	Understory (<20')	1=1-10%, 2=11-20%, 3=21-40%, 4=41-60% 5=61-80%, 6=81-100%
	4	5	6	
Dominant Species of Mature Trees	Canopy: *Liriodendron tulipifera, Quercus sp.* Mid-Story: *Fraxinus sp.* Understory: *Platanus occidentalis*			
% Trees w/ Exfoliating Bark	0	0	0	
Size Composition of Live Trees (%)	Small (3-8 in)	Med (9-15 in)	Large (>15 in)	
	20	20	60	
No. of Suitable Snags	0	0	0	

Standing dead trees with exfoliating bark, cracks, crevices, or hollows.
Snags without these characteristics area not considered suitable.

IS THE HABITAT SUITABLE FOR INDIANA BATS?

Additional Comments:

The bat habitat assessment area should be considered potential foraging habitat for both the Indiana and northern long-eared bat. The bat habitat assessment area should also be considered potential foraging habitat for the federally endangered gray bat, present in Harrison County. No potential roost trees were identified within the bat habitat assessment area; however, potential roost trees are likely present in the tangent forested area, which extends north from Watson Road. Flight corridors are present. No permanent water source appears to be present, but three nearby ponds would be sufficient to sustain any bat populations that may be in the area. Overall, the edge and rural-residential are more likely to be utilized by other species, but given the immediate presence of extensive forest networks, permanent water sources, flight corridors, and Buck Creek, occasional to frequent presence of Indiana and northern long-eared bats cannot be ruled out.

Attach aerial photo or project site with all forested areas labeled and a general description of the habitat

Photographic Documentation: habitat shots at edge and interior from multiple locations; Understory/midstory/canopy; examples of potential suitable snags and live trees; water sources

PHASE 1 SUMMER HABITAT ASSESSMENTS

T1-HA-1

INDIANA BAT HABITAT ASSESSMENT DATASHEET

Project Name: State Road 11 Extension			Date: May 7, 2021
Township/Range/Section:	5S/4E/8		Boone Township, Harrison County
Lat Long/UTM/Zone: 38.086088 N -86.099943 W	Western terminus 38.086238 N -86.105656 W	Eastern terminus 38.085884 N -86.098158 W	Surveyor: S. Langley

Brief Project Description

Four alternative routes are being considered to connect Stater Road 11 to State Road 135. Surveys of potential bat habitat and roosts trees are being conducted to assist in route selection and minimize environmental impacts.

Project Area

Project	Total Acres	Forest Acres	Open Acres
	7.32	7.32	0.00

Proposed Tree Removal (ac)	Completely cleared	Partially cleared (will leave trees)	Preserve acres-no clearing
	Unknown	Unknown	Unknown

Brief Project Description

Pre-Project	**Post-Project**
*See Project Description Above	Unknown at this time.

Brief Project Description

Flight corridors to other forested areas?

Flight corridors to tangent forested areas are present.

Describe Adjacent Properties (e.g. forested, grassland, commercial or residential development, water sources)

Adjacent land use is rural and consist of forested and agricultural areas.

Proximity to Public Land

What is the distance (mi.) from the project area to forested public lands (e.g., national or state forests, national or state parks, conservation areas, wildlife management areas)?

An Indiana Forest Bank – Harrison property is located approximately 0.64 mile west of the bat habitat assessment area.
Squire Boone Caverns is located approximately 1.98 miles southwest of the bat habitat assessment area.
The Perseverance Barrens Nature Conservancy is located approximately 2.87 miles north of the bat habitat assessment area.
The Three-Way Sedge Sink Hole Swamp Nature Conservancy is located approximately 3.03 miles south of the bat habitat assessment area.
Harrison-Crawford State Forest is located approximately 4.85 miles west of the bat habitat assessment area.

Attachment 5

PHASE 1 SUMMER HABITAT ASSESSMENTS

Use additional sheets to assess discrete habitat types at multiple sites in a project area
Include a map depicting locations of sample sites if assessing discrete habitats at multiple sites in a project area
A single sheet can be used for multiple sample sites if habitat is the same

Sample Site Description

Sample Site No.(s):T1-HA-1
The bat habitat assessment area is within an upland mature forest dominated by chestnut oak, white oak, shagbark hickory, and tulip poplar. The mid-story is dominated by American beech, flowering dogwood, and declining red cedar. Sugar maple and American beech are emerging within the understory. Spicebush is the predominant shrub species within the understory. Dead/dying ash and sassafras are prevalent on the northern and eastern forest edge.

Water Resources at Sample Site

Stream Type (# and length)	Ephemeral	Intermittent	Perennial	Describe existing condition of water sources: No water sources are located within the bat habitat assessment area. A pond is located approximately 0.04 mile north of the area. A wetland was identified within the northern portion of the bat habitat assessment area.
	N/A	N/A	N/A	
Pools/Ponds (# and size)	N/A	N/A		
		N/A		
Wetlands (approx. ac.)	N/A	0.10 acre		
	N/A	N/A		

Forest Resources at Sample Site

Closure/Density	Canopy (>50')	Midstory (20-50')	Understory (<20')	1=1-10%, 2=11-20%, 3=21-40%, 4=41-60% 5=61-80%, 6=81-100%
	4	5	3	
Dominant Species of Mature Trees	Canopy: *Quercus montana, Quercus alba, Carya ovata, Liriodendron tulipifera* Mid-Story: *Fagus grandifolia, Juniperus virginiana, Cornus florida* Understory: *Acer saccharum, Fagus grandifolia, Lindera benzoin*			
% Trees w/ Exfoliating Bark	1	1	5	
Size Composition of Live Trees (%)	Small (3-8 in)	Med (9-15 in)	Large (>15 in)	
	10	20	70	
No. of Suitable Snags	4	3	5	

Standing dead trees with exfoliating bark, cracks, crevices, or hollows.
Snags without these characteristics area not considered suitable.

IS THE HABITAT SUITABLE FOR INDIANA BATS?

Additional Comments:
The area is ideal roost and forage habitat for both the Indiana and northern-long eared bat. Flight corridors are present to tangent forested areas. Permanent water sources are readily available. A pond is located approximately 0.04 mile north of the bat habitat assessment area. An unnamed tributary to Buck Creek is located approximately 0.33 mile southeast of the bat habitat assessment area. Buck Creek is located approximately 0.56 mile west of the bat habitat assessment area. Twelve potential roost trees were identified within the habitat assessment area. Mature shagbark hickories in the area may provide additional roost opportunities. A large number of dead and dying ash are present within the bat habitat assessment area. Many of the dead ash do not yet possess ideal roost potential, but as decay progresses these trees will likely develop snags and exfoliating bark. This area is also potential foraging habitat for the federally endangered gray bat.

T1-HA-1 Potential Roost Trees

Species	DBH (cm)	Decomposition Stage	Roost Features
Fraxinus sp.	30	4	Snag, Cavities
Unknown	15	6	Cavities
Unknown	12	6	Cavities
Unknown	16	7	Snag, Cavities
Ulmus americana	24	3	Exfoliated Bark
Sassafras albidum	18	7	Snag, Cavities
Fraxinus sp.	39	6	Exfoliating Bark
Sassafras albidum	53.5	2	Snag
Carya ovata	61	1	Snag, Exfoliated Bark
Diospyros virginiana	60	2	Snag, Cavities
Platanus occidentalis	131	2	Snags
Acer saccharum	24	2	Snag, Cavities

Attach aerial photo or project site with all forested areas labeled and a general description of the habitat

Photographic Documentation: habitat shots at edge and interior from multiple locations; Understory/midstory/canopy; examples of potential suitable snags and live trees; water sources

Attachment 5

PHASE 1 SUMMER HABITAT ASSESSMENTS

T1-HA-2

INDIANA BAT HABITAT ASSESSMENT DATASHEET

Project Name: State Road 11 Extension			Date: May 7, 2021
Township/Range/Section:	5S/4E/7		Boone Township, Harrison County
Lat Long/UTM/Zone: 38.085858 N -86.112598 W	Western terminus 38.085478 N -86.114449 W	Eastern terminus 38.086195 N -86.109642 W	Surveyor: S. Langley

Brief Project Description

Four alternative routes are being considered to connect Stater Road 11 to State Road 135. Surveys of potential bat habitat and roosts trees are being conducted to assist in route selection and minimize environmental impacts.

Project Area

Project	Total Acres	Forest Acres	Open Acres
	11.5	11.24	0.26

Proposed Tree Removal (ac)	Completely cleared	Partially cleared (will leave trees)	Preserve acres-no clearing
	Unknown	Unknown	Unknown

Brief Project Description

Pre-Project	**Post-Project**
*See Project Description Above	Unknown at this time.

Brief Project Description

Flight corridors to other forested areas?

Yes, flight corridors to tangent forest areas are present.

Describe Adjacent Properties (e.g. forested, grassland, commercial or residential development, water sources)

Adjacent property use is rural, consisting of forested, agricultural, and rural-residential areas. Petroleum wells are present in properties adjacent to the bat habitat assessment area.

Proximity to Public Land

What is the distance (mi.) from the project area to forested public lands (e.g., national or state forests, national or state parks, conservation areas, wildlife management areas)?

An Indiana Forest Bank – Harrison property is located approximately 0.14 mile west of the bat habitat assessment area.
The Perseverance Barrens Nature Conservancy is located approximately 2.65 miles north of the bat habitat assessment area.
The Three-Way Sedge Sinkhole Swamp Nature Conservancy is located approximately 3.26 miles south of the bat habitat assessment area.
Harrison-Crawford State Forest is located approximately 4.80 miles west of the bat habitat assessment area.

PHASE 1 SUMMER HABITAT ASSESSMENTS

Use additional sheets to assess discrete habitat types at multiple sites in a project area
Include a map depicting locations of sample sites if assessing discrete habitats at multiple sites in a project area
A single sheet can be used for multiple sample sites if habitat is the same

Sample Site Description

Sample Site No.(s): T1-HA-2

The site is a diverse, maturing upland forest dominated by shagbark hickory, red oak, black oak, and American beech. Ash (likely white ash) was also dominant within in the canopy, but few individuals appear to have survived the emerald ash borer. Pockets of declining white pine and red cedar are also present. Several logging and petroleum well maintenance roads are present within the bat habitat assessment area. The mid-story and understory are fairly cluttered in the western portion of the habitat assessment area, but thins out on the eastern side.

Water Resources at Sample Site

Stream Type (# and length)	Ephemeral	Intermittent	Perennial	Describe existing condition of water sources: Buck creek is located approximately 0.14 mile from the bat habitat assessment area.
	N/A	N/A	N/A	
Pools/Ponds (# and size)	N/A	N/A		
		N/A		
Wetlands (approx. ac.)	N/A	N/A		
	N/A	N/A		

Forest Resources at Sample Site

Closure/Density	Canopy (>50')	Midstory (20-50')	Understory (<20')	1=1-10%, 2=11-20%, 3=21-40%, 4=41-60% 5=61-80%, 6=81-100%
	5	5	5	
Dominant Species of Mature Trees	Canopy: *Carya ovata, Fraxinus sp., Quercus velutina, Quercus rubra, Fagus grandifolia, Pinus strobus, Acer saccharum* Mid-Story: *Juniperus virginiana, Fagus grandifloia, Aesculus glabra, Cornus florida* Understory: *Aesculus glabra, Cornus florida, Lindera benzoin*			
% Trees w/ Exfoliating Bark	0	1	3	
Size Composition of Live Trees (%)	Small (3-8 in)	Med (9-15 in)	Large (>15 in)	
	10	20	70	
No. of Suitable Snags	0	0	3	

Standing dead trees with exfoliating bark, cracks, crevices, or hollows.
Snags without these characteristics area not considered suitable.

IS THE HABITAT SUITABLE FOR INDIANA BATS?

Additional Comments:

This area is ideal roost and foraging habitats for both the Indiana and northern long-eared bat. Flight corridors to tangent forested areas exist in the form of logging and petroleum well maintenance roads. Buck Creek (located 0.14 mile west of the bat habitat assessment area) provides a permanent water source. The thickness of the mid and understories is likely only a minor impediment to foraging, and may be beneficial to the gleaning strategy utilized by the northern long-eared bat. Four potential roost trees were identified within bat habitat assessment area. Shagbark hickories may provide additional roosts to those documented. Additional individual dead ash were identified that do not yet exhibit roost features, but likely will as decay progresses and the bark begins to exfoliate.

Identified Potential Roosts:

- *Fraxinus sp.* – 41cm DBH – Stage 3/4 – Exfoliating Bark
- *Fraxinus sp.* – 45cm DBH – Stage 3/4 – Exfoliating Bark
- *Fraxinus sp.* – 43cm DBH – Stage 3/4 – Exfoliating Bark
- Unknown (likely *Ulmus sp.* or possibly *Quercus alba*, the decay of the bark was too advanced for positive identification – 30cm DBH – Stage 6 – Exfoliating Bark – Cavities

This area is also likely suitable habitat for the federally endangered gray bat.

Attach aerial photo or project site with all forested areas labeled and a general description of the habitat

Photographic Documentation: habitat shots at edge and interior from multiple locations; Understory/midstory/canopy; examples of potential suitable snags and live trees; water sources

PHASE 1 SUMMER HABITAT ASSESSMENTS

T1-HA-3

INDIANA BAT HABITAT ASSESSMENT DATASHEET

Project Name: State Road 11 Extension			Date: May 7, 2021
Township/Range/Section:	5S/4E/7		Boone Township, Harrison County
Lat Long/UTM/Zone: 38.085335 N -86.115951 W	Western terminus 38.085158 N -86.116761 W	Eastern terminus 38.085517 N -86.115023 W	Surveyor: S. Langley

Brief Project Description

Four alternative routes are being considered to connect Stater Road 11 to State Road 135. Surveys of potential bat habitat and roosts trees are being conducted to assist in route selection and minimize environmental impacts.

Project Area

Project	Total Acres	Forest Acres	Open Acres
	3.07	3.07	0.00

Proposed Tree Removal (ac)	Completely cleared	Partially cleared (will leave trees)	Preserve acres-no clearing
	Unknown	Unknown	Unknown

Brief Project Description

Pre-Project	**Post-Project**
*See Project Description Above	Unknown at this time.

Brief Project Description

Flight corridors to other forested areas?

Yes, flight corridors to tangent forested areas are present.

Describe Adjacent Properties (e.g. forested, grassland, commercial or residential development, water sources)

Adjacent property use is rural, consisting of forested, agricultural, and rural-residential areas.

Proximity to Public Land

What is the distance (mi.) from the project area to forested public lands (e.g., national or state forests, national or state parks, conservation areas, wildlife management areas)?

An Indiana Forest Bank – Harrison property is located immediately west across Buck Creek, adjacent to the bat habitat assessment area.
The Perseverance Barrens Nature Conservancy is located approximately 2.97 miles north of the bat habitat assessment area.
The Three-Way Sedge Sinkhole Swamp Nature Conservancy is located approximately 3.05 miles southeast of the bat habitat assessment area.
Harrison-Crawford State Forest is located approximately 4.29 miles west of the bat habitat assessment area.

PHASE 1 SUMMER HABITAT ASSESSMENTS

Use additional sheets to assess discrete habitat types at multiple sites in a project area
Include a map depicting locations of sample sites if assessing discrete habitats at multiple sites in a project area
A single sheet can be used for multiple sample sites if habitat is the same

Sample Site Description

Sample Site No.(s):T1-HA-3

Riparian forest dominated by young black walnut and American elm. American sycamore and boxelder become more dominant within the floodplain of Buck Creek. A small clearing is located in the floodplain of Buck Creek. Several logging roads have been cut throughout the bat habitat assessment area. Buckeye dominant mid and understories.

Water Resources at Sample Site

	Ephemeral	Intermittent	Perennial	Describe existing condition of water sources: Buck Creek is located on the western end of the bat habitat assessment area. Buck Creek was flooded at the time of this survey.
Stream Type (# and length)	N/A	N/A	Buck Creek: 0.06 mile	
Pools/Ponds (# and size)	N/A	N/A		
		N/A		
Wetlands (approx. ac.)	N/A	N/A		
	N/A	N/A		

Forest Resources at Sample Site

	Canopy (>50')	Midstory (20-50')	Understory (<20')	1=1-10%, 2=11-20%, 3=21-40%, 4=41-60% 5=61-80%, 6=81-100%
Closure/Density	3	4	4	
Dominant Species of Mature Trees	Canopy: *Juglans nigra, Platanus occidentalis, Acer negundo,* and *Ulmus americana* Mid-Story: *Aesculus glabra* and *Acer negundo* Understory: *Aesculus glabra, Lindera benzoin,* and *Lonicera sp.*			
% Trees w/ Exfoliating Bark	0	0	1	
Size Composition of Live Trees (%)	Small (3-8 in)	Med (9-15 in)	Large (>15 in)	
	20	40	40	
No. of Suitable Snags	0	0	1	

Standing dead trees with exfoliating bark, cracks, crevices, or hollows.
Snags without these characteristics area not considered suitable.

IS THE HABITAT SUITABLE FOR INDIANA BATS?

Additional Comments:

The habitat within the assessment area is ideal foraging and roosting habitat for both Indiana and northern long-eared bat. The site has excellent flight corridors in the form of logging roads and natural clearings. Buck Creek provides an immediate and permanent water source. One potential roost tree was identified immediately north of the northernmost proposed route.

T1-16 - *Ulmus americana* – 50cm DBH – Stage 3 – Exfoliating Bark, Snags

This area is also likely suitable habitat for the federally endangered gray bat.

Attach aerial photo or project site with all forested areas labeled and a general description of the habitat

Photographic Documentation: habitat shots at edge and interior from multiple locations; Understory/midstory/canopy; examples of potential suitable snags and live trees; water sources

PHASE 1 SUMMER HABITAT ASSESSMENTS

T1-HA-4

INDIANA BAT HABITAT ASSESSMENT DATASHEET

Project Name: State Road 11 Extension Project			Date: May 7, 2021
Township/Range/Section:	5S/4E/7		Boone Township, Harrison County
Lat Long/UTM/Zone: 38.085084 N -86.117887 W	Western terminus 38.085206 N -86.119427 W	Eastern terminus 38.084847 N -86.116686 W	Surveyor: S. Langley

Brief Project Description

Four alternative routes are being considered to connect Stater Road 11 to State Road 135. Surveys of potential bat habitat and roosts trees are being conducted to assist in route selection and minimize environmental impacts.

Project Area

Project	Total Acres	Forest Acres	Open Acres
	3.27	3.27	0.00

Proposed Tree Removal (ac)	Completely cleared	Partially cleared (will leave trees)	Preserve acres-no clearing
	Unknown	Unknown	Unknown

Brief Project Description

Pre-Project	**Post-Project**
*See Project Description Above	Unknown at this time.

Brief Project Description

Flight corridors to other forested areas?

Yes, flight corridors to other forested areas are present.

Describe Adjacent Properties (e.g. forested, grassland, commercial or residential development, water sources)

Adjacent land use is rural, consisting of forested, agricultural, and rural-residential areas.

Proximity to Public Land

What is the distance (mi.) from the project area to forested public lands (e.g., national or state forests, national or state parks, conservation areas, wildlife management areas)?

The bat habitat assessment is located within an Indiana Forest Bank – Harrison property.
Squire Boone Caverns is located approximately 1.35 miles southwest of the bat habitat assessment area.
The Perseverance Barrens Nature Conservancy is located approximately 2.83 miles north of the bat habitat assessment area.
The Three-Way Sedge Sinkhole Swamp Nature Conservancy is located approximatley 3.11 miles southeast of the bat habitat assessment area.
Harrison-Crawford State Forest is located approximately 4.02 miles west of the bat habitat assessment area.

Attachment 5

PHASE 1 SUMMER HABITAT ASSESSMENTS

Use additional sheets to assess discrete habitat types at multiple sites in a project area
Include a map depicting locations of sample sites if assessing discrete habitats at multiple sites in a project area
A single sheet can be used for multiple sample sites if habitat is the same

Sample Site Description

Sample Site No.(s): T1-HA-4

The bat habitat assessment area is a mature upland forest situated an eastward facing slope. Dominant mature species include red oak and sugar maple, with a significant number of eastern white pine slowly dying back in the canopy. The mid-story is dominated by red cedar and emerging sugar maple. The understory is choked with invasive autumn olive.

Water Resources at Sample Site

Stream Type (# and length)	Ephemeral	Intermittent	Perennial	Describe existing condition of water sources: One 0.04 acre pool is located within the habitat assessment area. Buck Creek is located approximatley 0.15 mile east of the bat habitat assessment area.
	N/A	N/A	N/A	
Pools/Ponds (# and size)	N/A	One 0.04 acre pool located in the bat habitat assessment area.		
		N/A		
Wetlands (approx. ac.)	N/A	N/A		
	N/A	N/A		

Forest Resources at Sample Site

Closure/Density	Canopy (>50')	Midstory (20-50')	Understory (<20')	1=1-10%, 2=11-20%, 3=21-40%, 4=41-60% 5=61-80%, 6=81-100%
	3	4	5	
Dominant Species of Mature Trees	Canopy: *Quercus rubra*, *Acer saccharum*, and *Pinus strobus* Mid-Story: *Juniperus virginiana* and *Acer saccharum* Understory: *Elaeagnus umbellata*			
% Trees w/ Exfoliating Bark	0	0	0	
Size Composition of Live Trees (%)	Small (3-8 in)	Med (9-15 in)	Large (>15 in)	
	20	40	40	
No. of Suitable Snags	0	0	0	

Standing dead trees with exfoliating bark, cracks, crevices, or hollows.
Snags without these characteristics area not considered suitable.

IS THE HABITAT SUITABLE FOR INDIANA BATS?

Additional Comments:

The habitat is suitable for both Indiana bats and northern long-eared bats. The area is also potential forage habitat for the gray bat. Flight corridors to tangent forest areas are present. No potential roost trees were identified. A woodland pool and nearby Buck Creek provide reliable water sources.

This property is registered as an Indiana Forest Bank – Harrison property.

Attach aerial photo or project site with all forested areas labeled and a general description of the habitat

Photographic Documentation: habitat shots at edge and interior from multiple locations; Understory/midstory/canopy; examples of potential suitable snags and live trees; water sources

Attachment 5

PHASE 1 SUMMER HABITAT ASSESSMENTS

T1-HA-5

INDIANA BAT HABITAT ASSESSMENT DATASHEET

Project Name: State Road 11 Extension			Date: May 8, 2021
Township/Range/Section:	5S/4E/7		Boone Township, Harrison County
Lat Long/UTM/Zone: 38.085031 N -86.117801 W	Western terminus 38.085209 N -86.119582 W	Eastern terminus 38.084846 N -86.116584 W	Surveyor: S. Langley

Brief Project Description

Four alternative routes are being considered to connect Stater Road 11 to State Road 135. Surveys of potential bat habitat and roosts trees are being conducted to assist in route selection and minimize environmental impacts.

Project Area

Project	Total Acres	Forest Acres	Open Acres
	3.16	3.16	0.00

Proposed Tree Removal (ac)	Completely cleared	Partially cleared (will leave trees)	Preserve acres-no clearing
	Unknown	Unknown	Unknown

Brief Project Description

Pre-Project	**Post-Project**
*See Project Description Above	Unknown at this time.

Brief Project Description

Flight corridors to other forested areas?

Flight corridors to other forested areas are present.

Describe Adjacent Properties (e.g. forested, grassland, commercial or residential development, water sources)

Adjacent properties are rural with forested, agricultural, and rural-residential areas.

Proximity to Public Land

What is the distance (mi.) from the project area to forested public lands (e.g., national or state forests, national or state parks, conservation areas, wildlife management areas)?

The bat habitat assessment area is located within a property registered as and Indiana Forest Bank – Harrison property.
The Perseverance Barrens Nature Conservancy is located approximatley 2.76 miles north of the bat habitat assessment area.
The Three-Way Sedge Sinkhole Swamp Nature Conservancy is located approximatley 2.97 miles southeast of the bat habitat assessment area.
Squire Boone Caverns is located approximately 1.55 miles southwest of the bat habitat assessment area.
Harrison-Crawford State Forest is located approximately 4.21 miles west of the bat habitat assessment area.

PHASE 1 SUMMER HABITAT ASSESSMENTS

Use additional sheets to assess discrete habitat types at multiple sites in a project area
Include a map depicting locations of sample sites if assessing discrete habitats at multiple sites in a project area
A single sheet can be used for multiple sample sites if habitat is the same

Sample Site Description

Sample Site No.(s): T1-HA-5

The habitat assessment area is a gently sloping riparian bluff dominated by red oak, sugar maple, and ash.

Water Resources at Sample Site

	Ephemeral	Intermittent	Perennial	Describe existing condition of water sources: Buck Creek borders the east edge of the bat habitat assessment area. Buck Creek was flooded at the time of the survey.
Stream Type (# and length)	N/A	N/A	Buck Creek: 0.06 mile	
Pools/Ponds (# and size)	N/A	N/A		
		N/A		
Wetlands (approx. ac.)	N/A	N/A		
	N/A	N/A		

Forest Resources at Sample Site

	Canopy (>50')	Midstory (20-50')	Understory (<20')	1=1-10%, 2=11-20%, 3=21-40%, 4=41-60% 5=61-80%, 6=81-100%
Closure/Density	3	3	4	
Dominant Species of Mature Trees	Canopy: *Quercus rubra, Acer saccharum,* and *Fraxinus sp.* Mid-Story: *Ulmus americana, Fagus grandifolia,* and *Acer saccharum* Understory: *Elaeagnus umbellata*			
% Trees w/ Exfoliating Bark	0	0	1	
Size Composition of Live Trees (%)	Small (3-8 in)	Med (9-15 in)	Large (>15 in)	
	20	30	50	
No. of Suitable Snags	0	0	2	

Standing dead trees with exfoliating bark, cracks, crevices, or hollows.
Snags without these characteristics area not considered suitable.

IS THE HABITAT SUITABLE FOR INDIANA BATS?

Additional Comments:

This area is ideal roost and foraging habitat for both the Indiana and Northern long-eared bat. Flight corridors to tangent forest are present. Buck Creek provides an immediate and permanent water source.

Three potential roost trees were identified within the bat habitat assessment area:

- Quercus rubra – 80cm DBH – Stage 5/6 – Cavities – Snags
- *Fraxinus sp.* – 50cm DBH – Stage 3 – Exfoliating Bark
- *Fraxinus sp.* – 70cm DBH – Stage 3/4 Exfoliating Bark – Snags

This area is also likely suitable habitat for the federally endangered gray bat.

Attach aerial photo or project site with all forested areas labeled and a general description of the habitat

Photographic Documentation: habitat shots at edge and interior from multiple locations;
Understory/midstory/canopy; examples of potential suitable snags and live trees; water sources

Attachment 5

PHASE 1 SUMMER HABITAT ASSESSMENTS

T1-HA-1

INDIANA BAT HABITAT ASSESSMENT DATASHEET

Project Name: State Road 11 Extension			Date: May 6, 2021
Township/Range/Section:	5S/4E/8		Boone Township, Harrison County
Lat Long/UTM/Zone: 38.084275 N -86.091655 W	Western terminus 38.084077 N -86.092487 W	Eastern terminus 38.084465 N -86.091028 W	Surveyor: S. Langley

Brief Project Description

Four alternative routes are being considered to connect Stater Road 11 to State Road 135. Surveys of potential bat habitat and roosts trees are being conducted to assist in route selection and minimize environmental impacts.

Project Area

Project	Total Acres	Forest Acres	Open Acres
	1.12	1.12	0.00

Proposed Tree Removal (ac)	Completely cleared	Partially cleared (will leave trees)	Preserve acres-no clearing
	Unknown	Unknown	Unknown

Brief Project Description

Pre-Project	**Post-Project**
*See Project Description Above	Unknown at this time.

Brief Project Description

Flight corridors to other forested areas?

An unnamed tributary to Buck Creek serves as a flight corridor,

Describe Adjacent Properties (e.g. forested, grassland, commercial or residential development, water sources)

Adjacent property use is rural, consisting of agricultural, forested, and rural-residential areas.

Proximity to Public Land

What is the distance (mi.) from the project area to forested public lands (e.g., national or state forests, national or state parks, conservation areas, wildlife management areas)?

An Indiana Forest Bank – Harrison property is located approximately 1.41 miles west of the bat habitat assessment area.
Squire Boone Caverns is located approximately 2.53 miles southwest of the bat habitat assessment area.
The Three-Way Sedge Sinkhole Swamp Nature Conservancy is located approximately 2.88 miles south of the bat habitat assessment area.
Perseverance Barrens Nature Conservancy is located approximately 3.09 miles north of the bat habitat assessment area.
Harrison-Crawford State Forest is located approximately 5.60 miles west of the bat habitat assessment area.

PHASE 1 SUMMER HABITAT ASSESSMENTS

Use additional sheets to assess discrete habitat types at multiple sites in a project area
Include a map depicting locations of sample sites if assessing discrete habitats at multiple sites in a project area
A single sheet can be used for multiple sample sites if habitat is the same

Sample Site Description

Sample Site No.(s): T2-HA-1

The bat habitat assessment area is a thin strand of trees lining an unnamed tributary to Buck Creek. The area features a mix of mature riparian/bottomland species and successional upland species. The canopy is largely comprised of American Sycamore, American Elm, and red cedar. The sparse mid-story consists primarily of red cedar and mulberry. Autumn olive is present in the understory, along with a patchwork of dense multiflora rose and blackberry. A flight corridor is present between the unnamed tributary to Buck Creek and the mid-story trees. Grass and fallow ag fields border the bat habitat assessment area to the east and west.

Water Resources at Sample Site

Stream Type (# and length)	Ephemeral	Intermittent	Perennial	Describe existing condition of water sources: An unnamed tributary to Buck Creek is located within the bat habitat assessment area. The stream contained flowing water at the time of the survey and appears to be perennial.
	N/A	N/A	Unnamed Tributary to Buck Creek: 0.07 mile	
Pools/Ponds (# and size)	N/A	N/A		
		N/A		
Wetlands (approx. ac.)	N/A	N/A		
	N/A	N/A		

Forest Resources at Sample Site

Closure/Density	Canopy (>50')	Midstory (20-50')	Understory (<20')	1=1-10%, 2=11-20%, 3=21-40%, 4=41-60% 5=61-80%, 6=81-100%
	3	3	2	
Dominant Species of Mature Trees	Canopy: *Platanus occidentalis, Ulmus americana*, and *Juniperus virginiana* Mid-Story: *Juniperus virginiana* and *Morus sp.* Understory: *Eleagnus umellata*			
% Trees w/ Exfoliating Bark	0	0	0	
Size Composition of Live Trees (%)	Small (3-8 in)	Med (9-15 in)	Large (>15 in)	
	45	45	10	
No. of Suitable Snags	0	0	1	

Standing dead trees with exfoliating bark, cracks, crevices, or hollows.
Snags without these characteristics area not considered suitable.

IS THE HABITAT SUITABLE FOR INDIANA BATS?

Additional Comments:

The bat habitat assessment area is potential habitat for the Indiana and northern-long eared bat. The unnamed tributary to Buck Creek provides a permanent and immediate source of water. The open edge conditions of the area do not provide ideal foraging habitat; however, the flight corridor provided by the unnamed tributary to Buck Creek could serve as a sheltered route between forested areas. One potential roost tree was documented in the within the bat habitat assessment area. Information on the potential roost tree is provided below:

Platanus occidentalis – 65cm DBH – Stage 2 – Large Snag

Harrison County is within the known range of the federally endangered gray bat. This area should be regarded as potential foraging habitat for the species.

Attach aerial photo or project site with all forested areas labeled and a general description of the habitat

Photographic Documentation: habitat shots at edge and interior from multiple locations; Understory/midstory/canopy; examples of potential suitable snags and live trees; water sources

Attachment 5

`PHASE 1 SUMMER HABITAT ASSESSMENTS

T2-HA-2

INDIANA BAT HABITAT ASSESSMENT DATASHEET

Project Name: State Road 11 Extension			Date: May 6, 2021
Township/Range/Section:	5S/4E/18		Boone Township, Harrison County
Lat Long/UTM/Zone: 38.083754 N -86.122607 W	Western terminus 38.08343 N -86.12344 W	Eastern terminus 38.083697 N -86.122418 W	Surveyor: S. Langley

Brief Project Description

Four alternative routes are being considered to connect Stater Road 11 to State Road 135. Surveys of potential bat habitat and roosts trees are being conducted to assist in route selection and minimize environmental impacts.

Project Area

Project	Total Acres	Forest Acres	Open Acres
	0.77	0.77	0.00

Proposed Tree Removal (ac)	Completely cleared	Partially cleared (will leave trees)	Preserve acres-no clearing
	Unknown	Unknown	Unknown

Brief Project Description

Pre-Project	**Post-Project**
*See Project Description Above	Unknown at this time.

Brief Project Description

Flight corridors to other forested areas?

No flight corridor is present within this bat habitat assessment area.

Describe Adjacent Properties (e.g. forested, grassland, commercial or residential development, water sources)

Adjacent property use is rural, with forested, agricultural, and rural-residential areas.

Proximity to Public Land

What is the distance (mi.) from the project area to forested public lands (e.g., national or state forests, national or state parks, conservation areas, wildlife management areas)?

An Indiana Forest Bank – Harrison property is located approximately 0.10 mile east of the bat habitat assessment area.
Squire Boone Caverns is located approximately 1.49 miles southwest of the bat habitat assessment area.
The Perseverance Barrens Nature Conservancy is located approximately 3.07 miles north of the bat habitat assessment area.
The Three-Way Sedge Sinkhole Swamp Nature Conservancy is located approximately 3.11 miles southeast of the bat habitat assessment area.
Harrison-Crawford State Forest is located approximately 3.90 miles west of the bat habitat assessment area.

PHASE 1 SUMMER HABITAT ASSESSMENTS

Use additional sheets to assess discrete habitat types at multiple sites in a project area
Include a map depicting locations of sample sites if assessing discrete habitats at multiple sites in a project area
A single sheet can be used for multiple sample sites if habitat is the same

Sample Site Description

Sample Site No.(s):T2-HA-2

The bat habitat assessment area is a hedgerow of trees extending from a larger forest, north through two alternative routes. No flight corridor is present. The hedgerow is dominated by invasive tree-of-heaven. No water source is located in the immediate vicinity of the bat habitat assessment area.

Water Resources at Sample Site

Stream Type (# and length)	Ephemeral	Intermittent	Perennial	Describe existing condition of water sources: Buck Creek is located approximately 0.40 mile east of the bat habitat assessment area. A probable wetland is located approximately 0.26 mile west of the bat habitat assessment area.
	N/A	N/A	N/A	
Pools/Ponds (# and size)	N/A	N/A		
		N/A		
Wetlands (approx. ac.)	N/A	N/A		
	N/A	N/A		

Forest Resources at Sample Site

Closure/Density	Canopy (>50')	Midstory (20-50')	Understory (<20')	1=1-10%, 2=11-20%, 3=21-40%, 4=41-60% 5=61-80%, 6=81-100%
	4	4	5	
Dominant Species of Mature Trees	Canopy: *Ailanthus altissima* Mid-Story: *Ailanthus altissima* Understory: *Ailanthus altissima*			
% Trees w/ Exfoliating Bark	0	0	0	
Size Composition of Live Trees (%)	Small (3-8 in)	Med (9-15 in)	Large (>15 in)	
	60	30	10	
No. of Suitable Snags	0	0	0	

Standing dead trees with exfoliating bark, cracks, crevices, or hollows.
Snags without these characteristics area not considered suitable.

IS THE HABITAT SUITABLE FOR INDIANA BATS?

Additional Comments:

The area is not ideal, but possible foraging habitat for the Indiana and northern long-eared bat; however, the forest immediately south of the hedgerow is ideal roost and forage habitat for both species. No roost trees were identified in the bat habitat assessment area within the proposed SR 11 routes or immediately south of the proposed routes. Buck Creek and a probable wetland are located near the bat habitat assessment area.

Attach aerial photo or project site with all forested areas labeled and a general description of the habitat

Photographic Documentation: habitat shots at edge and interior from multiple locations; Understory/midstory/canopy; examples of potential suitable snags and live trees; water sources

Attachment 5

PHASE 1 SUMMER HABITAT ASSESSMENTS

T2-HA-3

INDIANA BAT HABITAT ASSESSMENT DATASHEET

Project Name: State Road 11 Extension			Date: May 7, 2021
Township/Range/Section:	5S/4E/7		Boone Township, Harrison County
Lat Long/UTM/Zone: 38.085618 N -86.107241 W	Western terminus 38.085601 N -86.111012 W	Eastern terminus 38.08574 W -86.105926 W	Surveyor: S. Langley

Brief Project Description

Four alternative routes are being considered to connect Stater Road 11 to State Road 135. Surveys of potential bat habitat and roosts trees are being conducted to assist in route selection and minimize environmental impacts.

Project Area

Project	Total Acres	Forest Acres	Open Acres
	4.96	4.96	0.00

Proposed Tree Removal (ac)	Completely cleared	Partially cleared (will leave trees)	Preserve acres-no clearing
	Unknown	Unknown	Unknow

Brief Project Description

Pre-Project	**Post-Project**
*See Project Description Above	Unknown at this time.

Brief Project Description

Flight corridors to other forested areas?

Flight corridors to tangent forested habitats are present within the bat habitat assessment area.

Describe Adjacent Properties (e.g. forested, grassland, commercial or residential development, water sources)

Adjacent property use is rural, consisting of forested, agricultural, and rural-residential areas.

Proximity to Public Land

What is the distance (mi.) from the project area to forested public lands (e.g., national or state forests, national or state parks, conservation areas, wildlife management areas)?

An Indiana Forest Bank – Harrison property is located approximately 0.14 mile west of the bat habitat assessment area.
The Perseverance Barrens Nature Conservancy is located approximately 2.65 miles north of the bat habitat assessment area.
The Three-Way Sedge Sinkhole Swamp Nature Conservancy is located approximately 3.26 miles south of the bat habitat assessment area.
Harrison-Crawford State Forest is located approximately 4.80 miles west of the bat habitat assessment area.

PHASE 1 SUMMER HABITAT ASSESSMENTS

Use additional sheets to assess discrete habitat types at multiple sites in a project area
Include a map depicting locations of sample sites if assessing discrete habitats at multiple sites in a project area
A single sheet can be used for multiple sample sites if habitat is the same

Sample Site Description

Sample Site No.(s): T2-HA-3

The bat habitat assessment area is within an intermediate forest on the edge of a larger forest, which is largely composed of mature and climax forested areas. Tulip poplar, ash, and red cedar are dominant within the canopy. Many of the ash trees have been affected by the emerald ash borer and are either dead or dying. Sugar maple has a minor presence within the canopy. The mid-story is chiefly composed of red cedar. American beech, American elm, sassafras, sugar maple, flowering dogwood, and young shagbark hickory are also present within the mid-story. Spicebush is dominant in the understory. No permanent water source is located within the bat habitat assessment area. Several trails transect the area.

Water Resources at Sample Site

Stream Type (# and length)	Ephemeral	Intermittent	Perennial	Describe existing condition of water sources: No permanent water source was located within the bat habitat assessment area. Buck Creek is located approximately 0.27 mile east from the area. A pond is located 0.36 miles northeast of the bat habitat assessment area.
	N/A	N/A	N/A	
Pools/Ponds (# and size)	N/A	N/A		
		N/A		
Wetlands (approx. ac.)	N/A	N/A		
	N/A	N/A		

Forest Resources at Sample Site

Closure/Density	Canopy (>50')	Midstory (20-50')	Understory (<20')	1=1-10%, 2=11-20%, 3=21-40%, 4=41-60% 5=61-80%, 6=81-100%
	4	5	5	
Dominant Species of Mature Trees	Canopy: *Liriodendron tulipifera, Juniperus virginiana,* and *Fraxinus sp.* Mid-Story: *Juniperus virginiana* Understory: *Lindera benzoin*			
% Trees w/ Exfoliating Bark	1	1	1	
Size Composition of Live Trees (%)	Small (3-8 in)	Med (9-15 in)	Large (>15 in)	
	10	45	45	
No. of Suitable Snags	0	0	0	

Standing dead trees with exfoliating bark, cracks, crevices, or hollows.
Snags without these characteristics area not considered suitable.

IS THE HABITAT SUITABLE FOR INDIANA BATS?

Additional Comments:

This bat habitat assessment area is suitable foraging habitat for the Indiana, northern long-eared, and gray bat. Flight corridors to tangent forested areas are present in the form of logging roads and paths. No potential roost trees were identified; however, the presence of decaying ash and maturing hickory will provide ideal roost habitat in the near future. At least six dead/dying ash were identified within the canopy. The identified ash do not currently exhibit ideal roost characteristics, but further decay will result in exfoliating bark and snags in the near future. No permanent water source was identified within the bat habitat assessment area; however, Buck Creek and a pond are both located within a half mile of the location.

Attach aerial photo or project site with all forested areas labeled and a general description of the habitat

Photographic Documentation: habitat shots at edge and interior from multiple locations; Understory/midstory/canopy; examples of potential suitable snags and live trees; water sources

PHASE 1 SUMMER HABITAT ASSESSMENTS

T2-HA-4

INDIANA BAT HABITAT ASSESSMENT DATASHEET

Project Name: State Road 11 Extension			Date: May 7, 2021
Township/Range/Section:	5S/4E/8		Boone Township, Harrison County
Lat Long/UTM/Zone: 38.085474 N -86.102492	Western terminus 38.085672 N -86.10570 W	Eastern terminus 38.08514 N -86.098141 W	Surveyor: S. Langley

Brief Project Description

Four alternative routes are being considered to connect Stater Road 11 to State Road 135. Surveys of potential bat habitat and roosts trees are being conducted to assist in route selection and minimize environmental impacts.

Project Area

Project	Total Acres	Forest Acres	Open Acres
	15.21	15.21	0.00

Proposed Tree Removal (ac)	Completely cleared	Partially cleared (will leave trees)	Preserve acres-no clearing
	Unknown	Unknown	Unknown

Brief Project Description

Pre-Project	**Post-Project**
*See Project Description Above	Unknown at this time.

Brief Project Description

Flight corridors to other forested areas?

Flight corridors to tangent forested areas are present within the bat habitat assessment area.

Describe Adjacent Properties (e.g. forested, grassland, commercial or residential development, water sources)

Adjacent property use is rural, consisting of forested, agricultural, and rural-residential areas.

Proximity to Public Land

What is the distance (mi.) from the project area to forested public lands (e.g., national or state forests, national or state parks, conservation areas, wildlife management areas)?

An Indiana Forest Bank – Harrison property is located approximately 0.64 mile west of the bat habitat assessment area.
Squire Boone Caverns is located approximately 1.98 miles southwest of the bat habitat assessment area.
The Perseverance Barrens Nature Conservancy is located approximately 2.87 miles north of the bat habitat assessment area.
The Three-Way Sedge Sink Hole Swamp Nature Conservancy is located approximately 3.03 miles south of the bat habitat assessment area.
Harrison-Crawford State Forest is located approximately 4.85 miles west of the bat habitat assessment area.

Attachment 5

PHASE 1 SUMMER HABITAT ASSESSMENTS

Use additional sheets to assess discrete habitat types at multiple sites in a project area
Include a map depicting locations of sample sites if assessing discrete habitats at multiple sites in a project area
A single sheet can be used for multiple sample sites if habitat is the same

Sample Site Description

Sample Site No.(s): T2-HA-4

The bat habitat assessment area is within a late-intermediary/early-mature upland forest. Tulip poplar, shagbark hickory, and sugar maple are the dominant species in the canopy. Sugar maple, American beech, sassafras, and flowering dogwood are the dominant species in the mid-story. Spicebush and sugar maple sapling are dominant within the understory. No permanent water source is located within the bat habitat assessment area. Several trails and logging roads transect the bat habitat assessment area. Canopy density is variable throughout, but tends to increase from east to west, approaching the interior of the forest.

Water Resources at Sample Site

Stream Type (# and length)	Ephemeral	Intermittent	Perennial	Describe existing condition of water sources: No permanent water source is located within the bat habitat assessment area. A pond is located approximately 0.10 mile north of the bat habitat assessment area. Buck Creek is located approximately 0.57 mile west of the bat habitat assessment area.
	N/A	N/A	N/A	
Pools/Ponds (# and size)	N/A	N/A		
		N/A		
Wetlands (approx. ac.)	N/A	N/A		
	N/A	N/A		

Forest Resources at Sample Site

Closure/Density	Canopy (>50')	Midstory (20-50')	Understory (<20')	1=1-10%, 2=11-20%, 3=21-40%, 4=41-60% 5=61-80%, 6=81-100%
	5	4	6	
Dominant Species of Mature Trees	Canopy: *Liriodendron tulipifera, Acer saccharum,* and *Carya ovata* Mid-Story: *Acer saccharum, Fagus grandifolia, Sassafras albidum,* and *Cornus florida* Understory: *Lindera benzoin* and *Acer saccharum*			
% Trees w/ Exfoliating Bark	1	1	5	
Size Composition of Live Trees (%)	Small (3-8 in)	Med (9-15 in)	Large (>15 in)	
	10	20	70	
No. of Suitable Snags	0	3	1	

Standing dead trees with exfoliating bark, cracks, crevices, or hollows.
Snags without these characteristics area not considered suitable.

IS THE HABITAT SUITABLE FOR INDIANA BATS?

Additional Comments:

The bat habitat assessment area is ideal roost and foraging habitat for the Indiana and northern-long eared bat. The density and interior position of the area is habitat most often associated with the northern long-eared bat. The area should also be considered foraging habitat for the federally endangered gray bat, present in Harrison County. The habitat assessment area has flight corridors to tangent forested areas in the form of trails and logging roads. No permanent water source was located within the bat habitat assessment area; however, Buck Creek and two ponds are within close proximity.

Four potential roosts were documented in the bat habitat assessment area. Four large shagbark hickories which may provide additional roost opportunities were also identified.

	Potential Roost Trees			
Tree ID	**Species**	**DBH (cm)**	**Decomposition Stage**	**Roost Features**
T2-2	*Unknown*	26	6	Fissures
T2-3	*Quercus sp.*	41	5	Fissures, Cavities
T2-4	*Sassafras albidum*	28	6	Cavities, Snag
T2-5	*Fraxinus sp.*	24	7	Exfoliating Bark

Attach aerial photo or project site with all forested areas labeled and a general description of the habitat

Photographic Documentation: habitat shots at edge and interior from multiple locations; Understory/midstory/canopy; examples of potential suitable snags and live trees; water sources

Attachment 5

PHASE 1 SUMMER HABITAT ASSESSMENTS

T2-HA-5

INDIANA BAT HABITAT ASSESSMENT DATASHEET

Project Name: State Road 11 Extension			Date: May 7, 2021
Township/Range/Section:	5S/4E/7		Boone Township, Harrison County
Lat Long/UTM/Zone: 38.084657 N -86.116006 W	Western terminus 38.084623 N -86.116349 W	Eastern terminus 38.084729 N -86.115657 W	Surveyor: S. Langley

Brief Project Description

Four alternative routes are being considered to connect Stater Road 11 to State Road 135. Surveys of potential bat habitat and roosts trees are being conducted to assist in route selection and minimize environmental impacts.

Project Area

Project	Total Acres	Forest Acres	Open Acres
	0.63	0.63	0.00

Proposed Tree Removal (ac)	Completely cleared	Partially cleared (will leave trees)	Preserve acres-no clearing
	Unknown	Unknown	Unknown

Brief Project Description

Pre-Project	**Post-Project**
*See Project Description Above	Unknown at this time.

Brief Project Description

Flight corridors to other forested areas?

Yes, flight corridors to tangent forested areas are present within the bat habitat assessment area.

Describe Adjacent Properties (e.g. forested, grassland, commercial or residential development, water sources)

Adjacent property is rural with forested, agricultural, and rural-residential areas.

Proximity to Public Land

What is the distance (mi.) from the project area to forested public lands (e.g., national or state forests, national or state parks, conservation areas, wildlife management areas)?

An Indiana Forest Bank – Harrison property is located immediately west across Buck Creek, adjacent to the bat habitat assessment area.
The Perseverance Barrens Nature Conservancy is located approximately 2.98 miles north of the bat habitat assessment area.
The Three-Way Sedge Sinkhole Swamp Nature Conservancy is located approximately 3.04 miles southeast of the bat habitat assessment area.
Harrison-Crawford State Forest is located approximately 4.29 miles west of the bat habitat assessment area.

PHASE 1 SUMMER HABITAT ASSESSMENTS

Use additional sheets to assess discrete habitat types at multiple sites in a project area
Include a map depicting locations of sample sites if assessing discrete habitats at multiple sites in a project area
A single sheet can be used for multiple sample sites if habitat is the same

Sample Site Description

Sample Site No.(s): T2-HA-5

The bat habitat is a bottomland riparian forest on the east bank of Buck Creek. A sparsely wooded clearing is present within the floodplain of Buck Creek. American sycamore, boxelder, and American elm dominate the canopy. Box elder and Ohio buckeye are the dominant species within the mid-story. Invasive autumn olive is prevalent within the understory. Species composition gradually transitions to upland species east and uphill from Buck Creek.

Water Resources at Sample Site

	Ephemeral	Intermittent	Perennial	Describe existing condition of water sources: Buck Creek is located within the bat habitat assessment area. Buck Creek was flooded at the time of the survey.
Stream Type (# and length)	N/A	N/A	Buck Creek: 0.03 mile	
Pools/Ponds (# and size)	N/A	N/A		
		N/A		
Wetlands (approx. ac.)	N/A	N/A		
	N/A	N/A		

Forest Resources at Sample Site

	Canopy (>50')	Midstory (20-50')	Understory (<20')	1=1-10%, 2=11-20%, 3=21-40%, 4=41-60% 5=61-80%, 6=81-100%
Closure/Density	3	3	3	
Dominant Species of Mature Trees	Canopy: *Platanus occidentalis*, *Acer negundo*, and *Ulmus americana* Mid-Story: *Acer negundo* and *Aesculus glabra*, Understory: *Eleagnus umbellata* and *Aesculus glabra*			
% Trees w/ Exfoliating Bark	0	0	0	
Size Composition of Live Trees (%)	Small (3-8 in)	Med (9-15 in)	Large (>15 in)	
	30	40	30	
No. of Suitable Snags	0	0	0	

Standing dead trees with exfoliating bark, cracks, crevices, or hollows.
Snags without these characteristics area not considered suitable.

IS THE HABITAT SUITABLE FOR INDIANA BATS?

Additional Comments:

This habitat is ideal for both the Indiana and northern-long eared bat. Flight corridors to tangent forested areas are present in the form of floodplain clearings. Buck Creek provides a permanent source of water. The riparian qualities of the area are especially ideal for the Indiana bat. No potential roosts were identified within the bat habitat assessment area.

This habitat is also suitable for the federally endangered gray bat.

Attach aerial photo or project site with all forested areas labeled and a general description of the habitat

Photographic Documentation: habitat shots at edge and interior from multiple locations; Understory/midstory/canopy; examples of potential suitable snags and live trees; water sources

Attachment 5

PHASE 1 SUMMER HABITAT ASSESSMENTS

T2-HA-6

INDIANA BAT HABITAT ASSESSMENT DATASHEET

Project Name: State Road 11 Extension			Date: May 7, 2021
Township/Range/Section:	5S/4E/7		Boone Township, Harrison County
Lat Long/UTM/Zone: 38.085001 N -86.114086 W	Western terminus 38.08550 N -86.11191 W	Eastern terminus 38.084729 N -86.115657 W	Surveyor: S. Langley

Brief Project Description

Four alternative routes are being considered to connect Stater Road 11 to State Road 135. Surveys of potential bat habitat and roosts trees are being conducted to assist in route selection and minimize environmental impacts.

Project Area

Project	Total Acres	Forest Acres	Open Acres
	2.85	2.85	2.85

Proposed Tree Removal (ac)	Completely cleared	Partially cleared (will leave trees)	Preserve acres-no clearing
	Unknown	Unknown	Unknown

Brief Project Description

Pre-Project	**Post-Project**
*See Project Description Above	Unknown at this time.

Brief Project Description

Flight corridors to other forested areas?

Flight corridors to tangent forested areas are located within the bat habitat assessment area.

Describe Adjacent Properties (e.g. forested, grassland, commercial or residential development, water sources)

Adjacent land use is rural, consisting of forested and agricultural areas.

Proximity to Public Land

What is the distance (mi.) from the project area to forested public lands (e.g., national or state forests, national or state parks, conservation areas, wildlife management areas)?

An Indiana Forest Bank – Harrison property is located approximately 0.04 mile west of the bat habitat assessment area.
The Perseverance Barrens Nature Conservancy is located approximately 2.98 miles north of the bat habitat assessment area.
The Three-Way Sedge Sinkhole Swamp Nature Conservancy is located approximately 3.04 miles southeast of the bat habitat assessment area.
Harrison-Crawford State Forest is located approximately 4.25 miles west of the bat habitat assessment area.

Attachment 5

PHASE 1 SUMMER HABITAT ASSESSMENTS

Use additional sheets to assess discrete habitat types at multiple sites in a project area
Include a map depicting locations of sample sites if assessing discrete habitats at multiple sites in a project area
A single sheet can be used for multiple sample sites if habitat is the same

Sample Site Description

Sample Site No.(s): T2-HA-6

The bat habitat assessment site is within a mature upland forest, west of and tangent to the riparian forest congruent with Buck Creek. Black oak, white oak, sugar maple, and shagbark hickory are the dominant species within the canopy. Sugar maple and red cedar are the dominant species within the mid-story. Sugar maple saplings and ash saplings are dominant in the understory. The mid-story and understory are relatively thin compared to the surrounding forest. No permanent water source is located within the bat habitat assessment area; however, Buck Creek is within close proximity. Trails and logging roads transect the bat habitat assessment area.

Water Resources at Sample Site

Stream Type (# and length)	Ephemeral	Intermittent	Perennial	Describe existing condition of water sources: Buck Creek is located approximately 0.03 mile southwest of the bat habitat assessment area. Buck Creek was flooded at the time of the survey.
	N/A	N/A	N/A	
Pools/Ponds (# and size)	N/A	N/A		
		N/A		
Wetlands (approx. ac.)	N/A	N/A		
	N/A	N/A		

Forest Resources at Sample Site

Closure/Density	Canopy (>50')	Midstory (20-50')	Understory (<20')	1=1-10%, 2=11-20%, 3=21-40%, 4=41-60% 5=61-80%, 6=81-100%
	4	3	3	
Dominant Species of Mature Trees	Canopy: *Quercus velutina, Quercus alba, Acer saccharum,* and *Carya ovata* Mid-Story: *Acer saccharum* and *Juniperus virginiana* Understory: *Acer saccharum* and *Fraxinus sp.*			
% Trees w/ Exfoliating Bark	0	1	1	
Size Composition of Live Trees (%)	Small (3-8 in)	Med (9-15 in)	Large (>15 in)	
	20	40	40	
No. of Suitable Snags	0	1	1	

Standing dead trees with exfoliating bark, cracks, crevices, or hollows.
Snags without these characteristics area not considered suitable.

IS THE HABITAT SUITABLE FOR INDIANA BATS?

Additional Comments:

The bat habitat assessment area is ideal roost and foraging habitat for both the Indiana and northern long-eared bat. The area should also be considered potential foraging habitat for the federally endangered gray bat, present in Harrison county. Flight corridors to tangent forested areas are present in the form of paths and logging roads. The relatively low density of the canopy and mid-story are also conducive to flight. Buck Creek provides a permanent water source, just west of the habitat assessment area. Two potential roost trees were identified within the bat habitat assessment area. Additionally three shagbark hickories were identified that may provide further roost opportunities. Two ash trees were also identified. The ash trees do not yet feature roost potential, but will likely develop exfoliating bark and snags as decay progresses.

Potential Roost Trees

Species	DBH (cm)	Decomposition Stage	Roost Features
Quercus velutina	40	6	Exfoliating Bark, Cavities
Ulmus americana	36	5	Exfoliating Bark

Attach aerial photo or project site with all forested areas labeled and a general description of the habitat

Photographic Documentation: habitat shots at edge and interior from multiple locations; Understory/midstory/canopy; examples of potential suitable snags and live trees; water sources

Attachment 5

PHASE 1 SUMMER HABITAT ASSESSMENTS

T2-HA-7

INDIANA BAT HABITAT ASSESSMENT DATASHEET

Project Name: State Road 11 Extension			Date: May 7, 2021
Township/Range/Section:	5S/4E/18		Boone Township, Harrison County
Lat Long/UTM/Zone: 38.082529 N -86.118852 W	Western terminus 38.08274 N -86.120082 W	Eastern terminus 38.083541 N -86.116884 W	Surveyor: S. Langley

Brief Project Description

Four alternative routes are being considered to connect Stater Road 11 to State Road 135. Surveys of potential bat habitat and roosts trees are being conducted to assist in route selection and minimize environmental impacts.

Project Area

Project	Total Acres	Forest Acres	Open Acres
	2.57	2.57	0.00

Proposed Tree Removal (ac)	Completely cleared	Partially cleared (will leave trees)	Preserve acres-no clearing
	Unknown	Unknown	Unknown

Brief Project Description

Pre-Project	**Post-Project**
*See Project Description Above	Unknown at this time.

Brief Project Description

Flight corridors to other forested areas?

Flight corridors to tangent forest areas are present within the bat habitat assessment area.

Describe Adjacent Properties (e.g. forested, grassland, commercial or residential development, water sources)

Adjacent property use is rural, consisting of forested, agricultural, and rural-residential areas.

Proximity to Public Land

What is the distance (mi.) from the project area to forested public lands (e.g., national or state forests, national or state parks, conservation areas, wildlife management areas)?

An Indiana Forest Bank – Harrison property is located north of and adjacent to the bat habitat assessment area.
Squire Boone Caverns is located approximately 1.33 miles southwest of the bat habitat assessment area.
Three-Way Sedge Sinkhole Swamp Nature Conservancy is located approximately 2.91 miles southeast of the bat habitat assessment area.
Perseverance Barrens Nature Conservancy is located approximately 3.12 miles north of the bat habitat assessment area.
Harrison-Crawford State Forest is located approximately 4.25 miles west of the bat habitat assessment area.

PHASE 1 SUMMER HABITAT ASSESSMENTS

Use additional sheets to assess discrete habitat types at multiple sites in a project area
Include a map depicting locations of sample sites if assessing discrete habitats at multiple sites in a project area
A single sheet can be used for multiple sample sites if habitat is the same

Sample Site Description

Sample Site No.(s): T2-HA-7

The bat habitat assessment area is located on a steep slope above the floodplain of Buck Creek within a mature upland forest. Sugar maple and red oak are the dominant species within the canopy. American beech, sugar maple, and red cedar are the dominant species within the mid-story. Beech saplings and spicebush are the dominant species within the understory.

Water Resources at Sample Site

Stream Type (# and length)	Ephemeral	Intermittent	Perennial	Describe existing condition of water sources: No permanent water sources are located within the bat habitat assessment area. A small woodland pond is located approximately 0.01 mile north of the area and was full at the time of the survey. Buck Creek is located approximately 0.07 mile east of the area and was flooded at the time of the survey.
	N/A	N/A	N/A	
Pools/Ponds (# and size)	N/A	N/A		
		N/A		
Wetlands (approx. ac.)	N/A	N/A		
	N/A	N/A		

Forest Resources at Sample Site

Closure/Density	Canopy (>50')	Midstory (20-50')	Understory (<20')	1=1-10%, 2=11-20%, 3=21-40%, 4=41-60% 5=61-80%, 6=81-100%
	5	5	4	
Dominant Species of Mature Trees	Canopy: *Acer saccharum, Quercus rubra* Mid-Story: *Fagus grandifolia, Acer saccharum, Juniperus virginiana,* Understory: *Fagus grandifolia, Lindera benzoin*			
% Trees w/ Exfoliating Bark	1	0	0	
Size Composition of Live Trees (%)	Small (3-8 in)	Med (9-15 in)	Large (>15 in)	
	30	30	40	
No. of Suitable Snags	0	0	0	

Standing dead trees with exfoliating bark, cracks, crevices, or hollows.
Snags without these characteristics area not considered suitable.

IS THE HABITAT SUITABLE FOR INDIANA BATS?

Additional Comments:

The bat habitat assessment area is suitable habitat for the Indiana and northern long-eared bat. The habitat should also be considered potential foraging habitat for the federally endangered gray bat, which is present in Harrison County. Flight corridors to tangent forested areas are present in the form of trails and canopy openings. No permanent water source is located within the bat habitat assessment area; however, a small woodland pond and Buck Creek are within a short distance. No potential roost trees were identified.

Attach aerial photo or project site with all forested areas labeled and a general description of the habitat

Photographic Documentation: habitat shots at edge and interior from multiple locations; Understory/midstory/canopy; examples of potential suitable snags and live trees; water sources

PHASE 1 SUMMER HABITAT ASSESSMENTS

T3-HA-1

INDIANA BAT HABITAT ASSESSMENT DATASHEET

Project Name: State Road 11 Extension			Date: May 7, 2021
Township/Range/Section:	5S/4E/8 & 17		Boone Township, Harrison County
Lat Long/UTM/Zone: 38.083923 N -86.10633 W	Western terminus 38.084295 N -86.111276 W	Eastern terminus 38.08318 N -86.100193 W	Surveyor: S. Langley

Brief Project Description

Four alternative routes are being considered to connect Stater Road 11 to State Road 135. Surveys of potential bat habitat and roosts trees are being conducted to assist in route selection and minimize environmental impacts.

Project Area

Project	Total Acres	Forest Acres	Open Acres
	22.19	22.19	22.19

Proposed Tree Removal (ac)	Completely cleared	Partially cleared (will leave trees)	Preserve acres-no clearing
	Unknown	Unknown	Unknown

Brief Project Description

Pre-Project	**Post-Project**
*See Project Description Above	Unknown at this time.

Brief Project Description

Flight corridors to other forested areas?

Flight corridors to tangent forest areas are present within the bat habitat assessment.

Describe Adjacent Properties (e.g. forested, grassland, commercial or residential development, water sources)

Adjacent land use is rural, consisting of forested, agricultural, and rural-residential areas.

Proximity to Public Land

What is the distance (mi.) from the project area to forested public lands (e.g., national or state forests, national or state parks, conservation areas, wildlife management areas)?

An Indiana Forest Bank – Harrison property is located approximately 0.77 mile east of the bat habitat assessment area.
Squire Boone Caverns is located approximately 2.04 miles southwest of the bat habitat assessment area.
Three-Way Sedge Sinkhole Swamp Nature Conservancy is located approximately 2.79 miles southeast of the bat habitat assessment area.
Perseverance Barrens Nature Conservancy is located approximately 3.04 mile north of the bat habitat assessment area.
Mosquito Creek DNR Nature Preserve is located approximately 4.33 miles southeast of the bat habitat assessment area.
Harrison-Crawford State Forest is located approximately 5.10 miles west of the bat habitat assessment area.

PHASE 1 SUMMER HABITAT ASSESSMENTS

Use additional sheets to assess discrete habitat types at multiple sites in a project area
Include a map depicting locations of sample sites if assessing discrete habitats at multiple sites in a project area
A single sheet can be used for multiple sample sites if habitat is the same

Sample Site Description

Sample Site No.(s): T3-HA-1

The bat habitat assessment site is within an interior, upland, beech/maple, late-mature or early climax forest. Sugar maple and American beech are the dominant species within the canopy. Shagbark hickory is also prevalent within the canopy. Sugar maple, American beech, and red cedar are the dominant species within the mid-story. Sugar maple saplings, American beech saplings, and spice bush are dominant within the understory. Two intermittent wetlands are present within the bat habitat assessment area. An abandoned house is present in the eastern end of the bat habitat assessment area. Bat use of this house is extremely likely. Various karst features are visible throughout the area.

Water Resources at Sample Site

Stream Type (# and length)	Ephemeral	Intermittent	Perennial	Describe existing condition of water sources: Two intermittent wetlands are located within the bat habitat assessment area. Buck Creek is located approximately 0.05 mile south of the bat habitat assessment area.
	N/A	N/A	N/A	
Pools/Ponds (# and size)	N/A	N/A		
		N/A		
Wetlands (approx. ac.)	N/A	PEM1A, 0.21 acre		
	N/A	PAB3G, 0.81 acre		

Forest Resources at Sample Site

Closure/Density	Canopy (>50')	Midstory (20-50')	Understory (<20')	1=1-10%, 2=11-20%, 3=21-40%, 4=41-60% 5=61-80%, 6=81-100%
	6	3	1	
Dominant Species of Mature Trees	Canopy: *Acer saccharum, Fagus grandifolia,* Mid-Story: *Acer saccharum, Fagus grandifolia, Juniperus virginiana* Understory: *Acer saccharum, Fagus grandifolia, Lindera benzoin*			
% Trees w/ Exfoliating Bark	0	1	1	
Size Composition of Live Trees (%)	Small (3-8 in)	Med (9-15 in)	Large (>15 in)	
	20	30	50	
No. of Suitable Snags	1	0	1	

Standing dead trees with exfoliating bark, cracks, crevices, or hollows.
Snags without these characteristics area not considered suitable.

IS THE HABITAT SUITABLE FOR INDIANA BATS?

Additional Comments:

The bat habitat assessment area should be considered prime foraging and roost habitat for the federally endangered Indiana bat and federally threatened northern long-eared bat. The bat habitat assessment area should also be considered potential foraging habitat for the federally endangered gray bat, present in Harrison County. Given the presence of karst features in the area, the potential presence of caves and associated gray bat colonies should be considered. This section of forest is part of a large contiguous forest, extending for over 16 miles Factors that make this area ideal bat habitat include: proximity to Buck Creek, presence of wetlands. presence of flight corridors, maturity of the forest, open mid-story, open understory,
An abandoned house and live shagbark hickories present within the bat habitat assessment area.

T3-HA-1 Potential Roosts

Tree ID	Species	DBH (cm)	Decomposition Stage	Roost Features
T3-1	*Fraxinus sp.*	20	3	Exfoliating Bark
T3-2	*Fraxinus sp.*	41	3	Exfoliating Bark

Attach aerial photo or project site with all forested areas labeled and a general description of the habitat

Photographic Documentation: habitat shots at edge and interior from multiple locations;
Understory/midstory/canopy; examples of potential suitable snags and live trees; water sources

Attachment 5

PHASE 1 SUMMER HABITAT ASSESSMENTS

T3-HA-2

INDIANA BAT HABITAT ASSESSMENT DATASHEET

Project Name: State Road 11 Extension			Date: May 7, 2021
Township/Range/Section:	5S/4E/7		Boone Township, Harrison County
Lat Long/UTM/Zone: 38.084412 N -86.112638 W	Western terminus 38.084197 N -86.114253 W	Eastern terminus 38.084368 N -86.111522 W	Surveyor: S. Langley

Brief Project Description

Four alternative routes are being considered to connect Stater Road 11 to State Road 135. Surveys of potential bat habitat and roosts trees are being conducted to assist in route selection and minimize environmental impacts.

Project Area

Project	Total Acres	Forest Acres	Open Acres
	6.01	6.01	6.01

Proposed Tree Removal (ac)	Completely cleared	Partially cleared (will leave trees)	Preserve acres-no clearing
	Unknown	Unknown	Unknown

Brief Project Description

Pre-Project	**Post-Project**
*See Project Description Above	Unknown at this time.

Brief Project Description

Flight corridors to other forested areas?

Flight corridors to tangent forest areas are present within the bat habitat assessment.

Describe Adjacent Properties (e.g. forested, grassland, commercial or residential development, water sources)

Adjacent land use is rural, consisting of forested, agricultural, and rural-residential areas.

Proximity to Public Land

What is the distance (mi.) from the project area to forested public lands (e.g., national or state forests, national or state parks, conservation areas, wildlife management areas)?

An Indiana Forest Bank – Harrison Property is located approximately 0.18 mile west of the bat habitat assessment area.
Squire Boone Caverns is located approximately 1.65 miles southwest of the bat habitat assessment area.
Perseverance Barrens Nature Conservancy is located approximately 2.95 miles north of the bat habitat assessment area.
Three-Way Sedge Sinkhole Swamp Nature Conservancy is located approximately 2.99 miles southest of the bat habitat assessment area.
Harrison-Crawford State Forest is located approximately 4.51 miles west of the bat habitat assessment area.
Mosquito Creek DNR Nature Preserve is located approximately 4.56 miles southeast of the bat habitat assessment area.

Attachment 5

PHASE 1 SUMMER HABITAT ASSESSMENTS

Use additional sheets to assess discrete habitat types at multiple sites in a project area
Include a map depicting locations of sample sites if assessing discrete habitats at multiple sites in a project area
A single sheet can be used for multiple sample sites if habitat is the same

Sample Site Description

Sample Site No.(s): T3-HA-2

The bat habitat assessment area is within an upland, late-mature or early climax, beech/maple forest. The dominant species within the canopy are sugar maple, American beech, shagbark hickory, and white ash. The dominant species within the mid-story are American beech and sugar maple. The dominant species within the understory are American beech, sugar maple, spicebush, and flowering dogwood. The canopy is dense, but the mid-story and understory are relatively open and conducive to bat flight and foraging. Flight corridors are present in the form of logging roads and mid-story gaps. The bat habitat assessment area is part of a large, contiguous forest, lining both banks of Buck Creek for over 16 miles. Two, dry ephemeral streams are present within the bat habitat assessment area. Buck Creek is located 0.09 mile south of the bat habitat assessment area. Two shallow, unnamed tributaries to Buck Creek are located immediately south of the bat habitat assessment area.

Water Resources at Sample Site

Stream Type (# and length)	Ephemeral	Intermittent	Perennial
	UNT 7, 0.08 mi UNT 8, 0.06 mi	N/A	N/A
Pools/Ponds (# and size)	N/A	N/A	
		N/A	
Wetlands (approx. ac.)	N/A	N/A	
	N/A	N/A	

Describe existing condition of water sources: Two ephemeral streams were identified in the bat habitat assessment area. Buck Creek is located approximately 0.09 mile south of the bat habitat assessment area. Buck Creek was flooded at the time of the survey.

Forest Resources at Sample Site

Closure/Density	Canopy (>50')	Midstory (20-50')	Understory (<20')
	5	3	2

1=1-10%, 2=11-20%, 3=21-40%, 4=41-60%
5=61-80%, 6=81-100%

Dominant Species of Mature Trees	Canopy: *Acer saccharum, Fagus grandifolia, Carya ovata, Fraxinus sp.* Mid-Story: *Fagus grandifolia, Acer Saccharum* Understory: *Fagus grandifolia, Acer Saccharum, Lindera benzoin, Cornus florida*

% Trees w/ Exfoliating Bark	0	1	1
Size Composition of Live Trees (%)	Small (3-8 in)	Med (9-15 in)	Large (>15 in)
	10	20	70
No. of Suitable Snags	0	1	1

Standing dead trees with exfoliating bark, cracks, crevices, or hollows.
Snags without these characteristics area not considered suitable.

IS THE HABITAT SUITABLE FOR INDIANA BATS?

Additional Comments:

The bat habitat assessment area should be considered prime foraging and roost habitat for both the Indiana and northern long-eared bat. The bat habitat assessment area should also be considered potential foraging habitat for the federally endangered gray bat, present in Harrison County. The availability of riparian corridors is ideal for Indiana bats. The upland, interior qualities of the area are ideal for northern-long eared bats. The proximity to Buck Creek, the availability of roost trees, and the interior location of the bat habitat assessment area within a contiguous forest lining Buck Creek for over 16 miles make this area highly ideal bat habitat. Several dead ash were identified within the bat habitat assessment area that have not yet developed potential roost qualities. As decay progresses, these trees will likely provide ideal roost habitat in the near future. Shagbark hickories present in the area may provide additional roost opportunities in addition to the potential roost identified below.

T3-HA-2 Potential Roost Trees

Tree ID	Species	DBH (cm)	Decomposition Stage	Roost Features
T3-3	*Fraxinus sp.*	24	3	Exfoliating Bark
T3-5	*Quercus rubra*	75	6	Snags, Cavities

Attach aerial photo or project site with all forested areas labeled and a general description of the habitat

Photographic Documentation: habitat shots at edge and interior from multiple locations; Understory/midstory/canopy; examples of potential suitable snags and live trees; water sources

PHASE 1 SUMMER HABITAT ASSESSMENTS

T3-HA-3

INDIANA BAT HABITAT ASSESSMENT DATASHEET

Project Name: State Road 11 Extension			Date: May 7, 2021
Township/Range/Section:	5S/4E/7		Boone Township, Harrison County
Lat Long/UTM/Zone: 38.084152 N -86.115024 W	Western terminus 38.084397 N -86.116183 W	Eastern terminus 38.084207 N -86.114262 W	Surveyor: S. Langley

Brief Project Description

Four alternative routes are being considered to connect Stater Road 11 to State Road 135. Surveys of potential bat habitat and roosts trees are being conducted to assist in route selection and minimize environmental impacts.

Project Area

Project	Total Acres	Forest Acres	Open Acres
	2.99	2.99	2.99

Proposed Tree Removal (ac)	Completely cleared	Partially cleared (will leave trees)	Preserve acres-no clearing
	Unknown	Unknown	Unknown

Brief Project Description

Pre-Project	**Post-Project**
*See Project Description Above	Unknown at this time.

Brief Project Description

Flight corridors to other forested areas?

Flight corridors to tangent forest areas are present within the bat habitat assessment.

Describe Adjacent Properties (e.g. forested, grassland, commercial or residential development, water sources)

Adjacent land use is rural, consisting of forested, agricultural, and rural-residential areas.

Proximity to Public Land

What is the distance (mi.) from the project area to forested public lands (e.g., national or state forests, national or state parks, conservation areas, wildlife management areas)?

An Indiana Forest Bank – Harrison property is located across Buck Creek, immediately west of the bat habitat assessment area.

PHASE 1 SUMMER HABITAT ASSESSMENTS

Use additional sheets to assess discrete habitat types at multiple sites in a project area
Include a map depicting locations of sample sites if assessing discrete habitats at multiple sites in a project area
A single sheet can be used for multiple sample sites if habitat is the same

Sample Site Description

Sample Site No.(s): T3-HA-3

The bat habitat assessment area is within a riparian forest located on the left (east) bank of Buck Creek. Dominant species within the canopy include black walnut, silver maple, box elder, and ash species. Dominant species in the mid-story include Ohio buckeye, box elder, and silver maple. Dominant species within the understory are Ohio buckeye and flowering dogwood. There are a few treeless patches within the Buck Creek floodplain. Logging roads and Buck Creek provided strong flight corridors to tangent forested areas. The bat habitat assessment site is located within a large contiguous forest that lines both banks of Buck Creek for over 16 miles.

Water Resources at Sample Site

Stream Type (# and length)	Ephemeral	Intermittent	Perennial	Describe existing condition of water sources: Buck Creek flows southeast for 0.07 mile on the western edge of the bat habitat assessment area. Buck Creek was flooded at the time of the habitat assessment survey.
	N/A	N/A	Buck Creek, 0.07 mile	
Pools/Ponds (# and size)	N/A	N/A		
		N/A		
Wetlands (approx. ac.)	N/A	N/A		
	N/A	N/A		

Forest Resources at Sample Site

Closure/Density	Canopy (>50')	Midstory (20-50')	Understory (<20')	1=1-10%, 2=11-20%, 3=21-40%, 4=41-60% 5=61-80%, 6=81-100%
	3	3	3	
Dominant Species of Mature Trees	Canopy: *Juglans nigra, Acer saccharinum, Acer negundo, Fraxinus sp.* Mid-Story: *Aesculus glabra, Acer negundo, Acer saccharinum* Understory: *Aesculus glabra, Cornus florida*			
% Trees w/ Exfoliating Bark	0	1	1	
Size Composition of Live Trees (%)	Small (3-8 in)	Med (9-15 in)	Large (>15 in)	
	20	30	40	
No. of Suitable Snags	0	2	1	

Standing dead trees with exfoliating bark, cracks, crevices, or hollows.
Snags without these characteristics area not considered suitable.

IS THE HABITAT SUITABLE FOR INDIANA BATS?

Additional Comments:
The bat habitat assessment area should be considered ideal foraging and roost habitat for both the Indiana and northern long-eared bat. The bat habitat assessment area should also be considered potential foraging habitat for the federally endangered gray bat, present in Harrison County. Buck Creek provides a strong flight corridor and a permanent source of drinking water. Logging roads in the eastern portion of the bat habitat assessment area also provide ideal flight corridors. The habitat is further enhanced by connection to an extensive forest lining Buck Creek for over 16 miles. The riparian nature of the area is especially ideal for the Indiana bat. Three potential roost trees were identified within the bat habitat assessment area.

T3-HA-3 Potential Roost Trees

Tree ID	Species	DBH (cm)	Decomposition Stage	Roost Features
T3-6	*Fraxinus sp.*	28	3	Exfoliating Bark
T3-8	*Juglans nigra*	40	2	Snag
T3-9	*Fraxinus sp.*	34	3	Exfoliating Bark

Attach aerial photo or project site with all forested areas labeled and a general description of the habitat

Photographic Documentation: habitat shots at edge and interior from multiple locations; Understory/midstory/canopy; examples of potential suitable snags and live trees; water sources

PHASE 1 SUMMER HABITAT ASSESSMENTS

T3-HA-4

INDIANA BAT HABITAT ASSESSMENT DATASHEET

Project Name: State Road 11 Extension			Date: May 7, 2021
Township/Range/Section:	5S/4E/7		Boone Township, Harrison County
Lat Long/UTM/Zone: 38.083845 N -86.119057	Western terminus 38.084064 N -86.122923 W	Eastern terminus 38.083693 N -86.115442 W	Surveyor: S. Langley

Brief Project Description

Four alternative routes are being considered to connect Stater Road 11 to State Road 135. Surveys of potential bat habitat and roosts trees are being conducted to assist in route selection and minimize environmental impacts.

Project Area

Project	Total Acres	Forest Acres	Open Acres
	10.36	10.36	10.36

Proposed Tree Removal (ac)	Completely cleared	Partially cleared (will leave trees)	Preserve acres-no clearing
	Unknown	Unknown	Unknown

Brief Project Description

Pre-Project	**Post-Project**
*See Project Description Above	Unknown at this time.

Brief Project Description

Flight corridors to other forested areas?

Flight corridors to tangent forest areas are present within the bat habitat assessment.

Describe Adjacent Properties (e.g. forested, grassland, commercial or residential development, water sources)

Adjacent land use is rural, consisting of forested, agricultural, and rural-residential areas.

Proximity to Public Land

What is the distance (mi.) from the project area to forested public lands (e.g., national or state forests, national or state parks, conservation areas, wildlife management areas)?

The bat habitat assessment area is within an Indiana Forest Bank – Harrison property.
Squire Boone Caverns is located approximately 1.47 miles southwest of the bat habitat assessment area.
Perseverance Barrens Nature Conservancy is located approximately 3.03 miles north of the bat habitat assessment area.
Three-Way Sedge Sink Hole Swamp Nature Conservancy is located approximately 3.04 miles southeast of the bat habitat assessment area.
Harrison-Crawford State Forest is located approximately 4.18 miles west of the bat habitat assessment area.
Mosquito Creek DNR Nature Preserve is located approximately 4.90 miles southeast of the bat habitat assessment area.

Attachment 5

PHASE 1 SUMMER HABITAT ASSESSMENTS

Use additional sheets to assess discrete habitat types at multiple sites in a project area
Include a map depicting locations of sample sites if assessing discrete habitats at multiple sites in a project area
A single sheet can be used for multiple sample sites if habitat is the same

Sample Site Description

Sample Site No.(s): T3-HA-4

The bat habitat assessment site is within a mature, upland forest. Dominant species within the canopy include sugar maple, American beech, tulip poplar, and American sycamore. Shagbark hickory and ash species were also present in the canopy. Young sugar maple and American beech were dominant within the mid-story. Spicebush was dominant within the understory. Buck Creek borders the habitat assessment area to the east. A small, man-made pond was located within the habitat assessment area. Large flight corridors are present over Buck Creek and several maintained paths. The western end of the bat habitat assessment area includes a fence row and upland beech forest, which slopes down to a more maple and tulip poplar dominated forest, which terminates on a riparian bluff over Buck Creek.

Water Resources at Sample Site

Stream Type (# and length)	Ephemeral	Intermittent	Perennial	Describe existing condition of water sources: Buck Creek borders the bat habitat assessment area to the east. A small pond is located in the bat habitat assessment area. The pond was full at the time of the survey. Buck Creek was flooded at the time of the survey.
	N/A	N/A	Buck Creek, 0.07 mile	
Pools/Ponds (# and size)	N/A	N/A		
		Pond, 0.21 acre		
Wetlands (approx. ac.)	N/A	N/A		
	N/A	N/A		

Forest Resources at Sample Site

Closure/Density	Canopy (>50')	Midstory (20-50')	Understory (<20')	1=1-10%, 2=11-20%, 3=21-40%, 4=41-60% 5=61-80%, 6=81-100%
	4	3	3	
Dominant Species of Mature Trees	Canopy: *Acer saccharum, Fagus grandifolia, Liriodendron tulipifera, Platanus occidentalis* Mid-Story: *Acer saccharum, Fagus grandifolia* Understory: *Lindera benzoin*			
% Trees w/ Exfoliating Bark	0			
Size Composition of Live Trees (%)	Small (3-8 in)	Med (9-15 in)	Large (>15 in)	
No. of Suitable Snags				

Standing dead trees with exfoliating bark, cracks, crevices, or hollows.
Snags without these characteristics area not considered suitable.

IS THE HABITAT SUITABLE FOR INDIANA BATS?

Additional Comments:

The bat habitat assessment area is within an Indiana Forest Bank property. The bat habitat assessment area should be considered ideal foraging and roost habitat for both the Indiana and northern long-eared bat. The bat habitat assessment area should also be considered potential foraging habitat for the federally endangered gray bat, present in Harrison County. The bat habitat assessment area is connected to a large, contiguous forest lining the banks of Buck Creek for over 16 miles. Buck Creek and several gravel trails provide strong flight corridors. Buck Creek and a small pond provide a permanent source of water. The riparian elements of the area are ideal for Indiana bats. The forested upland elements of the area are ideal for the northern long-eared bat. Four potential roost trees were identified within the bat habitat assessment area. Shagbark hickories present in the area may provide further roost opportunities. Additionally, several dead ash were observed in that did not exhibit roost potential qualities at the time of the survey. However, as decay progresses these dead ash will likely develop exfoliating bark, snags, etc. in the near future.

T3-HA-4 Potential Roost Trees

Tree ID	Species	DBH (cm)	Decomposition Stage	Roost Features
T3-10	*Liriodendron tulipifera*	48	1	Fissure
T3-11	*Liriodendron tulipifera*	37	4	Cavities, Exfoliating Bark
T3-12	*Liriodendron tulipifera*	44	5	Fissures, Cavities, Exfoliating Bark
T3-13	*Liriodendron tulipifera*	58	2	Fissures, Exfoliating Bark

Attach aerial photo or project site with all forested areas labeled and a general description of the habitat

Photographic Documentation: habitat shots at edge and interior from multiple locations; Understory/midstory/canopy; examples of potential suitable snags and live trees; water sources

Attachment 5

PHASE 1 SUMMER HABITAT ASSESSMENTS

INDIANA BAT HABITAT ASSESSMENT DATASHEET

Project Name: State Road 11 Extension Project (120-0046)			Date: April 22, 2021
Township/Range/Section:	5S/4E/17		Boone Township, Harrison County
Lat Long/UTM/Zone: 86.1028100 W 38.0812811 N	Western terminus 86.1052236 W 38.0811755 N	Eastern terminus 86.1007872 W 38.0813075 N	Surveyor: S. Langley

Brief Project Description

This survey serves as an examination of bat habitat and potential bat roosts in four potential routes being considered for the State Road (SR) 11 extension. SR 11 will be extended west to connect to SR 135 at the intersection of SR 135 and Watson Road.

Project Area

Project	Total Acres	Forest Acres	Open Acres
	10.53	10.00	0.53

Proposed Tree Removal (ac)	Completely cleared	Partially cleared (will leave trees)	Preserve acres-no clearing
	Unknown	Unknown	Unknown

Brief Project Description

Pre-Project	**Post-Project**
*See Project Description Above	Unknown at this time.

Brief Project Description

Flight corridors to other forested areas?

Yes.

Describe Adjacent Properties (e.g. forested, grassland, commercial or residential development, water sources)

Adjacent land use is rural, consisting of agriculture, petroleum wells, and forested areas.

Proximity to Public Land

What is the distance (mi.) from the project area to forested public lands (e.g., national or state forests, national or state parks, conservation areas, wildlife management areas)?

Indiana Forest Bank – Harrison is located approximately 0.59 mile west of the habitat assessment area.
Squire Boone Caverns is located approximately 1.82 miles southwest of the habitat assessment area.
Harrison-Crawford State Forest is located approximately 4.92 miles west of the habitat assessment area
Perseverance Barrens is located approximately 3.07 miles north of the habitat assessment area.
Three-way Sedge Sinkhole Swamp Nature Conservancy is located approximately 2.68 miles south of the habitat assessment area.
Mosquito Creek DNR Nature Preserve is located approximately 4.07 miles southeast of the habitat assessment area.
Harrison County Glades Nature Conservancy is located 4.52 miles east of the habitat assessment area.

PHASE 1 SUMMER HABITAT ASSESSMENTS

Use additional sheets to assess discrete habitat types at multiple sites in a project area
Include a map depicting locations of sample sites if assessing discrete habitats at multiple sites in a project area
A single sheet can be used for multiple sample sites if habitat is the same

Sample Site Description

Sample Site No.(s): T4-HA-1

The habitat assessment area is a mature, ash (*Fraxinus sp.*) dominant, upland forest. The forest had reached a mature stage where the secondary growth consisting of red cedar (*Juniperus virginiana*), black locust (*Robinia psuedoacacia*), red bud (*Cercis canadensis*), and sassafras (*Sassafras albidum*) had largely died off when emerald ash borer hit the area. Nearly all of the ash in the canopy are dead. Only one individual ash tree was observed to be relatively unaffected and healthy. The majority of trees in the canopy and mid-story are either dead or dying. Young shagbark hickory (*Carya ovata*) make up the majority of living trees within the mid-story.

The majority of the forested area is located on a knoll, which slopes down west into a dry bottomland. The habitat assessment area is bordered by a fallow ag field to the east, a petroleum well and fallow ag field to the south, a fallow ag field to the west, and connected to a large upland forest to the north.

Water Resources at Sample Site

Stream Type (# and length)	Ephemeral	Intermittent	Perennial	Describe existing condition of water sources:
	N/A	N/A	N/A	
Pools/Ponds (# and size)	N/A	N/A		Buck Creek: 0.15 mile West Unnamed Perennial Stream: 0.26 mile East
		N/A		
Wetlands (approx. ac.)	0.06 acres	N/A		
	N/A	N/A		

Forest Resources at Sample Site

Closure/Density	Canopy (>50')	Midstory (20-50')	Understory (<20')	1=1-10%, 2=11-20%, 3=21-40%, 4=41-60% 5=61-80%, 6=81-100%
	4	5	3	
Dominant Species of Mature Trees	Canopy: *Fraxinus sp.* Mid-Story: *Juniperus virginiana, Robinia psuedoacacia, Carya ovata* Understory: *Lonicera sp., Juniperus virginiana, Cercis canadensis*			
% Trees w/ Exfoliating Bark	1	5	10	
Size Composition of Live Trees (%)	Small (3-8 in)	Med (9-15 in)	Large (>15 in)	
	30	40	30	
No. of Suitable Snags	0	26	26	

Standing dead trees with exfoliating bark, cracks, crevices, or hollows.
Snags without these characteristics area not considered suitable.

IS THE HABITAT SUITABLE FOR INDIANA BATS?

Additional Comments:

This area is ideal habitat for both the Indiana bat (*Myotis sodalis*) and Northern long-eared bat (*Myotis septontrionalis*). This area may also serve as foraging habitat for the gray bat (*Myotis grisescens*).

This area has extremely high roost potential, featuring flight corridors to a large, contiguous forest, and a multitude of suitable roosts. The area was once a mature, ash dominant forest at a stage where the secondary growth had begun dying off, providing many potential roost amongst the dead black locust, red cedar, and red bud within the understory. Emerald ash borer has hit the area resulting in a massive die-off within the primary ash growth of the forest. Many of the mature ash have only recently died, and are not yet suitable roosts, but will provide ideal roosting habitat as the tree decays and the bark begins to peel, likely as decay progresses this summer (May-September 2021).

Roosting opportunities are provided by cedar cavities, locust fissures, and peeling ash bark. Further roosting opportunities for bark roosts are provided by living shagbark hickory. A total of 24 potential roost trees were identified, excluding shagbark and shellbark hickory.

T4-HA-1 Potential Roost Trees				
Tree ID	**Tree Species**	**DBH (cm)**	**Decomposition Stage**	**Roost Features**
T4-1	*Robinia pseudoacacia*	38	4	Fissures
T4-2	*Robinia pseudoacacia*	40	5	Fissures
T4-3	*Robinia pseudoacacia*	45	4	Fissures, Cavities
T4-5	*Robinia psuedoacacia*	66	5	Fissures
T4-6	*Fraxinus americana*	70	3	Exfoliating Bark
T4-7	*Fraxinus americana*	32	3	Exfoliating Bark
T4-8	*Juniperus virginiana*	35	6	Snag, Cavities
T4-9	*Celtis occidentalis*	35	4	Exfoliating Bark
T4-10	*Cercis canadensis*	27	4	Exfoliating Bark
T4-11	*Prunus serotina*	43	5	Exfoliating Bark
T4-12	*Fraxinus americana*	48	6	Exfoliating Bark
T4-13	*Fraxinus sp.*	17	4	Exfoliating Bark
T4-15	*Fraxinus sp.*	28	6	Exfoliating Bark
T4-16	*Fraxinus sp.*	37	3	Exfoliating Bark
T4-17	*Robinia pseudoacacia*	25.5	4	Fissures
T4-18	*Robinia pseudoacacia*	45	4	Fissures
T4-19	*Fraxinus sp.*	32	3	Exfoliating Bark
T4-20	*Fraxinus sp.*	27	6	Exfoliating Bark
T4-21	*Fraxinus americana*	53	3	Exfoliating Bark
T4-22	*Juniperus virginiana*	36	2	Cavities
T4-23	*Fraxinus sp.*	44	6	Cavities, Exfoliating Bark
T4-24	Unknown	42.5	5	Fissures, Cavities, Exfoliating Bark
T4-25	*Sassafras albidum*	30	5	Cavities, Exfoliating Bark
T4-26	*Quercus sp.*	38	6	Cavities, Exfoliating Bark
*T4-4 and T4-14 were skipped during tree number assignments by mistake. No trees were flagged under these numbers.				

Attach aerial photo or project site with all forested areas labeled and a general description of the habitat

Photographic Documentation: habitat shots at edge and interior from multiple locations;Understory/midstory/canopy; examples of potential suitable snags and live trees; water sources

Attachment 5

PHASE 1 SUMMER HABITAT ASSESSMENTS

T4-HA-2

INDIANA BAT HABITAT ASSESSMENT DATASHEET

Project Name: SR 11 Extension (120-0046)			Date: April 23, 2021
Township/Range/Section:	5S/4E/17		Boone Township, Harrison County
Lat Long/UTM/Zone: 86.0699038 W 38.04455701 N	Western terminus 86.0699038 W 38.0455701 N	Eastern terminus 86.0699038 W 38.0455701 N	Surveyor: S. Langley

Brief Project Description

This survey serves as an examination of bat habitat and potential bat roosts in four potential routes being considered for the State Road (SR) 11 extension. SR 11 will be extended west to connect to SR 135 at the intersection of SR 135 and Watson Road.

Project Area

Project	Total Acres	Forest Acres	Open Acres
	17.75	3.27	14.48

Proposed Tree Removal (ac)	Completely cleared	Partially cleared (will leave trees)	Preserve acres-no clearing
	Unknown	Unknown	Unknown

Brief Project Description

Pre-Project	**Post-Project**
*See Project Description Above	Unknown at this time.

Brief Project Description

Flight corridors to other forested areas?

The unnamed tributary to Buck Creek may serve as a flight corridor.

Describe Adjacent Properties (e.g. forested, grassland, commercial or residential development, water sources)

Adjacent land use is rural, consisting of agriculture, petroleum wells, and forested areas.

Proximity to Public Land

What is the distance (mi.) from the project area to forested public lands (e.g., national or state forests, national or state parks, conservation areas, wildlife management areas)?

Indiana Forest Bank – Harrison is located approximately 0.94 mile northwest of the habitat assessment area.
Three-Way Sedge Sinkhole Swamp Nature Conservancy is located approximately 2.64 miles south of the habitat assessment area.
Mosquito Creek DNR Nature Preserve is located approximately 3.92 miles southeast of the habitat assessment area.
Harrison County Glades Nature Conservancy is located approximately 4.33 miles east of the habitat assessment area.
Squire Boone Caverns is located approximately 2.16 miles southwest of the habitat assessment area.

PHASE 1 SUMMER HABITAT ASSESSMENTS

Use additional sheets to assess discrete habitat types at multiple sites in a project area
Include a map depicting locations of sample sites if assessing discrete habitats at multiple sites in a project area
A single sheet can be used for multiple sample sites if habitat is the same

Sample Site Description

Sample Site No.(s): T4-HA-2

The bat habitat assessment area consists of hedgerows and mature trees lining an unnamed tributary to Buck Creek bordering open ag fields and grass land. Dominant canopy species include American sycamore, red cedar, and ash species. The mid-story and understory predominantly consists of red cedar. Aside from the stream, the understory of the hedgerows are choked with multiflora rose and Japanese honeysuckle. The open mid-story and understory above the unnamed tributary to Buck Creek may serve as a flight corridor. Additionally a pond is located in the bat habitat assessment area.

Water Resources at Sample Site

Stream Type (# and length)	Ephemeral	Intermittent	Perennial	Describe existing condition of water sources: An unnamed tributary to Buck Creek and a pond are present within the bat habitat assessment area. The tributary was flowing at the time of the survey. The pond was full at the time of the survey.
	N/A	N/A	0.07 mile	
Pools/Ponds (# and size)	N/A	N/A		
		0.44 acre Perennial Pond		
Wetlands (approx. ac.)	Info Pending	Info Pending		
	Info Pending	Info Pending		

Forest Resources at Sample Site

Closure/Density	Canopy (>50')	Midstory (20-50')	Understory (<20')	1=1-10%, 2=11-20%, 3=21-40%, 4=41-60% 5=61-80%, 6=81-100%
	3	5	6	
Dominant Species of Mature Trees	Canopy: *Fraxinus sp., Platanus occidentalis, Juniperus virginiana* Mid-Story: *Juniperus virginiana* Understory: *Juniperus virginiana*			
% Trees w/ Exfoliating Bark	0	0	0	
Size Composition of Live Trees (%)	Small (3-8 in)	Med (9-15 in)	Large (>15 in)	
	40	40	20	
No. of Suitable Snags	0	0	0	

Standing dead trees with exfoliating bark, cracks, crevices, or hollows.
Snags without these characteristics area not considered suitable.

IS THE HABITAT SUITABLE FOR INDIANA BATS?

Additional Comments:

The bat habitat assessment area should be considered potential, but unlikely foraging habitat for the Indiana, northern long-eared, and gray bat species. No potential roost trees were identified within this area and utilization as roost habitat is unlikely. However, the unnamed tributary to Buck Creek is likely used by bats as a flight corridor to neighboring forested areas. Despite the overall poor habitat quality, the permanent water sources and flight corridor availability indicate the possible and likely use by bats.

Attach aerial photo or project site with all forested areas labeled and a general description of the habitat

Photographic Documentation: habitat shots at edge and interior from multiple locations; Understory/midstory/canopy; examples of potential suitable snags and live trees; water sources

PHASE 1 SUMMER HABITAT ASSESSMENTS

T4-HA-3

INDIANA BAT HABITAT ASSESSMENT DATASHEET

Project Name: State Road 11 Extension			Date: May 5, 2021
Township/Range/Section:	5S/4E/18		Boone Township, Harrison County
Lat Long/UTM/Zone: 38.08091 N -86.106969 W	Western terminus 38.080875 N -86.107387 W	Eastern terminus 38.080902 N -86.106579 W	Surveyor: S. Langley

Brief Project Description

Four alternative routes are being considered to connect Stater Road 11 to State Road 135. Surveys of potential bat habitat and roosts trees are being conducted to assist in route selection and minimize environmental impacts.

Project Area

Project	Total Acres	Forest Acres	Open Acres
	1.57	1.57	1.57

Proposed Tree Removal (ac)	Completely cleared	Partially cleared (will leave trees)	Preserve acres-no clearing
	Unknown	Unknown	Unknown

Brief Project Description

Pre-Project	**Post-Project**
*See Project Description Above	Unknown at this time.

Brief Project Description

Flight corridors to other forested areas?

Flight corridors to tangent forest areas are present within the bat habitat assessment area.

Describe Adjacent Properties (e.g. forested, grassland, commercial or residential development, water sources)

Adjacent land use is rural, consisting of forested, agricultural, and rural-residential areas.

Proximity to Public Land

What is the distance (mi.) from the project area to forested public lands (e.g., national or state forests, national or state parks, conservation areas, wildlife management areas)?

An Indiana Forest Bank – Harrison property is located approximately 0.50 mile northwest of the bat habitat assessment area.
Squire Boone Caverns is located approximately 1.68 miles southwest of the bat habitat assessment area.
Three-Way Sedge Sinkhole Swamp Nature Conservancy is located approximately 2.69 miles southeast of the bat habitat assessment area.
Perseverance Barrens Nature Conservancy is located approximately 3.19 miles north of the bat habitat assessment area.
Harrison-Crawford State Forest is located approximately 4.82 miles west of the bat habitat assessment area.

PHASE 1 SUMMER HABITAT ASSESSMENTS

Use additional sheets to assess discrete habitat types at multiple sites in a project area
Include a map depicting locations of sample sites if assessing discrete habitats at multiple sites in a project area
A single sheet can be used for multiple sample sites if habitat is the same

Sample Site Description

Sample Site No.(s): T4-HA-3

The bat habitat assessment site is within a mature upland forest. The forest is located on a steep, riparian bluff over the left (east) bank of Buck Creek. Dominant species within the canopy are black oak and sugar maple. American beech and sassafras are also prevalent within the canopy. American beech is the dominant species within the mid-story. Dominant species in the understory are American beech and flowering dogwood. Herbaceous cover includes fire pink (*Silene virginica*) and bear corn (*Conopholis americana*). Flight corridors are present. No permanent water source was observed within the bat habitat assessment area; however, Buck Creek is located in the valley immediately below the site. The area east of Buck Creek and west of the bluff could not be accessed for survey. At the time of the survey, Buck Creek was flooded, preventing access to the area from the west. The bluff hanging over Buck Creek is nearly vertical and could not be descended safely. Trees T4-33 through T4-36 are located on a 45 to 50 degree slope. Beyond trees T4-37 through T4-39, the slope exceeds 60 degrees and cannot be ascended or descended safely without proper climbing gear.

Water Resources at Sample Site

Stream Type (# and length)	Ephemeral	Intermittent	Perennial	Describe existing condition of water sources: No permanent water source was identified within the bat habitat assessment area. Buck Creek is located approximately 0.02 mile west of the bat habitat assessment area. Buck Creek was flooded at the time of the survey.
	N/A	N/A	N/A	
Pools/Ponds (# and size)	N/A	N/A		
		N/A		
Wetlands (approx. ac.)	N/A	N/A		
	N/A	N/A		

Forest Resources at Sample Site

Closure/Density	Canopy (>50')	Midstory (20-50')	Understory (<20')	1=1-10%, 2=11-20%, 3=21-40%, 4=41-60% 5=61-80%, 6=81-100%
	6	3	2	
Dominant Species of Mature Trees	Canopy: *Quercus velutina, Acer saccharum* Mid-Story: *Fagus grandifolia* Understory: *Fagus grandifolia, Cornus florida*			
% Trees w/ Exfoliating Bark	1	1	1	
Size Composition of Live Trees (%)	Small (3-8 in)	Med (9-15 in)	Large (>15 in)	
	10	20	70	
No. of Suitable Snags	3	2	8	

Standing dead trees with exfoliating bark, cracks, crevices, or hollows. Snags without these characteristics area not considered suitable.

IS THE HABITAT SUITABLE FOR INDIANA BATS?

Additional Comments:

The bat habitat assessment area should be considered ideal foraging and roost habitat for both the Indiana bat and northern long-eared bat. The bat habitat assessment area should also be considered potential foraging habit for the federally endangered gray bat, present in Harrison County. The bat habitat assessment area is part of a massive contiguous forest lining Buck Creek for over 16 miles to its confluence with the Ohio River. Mature riparian forest, such as this, are archetypal Indiana bat habitat. The interior, upland portions of this forest are ideal for the northern long-eared bat. Buck Creek and the relatively open mid-story and understory provide flight corridors to tangent forested areas. Nearby Buck Creek serves as a permanent source of water. Thirteen potential roost trees were identified in the bat habitat assessment area. Dead ash that do not yet exhibit roost features were observed in the bat habitat assessment area. As these ash decay, snags and exfoliating bark will develop, providing ideal bat maternal roosts in the near future.

T4-HA-3 Potential Roost Trees				
Tree ID	**Tree Species**	**DBH (cm)**	**Decomposition Stage**	**Roost Features**
T4-27	*Fagus grandifolia*	62	2	Cavities
T4-28	*Sassafras albidum*	20	5	Cavities, Exfoliating Bark
T4-29	*Sassafras albidum*	23	5	Snag, Exfoliating Bark
T4-30	*Sassafras albidum*	21	5	Snag, Cavities
T4-31	*Fagus grandifolia*	44.5	2	Cavities
T4-32	*Quercus alba*	47	7	Snag, Fissures, Exfoliating Bark
T4-33	*Quercus velutina*	79.5	2	Large Snag
T4-34	*Quercus alba*	44	7	Snag, Cavities, Exfoliating bark
T4-35	*Sassafras albidum*	33	2	Cavities
T4-36	*Sassafras albidum*	20	4	Cavities, Exfoliating Bark
T4-37	*Fraxinus sp.*	30	6	Fissures, Exfoliating Bark
T4-38	*Fraxinus sp.*	35	5	Cavities, Exfoliating Bark
T4-39	*Ulmus americana*	20	5	Exfoliating Bark

Attach aerial photo or project site with all forested areas labeled and a general description of the habitat

Photographic Documentation: habitat shots at edge and interior from multiple locations; Understory/midstory/canopy; examples of potential suitable snags and live trees; water sources

Attachment 5

PHASE 1 SUMMER HABITAT ASSESSMENTS

T4-HA-4

INDIANA BAT HABITAT ASSESSMENT DATASHEET

Project Name: State Road 11 Extension			Date: May 5, 2021
Township/Range/Section:	5S/4E/18		Boone Township, Harrison County
Lat Long/UTM/Zone: 38.08107 N -86.108279 W	Western terminus 38.081104 N -86.108563 W	Eastern terminus 38.080949 N -86.107887 W	Surveyor: S. Langley

Brief Project Description

Four alternative routes are being considered to connect Stater Road 11 to State Road 135. Surveys of potential bat habitat and roosts trees are being conducted to assist in route selection and minimize environmental impacts.

Project Area

Project	Total Acres	Forest Acres	Open Acres
	1.14	1.14	1.14

Proposed Tree Removal (ac)	Completely cleared	Partially cleared (will leave trees)	Preserve acres-no clearing
	Unknown	Unknown	Unknown

Brief Project Description

Pre-Project	**Post-Project**
*See Project Description Above	Unknown at this time.

Brief Project Description

Flight corridors to other forested areas?

Flight corridors to tangent forest areas are present within the bat habitat assessment area.

Describe Adjacent Properties (e.g. forested, grassland, commercial or residential development, water sources)

Adjacent land use is rural, consisting of forested, agricultural, and rural-residential areas.

Proximity to Public Land

What is the distance (mi.) from the project area to forested public lands (e.g., national or state forests, national or state parks, conservation areas, wildlife management areas)?

An Indiana Forest Bank – Harrison property is located approximately 0.41 mile northwest of the bat habitat assessment area.
Squire Boone Cavers is located approximately 1.64 miles southwest of the bat habitat assessment area.
Three-Way Sedge Sinkhole Swamp Nature Conservancy is located approximately 2.69 miles southeast of the bat habitat assessment area.
Perseverance Barrens Nature Conservancy is located approximately 3.21 miles north of the bat habitat assessment area.
Harrison-Crawford State Forest is located approximately 4.78 miles west of the bat habitat assessment area.

Attachment 5

PHASE 1 SUMMER HABITAT ASSESSMENTS

Use additional sheets to assess discrete habitat types at multiple sites in a project area
Include a map depicting locations of sample sites if assessing discrete habitats at multiple sites in a project area
A single sheet can be used for multiple sample sites if habitat is the same

Sample Site Description

Sample Site No.(s): T4-HA-4

The bat habitat assessment area incorporates a riparian forest on the right (west) bank of Buck Creek and a small island within Buck Creek. Only about half of the species located on the right bank are riparian, this may be due to the sudden drop off of the bank and soil drainage. The island is largely composed of riparian species. Dominant canopy species are red oak, American sycamore, and chestnut oak. The island canopy predominantly consist of American sycamore. Dominant species within the mid-story are blue beech (hornbeam) and Ohio buckeye. Ohio buckeye is the dominant species within the understory. The bat habitat assessment area is a portion of a large, contiguous forest which lines the banks of Buck Creek for approximately 16 miles to its confluence with the Ohio River. Buck Creek provides an ideal flight corridor and permanent source of water. The left (east) bank of Buck Creek was not accessible at the time of the survey, as Buck Creek was flooded and the approach from the east was too steep to safely descend.

Water Resources at Sample Site

Stream Type (# and length)	Ephemeral	Intermittent	Perennial	Describe existing condition of water sources: Buck Creek flows for 0.06 mile within the bat habitat assessment area. Buck Creek was flooded at the time of the survey.
	N/A	N/A	Buck Creek, 0.06 mile within the bat habitat assessment area	
Pools/Ponds (# and size)	N/A	N/A		
		N/A		
Wetlands (approx. ac.)	N/A	N/A		
	N/A	N/A		

Forest Resources at Sample Site

Closure/Density	Canopy (>50')	Midstory (20-50')	Understory (<20')	1=1-10%, 2=11-20%, 3=21-40%, 4=41-60% 5=61-80%, 6=81-100%
	4	5	4	
Dominant Species of Mature Trees	Canopy: *Quercus rubra, Platanus occidentalis, Quercus prinus* Mid-Story: Carpinus caroliniana, *Aesculus glabra* Understory: *Aesculus glabra*			
% Trees w/ Exfoliating Bark	0	0	1	
Size Composition of Live Trees (%)	Small (3-8 in)	Med (9-15 in)	Large (>15 in)	
	20	30	50	
No. of Suitable Snags	0	0	2	

Standing dead trees with exfoliating bark, cracks, crevices, or hollows.
Snags without these characteristics area not considered suitable.

IS THE HABITAT SUITABLE FOR INDIANA BATS?

Additional Comments:

The bat habitat assessment area should be considered ideal foraging and roost habitat for both the Indiana and northern long-eared bat. The bat habitat assessment area should also be considered potential foraging habitat for the federally endangered gray bat, present in Harrison County. In particular, the connection to a large, contiguous riparian forest, renders this habitat ideal for Indiana bats. Buck Creek serves as an ideal flight corridor and permanent source of water. Several American sycamore snags are present, but did not appear to be hollow or exhibit other characteristics indicative of bat roosts. Two potential roost trees were identified within the bat habitat assessment area.

T4-HA-4 Potential Roost Trees

Tree ID	Tree Species	DBH (cm)	Decomposition State	Roost Features
T4-40	*Quercus rubra*	70	4	Snags, Exfoliating Bark
T4-41	*Quercus rubra*	65	4	Snags, Exfoliating Bark

Attach aerial photo or project site with all forested areas labeled and a general description of the habitat

Photographic Documentation: habitat shots at edge and interior from multiple locations; Understory/midstory/canopy; examples of potential suitable snags and live trees; water sources

Attachment 5

PHASE 1 SUMMER HABITAT ASSESSMENTS

T4-HA-5

INDIANA BAT HABITAT ASSESSMENT DATASHEET

Project Name: State Road 11 Extension			Date: May 6, 2021
Township/Range/Section:	5S/4E/18		Boone Township, Harrison County
Lat Long/UTM/Zone: 38.080592 N -86.111933 W	Western terminus 38.080171 N -86.112208 W	Eastern terminus 38.080937 N -86.110419 W	Surveyor: S. Langley

Brief Project Description

Four alternative routes are being considered to connect Stater Road 11 to State Road 135. Surveys of potential bat habitat and roosts trees are being conducted to assist in route selection and minimize environmental impacts.

Project Area

Project	Total Acres	Forest Acres	Open Acres
	1.29	1.29	1.29

Proposed Tree Removal (ac)	Completely cleared	Partially cleared (will leave trees)	Preserve acres-no clearing
	Unknown	Unknown	Unknown

Brief Project Description

Pre-Project	**Post-Project**
*See Project Description Above	Unknown at this time.

Brief Project Description

Flight corridors to other forested areas?

Flight corridors to tangent forest areas are present within the bat habitat assessment area.

Describe Adjacent Properties (e.g. forested, grassland, commercial or residential development, water sources)

Adjacent land use is rural, consisting of forested, agricultural, and rural-residential areas.

Proximity to Public Land

What is the distance (mi.) from the project area to forested public lands (e.g., national or state forests, national or state parks, conservation areas, wildlife management areas)?

An Indiana Forest Bank – Harrison property is located approximately 0.30 mile northwest of the bat habitat assessment area.
Squire Boone Caverns is located approximately 1.51 miles southwest of the bat habitat assessment area.
Three-Way Sedge Sinkhole Swamp Nature Conservancy is located approximately 2.69+ miles southeast of the bat habitat assessment area.
Perseverance Barrens Nature Conservancy is located approximately 3.24 miles north of the bat habitat assessment area.
Harrison-Crawford State Forest is located approximately 4.61 miles west of the bat habitat assessment area.

PHASE 1 SUMMER HABITAT ASSESSMENTS

Use additional sheets to assess discrete habitat types at multiple sites in a project area
Include a map depicting locations of sample sites if assessing discrete habitats at multiple sites in a project area
A single sheet can be used for multiple sample sites if habitat is the same

Sample Site Description

Sample Site No.(s): T4-HA-5

The bat habitat assessment area is within an intermediate mesic forest growing in a sinkhole or similar karst feature. Dominant species within the canopy are American elm and white oak. A recently dead ash was also present in the canopy. Dominant species within the mid-story and understory are box elder and American elm. The bat habitat assessment area is connected to a series of contiguous riparian forests lining Buck Creek. Flight corridors are limited to forest gaps and nearby Buck Creek. No permanent water source was observed within the bat habitat assessment area.

Water Resources at Sample Site

Stream Type (# and length)	Ephemeral	Intermittent	Perennial	Describe existing condition of water sources: No permanent source of water was observed within the bat habitat assessment area. Buck Creek is located approximately 0.03 mile north of the bat habitat assessment area.
	N/A	N/A	N/A	
Pools/Ponds (# and size)	N/A	N/A		
		N/A		
Wetlands (approx. ac.)	N/A	N/A		
	N/A	N/A		

Forest Resources at Sample Site

Closure/Density	Canopy (>50')	Midstory (20-50')	Understory (<20')	1=1-10%, 2=11-20%, 3=21-40%, 4=41-60% 5=61-80%, 6=81-100%
	4	4	4	
Dominant Species of Mature Trees	Canopy: *Ulmus americana, Quercus alba* Mid-Story: *Acer negundo, Ulmus americana* Understory: *Acer negundo, Ulmus americana*			
% Trees w/ Exfoliating Bark	0	0	0	
Size Composition of Live Trees (%)	Small (3-8 in)	Med (9-15 in)	Large (>15 in)	
	20	70	10	
No. of Suitable Snags	0	0	0	

Standing dead trees with exfoliating bark, cracks, crevices, or hollows. Snags without these characteristics area not considered suitable.

IS THE HABITAT SUITABLE FOR INDIANA BATS?

Additional Comments:

Due to its connection with the large forest lining Buck Creek, bat habitat assessment area should be considered potential foraging habitat for both the Indiana and northern long-eared bat. The bat habitat assessment area should also be considered potential foraging habitat for the endangered gray bat, present in Harrison County. Nearby Buck Creek may serve as a crucial flight corridor and permanent source of water for any bats present within the area. No potential roost trees were identified within the bat habitat assessment area. A dead ash was identified. No features associated with bat roosts were evident; however, as decay progresses it is likely the tree will develop exfoliating bark, snags, and other features ideal for bat maternal colony use.

Attach aerial photo or project site with all forested areas labeled and a general description of the habitat

Photographic Documentation: habitat shots at edge and interior from multiple locations; Understory/midstory/canopy; examples of potential suitable snags and live trees; water sources

Attachment 5

PHASE 1 SUMMER HABITAT ASSESSMENTS

T4-HA-6

INDIANA BAT HABITAT ASSESSMENT DATASHEET

Project Name: State Road 11 Extension			Date: May 6, 2021
Township/Range/Section:	5S/4E/18		Boone Township, Harrison County
Lat Long/UTM/Zone: 38.080333 N -86.114606 W	Western terminus 38.081328 N -86.116893 W	Eastern terminus 38.080801 N -86.112049 W	Surveyor: S. Langley

Brief Project Description

Four alternative routes are being considered to connect Stater Road 11 to State Road 135. Surveys of potential bat habitat and roosts trees are being conducted to assist in route selection and minimize environmental impacts.

Project Area

Project	Total Acres	Forest Acres	Open Acres
	6.13	6.13	6.13

Proposed Tree Removal (ac)	Completely cleared	Partially cleared (will leave trees)	Preserve acres-no clearing
	Unknown	Unknown	Unknown

Brief Project Description

Pre-Project	**Post-Project**
*See Project Description Above	Unknown at this time.

Brief Project Description

Flight corridors to other forested areas?

Flight corridors to tangent forest areas are present within the bat habitat assessment area.

Describe Adjacent Properties (e.g. forested, grassland, commercial or residential development, water sources)

Adjacent land use is rural, consisting of forested, agricultural, and rural-residential areas.

Proximity to Public Land

What is the distance (mi.) from the project area to forested public lands (e.g., national or state forests, national or state parks, conservation areas, wildlife management areas)?

An Indiana Forest Bank – Harrison property is located approximately 0.12 mile north of the bat habitat assessment area.
Squire Boone Caverns is located approximately 1.35 miles southwest of the bat habitat assessment area.
Three-Way Sedge Sinkhole Swamp Nature Conservancy is located approximately 2.85 miles southeast of the bat habitat assessment area.
Perseverance Barrens Nature Conservancy is located approximately 3.18 miles north of the bat habitat assessment area.
Harrison-Crawford State Forest is located approximatley 4.30 miles west of the bat habitat assessment area.

PHASE 1 SUMMER HABITAT ASSESSMENTS

Use additional sheets to assess discrete habitat types at multiple sites in a project area
Include a map depicting locations of sample sites if assessing discrete habitats at multiple sites in a project area
A single sheet can be used for multiple sample sites if habitat is the same

Sample Site Description

Sample Site No.(s): T4-HA-6

The bat habitat assessment area is within a late-mature or early climax beech/maple upland forest. The bat habitat assessment area incorporates a long, sloping bluff above Buck Creek and the Buck Creek Floodplain. The dominant canopy species are sugar maple and American beech. Ash, tulip poplar, sassafras, and chestnut oak are also present in the canopy. The mid-story predominantly consists of American beech. The understory is predominantly comprised of spicebush. Strong flight corridors are present in the form of logging roads. Buck Creek is adjacent to the northeast portion of the bat habitat assessment area.

Water Resources at Sample Site

Stream Type (# and length)	Ephemeral	Intermittent	Perennial	Describe existing condition of water sources: Buck Creek flows for 0.07 mile along the northeast limit of the bat habitat assessment area. Buck Creek was flooded at the time of the survey.
	N/A	N/A	Buck Creek, 0.07 mile	
Pools/Ponds (# and size)	N/A	N/A		
		N/A		
Wetlands (approx. ac.)	N/A	N/A		
	N/A	N/A		

Forest Resources at Sample Site

Closure/Density	Canopy (>50')	Midstory (20-50')	Understory (<20')	1=1-10%, 2=11-20%, 3=21-40%, 4=41-60% 5=61-80%, 6=81-100%
	6	5	3	
Dominant Species of Mature Trees	Canopy: *Acer saccharum, Fagus grandifolia* Mid-Story: *Fagus grandifolia* Understory: *Lindera benzoin*			
% Trees w/ Exfoliating Bark				
Size Composition of Live Trees (%)	Small (3-8 in)	Med (9-15 in)	Large (>15 in)	
	20	40	40	
No. of Suitable Snags	0	0	7	

Standing dead trees with exfoliating bark, cracks, crevices, or hollows.
Snags without these characteristics area not considered suitable.

IS THE HABITAT SUITABLE FOR INDIANA BATS?

Additional Comments:

The bat habitat assessment area should be considered ideal foraging and roost habitat for both the Indiana and northern long-eared bat. The presence of both species is highly likely, given the availability of prime habitat and the proximity of major hibernacula within Harrison County. The bat habitat assessment area should also be considered potential foraging habitat for the federally endangered gray bat, present in Harrison County. The bat habitat assessment area is part of a contiguous riparian forest, which lines Buck Creek for over 16 miles. Strong flight corridors are present in the form of logging roads and adjacent Buck Creek. Buck Creek also provides a permanent source of water. Seven potential roost trees were identified within the bat habitat assessment area. Several dead ash were observed, which had not yet developed features suitable for bat roosts. As decay progresses, the ash will develop exfoliating bark, snags, etc., providing ideal habitat in the near future. Several living shagbark hickory identified in the area may provide further roost opportunities.

T4-HA-6 Potential Roost Trees

Tree ID	Species	DBH (cm)	Decomposition State	Roost Features
T4-42	*Fraxinus sp.*	40	3	Exfoliating Bark
T4-43	*Prunus serotina*	62	2	Hollow Snag
T4-44	*Liriodendron tulipifera*	36	1	Snag, Cavity, Fissure
T4-45	*Ulmus sp.*	17	6	Cavities, Fissure
T4-49	*Fraxinus sp.*	38	3	Exfoliating Bark
T4-50	*Fraxinus sp.*	34.5	3	Snag, Cavities, Exfoliating Bark
T4-51	*Quercus alba*	35	6	Snag, Cavities

Attach aerial photo or project site with all forested areas labeled and a general description of the habitat

Photographic Documentation: habitat shots at edge and interior from multiple locations; Understory/midstory/canopy; examples of potential suitable snags and live trees; water sources

PHASE 1 SUMMER HABITAT ASSESSMENTS

T4-HA-7

INDIANA BAT HABITAT ASSESSMENT DATASHEET

Project Name: State Road 11 Extension			Date: May 6, 2021
Township/Range/Section:	5S/4E/18		Boone Township, Harrison County
Lat Long/UTM/Zone: 38.082699 N -86.119431 W	Western terminus 38.083299 N -86.121561 W	Eastern terminus 38.081403 N -86.117022 W	Surveyor: S. Langley

Brief Project Description

Four alternative routes are being considered to connect Stater Road 11 to State Road 135. Surveys of potential bat habitat and roosts trees are being conducted to assist in route selection and minimize environmental impacts.

Project Area

Project	Total Acres	Forest Acres	Open Acres
	5.25	3.99	1.26

Proposed Tree Removal (ac)	Completely cleared	Partially cleared (will leave trees)	Preserve acres-no clearing
	Unknown	Unknown	Unknown

Brief Project Description

Pre-Project	**Post-Project**
*See Project Description Above	Unknown at this time.

Brief Project Description

Flight corridors to other forested areas?

Flight corridors to tangent forest areas are present within the bat habitat assessment area.

Describe Adjacent Properties (e.g. forested, grassland, commercial or residential development, water sources)

Adjacent land use is rural, consisting of forested, agricultural, and rural-residential areas.

Proximity to Public Land

What is the distance (mi.) from the project area to forested public lands (e.g., national or state forests, national or state parks, conservation areas, wildlife management areas)?

An Indiana Forest Bank – Harrison property is adjacent to the north of the bat habitat assessment area.
Squire Boone Caverns is located approximately 1.34 miles south of the bat habitat assessment area.
Three-Way Sedge Sinkhole Swamp Nature Conservancy is located approximately 3.02 miles southeast of the bat habitat assessment area.
Perseverance Barrens Nature Conservancy is located approximately 3.09 miles north of the bat habitat assessment area.
Harrison-Crawford State forest is located approximately 4.18 miles west of the bat habitat assessment area.

PHASE 1 SUMMER HABITAT ASSESSMENTS

Use additional sheets to assess discrete habitat types at multiple sites in a project area
Include a map depicting locations of sample sites if assessing discrete habitats at multiple sites in a project area
A single sheet can be used for multiple sample sites if habitat is the same

Sample Site Description

Sample Site No.(s): T4-HA-7

The bat habitat assessment area is within a young or early-mature, upland forest, situated on a ridge north of Union Chapel Road. The dominant species in the canopy and mid-story are sugar maple, American beech, and red cedar. White oak and ash are also present in the canopy. The beech and maple growth is still fairly young, and has begun to surpass and outcompete the intermediate red cedar layer. The understory is dominated by emerging sugar maple and American beech saplings. Flight corridors are present in the form of maintained gravel trails and mowed lanes for transmission lines. No permanent water source was identified within the bat habitat assessment area; however, Buck Creek is in the immediate vicinity and could serve as a water source for any local bat populations. The bat habitat assessment area is part of a larger, contiguous forest lining the banks of Buck Creek for at least 16 miles.

Water Resources at Sample Site

Stream Type (# and length)	Ephemeral	Intermittent	Perennial	Describe existing condition of water sources: No permanent water source was observed in the bat habitat assessment area. Buck Creek is located approximately 0.15 mile northeast of the bat habitat assessment are.
	N/A	N/A	N/A	
Pools/Ponds (# and size)	N/A	N/A		
		N/A		
Wetlands (approx. ac.)	N/A	N/A		
	N/A	N/A		

Forest Resources at Sample Site

Closure/Density	Canopy (>50')	Midstory (20-50')	Understory (<20')	1=1-10%, 2=11-20%, 3=21-40%, 4=41-60% 5=61-80%, 6=81-100%
	4	5	3	
Dominant Species of Mature Trees	Canopy: *Acer saccharum, Fagus grandifolia, Juniperus virginiana* Mid-Story: *Juniperus virginiana, Fagus grandifolia, Acer saccharum* Understory: *Fagus grandifolia, Acer saccharum*			
% Trees w/ Exfoliating Bark	0	1	0	
Size Composition of Live Trees (%)	Small (3-8 in)	Med (9-15 in)	Large (>15 in)	
	30	30	40	
No. of Suitable Snags	0	1	0	

Standing dead trees with exfoliating bark, cracks, crevices, or hollows.
Snags without these characteristics area not considered suitable.

IS THE HABITAT SUITABLE FOR INDIANA BATS?

Additional Comments:

The bat habitat assessment area should be considered probable foraging and roost habitat for both the Indiana and northern long-eared bat. The bat habitat assessment area should also be considered potential foraging habitat for the federally endangered gray bat, present in Harrison County. The density and limited number of available roosts are not ideal; however, the availability of flight corridors and the areas connection to the expansive forest surrounding Buck Creek render the presence of the Indiana and northern long-eared bats highly likely. One roost tree was identified within the bat habitat assessment area. Several dead ash, which do not yet display qualities associated with bat roosts were observed. Although these ash are not currently considered potential roosts, they likely will in the near future as decay progresses and exfoliating bark, snags, etc. begin to develop and provide roost opportunities.

T4-HA-7 Potential Roost Trees

Tree ID	Species	DBH (cm)	Decomposition Stage	Roost Features
T4-46	*Quercus alba*	31	3	Exfoliating Bark

Attach aerial photo or project site with all forested areas labeled and a general description of the habitat

Photographic Documentation: habitat shots at edge and interior from multiple locations; Understory/midstory/canopy; examples of potential suitable snags and live trees; water sources

PHASE 1 SUMMER HABITAT ASSESSMENTS

T4-HA-8

INDIANA BAT HABITAT ASSESSMENT DATASHEET

Project Name: State Road 11 Extension			Date: May 6, 2021
Township/Range/Section:	5S/4E/18		Boone Township, Harrison County
Lat Long/UTM/Zone: 38.082415 N -86.118878 W	Western terminus 38.082815 N -86.121099 W	Eastern terminus 38.081438 N -86.117323 W	Surveyor: S. Langley

Brief Project Description

Four alternative routes are being considered to connect Stater Road 11 to State Road 135. Surveys of potential bat habitat and roosts trees are being conducted to assist in route selection and minimize environmental impacts.

Project Area

Project	Total Acres	Forest Acres	Open Acres
	3.24	3.24	3.24

Proposed Tree Removal (ac)	Completely cleared	Partially cleared (will leave trees)	Preserve acres-no clearing
	Unknown	Unknown	Unknown

Brief Project Description

Pre-Project	**Post-Project**
*See Project Description Above	Unknown at this time.

Brief Project Description

Flight corridors to other forested areas?

Flight corridors to tangent forest areas are present within the bat habitat assessment area.

Describe Adjacent Properties (e.g. forested, grassland, commercial or residential development, water sources)

Adjacent land use is rural, consisting of forested, agricultural, and rural-residential areas.

Proximity to Public Land

What is the distance (mi.) from the project area to forested public lands (e.g., national or state forests, national or state parks, conservation areas, wildlife management areas)?

An Indiana Forest Bank – Harrison property is located approximately 0.08 mile north of the bat habitat assessment area.
Squire Boone Caverns is located approximately 1.22 miles southwest of the bat habitat assessment area.
Three-Way Sedge Sinkhole Swamp Nature Conservancy is located approximately 3.01 miles southeast of the bat habitat assessment area.
Perseverance Barrens Nature Conservancy is located approximately 3.15 miles north of the bat habitat assessment area.
Harrison-Crawford State Forest is located approximately 4.09 miles west of the bat habitat assessment area.

PHASE 1 SUMMER HABITAT ASSESSMENTS

Use additional sheets to assess discrete habitat types at multiple sites in a project area
Include a map depicting locations of sample sites if assessing discrete habitats at multiple sites in a project area
A single sheet can be used for multiple sample sites if habitat is the same

Sample Site Description

Sample Site No.(s): T4-HA-8

The bat habitat assessment area is within a mature oak/hickory upland forest, immediately south of Union Chapel Road. The bat habitat assessment area is located on a ridge, which slopes down to the south. White oak and shagbark hickory are the dominant species within the canopy. Redbud, American beech, and red cedar are the dominant species within the mid-story and understory. A driveway and canopy openings serve as flight corridors in the immediate area. No permanent water source was observed within the bat habitat assessment area. Buck Creek is located approximately 0.20 mile east of the bat habitat assessment area and likely serves as the primary water source for any bats present in the area.

Water Resources at Sample Site

Stream Type (# and length)	Ephemeral	Intermittent	Perennial	Describe existing condition of water sources: No permanent water source was observed within the bat habitat assessment area. Buck Creek is located approximately 0.20 mile east of Buck Creek.
	N/A	N/A	N/A	
Pools/Ponds (# and size)	N/A	N/A		
		N/A		
Wetlands (approx. ac.)	N/A	N/A		
	N/A	N/A		

Forest Resources at Sample Site

Closure/Density	Canopy (>50')	Midstory (20-50')	Understory (<20')	1=1-10%, 2=11-20%, 3=21-40%, 4=41-60% 5=61-80%, 6=81-100%
	4	4	4	
Dominant Species of Mature Trees	Canopy: *Quercus alba, Carya ovata* Mid-Story: *Fagus grandifolia, Cercis canadensis, Juniperus virginiana* Understory: *Cercis canadensis, Fagus grandifolia, Juniperus virginiana*			
% Trees w/ Exfoliating Bark	0	0	0	
Size Composition of Live Trees (%)	Small (3-8 in)	Med (9-15 in)	Large (>15 in)	
	20	30	50	
No. of Suitable Snags	0	1	1	

Standing dead trees with exfoliating bark, cracks, crevices, or hollows.
Snags without these characteristics area not considered suitable.

IS THE HABITAT SUITABLE FOR INDIANA BATS?

Additional Comments:

The bat habitat assessment area should be considered foraging and roost habitat for the Indiana and northern long-eared bat. The bat habitat assessment area should also be considered potential foraging habitat for the federally endangered gray bat, present in Harrison County. The presence of Indiana and northern-long eared bats is highly likely, as the bat habitat inspection area is connected to a large, contiguous forest lining the banks of Buck Creek for over 16 miles. Flight corridors are present. A permanent water source was not identified within the bat habitat assessment area; however, Buck Creek is nearby and would provide ample water for any bats present. Two potential roost trees were identified within the bat habitat assessment area. A dead ash that did not yet exhibit roost features was identified. The ash will likely be a potential roost in the near future, as decay progresses and exfoliating bark, snags, etc. develop. Live hickories identified in the area may also provide additional roost opportunities.

T4-HA-8 Potential Roost Trees

Tree ID	Species	DBH (cm)	Decomposition State	Roost Features
T4-47	*Quercus alba*	35	7	Cavities
T4-48	Unknown	30	7	Hollow Snag

Attach aerial photo or project site with all forested areas labeled and a general description of the habitat

Photographic Documentation: habitat shots at edge and interior from multiple locations; Understory/midstory/canopy; examples of potential suitable snags and live trees; water sources

United States Department of the Interior
Fish and Wildlife Service

Indiana Field Office (ES)
620 South Walker Street
Bloomington, IN 47403-2121
Phone: (812) 334-4261 Fax: (812) 334-4273

April 27, 2022

Peter Putzier
Lochmueller Group, Inc.
6200 Vogel Road
Evansville, IN 47715
Sent via email

Project: Des. 2001154 State Road (SR) 11 Extension from SR 135/Watson Rd to SR 11/SR 337/Melview Rd Intersection, Harrison County, Indiana

Dear Mr. Putzier:

This responds to your letter dated April 12, 2022, requesting U.S. Fish and Wildlife Service (Service) comments on the aforementioned project. The Service was inadvertently left off of the initial distribution list for early coordination.

These comments have been prepared under the authority of the Fish and Wildlife Coordination Act (l6 U.S.C. 661 et. seq.) and are consistent with the intent of the National Environmental Policy Act of l969, the Endangered Species Act of l973, as amended, and the U. S. Fish and Wildlife Service's Mitigation Policy.

The proposed project is located between the SR 135 and Watson Road junction to the west and the SR 11 and Melview Road/SR 337 junction to the east, 4.7 miles north of the existing junction between SR 135 and SR 11. The site is approximately 10 miles south of Corydon, Indiana along SR 135.

The proposed project will involve upgrading existing county roads and building a new terrain road to create a new east-west SR 11 connection across Buck Creek. The project proposes the construction of a new bridge across Buck Creek and installation of additional culverts spanning smaller streams. The exact size of these new structures is not yet known. Up to 29 acres of tree clearing may occur as part of the project. Construction is anticipated to begin in Summer 2025.

STUDY AREA

The topography in the area is generally rolling with a mix of forested areas, agricultural fields and scattered rural housing. Numerous tributaries to Buck Creek are located within the project area and a tall bluff is located along Buck Creek. Sinkholes and other karst features are also abundant in the region. This part of the state is typically underlain by karst limestone formations

which are often associated with an extensive network of subterranean caves, air passages, and waterways. Clusters of some of the most important caves in Indiana for bats and other cave fauna are found in Harrison and adjacent Crawford County.

ENDANGERED SPECIES

The proposed project is within the range of the federally endangered Indiana bat (*Myotis sodalis*) and gray bat (*Myotis grisescens*), and the federally threatened northern long-eared bat (*Myotis septentrionalis*). Indiana bats hibernate in caves then disperse to reproduce and forage in relatively undisturbed forested areas associated with water resources during spring and summer. Recent research has shown that they will inhabit fragmented landscapes with adequate forest for roosting and foraging. Young are raised in nursery colony roosts in trees, typically near drainage-ways in undeveloped areas. Like all other bat species in Indiana, the Indiana bat diet consists exclusively of insects.

There is suitable summer habitat for this species present throughout the area surrounding the project site, as well as multiple hibernacula approximately 9-13 miles northwest and southeast of the project. There are no current summer records of Indiana bats near the site but to our knowledge surveys have been limited in the area.

The northern long-eared bat was listed as threatened under the Endangered Species Act (ESA) (87 Stat. 884, as amended; 16 U.S.C. 1531 *et seq.*) in April 2015. The Service also developed a final 4(d) rule, which was published in the *Federal Register* on January 14, 2016. The 4(d) rule specifically defines the "take" prohibitions. At this time, no critical habitat has been proposed for the northern long-eared bat. Since the northern long-eared bat was not listed at the time of our original coordination, species-specific information is included below.

The entire state of Indiana is within the range of the northern long-eared bat. During the summer, northern long-eared bats typically roost singly or in colonies in cavities, underneath loose bark, in crevices, or in hollows of both live and dead trees and/or snags (typically ≥3 inches dbh). Males and non-reproductive females may also roost in cooler places, like caves and mines. The northern long-eared bat appears opportunistic in selecting roosts, using tree species based on presence of cavities or crevices or presence of peeling bark. It has also been occasionally found roosting in structures like barns and sheds (particularly when suitable tree roosts are unavailable). They forage for insects in upland and lowland woodlots and tree lined corridors. During the winter, northern long-eared bats predominately hibernate in caves and abandoned mine portals. Additional habitat types may be identified as new information is obtained.

There are a couple of capture records of the northern long-eared bat near the project area along Buck Creek. There are multiple hibernacula approximately 9-13 miles north/northwest and southeast of the project that are known to be used by northern long-eared bats.

Based on the information we have reviewed, there is suitable summer habitat present for **both** the Indiana bat and the northern long-eared bat throughout the area surrounding the project site, including wooded areas within the potential project boundary. Although portions of Harrison County are a heavily forested, we expect impacts may occur as a result of habitat loss and fragmentation. To avoid direct incidental take from removal of an occupied roost tree, tree-

clearing should be avoided during the period **April 1 – November 14.** This extended restricted timeframe is a result of the project being located within 10 miles of one Priority 1 and two Priority 2 Indiana bat hibernacula and the associated fall swarming habitat.

Please note that on March 23, 2022, the Service published a proposal to reclassify the northern long-eared bat as endangered under the Endangered Species Act. The U.S. District Court for the District of Columbia has ordered the Service to complete a new final listing determination for the NLEB by November 2022 (Case 1:15-cv-00477, March 1, 2021). The bat, currently listed as threatened, faces extinction due to the range-wide impacts of white-nose syndrome (WNS), a deadly fungal disease affecting cave-dwelling bats across the continent. The proposed reclassification, if finalized, would remove the current 4(d) rule for the NLEB, as these rules may be applied only to threatened species. Depending on the type of effects a project has on the NLEB, the change in the species' status may trigger the need to re-initiate consultation for any actions that are not completed and for which the Federal action agency retains discretion once the new listing determination becomes effective (anticipated to occur by December 30, 2022). If your project may result in incidental take of NLEBs after the new listing goes into effect this will need to be addressed in a consultation that includes an Incidental Take Statement.

The project is also within the range of the gray bat. Gray bats are year-round cave obligates, roosting in caves both during hibernation and the summer maternity season; they may also occasionally use structures for roosting. Foraging habitat of gray bats is generally correlated with rivers, streams, lakes or reservoirs and associated shorelines and riparian areas. They use forested corridors and tree cover to travel between caves and foraging areas. We have multiple records of gray bats in Harrison County, including summer captures along Buck Creek and winter and summer presence in several caves northwest of the project. Buck Creek is likely an important foraging and travelling route for this species based on the documented capture records along the stream, presence in nearby caves, and also the project's proximity to the Ohio River, another area of documented gray bat use.

OTHER SPECIES OF CONCERN

The following species have been found along Buck Creek downstream of the project area and are on the Service's National Listing Workplan. These species may require additional consideration depending on the listing outcomes and the project's construction timeframe. A species' inclusion in the Workplan does not mean it will be listed as endangered or threatened under the ESA. That determination would be made following a rigorous scientific assessment of the species' status to determine whether it meets the definition of an endangered or threatened species. If the Service determines a species warrants listing, we will undertake the appropriate rule-making process before the species receives protections under the ESA.

- Tri-colored bat (*Perimyotis subflavus*) – status assessment ongoing; National Listing Workplan date FY22
- Little brown bat (*Myotis lucifugus*) – status assessment ongoing; National Listing Workplan date FY23

POTENTIAL PROJECT IMPACTS/EFFECTS

Streams

There are multiple streams and wetlands in the study area, including Buck Creek and a known sinking stream area. Buck Creek is listed on the Natural Resource Commission's (NRC) Outstanding Rivers in Indiana list which identifies rivers and streams that have particular environmental or aesthetic interest.

Stream corridors like Buck Creek are important for food resources and animal movement, such as bats that use stream corridors for travelling and foraging. We anticipate that the proposed bridge over Buck Creek will be large enough to allow for bat movement beneath the structure and to help maintain some connectivity in the vicinity of the bridge; however, the introduction of noise and lights associated with new traffic could create barriers to bat movement.

Other small, headwater streams and springs in the vicinity are likely important habitat for aquatic insects, amphibians, and fish. Impacts to these features may have consequences for the conservation of biodiversity and should be minimized as much as possible.

Forest

Tree clearing will be required for the construction of the SR 11 Extension project. According to the early coordination letter, the project is anticipated to require up to 45 acres of permanent right-of-way (ROW), up to 5 acres of temporary ROW, and up to 29 acres of tree clearing. The new roadway may create a barrier to bats and other wildlife in this area as a result of habitat removal and increased noise and traffic.

Karst

According to your letter (and based on a recent site visit), multiple karst features have been identified in the project area. This includes several caves, numerous sinkholes, springs, and two sinking stream basin areas.

Excavation which intersects karst features or results in the rerouting of drainage can drastically alter underground water and air flow patterns, resulting in significant adverse impacts to karst ecosystems. Drainage containing contaminants from construction sites, highway ditches, or other sources can also have substantial impacts. Since karst groundwater systems receive very little filtering by soil percolation, subsurface water quality is very sensitive to pollutants in surface runoff.

Specific mitigation measures to address roadway run-off (including de-icing chemicals) and spills should be developed for any drainage features encountered. Grouting drainage features without fully understanding the surface and subsurface drainage patterns can result in additional problems, such as new sinkhole development. If applicable, road drainage should be prevented from entering any karst features by being directed away from them and sinkholes should be left undisturbed along with a minimum 25-foot buffer around the highest closed contour. Karst impacts will be evaluated and mitigated in accordance with the Indiana Department of

Transportation's procedures as outlined in their *Protection of Karst Features during Project Development and Construction* document. Impacts and treatment options should be coordinated with our office.

This review is provided as technical assistance only and **does not** preclude the need for further consultation on this project as required under Section 7 of the Endangered Species Act of 1973, as amended.

ADDITIONAL RECOMMENDATIONS

We recommend the following avoidance and minimization measures be included in the final project plans to minimize adverse impacts on fish and wildlife resources:

1. Revegetate all disturbed soil areas immediately upon project completion, using native trees and shrubs in the riparian zone wherever feasible. We recommend reforestation along riparian areas extend at least 30 meters perpendicular from the streambank**.**

2. Do not clear trees or understory vegetation outside the construction zone boundaries. (**This restriction is not related to the "tree clearing" restriction for potential Indiana Bat habitat.)**

3. Minimize the extent of artificial bank stabilization and use bioengineering methods wherever feasible.

4. If riprap is utilized for bank stabilization, extend it below low-water elevation to provide aquatic habitat (if applicable).

5. Use best methods to contain soil and sediment runoff during construction. Use silt curtains or other devices at the downstream end of the project to contain bottom sediment in the newly excavated channel and to prevent it from adding to the downstream sediment load. Maintain such devices by removal of accumulated sediment.

6. Restrict below low-water work in streams to placement of culverts, piers, pilings and/or footings, shaping of the spill slopes around the bridge abutments, and placement of riprap. Culverts should span the active stream channel, should be either embedded or a 3-sided or open-arch culvert, and be installed where practicable on an essentially flat slope. When an open-bottomed culvert or arch is used in a stream, which has a good natural bottom substrate, such as gravel, cobbles and boulders, the existing substrate should be left undisturbed beneath the culvert to provide natural habitat for the aquatic community.

7. Use project design and right-of-way control to prohibit or restrict secondary development in large forest blocks and near currently undeveloped forested waterways.

A permit under Section 404 of the Clean Water Act may be needed for the proposed project. Our recommendations to the U.S. Army Corps of engineers for permit conditions would be consistent with our comments here.

We appreciate the opportunity to comment at this stage of project planning. We look forward to continuing to coordinate as the project develops. If you have any questions about our recommendations, please contact Robin McWilliams Munson at (8l2) 334-426l (Ext. 207) or robin_mcwilliams@fws.gov.

Sincerely,

SCOTT PRUITT Digitally signed by SCOTT PRUITT
Date: 2022.05.05 15:31:20 -04'00'

Scott E. Pruitt
Field Supervisor

Cc (via email):
Sandy Bowman, INDOT, Indianapolis, IN
Jeremy Kieffner, Lochmueller Group, Evansville, IN
Kari Carmany-George, FHWA, Indianapolis, IN

SR 11 Extension Project
SR 135 to SR 11 / Old Hwy 337
Indiana Bat, Northern Long-Eared Bat, and Gray Bat
Biological Assessment
Harrison County, Indiana

November 15, 2022

Prepared for:

Project No.: 120002401E
INDOT Des. No.: 2001154

Lochmueller Group, Inc.
6200 Vogel Road
Evansville, Indiana 47715
Phone: 812.479.6200

Table of Contents

Figures

Appendices

SR 11 Extension Project
SR 135 to SR 11 / Old Hwy 337
Harrison County, Indiana
Des. No. 2001154

Indiana Department of Transportation
Federal Highway Administration

1 Introduction

The purpose of this biological assessment (BA) is to review the proposed SR 11 Extension Project in sufficient detail to determine whether the proposed action may affect any of the threatened or endangered species identified through coordination with the U.S. Fish and Wildlife Service (USFWS), namely the Indiana bat, northern long-eared bat, and the gray bat. This BA is prepared in accordance with legal requirements set forth under Section 7 of the Endangered Species Act (16 U.S. C. 1536 (c)) and follows the standards established in the Indiana Department of Transportation (INDOT) NEPA guidance.

2 Proposed Action

For the purposes of Endangered Species Act Section 7 formal consultation, the proposed action includes all roadway and bridge construction, as well as all stipulated avoidance/minimization measures (AMMs) and conservation measures (In-Lieu Fee Program payment) contained within this biological assessment.

2.1 Project Need

The need for the SR 11 Roadway Project is to improve safety in southern Harrison County, Indiana. The roadway network in southern Harrison County connecting SR 11 to SR 135 contains no roadways that meet current design standards. The roadways in this area are all narrow and have lane widths that average between 9 feet to 10 feet wide with no shoulders. In addition, these roadways have deficient horizontal and vertical alignments, which cause sight distance issues. Collectively, these deficiencies increase the potential for crashes. Specific geometric deficiencies of the roadways that currently connect SR 11 with SR 135 in southern Harrison County include:

- Old SR 11 to Old Goshen Road to Union Chapel Road to Watson Road to SR 135 – These roadways are narrow and have lane widths between 9 feet and 10 feet with no shoulders. There are seven locations where horizontal curvature is deficient and some with as low as 100-foot radius and eight locations where the vertical curvature causes sight distance issues. In addition, portions of these roadways have profile grades as steep as 6%.
- Old SR 11 to SR 135 – This roadway is narrow and has a lane width of 10 feet with no shoulders. There are twenty locations where the horizontal alignment is deficient requiring warning signs with advisory speed plaques as low as 20 mph. In addition, approximately 1 mile of the Old SR 11 is located within the floodway of the Ohio River and floodwaters from the Ohio River can cause the roadway to be closed to traffic.

- Old SR 337 to Lake Road to SR 135 – These roadways are narrow and have lane widths between 9 feet and 10 feet with no shoulders. There are fifteen locations where the horizontal alignment is deficient. Ten of the fifteen location where the horizontal alignment is deficient require warning signs with advisory speed plaques as low as 15 mph.
- Old SR 337 to Wiseman Road to SR 135 – These roadways are narrow and have lane widths between 9 feet and 10 feet with no shoulders. There are eighteen locations where the horizontal alignment is deficient requiring warning signs with advisory speed plaques of 15 to 20 mph.

INDOT's RoadHAT Version 4.1 tool uses two key indicators to evaluate roadway crash data. The Index of Crash Frequency (I_{cf}) assesses how the number of crashes recorded at intersections or along defined segments of roadways compared with comparable roads throughout Indiana. The Index of Crash Cost (I_{cc}) assesses how the total cost of crashes at intersections or along defined segments of roadways compares with those on similar roadways throughout Indiana. In this context, "cost" is an indicator of severity. Crashes resulting in fatalities or incapacitating injuries are far more costly than crashes that result only in property damage. A high I_{cc} indicates a higher-than-expected number of crashes resulting in fatalities or incapacitating injuries.

Both of these indices are measures of standard deviation. An index of 1.00 indicates that crash frequencies or cost are one standard deviation higher than comparable locations throughout Indiana and that the location has crash costs or frequencies that are higher than approximately 83% of similar locations in Indiana. An index of 2.0 indicates that the location has crash costs or frequencies which are higher than approximately 98% of similar locations in Indiana. The three east-west crossings of Buck Creek in southern Harrison County (Old Hwy 11, Union Chapel Road, and Old Hwy 337) each have elevated crash frequency ratings. The high indices at multiple locations in the project area support the conclusion that there are safety concerns in southern Harrison County and a need for transportation improvement. Appendix A Map1 Identifies locations in the project area where safety performance is in the "worst" two to three percent of all locations in Indiana based on the I_{cf}.

2.2 Project Purpose

The purpose for the SR 11 Extension project is to provide a roadway with improved safety performance connecting SR 11 to SR 135, which meets current INDOT design standards. A traffic study completed by Crawford, Murphy and Tilly (2021) identified that the SR 11 Extension Project would divert approximately 35% to 50% of the traffic off the local roadways. This reduction in traffic volumes on the local roadways that do not meet current design standards is anticipated to decrease the crash frequencies and improve safety for the traveling public in southern Harrison County.

3 Project Description

Based on the need provided in the Long-Range Transportation Plan (2003) for Harrison County, development of a reconstruction/widening/realignment/new roadway facility was identified to meet the project need.

3.1 Existing Old Hwy 11 Upgrade

Old Hwy 11 is a narrow 9 to 10-foot lane roadway with little to no shoulders and multiple substandard narrow radius horizontal and vertical curves from the SR 11 / Old Hwy 11 / Old Hwy 337 / Melview Road intersection to SR 135 at Mauckport. The southern terminus of Old Hwy 11 is also within the Ohio River floodway at Mauckport. Because Old Hwy 11 does not meet current design standards for a Rural Local Roadway, upgrades would require a higher level of design standards to match the functional classification of SR 11 east of the SR 11 / Old Hwy 11 / Old Hwy 337 / Melview Road intersection. The substandard curvatures were not conducive to tractor-trailers and resulted in encroachment into oncoming lanes when turning at intersections. Additionally, truck spinouts occur when climbing steep grades in wet conditions. For these reasons, in 2003 it was recommended that an upgrade to Old Hwy 11 was not practical and a more centralized east-west connection between SR 135 and SR 11 was recommended in the Long-Range Transportation Plan (2003).

3.2 Long-Range Transportation Plan

The Long-Range Transportation Plan for Harrison County (2003) indicated that an east-west reconstruction/widening/realignment/new roadway project in southern Harrison County was needed. Two corridors for a new centralized east-west roadway were considered in the Long-Range Transportation Plan: 1) the Watson Road Extension and 2) the Lake Road/Buck Creek Valley Road Improvement. The Indiana Comprehensive Plan Update (2008) included the east-west Watson Road connection. As part of the Long Range Transportation Plan development, a Steering Committee was formed, on-line mapping exercise and surveys were conducted, and a public open house meeting was held for public review and feedback. The 2040 Long Range Transportation Plan (2019) adopted on August 5, 2019 by the Commissioners included the Watson Road Extension as the corridor that would move forward as the east-west connection.

3.3 SR 11 Preliminary Corridor Study and Planning Level Cost Estimate

In 2019, INDOT contracted Crawford, Murphy, and Tilly (CMT) to evaluate Watson Road alternative alignments from SR 135 to SR 11. The study area was divided into three segments (A, B, and C) with three sub option alignments for crossing Buck Creek and evaluated using roadway geometry, earthwork calculations, environmental impacts, right-of-way impacts, and cost. This preliminary analysis report did not yield a likely preferred alternative. A Preliminary Alternatives Analysis was recommended to evaluate the corridor using more detailed engineering, environmental field work, karst study, and archaeological records check.

3.4 Tier 1 Level Corridor Evaluation

Although the Long-Range Transportation Plan and the Preliminary Corridor Study focused on the Watson Road Extension, the NEPA Early Coordination agency review response from the Indiana Department of Natural Resources requested that a more northern alternative along Heth Washington Road and St. Michaels Road also be evaluated to possibly reduce forest impacts. Subsequently, a due-diligence “Tier 1” level corridor review was conducted to evaluate the Heth-Washington Road / St. Michaels Road connection from SR 135 to Old Hwy 337 (including improvements to Old Hwy 337 south to SR 11) and the Watson Road Extension from SR 135 to SR 11/Old Hwy 337 / Old Hwy 11. Corridor comparisons were based on estimates of select environmental impacts, right-of-way impacts, and earthwork quantities using right-of-way footprints

developed with InRoads Design. Figure 1 summarizes the corridor comparisons. Appendix A Map 2 illustrates the two Tier 1 level corridor alignments, including three Watson Road corridor alternative options. Note: The use of "Tier" in the descriptions refers to a stratified corridor screening process for the SR 11 Extension Project and not a "Tiered" NEPA approach.

Figure 1 Summary of Tier 1 Heth Washington Road / St. Michaels Road and Watson Road Corridor Evaluation

Tier 1 Evaluation Considerations		Heth Washington Road / St. Michaels Road Corridor	Watson Road Corridor
Corridor Characteristics	Length	5.6 miles	5.1 miles
	Right-of-Way Width Existing Roads Buck Creek Valley	160 feet along Heth Washington Road 120 feet St. Michaels Road and Old Hwy 337 240 to 350 feet	150 feet along Watson Road 200 feet along Melview Road 300 to 525 feet
Environmental Impacts	Tree Removal	29 acres	21 acres
	Wetland Impacts	0 acre	0.046 acre
	Open Water Impacts	2.8 acres	0 acre
	Stream Impacts[1]	100 feet	596 feet
Right-of-Way Impacts	Residential Property	12 acres	17 acres
	Agricultural Property	41 acres	65 acres
	Undeveloped Property	39 acres	36 acres
	Commercial Property	1 acre	0 acre
	Residential Relocations	6	2
	Commercial Relocations	4	0
	Total Right-of-Way	92 acres	117 acres
Earthwork	Common Excavation	473,747 cys	408,676 cys
	Rock Excavation	332,720 cys	178,736 cys

[1]Stream impacts for Heth Washington Corridor based on USGS while field data was used for Watson Road Corridor
Red shading indicates the corridor with the greater impact for the specified parameter
Green shading indicates the corridor with the less impact for the specified parameter
Yellow shading indicates that the greater and less impact cannot be determined since stream impacts were determined differently for the two corridors.

In consideration of the following reasons, the Watson Road Extension was selected as the preferred corridor for further alternatives development instead of the Heth Washington Road / St. Michaels Road corridor.

- Watson Road Extension is estimated to have 27 percent fewer forest/woodland impacts.
- No open water impacts for Watson Road Extension.
- Greater potential for commercial impacts at intersection of Heth Washington Road and SR 135.
- Watson Road Extension is estimated to have 67 percent fewer residential relocations.
- The Heth Washington Road / St. Michaels Road corridor would require improvements to Old Hwy 337 resulting in a longer 5.6 mile project instead of the shorter 5.1 mile corridor for the Watson Road Extension.
- Watson Road Extension is estimated to have 14 percent less common excavation and 46 percent less rock excavation.

3.5 Watson Road Extension "Tier 2" Preliminary Alternatives Analysis

The Watson Road Extension preliminary alternatives evaluated for the east-west connection project included the No Build (Do Nothing Alternative) and three alignments as described below.

3.5.1 No Build/Do-Nothing Alternative

The No Build/Do Nothing Alternative would maintain the status quo of the transportation network for southern Harrison County. Old Hwy 11 to Mauckport, the Watson Road/Union Chapel Road/Old Goshen Road/Melview Road route, the Old Hwy 337/Buck Creek Valley/Harrison Heth Road route, and the Old Hwy 337/Lake Road route would remain as the only routes across Buck Creek from SR 135 to SR 11.

3.5.2 Build Alternative 1: Northern Buck Creek Crossing Option

The SR 11 Extension Project intersection with SR 135 would be shifted to the north to allow for a perpendicular approach instead of the existing 30 degree skew. From SR 135 the alignment would follow along the north side of Watson Road approximately 2.2 miles to Union Chapel Road intersection. The intersection would be shifted to the east-northeast with approximately 0.3 miles of Union Chapel Road realigned. The SR 11 Extension Project alignment would continue east-northeast with a slightly skewed crossing of Buck Creek through forestland and cropland for a distance of approximately 1.0 mile, gradually turn due east for approximately 1.0 mile through cropland, and then turn to the southeast across cropland to Melview Road and the SR 11/Old Hwy 11/Old Hwy 337 intersection. The existing intersection between Old Hwy 337 and SR 11/Old Hwy 11 would be reconfigured into a four-way approach. Access to Melview Road would be addressed with a new access point from the south side of the SR 11 Extension Project roadway. The overall mainline length of Alternative 1 is 5.05 miles.

3.5.3 Build Alternative 2: Central Buck Creek Crossing Option

The SR 11 Extension Project intersection with SR 135 would be shifted to the north as described for Alternative 1. Alternative 1 would also follow along the north side of existing Watson Road for a distance of approximately 1.8 miles to Meridian Lane at which point it would arc northeast then southeast to cross Union Chapel Road perpendicularly. East of the new Union Chapel Road/Delmer Lane intersection, the alignment would follow southeast along the north side of Union Chapel Road, then gradually arc to the east-northeast through upland woods and across cropland where it would span Buck Creek. East of Buck Creek the alignment would arc from the east-northeast to east-southeast through a large expanse of forestland for approximately 0.8 mile. Upon exit of the forestland, the alignment would arc due east through cropland and across a sinking stream for a distance of approximately 0.7 mile to Melview Road. East of the new intersection with Melview Road, the alignment would follow along Melview Road for approximately 0.6 mile to a new reconfigured intersection with SR 11, Old Hwy 11, and Old Hwy 337. The overall mainline length of Alternative 1 is 5.01 miles.

3.5.4 Build Alternative 3: Southern Buck Creek Crossing Option

The SR 11 Extension Project intersection with SR 135 would be shifted to the north as described for Alternatives 1 and 2. As with Alternative 2, Alternative 3 would follow along the north side of existing Watson Road for a distance of approximately 1.8 miles to Meridian Lane at which point it would arc northeast then southeast to cross Union

Chapel Road with a newly configured intersection. The alignment would continue to the southeast, generally paralleling the existing Union Chapel Road along the ridgeline as it descends down into the Buck Creek valley. Approximately 0.6 mile from the Union Chapel Road/Delmer Lane intersection the alignment arcs to the east-northeast across bottomland cropland where it would span the floodplain and cross Buck Creek nearly perpendicular. East of Buck Creek the alignment would continue through steep slope forestland, across cropland, a narrow wooded drainage way and gradually arc due east approximately 0.25 mile from Buck Creek. At this point, the alignment continues due east approximately 0.8 mile along an existing gas well gravel access roadway to Melview Road. East of the new Melview Road intersection, the alignment arcs to the northeast and back to due east where it merges back onto the existing Melview Road alignment for approximately 0.3 mile to a new reconfigured intersection with SR 11, Old Hwy 11, and Old Hwy 337. The overall mainline length of Alternative 1 is 5.07 miles.

3.6 Tier 2 Preferred Alternative Selection

The three SR 11 Extension Project Watson Road Corridor alternatives from the Tier 2 level review were evaluated based on select environmental impacts, right-of-way impacts, earthwork quantities, and project cost. Figure 2 summarizes the alternative comparisons.

Figure 2 Summary of Tier 2 Watson Road Corridor Alternatives Screening

Tier 2 Evaluation Considerations			Alternative 1 North	Alternative 2 Central	Alternative 3 South
Environmental Impacts	Tree Removal (acres)		19	28	15
	Wetland Impacts (acres)		0.138	0.000	0.000
	Open Water Impacts (acres)		0.118	0.003	0.003
	Stream Impacts (feet)		808	690	291
Right-of-Way Impacts	Residential Property (acres)		26	12	12
	Agricultural Property (acres)		66	62	66
	Undeveloped Property (acres)		24	52	31
	Residential Relocations (number)		2	2	2
	Total Right-of-Way (acres)		116	126	109
Earthwork	Common Excavation (CYS)	West of Buck Creek	248,230	224,252	206,766
		East of Buck Creek	243,317	349,499	155,764
	Rock Cut Excavation (CYS)	West of Buck Creek	85,976	86,550	0
		East of Buck Creek	79,057	200,577	84,049
	Borrow (CYS)	West of Buck Creek	0	326,747	171,780
		East of Buck Creek	0	0	0
Project Cost	Length		5.1	5.0	5.1
	Utility Cost		$4,351,980	$4,834,485	$4,782,515
	Right-of-Way Cost		$2,443,473	$1,825,784	$1,783,860
	Mitigation Cost		$1,515,640	$1,463,200	$1,298,000
	Construction Cost		$40,760,000	$48,220,000	$42,090,000

Based on the Tier 2 Alternative evaluation, **Alternative 3** was selected as the recommended preferred alternative for the SR 11 Extension Project. Therefore, this biological assessment has been completed to address potential impacts to the Indiana bat, northern long-eared bat, and gray bat through construction and operation of **Alternative 3**.

3.7 Proposed Highway/Bridge Summarization

3.7.1 Roadway

SR 11 east of the SR 11/Old Hwy 11/Old Hwy 337/Melview Road intersection is a Major Collector and the new SR 11 Extension Project will be developed as a 4R project with the same classification. The design speed is 55 mph with an anticipated posted speed of 45 mph. The roadway will include two 12-foot lanes, 4-foot paved and variable width compacted aggregate shoulders, with 6:1 fore slopes, 3:1 ditch slopes, and variable back slopes. Cut and fill sections will be required throughout the length of the roadway due to the rolling terrain. The typical section for the rock cut depends on the depth of the cut and the nature of the rock material (i.e., solid limestone or soft/weathered rock). For the deeper sections, steeper and terraced cuts will be used to achieve the required depth. For shallower sections, 3:1 back slopes will be used. Figure 3 illustrates the typical roadway section and Figure 4 illustrates the various rock cut sections.

Figure 3 Roadway Typical Section

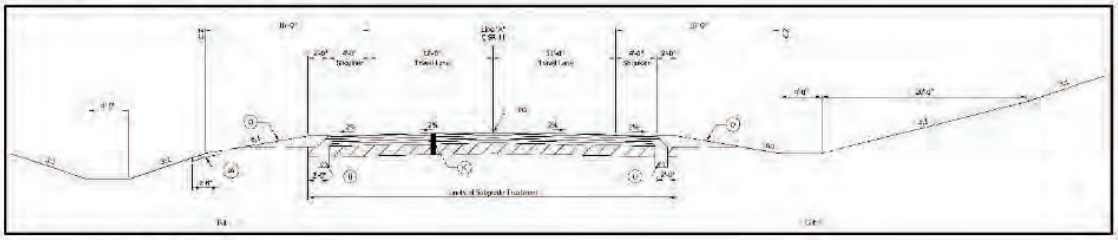
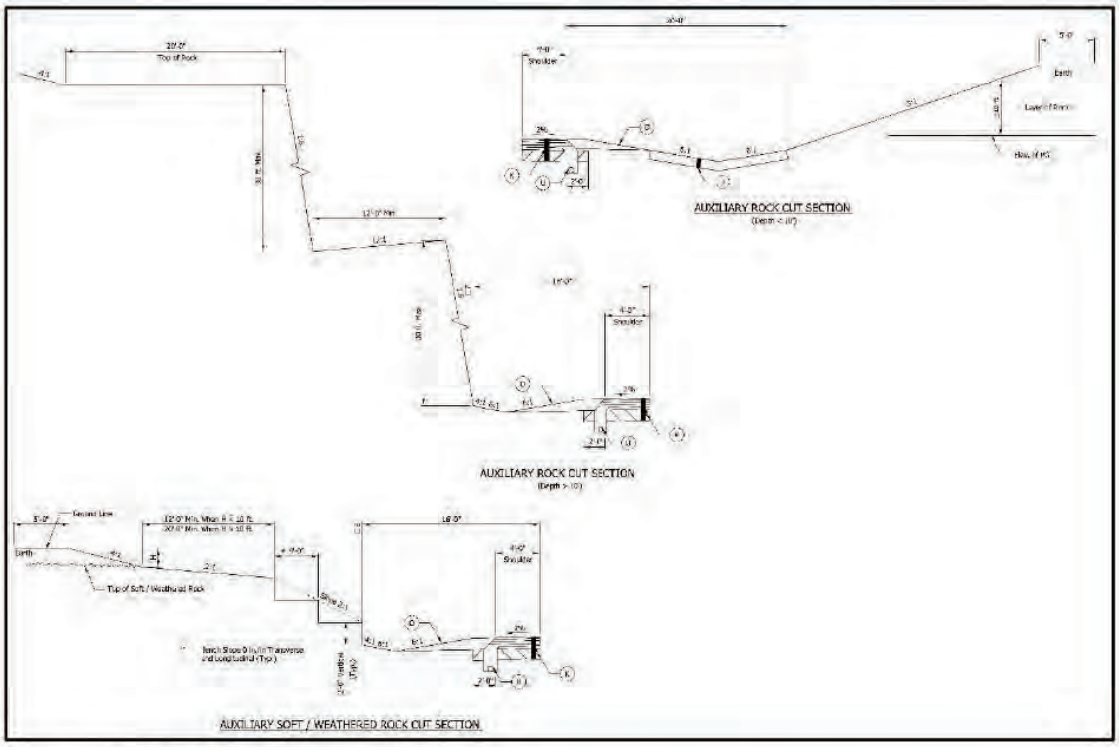


Figure 4 Rock Cut Typical Sections

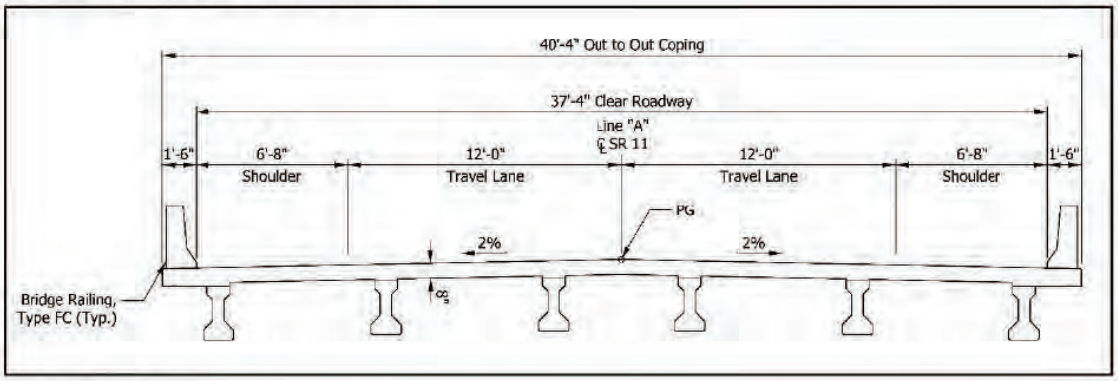


3.7.2 Bridge

Details for the bridge design were not available as of the drafting of this BA. The preliminary design estimates the bridge with be approximately 1,325 feet in length from the west side of the Buck Creek valley in the vicinity of existing Union Chapel Road to the bluff on the east side of Buck Creek. The bridge is anticipated to include nine spans, potentially less depending on the beam type chosen (prestressed concrete hybrid bulb-t beam or steel plate girder). The majority of the bridge length will span the floodplain west of Buck Creek. It is anticipated that two spans will be required to cross the channel, with a pier placed on the mid-channel island in Buck Creek. Maximum height of the bridge would be approximately 115 feet from the ground to the bottom of the beam at Buck Creek. Deep cuts into the limestone bedrock are anticipated into the bluff on the east side of Buck Creek to accommodate the profile of the bridge span across the floodplain. The cut into the bluff is needed to keep the height of the bridge from approaching 200 feet, to control the grade of the roadway across the valley, and provide the desired gradient for drainage control on the bridge.

Figure 5 provides a general typical section for the bridge including dimensions. The bridge will have a 40-foot 4-inch out to out width and a 37-foot 4-inch clear roadway consisting of two 12-foot lanes with 6-foot 8-inch shoulders and Type FC concrete bridge railings.

Figure 5 Buck Creek Bridge Typical Section



4 Project Area

The project area is located in south-central Harrison County on the Mauckport and Laconia 7.5-minute USGS topographic quadrangles (Appendix A Figure 2) in Sections 11, 12, 13, and 14 of Township 5 South, Range 5 East; and Sections 7, 8, 9, 16, 17, and 18 of Township 5 South, Range 4 East. The project area is bounded on the west by SR 135 and on the east by SR 11 and Old Hwy 337. The SR 11 Extension Project will require new right-of-way throughout the entire length, including additional right-of-way from properties along Watson Road, Union Chapel Road, and Melview Road.

4.1 Physiography

The SR 11 Extension Project is located within the Mitchell Plateau of the Southern Hills and Lowlands physiographic region. The Mitchell Karst Plain Section of the Highland Rim Natural Region is described as a relatively level unglaciated plain with sinkholes and caves, although limestone cliffs and rugged hills occur in some areas (Homoya et al. 1985). Indiana's prairie-like barrens and limestone glades are most prevalent within this section. Karst sinkhole swamps are the predominant wetland communities of the region comprised of swamp cottonwood (*Populus heterophylla*), pin oak (*Quercus palustris*), swamp white oak (*Quercus bicolor*), red maple (*Acer rubrum*), and sweetgum (*Liquidambar styraciflua*). Mesophytic forest communities of white oak (*Quercus bicolor*), sugar maple (*Acer saccharum*), shagbark hickory (*Carya ovata*), pignut hickory (*Carya glabra*), and white ash (*Fraxinus americana*) are most common, although drier communities comprised of post oak (*Quercus stellata*), chinquapin oak (*Quercus muhlenbergii*), and blue ash (*Fraxinus quadrangulata*) occur as well.

4.2 Geology and Karst

Bedrock geology of the SR 11 Extension Project area consists of Mississippian age limestone of the Blue River Group (Paoli, Ste. Genevieve, and St. Louis Limestone) and underlying Sanders Group (Salem, Harrodsburg, and Ramp Creek Limestone) which is exposed throughout the Buck Creek valley (Unterreiner 2006). The Sanders Group, as much as 120 feet thick, consists of skeletal limestone, fine-grained limestone, and dolomite with siltstone and shale inclusions. The bedrock plain dips downward (30 feet per mile) from northeast to southwest toward the Ohio River. The Blue River Group is comprised of micritic, skeletal, and oolitic limestone achieving a thickness of 450 feet. Blue River Group limestone is particularly prone to karst

feature development where the bedrock is very shallow. Bedrock topography generally matches surface topography throughout Harrison County and is generally at a depth of 20 to 50 feet in the Mitchell Plateau for the central portion of the county. Elevations in the project area range from approximately 430 feet above mean sea level (MSL) at Buck Creek to over 700 feet west of SR 135 and in the vicinity of Old Hwy 337.

The soluble limestone has resulted in extensive development of karst features including solution valleys, sinkholes, caves, sinking streams, underground drainage, and springs. This is most evident through the central portion of Harrison County through Palmyra, Corydon, and Laconia, including the SR 11 project area. Karst caves in these areas can be up to 15 feet in height, but are more typically only 1 to 5 feet. The limestone is overlain with broken limestone and a thin layer of red clayey soil material (terra rossa) between 20 and 50 feet thick, that was derived from various processes, including residual weathering of limestone.

Due to the fractured nature of the bedrock, local groundwater flow can vary greatly in terms of quantity and direction. Subterranean streams and conduits can extend for great distances and are therefore susceptible to a wide variety of contamination sources from surface and subsurface land uses. Dye tracing conducted in the SR 11 project area indicates that, in general, groundwater east of Buck Creek flows to the west and outlets into Buck Creek. However, water entering sinkhole features in the western portion of the project area is carried to the southwest toward the Ohio River, east of Mauckport, a distance of approximately 5 miles.

The majority of Harrison County, including the SR 11 Extension Project area, is within the Unglaciated Southern Hills and Lowlands unconsolidated aquifer system. Owing to the relatively thin nature of the regolith and windblown silt deposits overlying the bedrock and low permeability, there is very little water resource capacity. In many areas this geologic strata is unsaturated. The Blue River and Sanders Groups Aquifer System is the predominant bedrock aquifer in Harrison County and encompasses the SR 11 Extension Project.

4.3 Buck Creek Watershed

The SR 11 Extension Project action area is located in the southern portion of the Buck Creek 10-digit HUC watershed (0514010402), which encompasses 114 square miles of southern Harrison and a small portion of Floyd counties (Appendix A Map 4). Buck Creek is one of four major tributaries (Blue River, Indian Creek, Buck Creek, and Mosquito Creek) to the Ohio River in Harrison County.

Buck Creek is 29.6 miles in length and flows from the northeast, just east of Lanesville, to the southwest where it discharges into the Ohio River at Mauckport, Indiana. The existing Union Chapel Road Bridge at Buck Creek in the project area is approximately 9.9 miles upstream of the Ohio River and has a drainage area of 99 square miles at the bridge. Forest cover is a predominant land use (45 percent) within the watershed, particularly along Buck Creek and the major contributing tributaries. Elsewhere, where terrain is conducive, pasture land and cultivated cropland comprise nearly 50 percent of the landscape. Appendix B Table 1 summarizes land use within the Buck Creek watershed based on the National Land Cover Database (NLCD).

The entire length of Buck Creek from its headwaters to the confluence with the Ohio River has been designated an Indiana Outstanding River by the Natural Resources Commission as a State Heritage Program Site with outstanding ecological importance. With the exception of occasional bridge crossings, the Buck Creek stream channel has undergone very little alterations (i.e., channelization). However much of the flat narrow floodplain throughout the watershed has been cleared of forest and is cultivated as cropland.

Buck Creek meanders with a moderate degree of sinuosity through a narrow floodplain valley within the project area, where steep valley walls along the outer bends of the stream exhibit 190+ feet of elevation relief. The flat bottom streambed exhibits good pool/glide/riffle/run profile with gravel, cobble, and boulder substrates in higher flow areas with clean sand deposits in lower energy reaches. Because there are few contributing surface water streams of any significance on the adjacent karst plain landscape, Buck Creek is the primary habitat for aquatic macroinvertebrates that serve as a source of prey for bats in the region. Secondary aquatic resources are limited to a few sinking streams, ephemeral channels, and sinkhole ponds.

4.4 Managed Lands Proximity

The IDNR Managed Lands GIS dataset includes a number of public properties and private conservation lands within 10 miles of the project area. The closest of these is an Indiana Forest Bank site on an 18.8-acre tract of land immediately adjacent to Buck Creek and north of Union Chapel Road. The Indiana Forest Bank program is administered and managed through The Nature Conservancy encouraging private landowners to develop sustainable management plans for forest habitat with assistance from foresters, biologists, and botanists. This tract is in part within the preliminary Alternative 1 corridor.

Other managed lands proximal to the SR 11 project area include a tract of the Harrison-Crawford State Forest approximately 1.7 miles west of SR 135, Perseverance Barrens (The Nature Conservancy) approximately 3.0 miles north of Watson Road, South Harrison Park (Harrison County Parks and Recreation Department) approximately 3.0 miles east of SR 11 and Old Hwy 337, and Three-Way Sedge Sinkhole Swamp (The Nature Conservancy) approximately 2.8 miles south of Melview Road. Appendix A Map 5 shows managed land properties within ten miles of the project area. The Nature Conservancy properties are the only tracts located within the Buck Creek watershed.

5 Species of Concern and Critical Habitat

As part of the NEPA phase of the project development, an official endangered/threatened species list was generated for the SR 11 Extension Project action area online through USFWS ECOS-IPaC system, conducted on 14 October 2021 (Appendix C). Bat species of concern identified via the USFWS Early Coordination response dated 27 April 2022 (Appendix D) and the IDNR ER-24108 Early Coordination/Environmental Assessment response dated 6 October 2021 (Appendix E) for the project include:

- Indiana bat (*Myotis sodalis*) - Endangered
- Northern long-eared bat (*Myotis septentrionalis*) – Threatened; proposed Endangered
- Gray bat (*Myotis griscesens*) - Endangered

Critical habitat for the Indiana bat was established by the USFWS on 24 September 1976 (41 FR 41914-41916) includes two caves in Indiana. The SR 11 Extension Project is not within these designated critical habitat areas. However, the western SR 11 Extension intersection with SR 135 is within 2 miles of the 10-mile buffer for the Crawford/Harrison County Priority 1 cave identified as critical habitat. No critical habitat has thus far been identified by USFWS for the northern long-eared bat. There is currently no critical habitat designated for the gray bat within Indiana.

The Indiana bat, northern long-eared bat, and gray bat are each listed as state endangered by the Indiana Department of Natural Resources (IDNR) Division of Fish and Wildlife (Natural Resources Commission 2018, IDNR 2019).

6 Action Area

For the purposes of implementing Section 7 of the Endangered Species Act, the USFWS defines the action area as "all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action (50 CFR §402.02)." Since the purpose of the project is not to provide access to new areas for commercial or residential development, such indirect effects are not anticipated as a result of this action. Direct effects from the action are largely confined to the right-of-way footprint for the new highway alignment and realignment of local roads for access to the new highway. However, since the bat species of concern are highly mobile and make frequent use of streams, trails, and woodland edges as flyways and foraging areas, fragmentation of these corridors can have affects to the viability of the species habitat beyond the roadway footprint. Additionally, noise and vibration from equipment during construction and vehicle traffic noise from operation of the highway post-construction have the potential to affect suitability of adjacent habitat by bats. While the Indiana bat, northern long-eared bat, and gray bat vary in their summer/winter habitat affinities, their preferred foraging areas, and their foraging ranges, a single action area was developed collectively for the three species instead of a species specific action area for each bat.

For the SR 11 Extension Project, construction noise was used as a means to establish an action area boundary using a standardized methodology. Section 13.1.6 details the methodology used to define the effect space for construction noise anticipated for the SR 11 Extension Project based on the *Technical Guidance for Assessment and Mitigation of the Effects of Traffic Noise and Road Construction Noise on Bats* (West 2016). Using this approach, a uniform buffer distance of 5,000 feet offset from the preferred Alternative 3 centerline was used to define the action area (Appendix A Map 6). Although the terrain within the project area is not flat and the landscape includes a variety of ground cover types (i.e., forest) that can affect sound propagation, these factors are considered negligible in defining the action area for the Indiana bat, northern long-eared bat, and gray bat. In addition to equipment noise propagated through the air, vibration through the limestone from percussive and explosive activities during construction is also of concern for potential impacts to caves potentially used by bats in the vicinity of preferred Alternative 3. It is not expected that notable impacts to suitable bat cave habitats resulting from subsurface vibration would extend beyond the 5,000-foot buffer distance established for construction noise.

Based on the NLCD dataset, relative land use cover within the action area is similar to that for the Buck Creek watershed with pasture/hay/cropland making up 50 percent and the forestland cover type comprising 45 percent. Appendix B Table 2 summarizes land cover within the action area.

7 Species Status

Background habitat, annual life cycle, diet, and threat information for the Indiana bat and northern long-eared bat are provided for reference.

7.1 Indiana Bat

The Indiana bat was first described as a distinct species by Miller and Allen (1928) from a female specimen collected by J. O. Sibert on March 7, 1904, from [redacted] in Crawford County, Indiana. *Myotis* means "mouse ear," while *sodalis* is derived from the Latin word for "companion." The Indiana bat was listed as being in danger of extinction by USFWS under the Endangered Species Preservation Act of 1966 on March 11, 1967 (32 Federal Register [FR] 4001) and was subsequently listed as endangered under the Endangered Species Act of 1973, as amended. Critical habitat consisting of 11 caves (including two caves in Indiana) and two mines was established in 41 FR 41914 on September 24, 1976. A recovery plan was developed for the species in 1983 (USFWS 1983), and a draft revised version was prepared in April 2007 (USFWS 2007).

Range and Distribution

The Indiana bat range includes the eastern United States from Vermont to southern Wisconsin to eastern Oklahoma to northern Florida. USFWS (2007) reports that based on winter 2005 surveys, there were 23 total Priority 1 hibernacula in Illinois (n=1), Indiana (n=7), Kentucky (n=5), Missouri (n=6), New York (n=2), Tennessee (n=1), and West Virginia (n=1). Since then, four additional Priority 1 hibernacula have been designated in Missouri (n=2), Kentucky (n=1), and New York (n=1), bringing the total to 27 (USFWS 2019). USFWS biennial population estimate data from 1981 through 2019 indicate that the population experienced a low of 526,030 in 2001 with an apparent resurgence to 664,637 in 2007 (USFWS 2019). Possibly because of increased mortality resulting from white-nose syndrome (WNS), the population estimate has since declined to 537,297 in 2019. Based on the 2019 Range-wide Population Estimate, Missouri (36 percent), Indiana (34 percent), Illinois (15 percent) and Kentucky (10 percent) provide hibernacula for 95 percent of the population in the winter range.

Thirty-seven priority 1, 2, 3, and 4 hibernacula exist in Indiana (USFWS 2019 and 2007). Indiana populations seemingly increased slightly from estimates of 160,300 in 1965 to 238,068 in 2007; however, estimates before standardized surveys began in 1980 are unreliable (USFWS 2007). From 2007, populations experienced a small decline to 226,572 in 2013 with a larger decline to 180,611 in 2017, followed by a small resurgence up to 184,848 in 2019 (USFWS 2019). Redistribution of local winter populations from one cave to a nearby cave over the span of a few years has been reported in some instances (USFWS 2006 unpublished data as referenced in USFWS 2009).

A total of 269 summer maternity colonies have been documented from 16 states as of 2006, but this is considered to represent only a fraction of those that exist based on winter population estimates and average maternity colony size (USFWS 2007). Maternity colonies appear to be more abundant in the glaciated portions of the upper Midwest than the unglaciated regions of the Midwest or the Mideast portion of the range (USFWS 2007).

Diet

Moths, beetles, midges, flies, wasps, stoneflies, flying ants, caddisflies, brown leafhoppers, treehoppers, lacewings, and weevils (Kiser and Elliott 1996; Murray and Kurta 2002; Whitaker 2004) comprise the majority of the Indiana bat diet.

Winter Hibernation

In southern Indiana, winter hibernation in caves and mines generally occurs as late as November or December to as early as mid-March. Hall (1962) and LaVal and LaVal (1980) report hibernation typically occurs from October to April, while Kurta et al. (1997) and Hicks (2004) extend hibernation from September to May in northern areas including New York, Vermont, and Michigan (USFWS 2007).

In 2005, 30 percent of the population was considered to hibernate in human-made hibernacula (mines, tunnels, dams) (USFWS 2006 unpublished data as referenced in USFWS 2009). Caves used by Indiana bats are well ventilated (they usually have a chimney effect) and store large volumes of cool air with constant temperatures 3°C to 7.2°C (37.4°F to 45°F) (Tuttle and Kennedy 2002). Brack et al. (2003) observed that within Indiana hibernacula the highest concentrations of Indiana bats were found at sites with mid-winter temperatures of 6°C to 7°C (42.8° to 44.6°F). The Indiana bat is very sensitive to temperature changes and typically does not use caves that flood. It prefers caves that have domes, caverns, and diversity in form.

During winter hibernation, some caves support from 20,000 to 50,000 or more bats. Hibernating bats form large, compact clusters with as many as 5,000 individuals, averaging 500 to 1,000 bats per cluster (USFWS 2004). Pennsylvania Natural Heritage Program (PNHP 2007) reported clusters with 2,690 bats per square meter (250 bats per square foot) (PNHP 2007), while the New York Department of Environmental Conservation (New York Department of Environmental Conservation undated) reported more than 3,230 bats per square meter (300 bats per square foot). Several researchers have noted an inverse relationship between ambient roost temperature and the size of hibernating clusters (Clawson et al. 1980; Brack et al. 1984) as reported by USFWS (2007).

Bats go into deep hibernation (torpor) in winter, but have the ability to arouse very quickly which might be an adaptive mechanism for survival. During the hibernation period, bats arouse about once every two weeks and stay aroused for a short time period of one to two hours (Reeder et al. 2012). Cumulative arousals throughout hibernation cause much of their stored fat energy to be metabolized and not available for use in the spring. The function of the arousal is not known for sure, but it might be to drink, to exercise, or to expel waste products. However, the purpose of arousal is not to feed.

Disturbances in the winter can be deleterious. Awakening these bats can deplete their fat reserves. For this reason, gates at the entrance or fences around these caves have been used as conservation measures. When huddled together (clustered), individuals on the perimeter of the group are more susceptible to freezing than those in the middle of the mass.

Spring Staging

Spring staging generally occurs from mid-March to mid-May when males and females emerge from caves. They are hungry and thin after three to four or more months of hibernation.

Indiana bats feed and congregate around these caves before migrating to their summer homes. Males usually stay near the hibernacula but might leave the area entirely (USFWS 2007). Indiana bats have been found to migrate 64 to 80 kilometers (40 to 50 miles) a day with total distances of several hundred kilometers. One female released in southeastern New York moved 56 kilometers (35 miles) in approximately 85 minutes (Sanders et al. 2001), while one female bat released from Canoe Creek Mine in Pennsylvania traveled approximately 96 kilometers (60 miles) in one evening (Butchkoski and Turner 2005). Twelve female Indiana bats from maternity colonies in Michigan migrated an average of 476 kilometers (296 miles) to their hibernacula in Indiana and Kentucky, with a maximum migration of 574 kilometers (357 miles) (Winhold and Kurta 2006). Females usually migrate farther than males.

The females (as in other bat species) show delayed fertilization; that is, they mate with males in the fall and store sperm alive in pouches connected to the uterus. Upon an egg moving down into the uterus, sperm is discharged from these pockets and fertilizes the egg. The fertilized egg (embryo) then implants itself into the uterus. When females leave the cave, they are pregnant and prepared to start a new generation in their summer woodland habitat.

Summer Habitat

Indiana bats occupy summer habitat from mid-May to mid-August. Females and males arrive at their summer habitat in May. Summer roosting sites include primarily dead trees with cavities and/or exfoliating bark or living trees with shaggy bark (for example, shagbark hickory). Larger trees are usually preferred over smaller trees because they provide an ample amount of solar radiation and protection from the wind and rain. Numerous studies indicate that Indiana bats exhibit site fidelity to their traditional summer maternity areas (Callahan et al. 1997; Gardner, Garner, and Hofmann 1991a, 1991b; Gardner, Hofmann, and Garner 1996; Humphrey et al. 1977; Whitaker and Sparks 2003; Whitaker et al. 2004).

Nursery colonies often use several roost trees. Roost trees may be primary roost trees (emergence count ≥ 30 bats) or alternate roost trees (emergence count < 30 bats). Ideal primary roost trees are large trees with sloughing bark exposed to the sun where they secure themselves under the bark, in crevices or cavities during the day. At night, they are actively feeding on insects and use the undersides of bridges on occasion as night roosts (Kiser et al. 2002). Cervone et al. (2016) found Indiana bats roosting below a bridge during the day and night. The majority of summer maternity colonies use large dead or live trees near major streams in both bottomland and upland areas.

A maternity colony can vary greatly in size (USFWS 2007), but typically consists of 25 to 325 adult females, averaging 80 adult females (Whitaker and Brack 2002). Although most documented maternity colonies contained 100 or fewer adult females (Harvey 2002), as many as 384 bats have been reported emerging from one maternity roost tree in Indiana (Whitaker and Brack 2002).

Young are born between late June and early July. This process is called parturition, and the adult females lactate (produce milk) at that time. Females do not carry the young unless they need to move them and, under such conditions, they will carry them on their abdomen. The young become volant (able to fly) between early July and early August, at which time the adult females become non-reproductive. Most young are volant by mid-July. Males might form bachelor colonies during the summer.

Fall Swarming

Fall swarming generally occurs mid-August to November. With the onset of fall and cooler temperatures, males return to the caves. They are at the entrances to the caves when the females and young arrive. Males then mate with females. Swarming is a milling of the bats around and out of the cave entrance. It might have several functions, but one seems to be to bring the sexes together for mating. It is not known whether juvenile females mate their first autumn. Limited mating might occur in the spring and in the cave during winter (Hall 1962).

Members of both sexes feed and gain weight through the fall, thus putting on fat (energy) needed to help them through hibernation. LaVal and LaVal (1980) found females to reach maximum weight in early October, while the males reached maximum weight in late October. The males follow the females into hibernation, and both sexes stay in the cave when outside temperatures trend towards freezing.

Threats

Human disturbances at winter hibernacula, summer and winter habitat loss, wind farm fatalities, and WNS are known threats to the species and chief factors for population declines. However, in recent years, WNS and wind farms have been considered the primary causes of death for Indiana bats (Boyles et al. 2011).

WNS is a disease caused by the cold-loving fungus, *Pseudogymnoascus destructans* (formerly called *Geomyces destructans*), that affects bats during winter hibernation. Since first reported in New York in 2006, the USFWS estimates that at least 5.7 million to 6.7 million bats have died from WNS (USFWS 2012). The disease originally spread south along the Appalachian Mountains, north into Canada and southwest into Tennessee, Missouri, and Iowa. WNS was first reported in Indiana in January 2011.

Once embedded into the epidermis, the fungus causes open sores (lesions) in the epidermis and dermis in especially bare areas like the nose, forearms, and wings. If the bat survives, such lesions heal as scars. The fungus grows in temperatures around 4°C to 20°C (39.2°F to 68.0°F) (Chaturvedi et al. 2010). The upper critical temperature for growth is between 19°C and 19.8°C (66.2°F and 67.6°F). At temperatures above 12°C (53.6°F) the fungus undergoes modification of arthrospores and chlamydospores that can facilitate enhance persistence of the fungus; however, warmer temperatures generally decrease overall reproductive capacity (Verant et al. 2012).

Bats usually come into hibernation with extra grams of fat, the majority of which is used in arousals. The remaining grams of fat are needed to sustain bats through the duration of hibernation. Fungal lesions caused by the fungus cause the bat to become more active and waste critical energy reserves. When this happens, bats might leave the cave in winter in search of food, and ultimately die in or out of the cave from starvation.

Wind farms (becoming more prevalent in the landscape) are also reported to kill many bats. Most such losses affect bats that migrate long distances, such as the hoary bat (*Lasiurus cinereus*), eastern red bat (*Lasiurus borealis*), and silver-haired bat (*Lasionycteris noctivagans*). However, an Indiana bat was killed at a wind farm in Benton County, Indiana, circa September 2009 (Johnson et al. 2010).

The population may also be declining because of pesticide use, possibly through bioaccumulation from eating contaminated insects, drinking contaminated water or direct absorption of the chemicals while feeding in areas that have recently been treated (Mohr 1953; Schmidt et al. 2002; USFWS 2006, 2007).

7.2 Northern Long-eared Bat

The northern long-eared bat was first recognized as a distinct species instead of a subspecies of Keen's long-eared myotis (*Myotis keenii*) by van Zyll de Jong (1985) in 1979 based on geographic separation and morphological characteristics (78 FR 61051). On 2 October 2013, the USFWS published a proposed rule (78 FR 61046) to list the northern long-eared bat as endangered. Subsequently, a proposed species-specific rule under Section 4(d) of the Act was published on 15 January 2015 (80 FR 2371) to list the species as threatened. On 2 April 2015, the USFWS published the final rule listing the species as threatened with an Interim 4(d) Rule (80 FR 17974). The listing became effective on 4 May 2015. On 23 March 2022, the USFWS published a proposed rule (87 FR 16442) to list the species as endangered, thus removing the current 4(d) rule for the species. The change in listing is anticipated to occur by 30 December 2022; therefore, the new endangered status would be applicable to the SR 11 Extension Project.

Range and Distribution

The northern long-eared bat range includes the eastern and north-central United States and all Canadian provinces west to the southern Yukon Territory and eastern British Columbia. In the United States, it includes 39 states from Maine west to Montana, south to eastern Kansas, eastern Oklahoma, Arkansas, and east to northern Florida. It was more commonly observed in the northeastern portion of its U.S. range than in the southern and western regions (Amelon and Burhans 2006; Caceres and Barclay 2000). Within this range, more than 780 hibernacula have been identified in 27 states, more than 60 percent of which are in Pennsylvania, Missouri, West Virginia, Michigan, and Kentucky (Whitaker and Hamilton 1998). The April 2, 2015 final listing rule and interim 4(d) rule indicated that there were 25 known hibernacula for the northern long-eared bat in Indiana (USFWS 2015). Subsequently, the January 5, 2016 Programmatic Biological Opinion on Final 4(d) Rule revised this figure to 69 Indiana hibernacula (USFWS 2016). As of the date of this report, USFWS unpublished data indicates that there are 93 caves being used as winter hibernacula for the northern long-eared bat.

The U.S. range has been divided into four populations (eastern, Midwest, southern, and western), although these are not considered isolated populations from each other (78 FR 61052). It is less common in the southern and western portions of the range, but is fairly common in the Midwest population area (Illinois, Indiana, Iowa, Michigan, Minnesota, Missouri, Ohio, and Wisconsin). Although Indiana has fewer known hibernacula than most of the other states that make up the Midwest population, the northern long-eared bat has historically been considered the fourth or fifth most abundant species statewide and the most frequently captured at mine entrances.

USFWS compared captures of a three-year survey conducted in northern Indiana (King 1993) and a three-summer survey in south-central Indiana (Sheets et al. 2013). In the former, only four percent of the captures were northern long-eared bats, versus 38 percent in the latter. These results suggest that habitat abundance or other environmental conditions are more

favorable in the southern portion of the state. Range-wide or Indiana population estimates have not been generated by USFWS.

Diet

The northern long-eared bat has a diverse diet including moths, flies, leafhoppers, caddisflies, spiders, and beetles, with diet composition differing geographically and seasonally (Brack and Whitaker 2001). The most common insects found in the diets of northern long-eared bats are moths and beetles (Brack and Whitaker 2001; Feldhamer et al. 2009), with spiders also being a common prey item (Feldhamer et al. 2009). Foraging techniques include hawking (catching insects in flight) and gleaning (picking insects off stationary features such as leaves or branches) in conjunction with passive acoustic cues (Nagorsen and Brigham 1993; Ratcliffe and Dawson 2003). Gleaning allows this species to gain a foraging advantage for preying on moths because moths are less able to detect high-frequency echolocation calls (Faure et al. 1993). Spiders, other non-flying insects, and green plant material, have also been present in their feces, which suggests considerable gleaning behavior.

Winter Hibernation

Caves and mines are used by the northern long-eared bat in winter. Hibernacula used are typically large, with large passages and entrances, relatively constant and cooler temperatures, high humidity, and no air currents. The sites favored by them are often in very high-humidity areas, to such a large degree that droplets of water are often observed on their fur. They are typically found roosting in small crevices or cracks in cave or mine walls and can often be overlooked in surveys. To a lesser extent, they have been found overwintering in habitats that resemble caves or mines, habitats such as abandoned railroad tunnels and storm sewers (Goehring 1954), hydroelectric dams (Kurta and Teramino 1994), aqueducts (French 2012), or other “unsuspected retreats” where caves and mines are not present.
Northern long-eared bats have shown a high degree of philopatry (using the same site multiple years) for a hibernaculum. Other species in Indiana that commonly occupy the same hibernacula with the northern long-eared bat are the little brown bat (*Myotis lucifigus*), big brown bat (*Eptesicus fuscus*), tri-colored bat (*Perimyotis subflavus*), and Indiana bat. Northern long-eared bats often move between hibernacula throughout the winter, which may further decrease population estimates. Similarly, this species has been found to fly in and out of some of the mines and caves in southern Indiana throughout the winter (Whitaker and Mumford 2009).

Spring Staging

Both males and females emerge from caves and mines in spring. Northern long-eared bats exhibit significant weight loss during hibernation. One Indiana study showed a 41 to 43 percent loss (Whitaker and Hamilton 1998). During staging, northern long-eared bats are flying in and out of caves to feed and congregate before migrating to their summer homes.

The northern long-eared bat is not considered a long-distance migratory species. Short migratory movements between summer roost and winter hibernacula are typically between 56 to 88 kilometers (35 to 55 miles) (Griffin 1945; Nagorsen and Brigham 1993). However, movements may range from 8 to 270 kilometers (5 to 168 miles) (Griffin 1945).

When females leave the cave, they are pregnant and ready to start a new generation in their summer woodland habitat. Gestation is approximately 60 days (van Zyll de Jong 1985). Males are reproductively inactive until late July, with testes descending in most males during August and September (Amelon and Burhans 2006; Caire et al. 1979).

Summer Habitat

During the summer, northern long-eared bats typically roost singly or in colonies underneath bark or in cavities or crevices of both live trees and snags. Males and non-reproductive females' summer roost sites may also include cooler locations, such as caves and mines (Barbour and Davis 1969). They also have been found roosting in human-made structures, such as buildings, barns, a park pavilion, sheds, cabins, under eaves of buildings, behind window shutters, and in bat houses (Amelon and Burhans 2006; Barbour and Davis 1969; Cope and Humphrey 1972; Kath, personal communication, April 9, 2013; Mumford and Cope 1964; Timpone et al. 2010; Whitaker and Mumford 2009) and below bridges (Carter and Feldhamer 2005). This species appears to be somewhat opportunistic in roost selection. Canopy cover at northern long-eared bat roosts has ranged from 56 percent (Timpone et al. 2010) to greater than 84 percent (Lacki and Schwierjohann 2001). Females tend to roost in more open areas than males, likely because of the increased solar radiation, which aids in pup development (Perry and Thill 2007). Roosts are also largely selected below the canopy, which could be attributable to the species' ability to exploit roosts in cluttered environments; their gleaning behavior suggests an ability to easily maneuver around obstacles (Foster and Kurta 1999; Menzel et al. 2002).

One study found that northern long-eared bats roost more often on upper and middle slopes than on lower slopes, suggesting a preference for higher elevations because of increased solar heating (Lacki and Schwierjohann 2001). Northern long-eared bats switch roosts often (Sasse and Pekins 1996), typically every two to three days (Carter and Feldhamer 2005; Foster and Kurta 1999; Owen et al. 2002; Timpone et al. 2010). Reasons for switching might be temperature, precipitation, predation, parasitism, and ephemeral roost sites (Carter and Feldhamer 2005). They have also been found roosting below bridges in Illinois (Feldhamer et al. 2003).

The northern long-eared bat is comparable to the Indiana bat in terms of summer roost selection, but appears to be more opportunistic (Carter and Feldhamer 2005; Timpone et al. 2010). A small amount of overlap in roost selection might occur between these two species (Foster and Kurta 1999; Timpone et al. 2010). Maternity colonies, consisting of females and young, are generally small, numbering from about 30 (Whitaker and Mumford 2009) to 60 individuals (Caceres and Barclay 2000). Adult females give birth to a single pup. Birth likely occurs in late May or early June (Caire et al. 1979; Easterla 1968; Whitaker and Mumford 2009) but can occur as late as July (Whitaker and Mumford 2009). Juveniles are volant within 21 days of birth (Krochmal and Sparks 2007; Kunz 1971). Adult longevity is estimated to be up to 18.5 years (Hall et al. 1957), with the greatest recorded age of 19 years (Kurta 1995).

Emerging at dusk, most foraging occurs above the understory, 0.9 to 3.0 meters (three to ten feet) above the ground, but under the canopy (Nagorsen and Brigham 1993) on forested hillsides and ridges, rather than along riparian areas (Brack and Whitaker 2001; LaVal et al.

1977). This coincides with data indicating that mature forests are important habitat for foraging in this species (Caceres and Pybus 1997).

Fall Swarming

With the onset of fall and cooler temperatures, males return to the caves. They are at the entrances when females and young arrive. Elevated hormone levels trigger males to mate with females. Hibernating females store sperm until spring, exhibiting delayed fertilization (amphigonia retardata). Swarming might have several functions, but one seems to be to bring the sexes together for mating. Members of both sexes feed and gain weight through the fall, thus putting on fat (energy) to help them survive hibernation. It is unknown whether juvenile females mate their first autumn. Limited mating might occur in the cave in winter and might even occur in the spring. When temperatures are 10°C (50°F) or less, the bats start to stay inside caves.

Threats

Threats to the northern long-eared bat are generally the same as those described for the Indiana bat. However, no threat is considered as severe and immediate to the northern long-eared bat's persistence as WNS. Habitat loss continues to be a contributing factor and a limiting factor in its potential for recovery. The species was relatively common in Indiana prior to the arrival and spread of WNS to the state circa 2011.

7.3 Gray Bat

On April 21, 1975, the USFWS proposed listing the gray bat as endangered or threatened under the Endangered Species Act (USFWS 1975). On April 28, 1976, the gray bat was listed as endangered (USFWS 1976). A 5-year review of the gray bat was published on March 30, 2006 (USFWS 2006). The species was designated as state endangered by the IDNR in the second amendment of the NRC roster listing May 1, 1992 (Natural Resource Commission 1992, IDNR 2020).

Range and Distribution

Gray bat distribution extends as far north as southern Indiana (Brack et al. 1984), as far west as southeastern Kansas (Choate and Decher 1996), and as far east as western North Carolina and Virginia (Decher and Choate 1995). Because it is nearly an exclusive cave-dwelling species, the gray bat is most abundant in the karst regions of Missouri, Arkansas, Kentucky, Tennessee, and Alabama (Barbour and Davis 1969). The species is also a well-known migrant and occasionally occurs many miles outside its normal range (Stihler and Brack 1992, Tuttle et al. 2005). In Indiana, spring, summer, and fall capture data are largely confined to the Ohio River border counties of Spencer, Perry, Crawford, Harrison, Floyd, and Clark, with additional older records in Lawrence and Jennings counties. More recently known exceptions include gray bat summer captures in Morgan and Marion counties within central Indiana. Acoustic call data also suggest possible presence elsewhere in southern Indiana.

Spring Migration

Male gray bats emerge from winter hibernation in early March and begin migration to summer habitat with females following shortly thereafter in late March. During the migration between winter and summer caves, gray bats stop at well-defined sites known as transient

caves through April. By mid-May females have moved to maternity caves and males to bachelor roosts. Gray bats of all ages and sexes occur at both the maternity and transient caves in July and August, marking the swarming stage of the annual cycle. Migration to winter hibernacula from summer roosts begins in August and lasts through early November (Missouri Department of Conservation 2000). Mating occurs soon after adults arrive at the hibernaculum. Females begin hibernation immediately afterward, while males and juveniles will remain active for an additional several weeks. By the beginning of November, all bats are usually hibernating.

Winter Hibernacula and Summer Caves

Gray bats utilize different caves for both winter hibernation and summer roosting, although some gray bats are also known to use storm sewers (Harvey and McDaniel 1988, Decher and Choate 1995), bridges (Johnson et al. 2002, Cervone and Yeager 2016), quarries, mines (Brack et al. 1984), and other man-made buildings and tunnels (Elder and Gunier 1978, Evans and Drilling 1992, Missouri Department of Conservation 2016). Gray bats are philopatric to their same hibernacula, summer caves, and even migratory stop-over sites each year (LaVal and LaVal 1980). Gray bat hibernacula are often vertical caves with domed rooms where cold air enters and then gets trapped. Temperatures within these areas typically range between 6.1°C to 11.1°C (43°F to 52°F) (Tuttle 1976a; 1979). Gray bats form large, irregular clusters and have a distinctive loose armed position. In summer, females and pups form maternity colonies in caves with subterranean water sources and domed ceilings capable of trapping warm air with temperatures between 13.9°C to 26.1°C (57°F to 79°F) (Tuttle 1976a). Maternity colonies are often within 0.6 to 2.5 miles of surface water sources (Tuttle 1976b, USFWS 1997c). Male gray bats form bachelor colonies in the summer, though many do not roost separately until females give birth to a single pup in late May or early June (USFWS 1982).

Foraging and Diet

Foraging habitat for the gray bat typically includes streams, lakes, or wetland features, where gray bats can forage for aquatic and terrestrial flying insects (Tuttle 1976b, LaVal et al. 1977, USFWS 1982, Clawson and Titus 1992, Best and Hudson 1996, Missouri Department of Conservation 2000). Specific macro-habitat characteristics of waterways and adjacent areas may vary in importance among different gray bat colonies (Moore et al. 2017). Forest areas surrounding caves, and flyways are also important foraging habitat for gray bats (Tuttle 1979), particularly juveniles (Brack and LaVal 2006). Individual gray bats may travel 12 to 21 miles to forage, depending on available habitat and colony size (LaVal and LaVal 1980). However, increased distances to foraging areas may lead to a decreased rate of growth by the pups (Tuttle 1976a). Gray bats commonly prey on caddisflies (Trichoptera), beetles (Coleoptera), and moths (Lepidoptera), and to a lesser extent stone flies (Plecoptera), may flies (Ephemeropta), and true flies (Diptera) (Brack and LaVal 2006).

Threats

Gray bats were initially listed as endangered because of their sensitivity to disturbance, which may lead them to abandon caves or move to areas that provide protection, but also lower quality microhabitats (Tuttle 1975; 1979). As with other Myotis bat species, the gray bat is also susceptible to WNS infection. Additional threats to populations include adverse modification of caves, disturbance of bats in the caves, impoundment of waterways, chemical

contamination, and climate change (USFWS 2009b). Reduction in insect prey through deforestation in foraging areas has the potential to affect gray bat populations. Flooding of caves used by gray bats resulting from waterway impoundments (USFWS 1982) can have adverse effects on roosting habitat, and organochloride pesticides have been cited as having adverse biological effects (Geluso et al. 1976, Clark et al. 1978).

8 USFWS and IDNR Species Accounts

As noted in the previous section, the Indiana bat, northern long-eared bat, and gray bat were identified as species of potential occurrence through coordination with USFWS and IDNR (Appendices C, D, and E). Indiana bat, northern long-eared bat, and gray bat occurrence information evaluated for the SR 11 Extension Project was obtained from USFWS Bloomington Field Office via a data sharing agreement executed on 10 January 2020. Similarly, current IDNR occurrence information from the Indiana Natural Heritage Data Center was obtained through a data sharing agreement executed May 2019.

8.1 Indiana Bat

Appendix A Map 7 includes generalized mapping of Indiana bat occurrence data from the USFWS and IDNR. Data is mapped to the Section level of the Public Land Survey System (PLSS) grid. There are multiple USFWS and IDNR Indiana bat summer capture and winter observation records within ten miles of the action area. Summer captures include multiple adult male mist net records from 2004 within the Harrison-Crawford State Forest to the northwest of the SR 11 action area. There are also several hibernacula documented for the Indiana bat within ten miles.

- Priority 1 cave ([redacted]) within Cold Friday Hollow has 2019 Indiana bat documented winter presence located approximately 7.2 miles to the northwest of the SR 11 project.
- Priority 2 cave ([redacted]) within the Harrison-Crawford State Forest has 2009 Indiana bat documented presence located approximately 9.4 miles to the northwest of the SR 11 project.
- Priority 2 cave ([redacted]) near the southern tip of Harrison County has 2019 Indiana bat documented presence located approximately 6.8 miles to the southwest of the SR 11 project.
- Priority 3 cave (unnamed) within an unnamed drainage of Indian Creek with 2018 Indiana bat presence is located approximately 8.1 miles to the north of the SR 11 project.
- Priority 3 cave ([redacted]) in the karst plain south of Corydon with 2016 Indiana bat presence is located approximately 7.4 miles north of the SR 11 project.

[redacted] and [redacted], both notable Priority 1 Indiana bat hibernacula, are greater than 10 miles from the SR11 project. The USFWS dataset does not include any Indiana bat roost trees within 10 miles of the SR 11 project. This is most likely attributed to the lack of radio-telemetry tracking conducted within this portion of southern Indiana.

8.2 Northern Long-eared Bat

Appendix A Map 8 includes generalized mapping of northern long-eared bat occurrence data from the USFWS and IDNR. Data is mapped to the Section level of the Public Land Survey System (PLSS) grid. There are multiple USFWS and IDNR northern long-eared bat summer capture and winter observation records within ten miles of the SR 11 project. Summer mist net capture records include the same locations within Harrison-Crawford State Forest where Indiana bats were recorded. Additionally, the USFWS dataset has 1992 and 1998 records within Buck Creek to the south of the SR 11 project in the vicinity of [redacted], and a single 1992 adult male capture within the Mosquito Creek drainage in the extreme southern part of Harrison County. As with the Indiana bat, there are also winter hibernacula records for the northern long-eared bat in [redacted], [redacted], unnamed cave, [redacted], and [redacted].

[redacted] and [redacted], known hibernacula for the northern long-eared bat, are greater than 10 miles from the SR11 project. The USFWS dataset does not include any northern long-eared bat roost trees within 10 miles of the SR 11 project. The lack of northern long-eared bat roost data statewide is primarily attributed to its more recent listing (2015) as threatened, prior to which radio telemetry tracking was not required as part of presence/probable absence surveys.

8.3 Gray Bat

Appendix A Map 9 includes generalized mapping of gray bat occurrence data from the USFWS and IDNR. Data is mapped to the Section level of the Public Land Survey System (PLSS) grid. USFWS and IDNR data include gray bat summer capture and winter observation records at two general locations within ten miles of the SR 11 project. A 1993 winter hibernacula record at [redacted] within the Harrison-Crawford State Forest is approximately 7.2 miles to the northwest. Additionally, the gray bat was documented on Buck Creek in the summer of 1998 in the vicinity of [redacted]. Recently, new gray bat summer and winter occurrence data in Harrison County has been generated from field investigations; however, this location information is currently not available through the Indiana Natural Heritage Data Center.

9 Presence / Probable Absence Determination

In consideration of existing USFWS and IDNR summer and winter hibernacula records for the Indiana bat, northern long-eared bat, and gray bat in southern Harrison County, the abundance of suitable bat habitat within the karst terrain of the project area, and the SR 11 NEPA / letting schedule, each bat species is **"presumed present"** within the project area. Therefore, a summer presence/probable absence survey via mist netting or acoustic monitoring was not conducted along flyways in accordance with Phase 2 of the *Range-Wide Indiana Bat and Northern Long-Eared Bat Survey Guidelines* (USFWS 2022). Additionally, there were no harp trapping surveys conducted at local caves in the project area to ascertain summer or winter occupancy by the three bat species.

Based on USFWS/IDNR occurrence records and observations from the habitat assessment and potential roost inventory conducted for the Indiana bat and northern long-eared bat, it is concluded that summer habitat, including possible maternity use, is present and there are multiple flyways and foraging areas for both species within the action area. Therefore, presumed presence assumptions include:

1. Indiana bats and northern long-eared bats have established a maternity colony within the action area.
2. Indiana bats and northern long-eared bats travel and forage along Buck Creek, associated tributaries, trails, and utility corridors.
3. Indiana bats and northern long-eared bats hibernate in at least one of the caves within the action area.

The gray bat is most often perceived as a summer resident of southeastern Indiana, namely the Sellerburg area. However, there are multiple occurrence records elsewhere in Indiana including Harrison and Crawford counties. USFWS/IDNR data indicate that [redacted] and [redacted] have previously served as summer habitat and possibly winter hibernacula. A recent study/survey of gray bats in Indiana commissioned by the IDNR has generated additional data on gray bat distribution and seasonal occupancy within Indiana, including southern Harrison County (published data expected in September 2022). While [redacted] and [redacted] are approximately 8 miles and 12 miles from the SR 11 project, respectively, USFWS also has summer capture data from 1998 on Buck Creek in the vicinity of [redacted] to the south of the SR 11 Extension Project. This presence raises the question as to what extent (spatially and temporally) the gray bat is active and uses the Buck Creek watershed for summer and/or winter activities. Because many of the smaller caves within this watershed have never been investigated for summer/winter bat use, it remains unknown as to if the species historically or currently uses these karst features; or alternatively, does Buck Creek only serve as foraging habitat for bats roosting elsewhere in the region during the summer. Based on known distribution in southern Harrison, Crawford, and Floyd counties, gray bats are more likely using caves within the more heavily forested landscape of the Blue River (Crawford County), Potato Run and Cold Friday Hollow (southwest Harrison County), Knobs Creek (Floyd County), and possibly the Mosquito Creek (southeast Harrison County) watersheds as summer or winter habitat. Therefore, it is believed that the more sparsely and fragmented forestland within the Buck Creek sinkhole plain habitat is used by gray bats for foraging. This conclusion is substantiated by the 1998 gray bat capture data on Buck Creek near [redacted]. Based on this presumption, gray bats might be accessing Buck Creek from caves to the northwest or southeast (Mosquito Creek watershed) via the Ohio River. It is also considered plausible that foraging presence of gray bats in Buck Creek may originate from resident bats south of the Ohio River in Mead County, Kentucky. From this assessment, presumed presence assumptions for the gray bat include:

1. Gray bats travel and forage along Buck Creek through the action area.
2. Gray bats may, but not likely, use at least one of the caves within the action area for summer roosting.

10 Field Investigations

Various field investigations related to Indiana bat, northern long-eared bat, and gray bat habitat and karst feature identification have been conducted for the SR 11 project. Figure 6 summarizes activities conducted on each of these dates.

Figure 6 Bat habitat assessment chronology for SR 11 Extension Project

Date	Summary of Activity
24 February 2021 to 30 May 2021	Lochmueller Group geologists conducted field work to identify and characterize all karst features within an 821 acre survey area for the preliminary alternatives
22 April 2021	Lochmueller Group biologists examined all culverts along Watson Road, Union Chapel Road, Melview Road, and private access roads.
4, 9 November 2021 12 January 2022	Hydrogeology, Inc. conducted dye tracing study to determine underground karst flow patterns from sinkholes and sinking streams to springs and caves.
1 April 2022	Lochmueller Group biologists evaluated Union Chapel Bridge at Buck Creek for bat habitat
1 April 2022 27 April 2022	Lochmueller Group biologists sampled background sound levels within representative habitat areas throughout the project area.
22-23 April 2021 5-8 May 2021 1,27,29 April 2022	Lochmueller Group biologists conducted field investigation to evaluate woodland bat habitat for areas covering all preliminary alternatives.
29 April 2022	Lochmueller Group biologist and geologist investigated entrances to Newton Cave and Watson Spring Cave.

10.1 Union Chapel Road Bridge Evaluation and Buck Creek Watershed Bridges

The Union Chapel Road Bridge at Buck Creek is one of six public bridges that spans the stream. This two-span, concrete cast-in-place, continuous slab bridge is located within the bottom of the narrow Buck Creek valley immediately north of the Otterbein Road intersection. The bridge was investigated on 1 April 2022 for bat presence and/or secondary signs of bat occurrence (i.e., guano deposits, staining), but no evidence of bat use was observed. Because the bridge has a cast-in-place continuous slab deck, there are no end bent expansion gaps, narrow seams between box beams, or vertical beam/stringer facades where bats typically roost. Roosting opportunities are limited to the vertical concrete surface of the central pier. Appendix F includes the Bridge/Structure Bat Assessment Form and photos for the Union Chapel Road bridge at Buck Creek.

The remaining Buck Creek bridges were not investigated for bat presence as part of the SR 11 Extension Project, but are inventoried in Appendix Table 3 and presented in Appendix A Map 10. Table 3 includes the asset number, crossing road, bridge type, last inspection date, bat inspection result, and likelihood of bat roosting based on review of available inspection report photos. In addition to the six bridges on Buck Creek, there are eighteen other bridges that span Buck Creek tributaries as inventoried in the INDOT Bridge Inspection Application System (BIAS). The pre-stressed concrete box beam/girder and continuous slab bridges are the most common type within the Buck Creek watershed. Suitability for roosting is heavily dependent upon the availability of seams/gaps at the abutments, expansion seams, and between adjacent box beams. Box beam seams/gaps are often too tight (≤0.25 inch) and bats are denied access. However, in the absence of such cracks and crevices, bats may be found roosting on open face concrete surfaces beneath girder and I-beam bridges. In contrast, the concrete slab decks are generally regarded as having low probability for bat roosting. Understandably, other environmental conditions also factor in determining roost suitability. Examples of these conditions include bridge size, intact associated riparian corridor, feature spanned by bridge (i.e., stream, road), level of disturbance below the bridge, flooding potential, and microclimate wind and heat factors. Based on this desktop review, it is concluded that the Union Chapel Road Bridge does not represent a suitable day or night roost

for bats. However, there are multiple pre-stressed concrete box beam bridges within the Buck Creek watershed that may serve as potential roosts for bats.

10.2 Culvert Bat Presence Survey

A total of 24 culverts within the three alternative corridors were inventoried and investigated for potential bat use (Appendix B Table 4). These included drainage structures under SR 135, Watson Road, Union Chapel Road, Melview Road, Old Hwy 337, and gas well gravel access roads. The majority of these are small (less than 24-inch diameter) corrugated steel or plastic pipes and generally lack potential for bat use. Larger steel pipes under Old Hwy 337, Melview Road, and the gas well gravel access road across a sinking stream are also considered unsuitable for bat roosting. A single concrete box culvert (8-foot by 4-foot) that conveys water from the sinking stream under a gas well gravel access road is not considered favorable for bat roosting based on size and habitat surrounding.

10.3 Woodland Bat Habitat Assessment

The Indiana bat and northern long-eared bat are largely dependent on forest and other areas of tree cover for roosting, foraging, and flyways. Land use throughout the action area is a mosaic of woodland, cropland, pasture, residential property, and miscellaneous green space. Woodland habitat is primarily associated with Buck Creek valley, a large portion of the karst plain east of Buck Creek, and to a lesser extent areas of the karst plain west of Buck Creek. With the exception of small remnant woodland fragments, much of the karst plain beyond the Buck Creek valley has been cleared for cropland/pasture. Woodland habitat within the action area and more specifically in the three Tier 2 alternative corridors varies from clusters of scattered individual trees in residential settings, to narrow linear corridors of trees along road and field edges, to small isolated woodlot fragments, to large expansive woodland tracts greater than 40 acres in size.

Woodland habitat areas within the 400-foot wide alternative corridors were delineated via GIS using recent aerial photographs and field observations. Individual woodland habitat areas were defined based on woodland/field edges, fragmentation from roads and utility easements, and wooded sinkholes. Additionally, clusters of trees in residential settings were aggregated into a single habitat area. Where trees were widely spaced within a habitat area or a single tree was isolated in a field, these individual features were represented with 15-foot radius circles. A habitat assessment was conducted for each woodland unit in accordance with the Phase 1 habitat assessment protocol in the *Range-Wide Indiana Bat and Northern Long-eared Bat Survey Guidelines* (USFWS 2022). In many instances, the woodland habitat feature extends well beyond the alternative corridor limits. In these cases, only that portion of the woodland within the corridor was assessed as a habitat area. Each habitat area was characterized in terms of dominant canopy species, relative cover by age class, and canopy/mid-story/understory cover. Additionally, individual live and dead snag potential bat roost trees were identified and documented for each habitat area in terms of species, diameter, estimated height, stage of decay, and available roosting features (i.e., exfoliating bark, cavities, hollows, crevices). Appendix G includes the Phase 1 Summer Habitat Assessment Forms for each habitat unit evaluated. Appendix H provides representative photographs for each habitat area. Appendix I includes photographs of potential roosts documented.

Based on the results of the assessments, the Indiana bat and northern long-eared bat habitat suitability for each area was classified as either “high”, “moderate”, “low”, or “none”. Habitats considered “high” were generally larger mature forested areas in close proximity to Buck Creek with flight corridors and available live shagbark hickory or dead snag trees for roosting. “Moderate” areas were more fragmented woodlots more distal from Buck Creek, but still exhibited direct contiguous connections to Buck Creek and may or may not have quality roost trees. “Low” potential habitat areas were more heavily fragmented/isolated woodlots, forest edges along Watson Road that lacked quality roost trees, or narrow tree row habitats between fields that likely only serve as flyway edges. Areas designated as “none” were small areas where the tree composition was not suited for Indiana bat or northern long-eared bat use, the understory was far too cluttered for bat movements, linear tree row areas of little potential for foraging, scattered trees in residential and field settings where none of the trees represented potential roost trees, and ornamental tree plantings very close to roads. Although woodland habitat preferences for the Indiana bat and the northern long-eared bat vary slightly (i.e., Indiana bat more open understory, northern long-eared bat more clutter tolerant), no effort was made to rate the suitability of the individual habitat areas separately for each species. In the larger forested habitat areas immediately east and west of Buck Creek, portions of the woods might be more favorable to the northern long-eared bat and vice versa for the Indiana bat.

Construction limits were developed during preliminary engineering based on the alternative centerlines, roadway profile, proposed typical cross section, and surface model. To assess potential impacts to forest habitat, the construction limits for each alternative were buffered by 20 feet to represent the extent of tree clearing anticipated for construction. These limits were used to estimate the acreage of tree clearing at each bat forest habitat area for each proposed alternative. Appendix A Map 11 illustrates the forest impacts for each alternative broken down by bat habitat suitability. Appendix B Table 5 provides a detailed listing of anticipated impacts at each habitat area.

Anticipated forest impacts along Watson Road from SR 135 to Union Chapel Road are the same for each of the three alternatives since they share an alignment for the first 1.8 miles of the project. Along this section of the proposed roadway reconstruction, forest impacts primarily involve clearing of woodland edge habitat immediately adjacent to Watson Road. These involve small tracts of fragmented woods and scattered residential tree clusters, as well as large tracts of woods that extend to the edge of Watson Road. Impacts to trees for the reconfiguration of the SR 11/Old Hwy 11/Old Hwy 337 intersection at the east end of the project are also the same for each alternative and only involve loss of residential parcel trees and roadside tree rows not considered suitable bat habitat.

Therefore, the difference in forest impacts between the three alternatives is due to the variation in the alignments for the 2.5 miles between Union Chapel Road and Melview Road. The largest disparity in forest habitat impacts is the location where each alignment crosses the Buck Creek valley and passes through the extensive forest tract to the east of Buck Creek. Alternative 2 would result in the largest direct loss (19.8 acres) and longest breach (0.8 mile) through this mature high quality forest habitat. Because Alternative 1 would in part traverse through an agricultural field previously cleared of trees on the karst plain east of Buck Creek, impacts to this large contiguous forest tract would be reduced to 9.2 acres over a distance of

0.4 mile. In contrast, Alternative 3 crosses Buck Creek further to the south where agricultural clearing on the karst plain east of the stream is more extensive. As a result, Alternative 3 would only result in the loss of approximately 3.2 acres of this large woodland tract; this includes two bifurcations totaling 0.11 mile in length and the removal of woodland edge habitat along 0.15 mile of an existing gas well access road.

10.4 Karst Feature Inventory and Evaluation

There are a large number of various karst features throughout the project area. Karst geologists surveyed an area of approximately 900 acres that included all of the three preliminary alternative corridors to inventory and characterize karst features within the landscape of the project area. This effort yielded 111 features that were classified as sinkhole, sink point, soil piping, sinking stream, or spring (Appendix A Map 12).

- Sinkhole - A basin or funnel-shaped hollow in limestone, ranging in diameter from a few feet to up to 300 feet and in depth from a few to several hundred feet.
- Sink point - Location where water sinks into the ground, often at the end of a drainage feature that is not classified as a stream. These typically drain portions of broad basins. Often sink points are marked by the accumulation of logs/sticks and organic debris (that may obscure soil piping) over the point where water sinks into the ground.
- Soil piping - A location where water sinking into the subsurface through soil has eroded overlying cohesive clay soil creating a hollow void-pipe into the ground. Soil pipes can occur at the bottom of sinkholes, in large basins, or in flat topography.
- Sinking stream - A surface-flowing stream that disappears underground. These include ephemeral and intermittent streams that may not have been flowing at the time of karst inspection but show clear signs of sinking (sudden loss of channel).
- Spring - Any natural discharge of water from a rock or soil onto the surface of the land or into a body of surface water.

Each of these features were evaluated for their potential to serve as a portal into a potential underground void accessible to bats for summer and/or winter hibernacula use. The sinkholes vary in size and depth and depending on the filtration rate of the overlying soil they can be dry, seasonally wet, or permanently inundated (pond). In nearly all instances, these features do not include a swallet providing access to a larger underground cavity or cave. However, these may serve as a source for seasonal or permanent water and prey valuable to foraging bats. Similarly, none of the sink points or soil piping features identified provided access to underground voids of suitable size for bats to exploit.

A small number of sinking stream points were identified, the most notable of which is the point where the primary surface stream in the eastern portion of the project area disappears into the underlying limestone conduits approximately 1,300 feet south of preferred Alternative 3 (Appendix A Map 12 Sheet 4). This sinking stream basin is a valuable water resource because dye tracing has shown this is likely a major contributing source of water into Watson Spring.

The majority of the springs identified in the karst survey area discharge along or in close proximity to Buck Creek. Two of these features were evaluated for potential bat use based on

descriptions provided by the geologists. The first spring was located on the steep valley slope east of Buck Creek within the Alternative 2 corridor and consisted of a narrow 4 to 6 inch tall crevice in the limestone with moderate water flow and a saturated ceiling. Less than 6 feet into the limestone the horizontal crevice ended and water was carried through the much smaller fractures in the limestone. Due to the small size, limited depth, and degree of wetness, this feature is not considered suitable for bat occupancy.

The second spring is located in the Watson Spring drainage on the east side of Buck Creek between Union Chapel Road and the Alternative 3 corridor. The upper headwaters reach of the Watson Spring valley has multiple spring discharge points. One of these, on the north side of the valley, discharges at the base of the hillslope directly into the stream via an exposed conduit. The remaining spring discharge areas are from exposed limestone fractures that occur on the higher elevation headwater slopes. With the exception of [redacted] (Section 10.5), these springs do not have openings suitable for bat access.

10.5 [redacted] and [redacted] Assessment

[redacted], a commercial tour cave located west of Buck Creek and south of the project area, is not within the SR 11 Extension Project action area. Southern Harrison County cave location data received from the Indiana Cave Survey indicates that there are ten documented caves within the SR 11 Extension Project action area (Appendix B Table 6). Of these, only two are within 0.5 mile of preferred Alternative 3.

[redacted] is located within the extreme headwater reach of [redacted], approximately 0.2 mile from the confluence with Buck Creek. Appendix J includes photographs of the entrance and crawl way. The cave opening is approximately two feet wide and one foot high and is located roughly one-third of the way up the valley slope. From the Indiana Cave Survey (Indiana Cave Survey 2018) and Bloomington Indiana Grotto Newsletter (Bloomington Indiana Grotto 1967) descriptions, a fifteen-foot breakdown crawl leads to the main underground stream passage, which is approximately five feet in height. At approximately 30 feet to the north the passage terminated in breakdown. To the south for a distance of approximately 200 feet, water depth increased and the ceiling became lower, thus preventing advancement without special gear. Based on these descriptions, this small cave feature appears to offer little in the way of suitable summer or winter cave habitat for the Indiana bat, northern long-eared bat or the gray bat due to limited space, lack of airflow, and potential high water conditions.

[redacted] is located on the face of a very steep valley slope a short distance west of Buck Creek. The entrance is approximately 20 foot wide and four foot in height, but is reduced to a tight, wet breakdown crawl space approximately 30 feet from the entrance. Appendix J includes photographs of the entrance and crawl way. From the Indiana Cave Survey description, after about 50 feet, the crawl way opens up to a walking stream passage section, beyond which there are alternating crawl spaces and open rooms, including a deep “bath tub” section. The cave has a six-inch PVC pipe throughout its length and a pump installed through the ceiling of the cave by the landowner to operate a geothermal heating/cooling system for his residence. The landowner periodically enters the cave for maintenance of the geothermal system and indicated that two bats were once observed in the cave during the summer, although the species of bat was not known and date/year not provided. Given its close

proximity to Buck Creek, open room features, and direct observations of bats by the owner in the past, [redacted] is considered to be suitable for bat use. This resource is not considered to be suitable winter hibernacula habitat for either of the three listed species. Nor is it considered probable that it is being used as summer maternity colony habitat for the gray bat. Its potential use is considered to be limited to individual or small groups of non-reproductive bats present within the Buck Creek valley.

11 USFWS Coordination Chronology

Coordination chronology with the USFWS Bloomington Field Office for the SR 11 Extension Project is summarized in Figure 7.

Figure 7 USFWS coordination chronology for the SR 11 Extension Project

Date	Summary of Activity
25 October 2021	Section 7 consultation kick-off meeting
12 April 2022	Early Coordination request sent out to USFWS
12 April 2022	USFWS, INDOT, and Lochmueller Group field visit. Included six field review locations to present the three alternatives under consideration and discuss concerns related to the Indiana bat, northern long-eared bat, and gray bat.
27 April 2022	USFWS Early Coordination response received
12 August 2022	Draft Biological Assessment submitted to USFWS for review
16 September 2022	USFWS provides comments on Draft Biological Assessment
5 October 2022	USFWS provides additional comments on Draft Biological Assessment

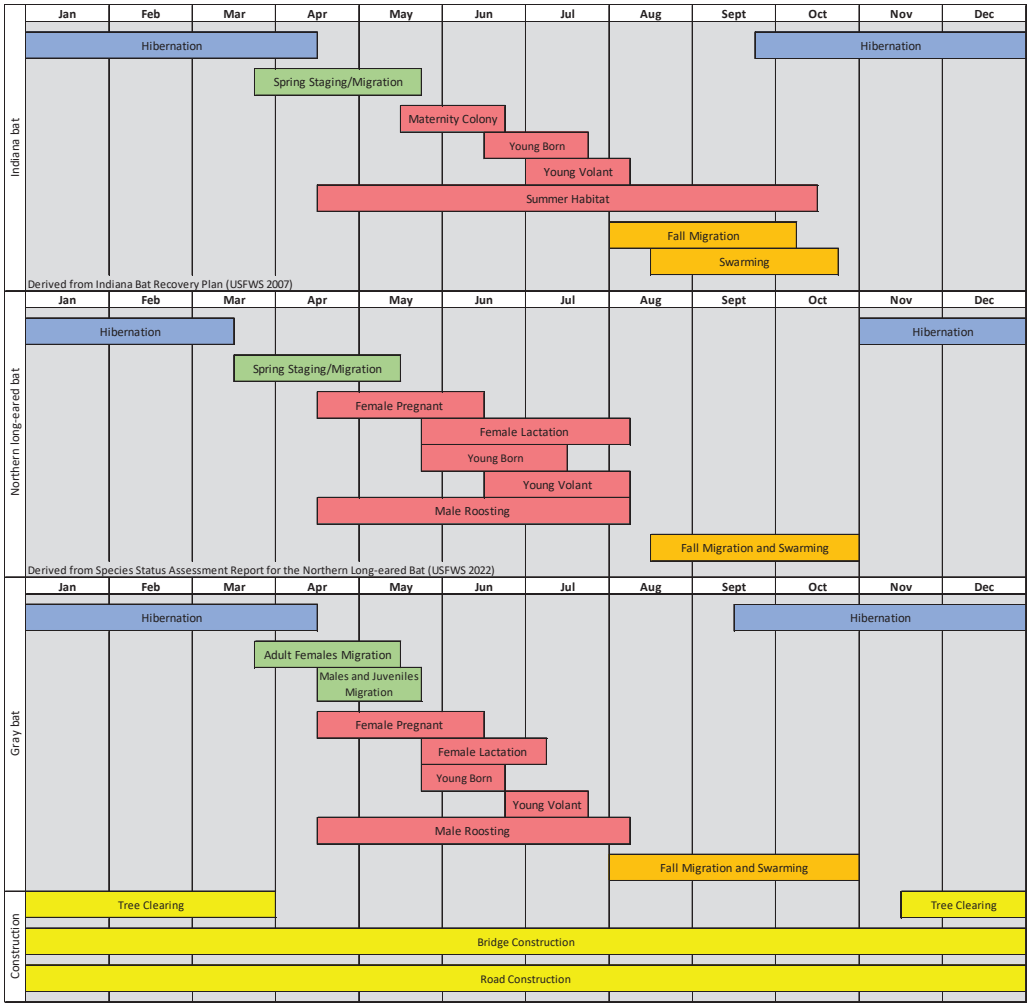
12 Avoidance and Minimization Measures

To reduce and minimize the effects of the SR 11 Extension Project to the Indiana bat, northern long-eared bat, and gray bat, INDOT has developed avoidance and minimization measures (AMMs), as applicable. AMMs applicable to this project will be incorporated into the project design through unique special provisions (USPs) as needed. The early stages of road and bridge plan development precludes the ability to provide specific details on certain AMMs outlined in the biological assessment. In these instances, the AMMs are provided in conceptual form. As design proceeds and more details become available on AMMs (e.g., roadway runoff treatment for karst, bridge drainage design), continuing coordination with the USFWS INFO will be ongoing to keep the Service informed and receive concurrence that the proposed measures will sufficiently address the anticipated impacts of concern.

12.1 Project Timing/Scheduling

Seasonal timing of construction during the fall/winter/spring can be a very beneficial avoidance measure and a primary AMM for road and bridge construction projects since the work can be conducted during a period when Indiana bats, northern long-eared bats, and gray bats are not active in these habitats. However, for large-scale projects such as SR 11, it is impractical to restrict construction of the roadway and bridge entirely to the inactive bat season. Figure 8 provides approximate annual life cycles for the three species relative to anticipated construction periods.

Figure 8 Indiana bat, northern long-eared bat, and gray bat annual life cycles relative to anticipated SR 11 Extension Project construction activities



12.2 Tree Clearing Restrictions

As described in Section 10.3, impacts to forests and the need to clear trees for preferred Alternative 3 is unavoidable. The 19.91 acres of forest/trees to be cleared occurs throughout the entire project area, although the majority of the clearing is within the Buck Creek valley and the upper karst sinkhole plains immediately west and east of the bluffs. To avoid potential impacts to Indiana bat and northern long-eared bat roosting during the summer maternity season and within fall swarming zones associated with P1/P2 caves in Harrison and Crawford counties, an AMM that prohibits tree clearing from 1 April through 15 November shall be incorporated into the project construction contract as a special provision.

12.3 Bridge Inspections, Physical Exclusion, and Acoustic Deterrent Measures

While the SR 11 Extension Project does not involve the demolition and reconstruction of a replacement bridge, construction of a new large bridge across the Buck Creek valley has the potential for bat roosting conflicts. Construction of piers and bridge decks often require the use of false work and forms for pouring concrete. These temporary structures can sometimes create gaps and crevices that bats opportunistically chose to use for day and night roosting. Subsequent removal of such temporary features can result in injury or death of day roosting bats. In an effort to avoid such conflicts, an AMM requiring routine inspections of the bridge for bats during construction shall be incorporated into the project construction contract. In the event that bats are found to be using portions of the bridge for roosting during construction, an AMM to use physical exclusion techniques (Styrofoam sheets, foam backer rolls, expansion foam) to seal off gaps and crevices will be evaluated and implemented if considered appropriate. The use of acoustic deterrent devices for the entire bridge as a preventative measure is considered impractical. However, if bat presence is identified at a specific location under the bridge during construction where physical exclusion techniques would not be effective, the use of an acoustic deterrent or other deterrent technique will be evaluated and implemented if considered appropriate.

12.4 Night Construction

Spoelstra et al. (2017) determined that bats of the *Myotis* genus tended to be light shy and avoid areas where artificial white and green light was present in otherwise dark and undisturbed environments. The SR 11 Extension Project is located in a rural landscape where there are no streetlights along SR 135, Watson Road, Union Chapel Road, Melview Road, SR 11, Old Highway 11, or Old Highway 337. However, there are several locations within the project area where security lights (aka dusk-to-dawn lights) are located on residential properties or farm buildings. This scattered light intrusion is not expected to preclude Indiana bat, northern long-eared bat, and/or gray bat presence within otherwise suitable roosting and foraging habitat for the species.

The majority of the SR 11 construction work is expected to take place during daytime hours and would therefore not require any temporary lighting. However, for particular phases of the construction process (e.g., summertime concrete pours), INDOT and/or the contractor may elect to conduct all or part of a particular construction element at night when temperatures are cooler, thus requiring the use of portable temporary lighting. Buck Creek and the forest habitat within the valley are regarded as the areas of highest quality roosting and foraging habitat for the Indiana bat, northern long-eared bat, and gray bat. Therefore, an AMM that prohibits or limits night construction and the use of temporary lighting during bridge construction within the Buck Creek valley shall be included in the project construction contract.

12.5 Erosion Control

The Indiana bat diet is diverse and consists of moths, beetles, midges, flies, wasps, stoneflies, flying ants, caddisflies, brown leafhoppers, treehoppers, lacewings, and weevils (Kiser and Elliott 1996; Murray and Kurta 2002; Whitaker 2004). The northern long-eared diet is comparable consisting of moths, flies, leafhoppers, caddisflies, spiders, and beetles, although

diet composition differs geographically and seasonally (Brack and Whitaker 2001). The most common insects found in the diets of northern long-eared bats are moths and beetles and to a lesser extent spiders (Brack and Whitaker 2001; Feldhamer et al. 2009). While the diets of these bats are not restricted to a specific insect or group of insects, they are still reliant on an abundant selection of prey. Since a diverse insect community is in part dependent on water chemistry, reduced sedimentation, and structural stream components for habitat (i.e., gravel, cobble, boulders, woody debris, and macrophyte vegetation), bat presence for foraging along a stream is also related to maintaining good water quality. Additionally, bats use standing water in wetland habitats as a direct source of drinking water.

When best management practices (BMPs) for road and bridge construction projects are not properly developed and implemented, these activities can result in temporary and long-term degradation of water quality through increased siltation or introduction of hazardous materials (e.g., fuel, oils, grease, and solvents) into streams and wetlands via on-site spills. Substantial ground disturbance will occur within the Buck Creek valley for bridge construction and throughout the karst plains to the east and west for roadway construction. An erosion control plan sensitive to the unique challenges of protecting karst groundwater will be developed in accordance with INDOT standards and Indiana Department of Environmental Management (IDEM) requirements. The erosion plan will include, but not necessarily be limited to, silt fences, and temporary seed mix to control migration of sediment into Buck Creek, contributing surface water features, and sinkholes. All erosion control measures will be routinely inspected and maintained in good working order throughout the duration of the project.

12.6 Water Quality

Migration of roadway contaminants (e.g. metals, oil, grease, and volatile organic compounds (VOCs), from roadway runoff into Buck Creek and the subterranean drainage system is of particular concern due to the high quality of the Buck Creek aquatic system and the extensive karst development of the project area. To project these water resources during and post-construction, specific AMMs will be incorporated into the design to intercept contaminants leaving the roadway prior to discharge into Buck Creek or the underground karst system. This will include detention basins along the roadway and a system to control drainage runoff from the new Buck Creek Bridge. The bridge design will either eliminate drop drains on the bridge deck directly above Buck Creek, or will capture the bridge runoff within an enclosed drainage system and direct the discharge onto the floodplain to the west of the channel where the runoff water can be filtered via the floodplain soils and vegetation.

13 Impact Assessment

The following effects analysis addresses direct, indirect, and cumulative impacts anticipated for the Indiana bat, northern long-eared bat, and gray bat for the SR 11 Extension Project as described in Section 3.

13.1 Direct Impacts

SR 11 Extension Project potential direct impacts for the Indiana bat, northern long-eared bat, and gray bat are summarized for forest habitat loss, maternity colony affects, flyway/foraging impacts, fall swarming habitat impacts, nighttime/light impacts, water quality impacts,

construction noise impacts, construction vibration impacts, and operation/maintenance impacts.

13.1.1 Direct Take from Tree Clearing

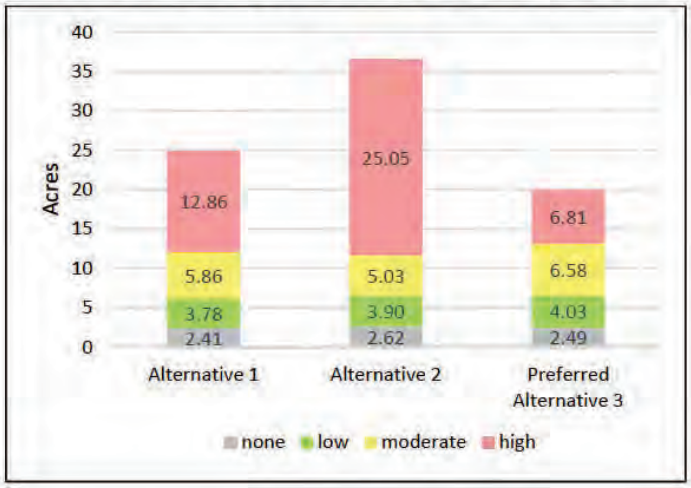
The Indiana bat and northern long-eared bat are nearly exclusive summer tree roosting bat species, whether it be a maternity colony, non-reproductive females, or adult males. Bats day roosting in trees during the spring staging period, summer maternity season, and/or the fall swarming period are at risk of death or injury if trees are felled for road/bridge construction during the active season in forest habitat occupied by bats. Project scheduling of tree clearing during the late fall, winter, and early spring is the most effective AMM that INDOT employs to insure direct take of bats is avoided to the maximum extent practical.

13.1.2 Forest Habitat Impacts

Forest Loss

The loss of forest/tree habitat is unavoidable for the SR 11 Extension Project. Figure 9 illustrates that of the three Tier 2 alternatives, preferred Alternative 3 would result in the least acreage of forest loss (19.91 acres). The field assessments conducted for the forest habitat areas that would be impacted by preferred Alternative 3 concluded that approximately 17.42 acres of the total forest/tree habitat impacted was suitable for Indiana bat and/or northern long-eared bats. Additionally, the forest habitat assessment survey documented a minimum of 98 live trees or dead snags as potential bat roost trees within the 400-foot wide corridor for preferred Alternative 3. Of these, 49 potential bat roost trees are located within the 20-foot buffered preliminary design construction limits. Appendix A Map 11 and Appendix B Table 7 highlight the individual potential roost trees that would be impacted by preferred Alternative 3.

Figure 9 Bat forest habitat impact summary for Tier 2 alternatives



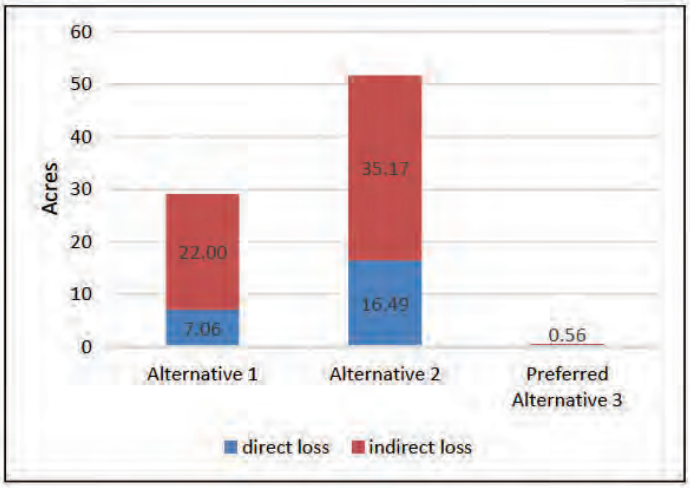
Forest Fragmentation

The majority of the forest/tree impacts resulting from preferred Alternative 3 would involve forest edge habitat associated with small wood lots or large forest tracts that abut existing roads (i.e., Watson Road, Union Chapel Road, Melview Road, and a gravel gas well access road). Appendix A Map 11 shows these locations for preferred Alternative 3. In nearly all instances, tree clearing will occur within 0 to 100 feet of an existing road or to a lesser extent from 100 to 300 feet from a roadway. Forest edge habitat can be a valuable roosting and foraging resource for Indiana bats and northern long-eared bats. With one exception, the preferred Alternative 3 alignment is not expected to generate forest remnants or result in fragmentation that reduces the quality of the remaining woodland. The Buck Creek crossing is the one location where the continuum of riparian and bluff forest habitat will be bifurcated by the alignment as it spans the valley (Appendix A Map 11 Sheet 4). In comparison, this bifurcation is far less than that which would be required for Alternatives 1 and 2.

Core Forest

Core forest habitat can be a valuable resource for wildlife since it is often less likely to be disturbed by invasive species and neighboring land uses (i.e., row crops, pasture, residential, industrial, etc.). However, for the Indiana bat and the northern long-eared bat, core forest is not necessarily a priority requirement for foraging, roosting, and maternity colony establishment. Many times, quality maternity trees with high occupancy are located along or very near the edge of forest tracts and not deep within the interior of the forest. For the purposes of the SR 11 Extension Project, core forest is defined as interior woodland habitat that is 328 feet (100 meters) from a forest edge. The forest edge is defined as any adjacent cleared polygon (fields, residential parcels) or linear features (roadways, large streams, cleared utility easements). Narrow ATV trails, old logging roads with canopy cover, or other minor clearings in an otherwise intact forest tract are not considered forest edge delineators.
Based on this definition, the large forest tract east of Buck Creek is the only forested area impacted by the three Tier 2 alternatives that is considered to include core forest (Appendix A Map 13). Core forest impacts/loss were determined in two manners – direct loss and indirect loss. Direct loss is the area of core forest removed through tree clearing. Indirect loss is the portion of the original core forest area that no longer meets the core forest definition through creation of new forest edges. Figure 10 illustrates the anticipated core forest impacts for the Tier 2 alternatives. Alternative 2 would incur the largest core forest impact due to its long bifurcation of the mature forest tract east of Buck Creek. As illustrated on Appendix A Map 13, Alternative 3 would not directly encroach upon any core forest, but since it removes a portion of edge habitat associated with this large tract, the calculated indirect loss would be 0.56 acres and is considered relatively insignificant.

Figure 10 Core forest impact summary for Tier 2 alternatives



13.1.3 Indiana Bat and Northern Long-Eared Bat Maternity Colony Impacts

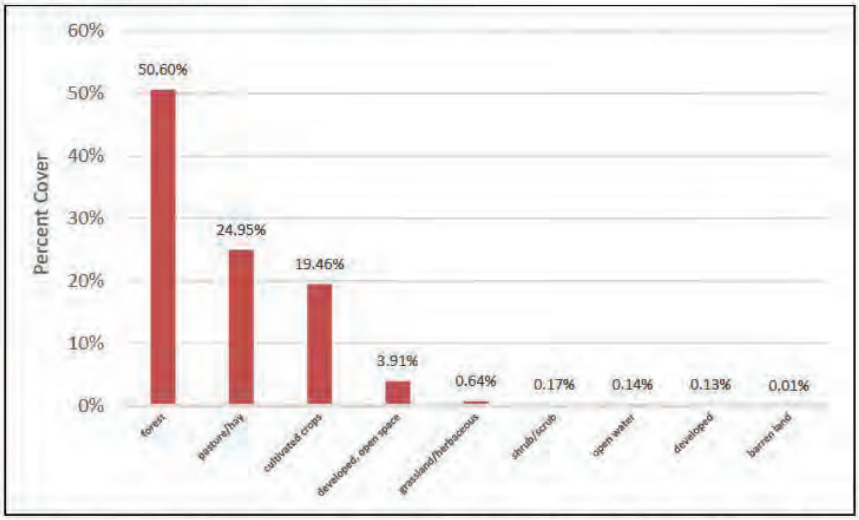
The Indiana bat and northern long-eared bat use similar summer habitats for roosting and maternity colony locations, namely forested wetlands, bottomlands, or adjacent uplands. Summer roosting sites typically include dead or dying trees with cavities and/or exfoliating bark or living trees with shaggy/sloughing bark exposed to the sun (e.g., shagbark hickory) where the bats shelter themselves under the bark or in crevices and cavities during the day. However, both of these species have been documented using bridges on occasion as night roosts (Kiser et al. 2002) and day roosts (Cervone et al. 2016) and are occasionally also known to roost in structures.

Indiana bat

The USFWS typically define Indiana bat colony limits using a 2.5-mile radius buffer around a known primary roost tree or the centroid of multiple roost trees. Alternatively, when roost tree locations are not available but only capture locations are known, a 5-mile buffer for the capture record can be used to estimate the landscape area within which a maternity bat colony is likely located. The USFWS and IDNR do not have any previous records for Indiana bat roost trees or capture locations within the SR 11 Extension Project action area. However, since the Section 7 impact analysis is being conducted based on "assumed presence" of the species, it is also assumed that preferred Alternative 3, in part, is within an "assumed maternity colony". The woodland habitat assessment conducted for each of the habitat units within the Tier 2 alternative corridors inventoried numerous dead snags, many of which have the potential for Indiana bat roosting, including possible maternity colony roosts. The majority of these potential roosts are located within the large woodland tracts associated with the Buck Creek valley and the upper bluff areas. Based on the assumption that an Indiana bat maternity colony(ies) are present within the SR 11 Extension Project action area, two potential scenarios were posed. In the first scenario, a single maternity colony was centered along Buck Creek within the Alternative 3 corridor. For the second scenario, two overlapping maternity colonies

were each centered along Buck Creek, one approximately 1.7 miles north of Alternative 3 and one approximately 1.8 miles south of Alternative 3. Approximately 22 percent of each colony overlaps. Appendix A Map 14 shows the assumed maternity colony limits and illustrates land use within a 2.5-mile radius of the assumed colony epicenters. Appendix B Table 8 provides a land use breakdown within the assumed colony limits which is predominantly forest (51 to 54 percent) and cropland/pasture (41 to 44 percent). Figure 11 summarizes the land use within the 2.5-mile radius for the single Indiana bat colony scenario.

Figure 11 Land cover within 2.5-mile radius of an assumed Indiana bat maternity colony along Buck Creek at preferred Alternative 3



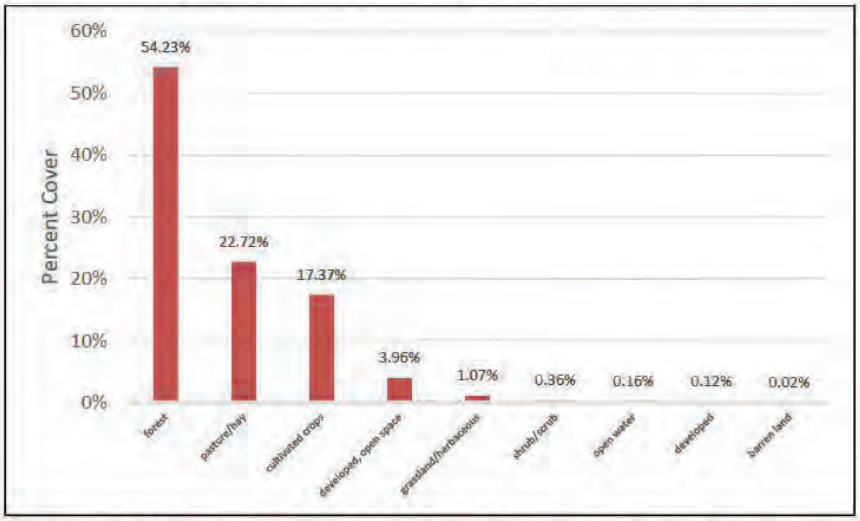
Since a presence/absence survey was not conducted for the SR11 Extension Project and no specific maternity roost trees were identified for the Indiana bat, emergence data for estimating colony size is also lacking. Through coordination with the USFWS Indiana Field Office (INFO), an average assumed Indiana bat colony consists of 80 adult females and 80 pups.

Northern long-eared bat

The USFWS typically define northern long-eared bat colony limits using a 1.5-mile radius buffer around a known primary roost tree or the centroid of multiple roost trees. Alternatively, when roost tree locations are not available but capture locations are known, a 3-mile buffer for the capture record can be used to estimate the landscape area within which a maternity bat colony is likely located. The USFWS and IDNR also lack data for northern long-eared bat roost trees or capture locations within the SR 11 Extension Project action area. Therefore, the "assumed maternity colony" methodology employed for the Indiana bat was also used for the northern long-eared bat to determine potential colony limits and preferred Alternative 3 impacts. The single colony epicenter was again set along Buck Creek within the Alternative 3 corridor, while the epicenters for the two overlapping colony scenario were set

approximately 0.8 mile to the north of Alternative 3 at Buck Creek and 1.3 miles to the southeast of Alternative 3 at Buck Creek. Appendix A Map 15 shows the assumed northern long-eared maternity colony limits and illustrates land use within a 1.5-mile radius of the assumed colony epicenters. Appendix B Table 9 provides a land use breakdown within the colony limits which is predominantly forest (54 to 59 percent) and cropland/pasture (36 to 41 percent). Figure 12 summarizes the land use within the 1.5-mile radius for the single northern long-eared bat colony scenario.

Figure 12 Land cover within 1.5-mile radius of assumed northern long-eared bat maternity colony along Buck Creek at preferred Alternative 3



Again, since a presence/absence survey was not conducted for the SR11 Extension Project and no specific maternity roost trees were identified for the northern long-eared bat, emergence data for estimating colony size is also lacking. Through coordination with the USFWS INFO, an average assumed northern long-eared bat colony consists of 50 adult females and 50 pups.

13.1.4 Flyway and Foraging Impacts

The Indiana bat, northern long-eared bat, and gray bat use natural corridors (streams and forest edge) and avenues created by man through forests (county roads, logging roads, trails, cleared utility easements) as flyways and foraging habitats. Within the SR 11 Extension Project, Buck Creek is the primary transportation and foraging habitat resource. To a lesser extent, Indiana bats, northern long-eared bats, and gray bats will also likely use Buck Creek tributary streams, old logging paths on the bluff east of Buck Creek, agricultural field access paths, ATV trails, power line easements, other miscellaneous linear clearings on the landscape, and forest edges as flyways from roosting sites to foraging areas. Appendix A Map 16 illustrates potential flyway/foraging corridors and their relative position to the three proposed Tier 2 alternatives.

13.1.5 Fall Swarming Habitat Impacts

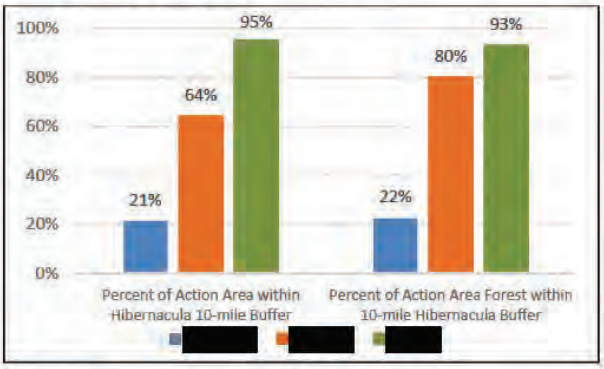
The Indiana bat, northern long-eared bat, and gray bat each undergo fall swarming prior to entering hibernation during the winter. During this period bats become active within suitable habitat in the vicinity of cave hibernaculum(a). These areas may or may not be the same forest habitats used for summer habitat. For the Indiana bat, the USFWS considers suitable habitat within 10 miles of Priority 1 and 2 hibernacula and within 5 miles of Priority 3 and 4 hibernacula to be of value and concern for fall swarming activities. Similarly, USFWS considers a 5-mile buffer when considering assessment of potential impacts to northern long-eared bats during fall swarming. Lastly, a 10-mile buffer is also used to establish a fall swarming area of concern around gray bat hibernacula.

Appendix A Map 17 illustrates the respective 10-mile and 5-mile limits for previously documented Indiana bat hibernacula. While the preferred Alternative 3 alignment and action area are greater than 10 miles from [redacted], [redacted], and [redacted], much of the preferred Alternative 3 alignment and action area are within the outer periphery of the [redacted], [redacted], and [redacted] fall swarming limits. Figure 13 illustrates the percentage of the action area within each hibernacula 10-mile buffer and the percentage of forest in the action area that is within the hibernacula 10-mile buffer.

Appendix A Map 18 illustrates the 5-mile limits for previously documented northern long-eared bat hibernacula. Since the horizontal fall swarming limits for the northern long-eared bat are not considered to cover as much of the landscape as the Indiana bat, the preferred Alternative 3 alignment and action area are beyond any fall swarming areas of concern for the species.

Appendix A Map 19 illustrates the 10-mile limit for previously documented gray bats from spring, fall, and summer at [redacted] and [redacted] and a winter observation at [redacted]. While the preferred Alternative 3 alignment and action area are greater than 10 miles from [redacted] and [redacted], much of the preferred Alternative 3 alignment and action area are within the outer periphery of the [redacted] fall swarming limits.

Figure 13 Percent of Action Area and Action Area Forest within Hibernacula 10-mile Buffer



13.1.6 Night Construction/Light Impacts

Bat species react differently to the presence of light, be it natural (moonlight) or artificial (streetlight or dusk-to-dawn light). Some species are documented to avoid illuminated areas, while other species favor foraging in lit areas because of the insects that are attracted to the light. Spoelstra (2017) found that *Myotis* species in the Netherlands tended to avoid artificially white light areas, while *Pipistrellus* species were undeterred and favored the insect densities around streetlights. *Eptesicus serotinus* were also found to be equally abundant in white light streetlight areas as in dark locations.

The need for night construction on roadway/bridge projects using temporary lighting is always a possibility for various reasons. While this is not necessarily of particular concern on the sinkhole plains to the west and east of Buck Creek, nighttime construction and the introduction of lighting for the Buck Creek bridge construction has the potential to temporarily compromise the foraging integrity along this valuable flight corridor.

13.1.7 Water Quality Impacts

Stream water quality (chemical components and suspended solids), as well as stream substrate structure, influence insect composition and prey availability for foraging bats. Bats also use streams as a source of drinking water. Therefore, streams that experience high levels of contaminants from road runoff (grease/oil, salts, and heavy metals) and agricultural runoff (pesticides, herbicides, and fertilizers) may serve as sources for bioaccumulation of toxic compounds in bats that frequent these waters.

13.1.8 Construction Noise Impacts

Bats are exposed to a variety of sound sources including echolocation calls (their own and other bat species), communication signals, prey and predator sounds, as well as continuous and episodic sounds from anthropogenic sources, including highway traffic and construction (West 2016). Highway noise, both construction and traffic, can cause acute acoustic trauma, disturbance and displacement (food and shelter resources),

and signal masking, which can result in adverse effects such as roost abandonment, avoidance of foraging areas, inefficient allocation of time and energy, and degradation of physiological, conditional, and social order (West 2016). Locally, background noise along SR 11 is comprised of birds, wind/rustling leaves, insects, existing traffic on Watson Road and Melview Road, as well as periodic residential anthropogenic noise (e.g., mowers, air conditioners, barking dogs) from the scattered residential properties throughout the landscape.

The specific inventory of construction equipment required for the SR 11 Extension Project is unknown; however, it is expected to include a variety of noise sources related to engines, excavation (bucket rattling), and percussive impacts (mounted impact hammers, hoe rams, and jackhammers). Figure 14 includes sound level ranges for various types of construction equipment in dBA at 50 feet (West 2016).

Figure 14 Noise levels for construction equipment

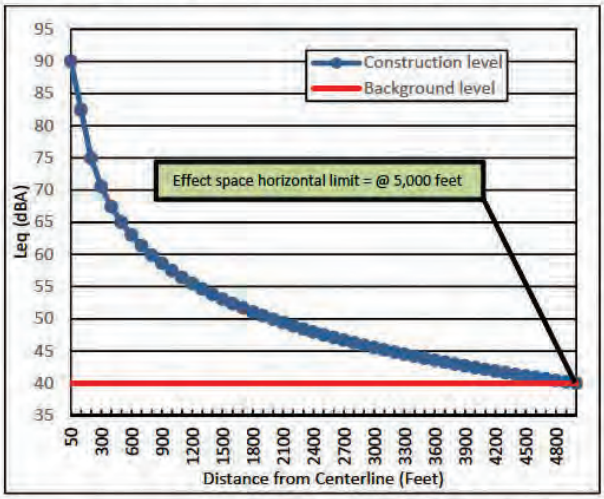
Equipment Type	*Sound Level Range (L_{eq})**	*Average Sound Level (L_{eq})**
Pickup truck	*55 to 71 dBA*	*63.0 dBA*
Chain saws	*75 to 86 dBA*	*80.5 dBA*
Ground compactor	*80 to 82 dBA*	*81.0 dBA*
Jackhammer	*74 to 89 dBA*	*81.5 dBA*
Backhoe	*80 to 84 dBA*	*82.0 dBA*
Concrete truck	*81 to 85 dBA*	*83.0 dBA*
Pumps, generators, compressors	*81 to 87 dBA*	*84.0 dBA*
Paver	*80 to 89 dBA*	*84.5 dBA*
Compressor	*80 to 90 dBA*	*85.0 dBA*
Mounted impact hammer hoe-ram	*85 to 90 dBA*	*87.5 dBA*
Dump truck	*82 to 98 dBA*	*90.0 dBA*
Diesel truck	*85 to 96 dBA*	*90.5 dBA*
Track hoe	*71 to 106 dBA*	*98.5 dBA*

* L_{eq} measured at 50 feet from source

A generalized impact assessment of point source construction noise was conducted based on methodology in the *Technical Guidance for Assessment and Mitigation of the Effects of Traffic Noise and Road Construction Noise on Bats* (West 2016) to determine the "effect space", or approximate distance from the SR 11 Extension Project preferred Alternative 3 alignment that the anticipated construction noise is equal to the background noise. Collective construction noise was estimated at 90 dBA based on the anticipated equipment with the greater SPL ratings provided in Figure 14 for L_{eq} noise levels at 50 feet. Background noise levels were determined at five locations throughout the project area using a Larson Davis Type 1L sound level meter. This yielded an average background level of 40.0 dBA representing the relatively quiet rural landscape where traffic is not currently a dominant contributing source. Following the methodology and equations provided in West (2016), construction noise level is expected to equal the background level through attenuation at a horizontal distance of approximately 5,000 feet from the preferred Alternative 3 alignment. Figure 15 illustrates the expected attenuation of construction noise progressing away from preferred Alternative 3. Appendix A Map 20 shows the anticipated distance of the 5,000-foot buffer defining the horizontal effect space for construction noise. This distance was used to define the action area for this BA. Note

that this likely reflects the maximum distance since terrain and other factors were not factored into this analysis. The limits of vertical effect space were not determined since Indiana bat and northern long-eared bat activity is generally confined close to the ground in woodland riparian habitats.

Figure 15 Predicted construction noise effect space limit



West (2016) identifies five special zones for highway projects within which bats may potentially experience effects from noise. Sudden and loud percussive sounds associated with road construction have the potential for temporary or permanent hearing loss in bats. Zones 1 and 2 closest to the highway are the areas where permanent and temporary loss is possible. Acoustic trauma resulting in hearing and echolocation loss in bats is regarded as unlikely because they have developed behavioral morphological (e.g., changing shape and orientation of ear or folding tragus), and physiological (e.g., tympanic muscle contraction) mechanisms to reduce the risk. It is more likely that any bats roosting on or near a bridge would abandon the area (behavioral response) during project staging or early disruptive construction activities before being subjected to exceptionally loud damaging noise from construction equipment. Masking of echolocation signals (Zones 1 through 3) is also considered low risk for bats because the spectrum for construction noise does not overlap with the ultrasonic frequencies of bats, particularly the high echolocation frequencies of *Myotis* bats. Construction noise does however have some potential for masking of passive listening of acoustic signals, environmental sounds, and social vocal communication occurring at lower frequencies.

Since the Indiana bat, northern long-eared bat, and gray bat have the potential to be present during the day (roosting) and night (foraging) construction noise during any part of the day is considered to be a point of concern for bats depending on their proximity to the construction area. Specifically, there is a high probability of Indiana bats and northern long-eared bats roosting in trees immediately adjacent to the preferred Alternative 3 alignment in the Buck Creek Valley and forested bluff habitat

to the east and west. The estimated noise effect space for potential effects related to traffic noise are covered in Section 13.1.10 Operation and Maintenance.

13.1.9 Construction Vibration Impacts

Percussive construction activities (mounted impact hammer, hoe ram, jack hammer) and bedrock blasting for roadway cut sections can generate vibrations though the ground that could have an adverse effect on underground wildlife habitats such as caves used by bats. If severe enough, vibrations of the cave wall/ceilings can disrupt hibernating bats (Indiana bat, northern long-eared bat, or gray bat) resulting in arousal or disturb day roosting gray bats in the summer.

The Programmatic Biological Opinion for Transportation Projects in the Range of the Indiana Bat and Northern Long-Eared Bat (USFWS 2018) summarizes several articles addressing the effects of vibration on bats using peak particle velocity (PPV) as the metric for assessment. The West Virginia Department of Environmental Protection (2006) indicated that hibernating bats withstood vibrations measured at 0.06 to 0.20 inches per second (in/sec) in a mine portal with no signs of disturbance. A U.S. Army Corps of Engineers study found that blasting within 393 feet of a cave with hibernating bats where the PPV registered 0.02 in/sec did not have any effect to the bats (Myers 1975). An investigation of blasting effects to bats in caves within 1,000 feet of a quarry operation in Jamesville, New York with PPV levels greater than 0.25 in/sec concluded that this activity had no apparent impact to the bat population (Besha 1984).

The U.S. Geological Survey conducted a study to generate vibration data (velocity and acceleration) from multiple construction sources (hammer drill, plate compactor, and jackhammer) and personnel walking through a cave passage at Mammoth Cave, and compare it to literature threshold levels (0.1 – 0.25 in/sec)for disturbance of hibernating bats (Adams et al 2016). This survey documented a maximum velocity of 0.000126 in/sec recorded at a geophone near an Indiana bat hibernation area generated by use of a jackhammer in an adjacent cave passage approximately 260 feet distance from the hibernation area. This is considered to be well below the level of human perception for vibration and previously documented ranges recommended to avoid impacts to bats (0.1-0.25 in/s).

In addition to direct disturbance of bats in caves/mines, vibration has the potential to alter the structure of cave systems by modifying microclimate conditions to the extent that the resource is no longer suitable for bat usage. Potential modifications include large collapses changing the physical morphology of the cave (loss of traditional roost spots), smaller collapses shifting soils into voids that change air flow, and changes in cave structure that modify hydrology patterns. Based on available research, USFWS adopted a maximum threshold PPV level of 0.1 in/sec for vibration impacts at hibernaculum(a) in the Programmatic Biological Opinion (USFWS 2018). Furthermore, several states, including Indiana, have adopted regulations that require residents within 0.5 miles to be notified of basting activities (USFWS 2018). Similarly, USFWS considers 0.5 mile as a distance defining an area of concern within which an analysis of effects to hibernacula from blasting activities should be undertaken (USFWS 2018).

[redacted] and [redacted] are the two closest known caves to the preferred Alternative 3 alignment. [redacted] is approximately 0.23 mile south of the alignment east of Buck Creek and [redacted] is approximately 0.43 mile south of the alignment along Watson Road to the west of Buck Creek. Because PPV levels are in part a function of the vibration source, type of bedrock material, degree of bedrock fragmentation, and composition of interstitial voids of the fractured bedrock (i.e., soil, water, air), estimation of anticipated velocity levels at these two locations is not possible. While both of these caves are within 0.5 mile of the preferred Alternative 3 alignment, the potential for impacts to these potential bat caves from vibration are considered low for the construction equipment and potential blasting anticipated for the project.

13.1.10 Operation and Maintenance Impacts

SR 11 currently functions as a rural minor arterial highway and will continue as such following extension of the roadway to SR 135.

Traffic Noise

Since the project is intended to provide a new east-west travel option across Buck Creek in southern Harrison County, the preferred Alternative 3 would result in a notable increase in traffic volumes along Watson Road and introduce potential noise impacts associated with a new alignment roadway within the Buck Creek valley.

2017 average annual daily traffic (AADT) and design hourly volume (DHV) data for local roadways in the INDOT Traffic Count Database System are provided in Figure 16. 2020 traffic data was not used due to the effect of COVID-19 on traffic volumes during that time period.

Figure 16 2017 AADT and DHV traffic data for SR 11 project area roadways

Roadway	2017 AADT (vehicles per day)	2017 DHV (vehicles per hour)
SR 135 south of Watson Road	4,578	504
SR 11 east of Old Hwy 337	1,146	127
Old Hwy 11 south of SR 11	970	101
Old Hwy 337 north of SR 11	685	86
Watson Road east of SR 135	332	39
Union Chapel Road	404	71
Old Goshen Road	226	29

The SR 11 traffic study (Crawford, Murphy and Tilly 2021) estimates that the 2026 AADT (roadway first open to traffic) would be 1,260 vpd with a 2046 design year AADT of 1,325 vpd. Commercial vehicles are expected to comprise 5 percent of the AADT. Using 10 percent of the AADT to calculate the DHV, hourly volumes are expected to be 126 vph in 2026 and 133 vph in 2046. Therefore, design year traffic volumes along the existing section of Watson Road between SR 135 and Union Chapel Road are expected to increase four-fold with the new SR 11 Extension roadway.

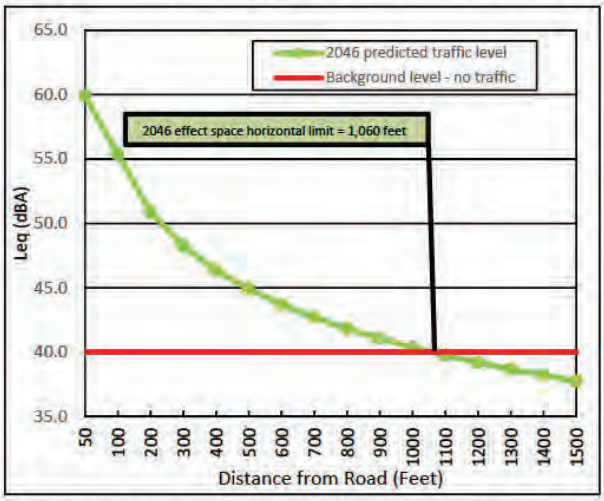
Traffic noise has been shown to deter bats from foraging in the vicinity of highways (Siemers and Schaub 2011). Traffic noise is less likely to result in permanent (PTS) or

temporary (TTS) threshold shift (reduction in auditory sensitivity), especially at the relatively low to volumes experienced and anticipated on this rural SR 11 Extension Project. However, depending on the species of bat, traffic noise has the potential for echolocation masking, passive listening effects, and vocal communication disruption. Echolocation masking occurs when competitive sound sources of sufficient intensity interfere with a bats ability to clearly detect its and others echolocation signals for navigation and prey detection/capture while foraging. Overlap of bat echolocation frequencies with the traffic noise spectrum is more likely with low frequency bats like the big brown bat than high frequency bats like *Myotis sp*. Passive listening disruption from traffic noise can affect a bats ability to interpret biologic information sounds like wind, insect prey, communication with other bats, predator detection, and assessment of other threats. Frequencies used for vocal communication between bats and their offspring in roosts often overlaps with the spectrum of highway noise. Therefore, where highway noise is of sufficient intensity proximal to roosts (nearby trees or below bridges), the potential exists for vocal communication disruption.

A general desktop evaluation of traffic noise impact was conducted using the *Technical Guidance for Assessment and Mitigation of the Effects of Traffic Noise and Road Construction Noise on Bats* (West 2016) and the FHWA Traffic Noise Model (TNM 2.5) to estimate expected sound pressure levels (SPL) based on baseline field measurements and projected 2046 traffic data estimates. Sound pressure levels were measured at five locations within the SR 11 Extension Project action area. Given the rural nature and lack of any significant anthropogenic noise sources, an existing background SPL of 40.0 dBA was based on the average of the ten L_{eq} measurements from the five locations.

Based on 2046 DHV traffic, the TNM 2.5 predicted hourly SPL at 50 feet from the roadway was 59.9 dBA. Therefore, the approximate 2046 effect space (distance from the roadway where the 2046 highway traffic noise is equal to the existing background noise) was calculated to be 1,060 feet following the methodology of West (2016). Figure 16 illustrates the expected attenuation of traffic noise and design year 2046 effect space progressing away from the proposed SR 11 Extension Project alignment. Appendix A Map 21 shows the 2046 horizontal effect space limits for anticipated highway traffic. As with the construction noise assessment, the limits of vertical effect space were not determined since Indiana bat and northern long-eared bat activity is generally confined close to the ground in woodland riparian habitats.

Figure 17 Predicted highway traffic noise effect space limit



Although episodic peaks in noise from loud passing trucks occur, the overall traffic noise levels predicted are considered to be tolerable by Indiana bats, northern long-eared bats, and gray bats and are not expected to result in their exclusion from the Buck Creek floodplain valley and adjacent karst plains under future normal post-construction highway operating conditions.

Vehicle-Bat Collisions

The existing roadway infrastructure within the project area includes several low volume roads (Watson Road, Union Chapel Road, Goshen Road, Melview Road) which provide opportunities, albeit minimal, for vehicle-bat collisions. The Union Chapel Road Bridge crossing of Buck Creek is the most likely location where such conflicts are likely to occur since Buck Creek is the most prominent local flyway/foraging route.

The SR 11 Extension Project Alternative 3 alignment will establish a new Buck Creek crossing and carry a greater volume of traffic through the existing Watson Road, Union Chapel Road, and Melview Road corridors. The wider road cross-section and the moderate increase in traffic is not expected to pose a significant increase in the risk for bat-vehicle collisions. Because the new proposed bridge over Buck Creek will be 100+ feet above the stream and adjacent floodplain, this level of clearance will provide for ample horizontal and vertical space beneath the bridge for unobstructed bat movements. Therefore, the new bridge is not considered to encumber flight/foraging activities along this reach of Buck Creek and would not result in a significant increase in bat –vehicle collisions.

Permanent Street Lighting

These are no plans to include street lighting along any portion of the SR 11 Extension Project roadway. The new SR 11 intersections with SR 135 and with Old Hwy 11 and Old Hwy 337 will not include streetlights. Traffic control at the SR 135 intersection will

be accomplished with a red/yellow flashing signal. The intersection with Old Hwy 11 and Old Hwy 337 will use a four-way stop sign with no lighting.

Road Maintenance

Anticipated routine maintenance activities (i.e., pothole repair, seasonal shoulder mowing, snow removal) along the SR 11 Extension Project roadway are considered to have minimal to no potential for adverse effects to bats. The most noteworthy annual maintenance activity anticipated is treatment of pavement with sand, salt, or brine solution in the winter to abate snow and ice buildup. Seasonal mowing of the shoulder areas will be scheduled by the District as it is for all other state highways.

Road Contaminant Runoff and Hazardous Spills

Heavy metals, salts, oil, grease, and other volatile organic compounds (VOCs) deposited on highways are eventually flushed from the pavement and may ultimately migrate to nearby wetlands and streams. In karst regions this is of particular concern since highway runoff contaminants or hazardous materials from spills (inadvertent discharges or releases from accidents) can quickly be transported into subterranean stream systems through the underlying porous limestone bedrock.

13.2 Direct Impact Effects Analysis

The effects analysis has been organized according to individual work activities and stressors required for the proposed construction. The effects pathway for each activity is provided to document the stressor, spatial/temporal exposure, species response, avoidance/minimization measure, and pathway. The USFWS previously generated a comprehensive listing of potential Indiana bat stressor responses for the I-69 Biological Opinion (USFWS 2011). These have been adopted for use on the SR 11 Extension Project as a standardized method for classification. The stressors and effects pathway responses developed for the Indiana bat are also considered to represent an appropriate Stressor-Exposure-Response assessment for the northern long-eared bat and gray bat.

- No response
- Startled with increased respiration rate
- Death/injury of adults and/or offspring
- Flees from roost during daylight with increased predation risk
- Abandons roost site
- Abandons foraging area
- Shifts focal roosting and/or foraging areas
- Increased energy expenditures with reduced fitness (short term)
- Reduced energy expenditures with increased fitness (long-term)
- Aborted pregnancy, reproductive failure
- Increased torpor, delayed development/parturition, and/or sexual maturation of offspring
- Short-term reduction in colony reproductive rate (3-4 seasons)
- Short-term reduction in colony/hibernaculum size (3-4 season)
- Long-term increase in colony reproductive rate
- Long-term increase in colony/hibernaculum size/fitness level

- Long-term decrease in colony/hibernaculum size/fitness level

13.2.1 Tree Removal

Stressor:	Felling trees during the bat active season when Indiana bats and/or northern long-eared bats are present in trees within the right-of-way as either a maternity colony or individual bats.
Exposure Temporal:	1. Spring, summer, and fall active season.
Exposure Spatial:	1. All woodland areas within the preferred alternative right-of-way where suitable habitat is present.
Response:	1. No response. 2. Death/injury to adults or juveniles if bats are present and tree clearing for construction is conducted during the active season. 3. Abandons use of tree(s) as maternity colony roost(s).
Relevant AMMs:	1. Contractor shall not clear any trees between 1 April and 15 November.
Pathway:	Without implementation of a seasonal summer tree clearing restriction for construction, bats roosting in trees within the right-of-way during the summer could potentially be flushed from the tree during the day or injured/killed when a roost tree is felled. Adherence to the INDOT Standard Specification AMM requires that the tree clearing element of the project be taken into consideration throughout the project planning process.

13.2.2 Habitat Loss and Fragmentation

Stressor:	Direct loss of high quality primary and/or secondary maternity roost trees. Increased disturbance to maternity roosts adjacent to the new roadway from construction activities and/or post-construction operation of the roadway. Modification or elimination of existing flyways and foraging corridors.
Exposure Temporal:	1. Permanent loss of potential roosting habitat. 2. Permanent loss or displacement of maternity roosts or entire maternity colony. 3. Temporary disturbance within fall swarming habitat 4. Permanent severance of existing flyways connecting roosting habitat to foraging habitat. 5. Permanent encroachment across quality foraging corridors.
Exposure Spatial:	1. All locations where potential maternity colonies occur within the action area, particularly in close proximity to the new roadway. 2. Primarily flight corridors associated with Buck Creek and the adjacent bluff forest habitat.
Response:	1. No response. 2. Abandons use of tree(s) previously used as maternity colony roost(s). 3. Low probability of aborted pregnancy. 4. Short-term reduction in colony reproductive rate resulting from the new highway while the species adjusts to the changes in the landscape. 5. Abandons all or portions of existing foraging areas. 6. Shifts focus to other connecting flight corridors and restricts foraging range.
Relevant AMMs:	1. There are no specific AMMS recommended to avoid or minimize impacts to flight/foraging corridors. Maximum minimization has been accomplished through alternative selection.

Relevant AMMs:	1. There are no specific AMMS recommended to avoid or minimize impacts to flight/foraging corridors. Maximum minimization has been accomplished through alternative selection. 2. A Construction in a Floodway permit (CIF) from the Indiana Department of Natural Resources for tree clearing in the Buck Creek floodplain will likely require compensatory mitigation through tree planting elsewhere within the floodplain. This project related action would indirectly benefit bats in the area through habitat restoration.
Pathway:	Severe changes in landscape setting can alter macro- and micro-habitat conditions, including flight corridors, that bats are reliant on for quality suitable habitat.

13.2.3 Night Construction/Lighting

Stressor:	The use of high intensity lights for night construction work.
Exposure Temporal:	1. Temporary effect during construction from spring to late summer during period of bat activity.
Exposure Spatial:	1. Confined to immediate vicinity of road and bridge construction areas
Response:	1. No response. 2. Abandons foraging area. 3. Abandons roost site. 4. Shifts focal roosting and foraging areas. 5. Abandons use of tree(s) as maternity colony roost(s). 6. Increased energy expenditures with reduced fitness (short term).
Relevant AMMs:	1. Limit nighttime construction activities using temporary portable lights to the least number of nights required. 2. Consider prohibiting night construction for the Buck Creek bridge. 3. Direct temporary lighting away from adjacent woodland foraging habitat.
Pathway:	Construction activities that require the use of bright lights at night would discourage bats from back-and-forth movements below the bridge and foraging along Buck Creek during construction. Bats roosting north and south of the bridge might be cut off from available foraging habitat on the opposite side of the bridge.

13.2.4 Water Quality

Stressor:	Water quality degradation from runoff and potential hazardous chemical spills during construction and possible contamination of groundwater via karst features including caves used by bats.
Exposure Temporal:	1. Primary exposure during construction period. 2. Secondary long-term exposure post-construction.
Exposure Spatial:	1. Buck Creek 2. All sinkhole points of groundwater recharge along the highway corridor.
Response:	1. No response 2. Abandons foraging area. 3. Shifts focal roosting and foraging areas.
Relevant AMMs:	1. Maintain erosion and sediment runoff control measures to reduce suspended solids from migrating into Buck Creek and tributaries. 2. Use temporary and permanent seeding to minimize erosion and sediment migration into Buck Creek during construction and post-construction. 3. Confine fueling and other hazardous material activities at locations where accidental spills can be best managed.

	4. Develop and implement spill prevention and spill cleanup plan to avoid contaminants from entering sinkholes and Buck Creek. 5. Include entrapment basins along roadway to intercept roadway contaminant migration into underground karst features. 6. Incorporate containment measures into bridge design to reduce solid debris material off bridge from being permanently deposited in Buck Creek.
Pathway:	Water quality degradation from construction activities via sedimentation or introduction of hazardous fluids into Buck Creek can have long-term effects on aquatic habitat for macroinvertebrates which serve as prey for bats. Similarly, migration of road runoff contaminants from post-construction operation can have permanent detrimental effects to subsurface stream and bedrock aquifer water quality without proper containment measures.

13.2.5 Construction Noise

Stressor:	Percussive impact and heavy engine noise during construction. Increased roadway car and truck traffic on existing road and new road alignment post-construction.
Exposure Temporal:	1. Temporary effect from construction equipment for two to three years during construction from spring through summer. 2. Permanent effect from highway traffic throughout the year during spring staging, summer maternity, and fall swarming seasons.
Exposure Spatial:	1. Road/bridge construction noise impacts have the potential to extend less than one mile from the roadway alignment. 2. The effects of roadway operation post-construction are expected to be no more than 1000 feet from the roadway alignment.
Response:	1. No response. 2. Flees from roost during daylight with increased predation risk. 3. Abandons roost site. 4. Abandons foraging area. 5. Shifts focal roosting and/or foraging areas. 6. Increased energy expenditures with reduced fitness (short term).
Relevant AMMs:	1. Maintain equipment in good working order. 2. Restrict construction within Buck Creek valley to daytime except for nighttime pouring of concrete bridge deck if needed.
Pathway:	Noise of sufficient energy resulting from construction activities has the potential to disturb and displace bats roosting in the immediate vicinity of the bridge in the summer. Signal masking of echolocation and low frequency communication is also not likely to be of concern.

13.2.6 Vibration

Stressor:	Vibrations transmitted through bedrock to cave hibernacula from percussive impacts and blasting of bedrock.
Exposure Temporal:	1. Temporary intermittent effect during year-round construction.
Exposure Spatial:	1. Subsurface vibration effects limited to less than 0.5 mile from construction area.
Response:	1. No response. 2. Bats potentially startled and aroused in caves. 3. Bats abandon cave.

	4. Increased energy expenditures with reduced fitness (short term).
Relevant AMMs:	1. Consideration to confining heavy vibration activities (i.e., blasting) to summer months when Indiana bats and/or northern long-eared bats would not be using caves.
Pathway:	Vibration of sufficient energy resulting from construction activities to disturb bats roosting in the most proximal caves to the highway alignment is considered unlikely.

13.2.7 Operation and Maintenance

Stressor:	Traffic noise, vehicle-bat collisions, permanent lighting, road maintenance, and hazardous spills post-construction.
Exposure Temporal:	1. In perpetuity throughout the life of the highway.
Exposure Spatial:	1. Within and immediately adjacent to the highway right-of-way.
Response:	1. No response. 2. Death/injury to adults or juveniles from vehicle-bat collisions. 3. Abandons nearby roost site. 4. Abandons local foraging areas. 5. Shifts focal roosting and/or foraging areas. 6. Increased energy expenditures with reduced fitness (long term).
Relevant AMMs:	1. Roadway design will incorporate detainment features to intercept and contain road runoff contaminants and hazardous spill materials as a means to protect karst groundwater resources. 2. The bridge drainage system will be designed to prevent runoff from being deposited directly into Buck Creek from deck drains. All roadway runoff will be captured and discharged onto the floodplain to allow for filtering of roadway contaminants. The use of drains that drop runoff directly from the deck to the ground below will not be included in the bridge design for the spans over the Buck Creek channel.
Pathway:	Post-construction operation and maintenance of SR 11 through multiple pathways poses the same minimal risk to bats that the existing roadway network currently does.

13.3 Indirect Impacts

The purpose and need for the SR 11 Extension Project is to provide for a safer east-west route through southern Harrison County and across Buck Creek through improvement of existing travel patterns. The SR 11 Extension Project is not anticipated to induce new industrial, commercial, or residential development within southern Harrison County beyond that which would likely happen if the road were not constructed.

Continued development of residential lots within the existing housing subdivisions along Asher Court and Valiz Road would likely continue without the new roadway. Creating a new junction between two state highways has the potential to induce roadside travel/market-type developments. However, there is currently a Marathon gas/convenient mart facility along SR 135 just 2.5 miles north of Watson Road and a Dollar General one mile to the north, so it is unlikely that similar businesses would develop here. At the east end of the SR 11 Extension,

Project there are no local gas stations or markets within several miles of the SR 11/Old Hwy 11/Old SR 337 intersection. In the event that such a development were to become established at this intersection, the loss of bat suitable forest habitat is not anticipated because the landscape in the immediate vicinity of the proposed intersection is devoid of forest and woodlots. Therefore, it is concluded that there are no foreseeable indirect impacts, and any such unforeseen impacts would likely be negligible and not of concern regarding impacts to the Indiana bat, northern long-eared bat, or gray bat.

13.4 Cumulative Impacts

Southern Harrison County is largely forested and agricultural (row crops and pasture) with scattered and small clusters of residential properties. Communities south of Corydon such as Elizabeth, New Middleton, New Amsterdam, Laconia, and Mauckport, generally consist of several residences, local support services, with limited to no commercial or industrial operations. Furthermore, there is very little on-going or anticipated commercial business establishment or large-scale rural residential development within southern Harrison County for consideration of cumulative impacts to the Indiana bat, northern long-eared bat, and/or gray bat.

The most notable proposed industrial developments in the region are the Nucor Steel plant at Brandenburg, KY and the proposed new grain elevator at Mauckport, IN. The Nucor Steel facility is reportedly to be located at the former site of the Consolidated Grain and Barge Riverport terminal in Meade County, KY south of the Ohio River. Specifics on the development of these large-scale industrial sites is unknown; however, each has the potential to reduce potential bat habitat through additional tree clearing within the Ohio River floodplain.

As of May 2022, INDOTs Next Level Road program web site lists six road and five bridge projects, in southern Harrison County scheduled for 2020 through 2025 (Appendix B Table 10 and Appendix A Map 22). Bridge projects vary from small structure replacements, to deck overlays, to deck replacements, to entire bridge replacements. The road projects vary from HMA overlays to pavement replacements. Each of these projects will undergo separate Section 7 coordination as applicable. Nonetheless, it is not anticipated that the scope and nature of these projects would have a perceptible cumulative impact to Indiana bat, northern long-eared bat, or gray bat populations within the area and are therefore perceived as negligible.

14 Conservation Measures

14.1 Indiana Bat and Northern Long-Eared Bat In-Lieu Fee Conservation Fund

Through the selection of preferred Alternative 3, impacts to suitable bat habitat (i.e., forest habitat of high, moderate, and low suitability) have been minimized to the maximum extent possible considering the extensive coverage of forested habitat associated with Buck Creek in southern Harrison County. Additionally, through implementation of the April 1 to November 15 tree clearing restriction AMM, potential direct impacts to the Indiana bat and northern long-eared bat have been further minimized.

Nonetheless, unavoidable and irreversible loss of roosting and foraging bat habitat associated with Buck Creek warrants compensatory mitigation for the SR 11 Extension Project. Therefore, the Range-Wide Indiana Bat In-Lieu Fee Program (USFWS 2017) will be used as a conservation measure

typically used in conjunction with the Programmatic Biological Opinion for Transportation Projects in the Range of the Indiana Bat and Northern Long-Eared Bat (USFWS 2018), its use for informal/formal Section 7 consultation with the USFWS is permissible. Proposed payment into the in-lieu fee (ILF) program was determined using the following approach:

(Acres of suitable habitat) x (Replacement ratio) x (Per acre cost)

The woodland bat habitat assessment (Section 10.3) indicated that preferred Alternative 3 would impact an estimated 19.91 acres of forest/tree habitat. However, approximately 2.49 acres of this total was not considered to have even low suitability; therefore, suitable bat habitat impacts resulting from preferred Alternative 3 are estimated at 17.42 acres. In most instances, the USFWS considers 3:1 to be an appropriate replacement mitigation ratio for bat habitat forest impacts. Through informal coordination with the USFWS Bloomington Field Office, the Service has indicated that a 3:1 ratio should be used to calculate the mitigation acreage estimate for impacts greater than 300 feet from existing paved roads. For impacts to suitable bat habitat less than 300 feet from existing paved road, a 1.5:1 ratio would be appropriate. Lastly, as part of the Range-Wide Indiana Bat In-Lieu Fee Program Instrument, the USFWS has developed a state based fee schedule for calculating compensatory mitigation fees (Exhibit E Table 2 of the Program Instrument). The most current "cost per acre land value" provided (November 2020 to November 2021) for the state of Indiana is $9,354/acre. Based on these three variables, Figure the ILF payment for loss of suitable bat habitat resulting from the SR 11 Extension Project is estimated at $310,646.

Figure 18 In-lieu fee summary for SR 11 bat habitat loss compensation

Tree removal location	Acreage	Ratio	Per acre cost	In-Lieu Fee
Impacts <300 feet	12.70 acres	1.5:1	$9,354	$178,174
Impacts >300 feet	4.72 acres	3:1		$132,452
Total				$310,646

15 Conclusion and Determination of Effects

The ECOS-IPaC official species list generated for the SR 11 Extension Project identified three federally listed bat species of potential concern for the project area (Indiana bat, northern long-eared bat, and gray bat). This effects determination was based on the anticipated impacts to both bat species from the Stressor-Exposure-Response analysis for the proposed construction activities as outlined in Section 11.

15.1 Indiana Bat –Likely To Adversely Affect

USFWS/IDNR available data indicate that there are no Indiana bat records from within the Buck Creek watershed, or more specifically within close proximity to the SR 11 Extension Project. However, since a presence/absence survey has not been completed for this project, presence is assumed based on available habitat within the action area that would be directly impacted by the proposed action. It is also assumed that a maternity colony is present and centered within the anticipated disturbance limits of preferred Alternative 3. Furthermore, the proposed action has the potential to interfere with Indiana bat movement and foraging corridors. Adherence to recommended AMMs will lessen the severity of the proposed action impact to the Indiana bat; however, total avoidance of impacts is not possible as outlined in the Effects Analysis.

Based on the analysis of available data it is concluded that a **"likely to adversely affect"** effects determination for the Indiana bat is considered appropriate for the proposed action.

15.2 Northern Long-eared Bat – Likely to Adversely Affect

USFWS/IDNR available data indicate that there are older 1992 and 1998 northern long-eared bat summer mist net capture records along Buck Creek to the south of the SR 11 Extension Project in the vicinity of [redacted]. Since a presence/absence survey has not been completed for this project, presence is assumed based on these previous records and available habitat within the action area that would be directly impacted by the proposed action. It is also assumed that a maternity colony is present and centered within the anticipated disturbance limits of preferred Alternative 3. Furthermore, the proposed action has the potential to interfere with northern long-eared bat movement and foraging corridors. Adherence to recommended AMMs will lessen the severity of the proposed action impact to the northern long-eared bat; however, total avoidance of impacts is not possible as outlined in the Effects Analysis.

Based on the analysis of available data it is concluded that a **"likely to adversely affect"** effects determination for the northern long-eared bat is considered appropriate for the proposed action.

15.3 Gray Bat – May Affect, Not Likely to Adversely Affect

USFWS/IDNR available data indicate that there are older 1998 gray bat summer mist net capture records along Buck Creek to the south of the SR 11 Extension Project in the vicinity of [redacted]. Since a presence/absence survey has not been completed for this project at any of the smaller local caves in southern Harrison County, presence is assumed based on these previous records. Gray bat use of [redacted] is not considered probable. Potential use of [redacted] is considered to be limited to individuals or small groups of non-reproductive (non-maternity colony) gray bats in the summer. [redacted] is also not considered to be suitable for gray bat winter hibernacula use. Therefore, the assumed presence of the gray bat within the SR 11 Extension Project is considered to be limited to foraging primarily along Buck Creek and potential use of [redacted]. The proposed action has the potential to interfere with gray bat movement and foraging corridors, but would not conflict with any continued use of [redacted]. Adherence to recommended AMMs will lessen the severity of the proposed action impact to the gray bat; however, total avoidance of impacts is not possible as outlined in the Effects Analysis.

Based on the analysis of available data it is concluded that a **"may effect, not likely to adversely affect"** effects determination for the gray bat is considered appropriate for the proposed action.

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17 List of Preparers

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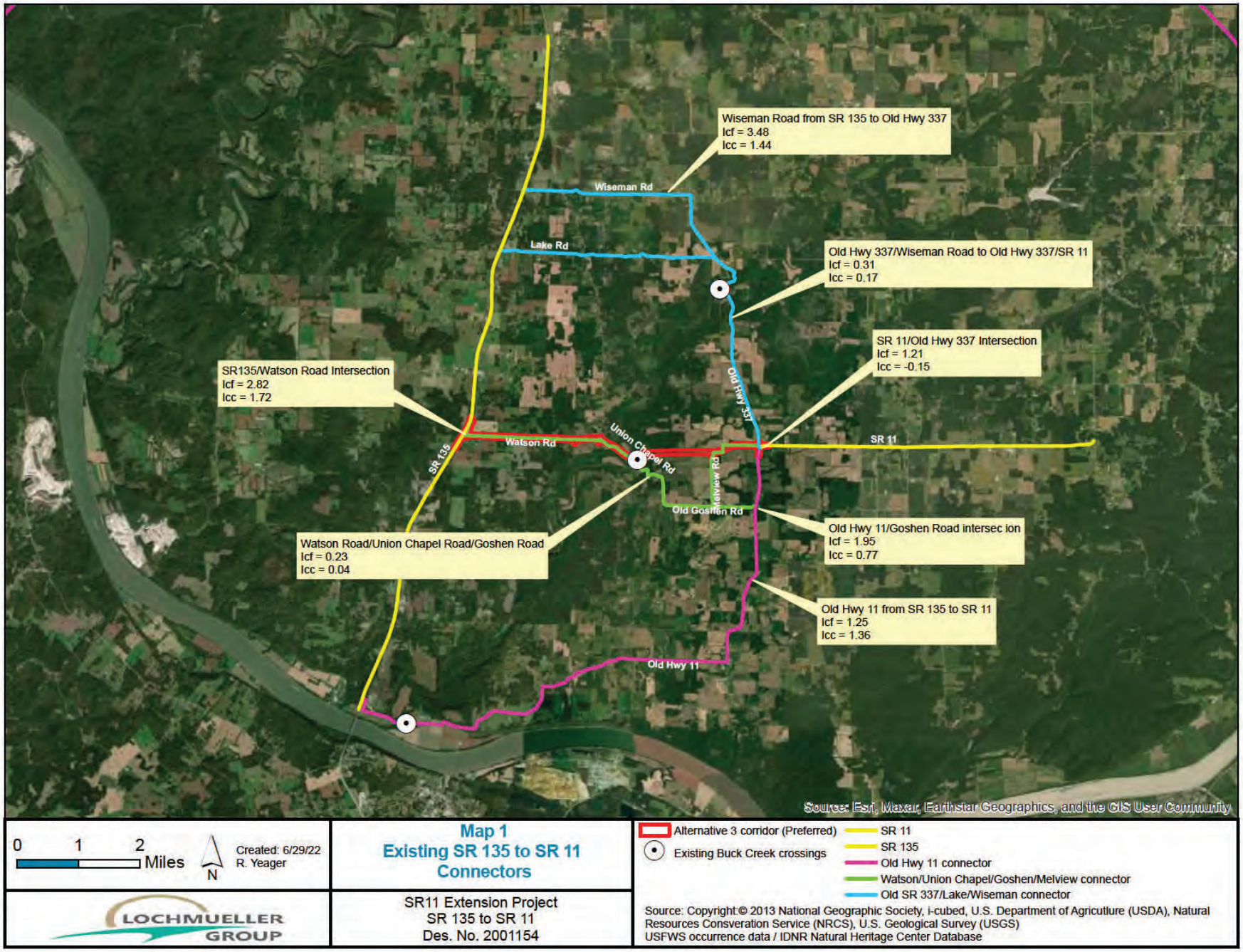
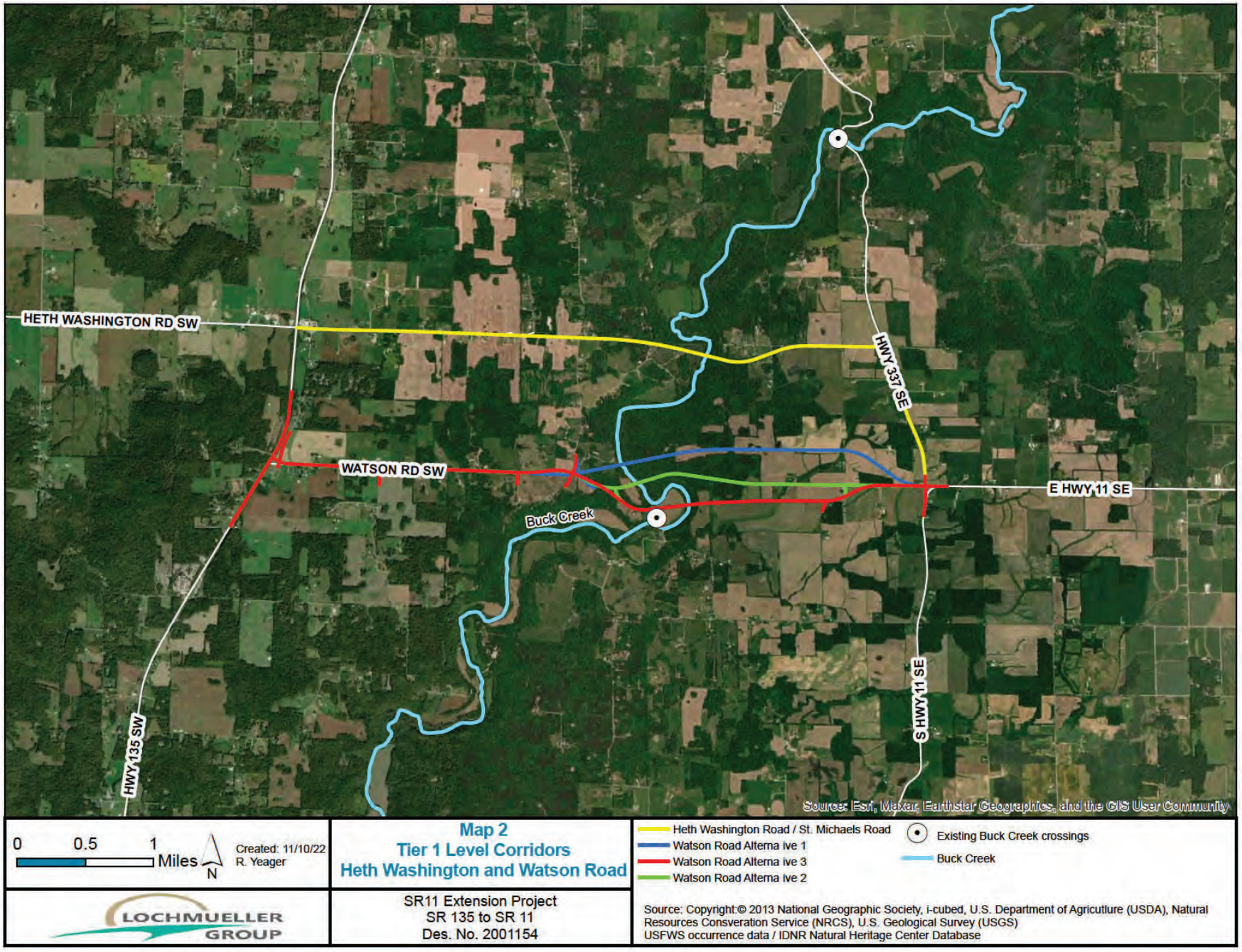
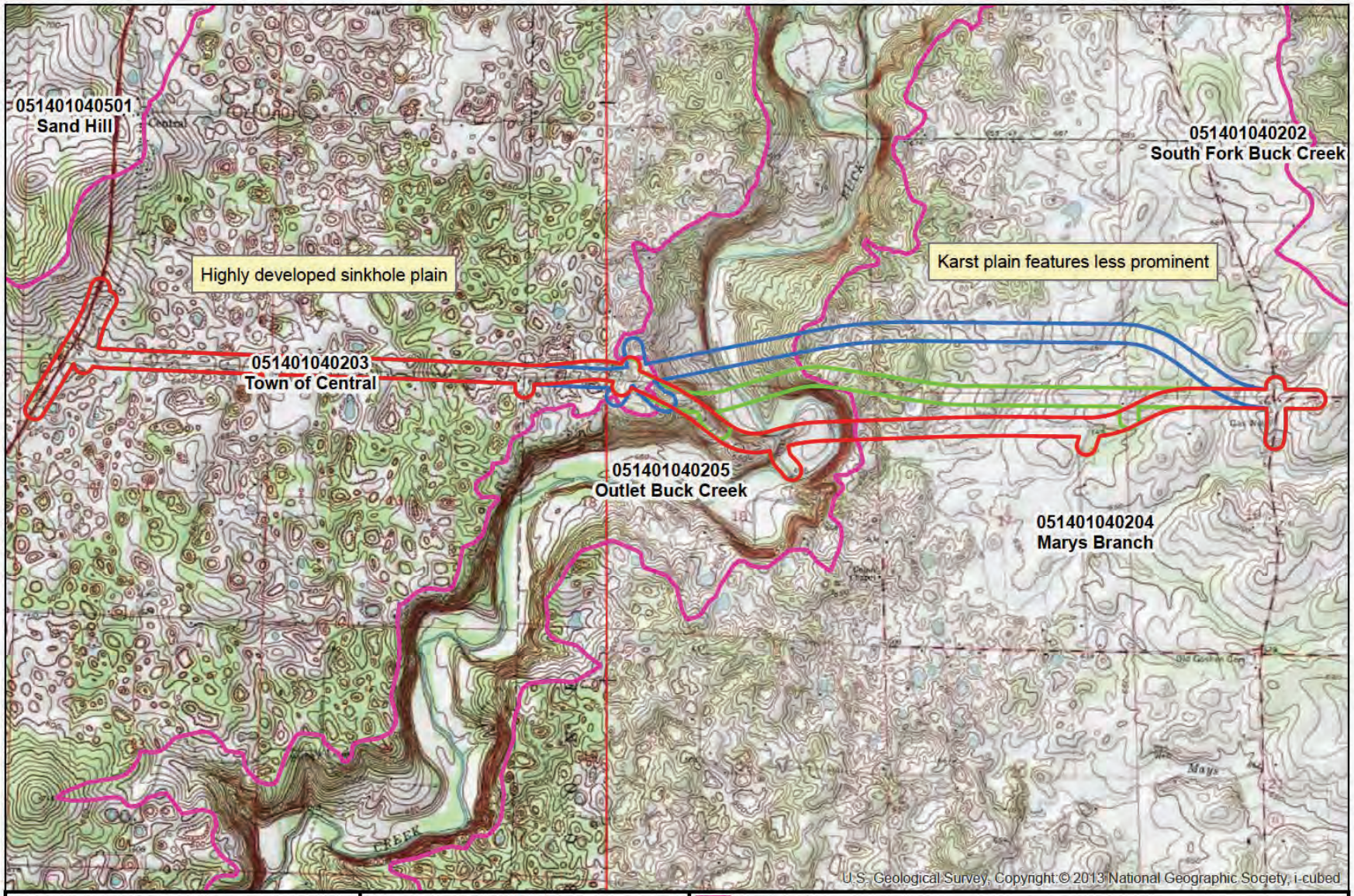
E-mail: ryeager@lochgroup.com

Appendix A

Maps


Wiseman Road from SR 135 to Old Hwy 337
Icf = 3.48
Icc = 1.44
Wiseman Rd
Lake Rd
Old Hwy 337/Wiseman Road to Old Hwy 337/SR 11
Icf = 0.31
Icc = 0.17
SR 11/Old Hwy 337 Intersection
Icf = 1.21
Icc = -0.15
SR135/Watson Road Intersection
Icf = 2.82
Icc = 1.72
Old Hwy 337
SR 135
Watson Rd
Union Chapel Rd
SR 11
Melview Rd
Old Goshen Rd
Old Hwy 11/Goshen Road intersec ion
Icf = 1.95
Icc = 0.77
Watson Road/Union Chapel Road/Goshen Road
Icf = 0.23
Icc = 0.04
Old Hwy 11 from SR 135 to SR 11
Icf = 1.25
Icc = 1.36
Old Hwy 11
Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community
0 1 2 Miles
N
Created: 6/29/22
R. Yeager
Map 1
Existing SR 135 to SR 11
Connectors
LOCHMUELLER GROUP
SR11 Extension Project
SR 135 to SR 11
Des. No. 2001154
Alternative 3 corridor (Preferred)
Existing Buck Creek crossings
SR 11
SR 135
Old Hwy 11 connector
Watson/Union Chapel/Goshen/Melview connector
Old SR 337/Lake/Wiseman connector
Source: Copyright© 2013 National Geographic Society, i-cubed, U.S. Department of Agriculture (USDA), Natural Resources Consveration Service (NRCS), U.S. Geological Survey (USGS)
USFWS occurrence data / IDNR Natural Heritage Center Database


HETH WASHINGTON RD SW
WATSON RD SW
HWY 337 SE
E HWY 11 SE
S HWY 11 SE
HWY 135 SW
Buck Creek
Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community
0 0.5 1 Miles
N
Created: 11/10/22
R. Yeager
Map 2
Tier 1 Level Corridors
Heth Washington and Watson Road
LOCHMUELLER GROUP
SR11 Extension Project
SR 135 to SR 11
Des. No. 2001154
Heth Washington Road / St. Michaels Road
Watson Road Alterna ive 1
Watson Road Alterna ive 3
Watson Road Alterna ive 2
Existing Buck Creek crossings
Buck Creek
Source: Copyright:© 2013 National Geographic Society, i-cubed, U.S. Department of Agriculture (USDA), Natural Resources Consveration Service (NRCS), U.S. Geological Survey (USGS)
USFWS occurrence data / IDNR Natural Heritage Center Database


051401040501
Sand Hill
Highly developed sinkhole plain
051401040203
Town of Central
051401040205
Outlet Buck Creek
051401040202
South Fork Buck Creek
Karst plain features less prominent
051401040204
Marys Branch
U.S. Geological Survey, Copyright:© 2013 National Geographic Society, i-cubed
0 1,500 3,000 Feet
N
Created: 6/29/22
R. Yeager
Map 3
USGS Quadrangle Map
1:32,000 scale
12-Digit HUC
Alternative 1 corridor
Alternative 2 corridor
Alternative 3 corridor (Preferred)
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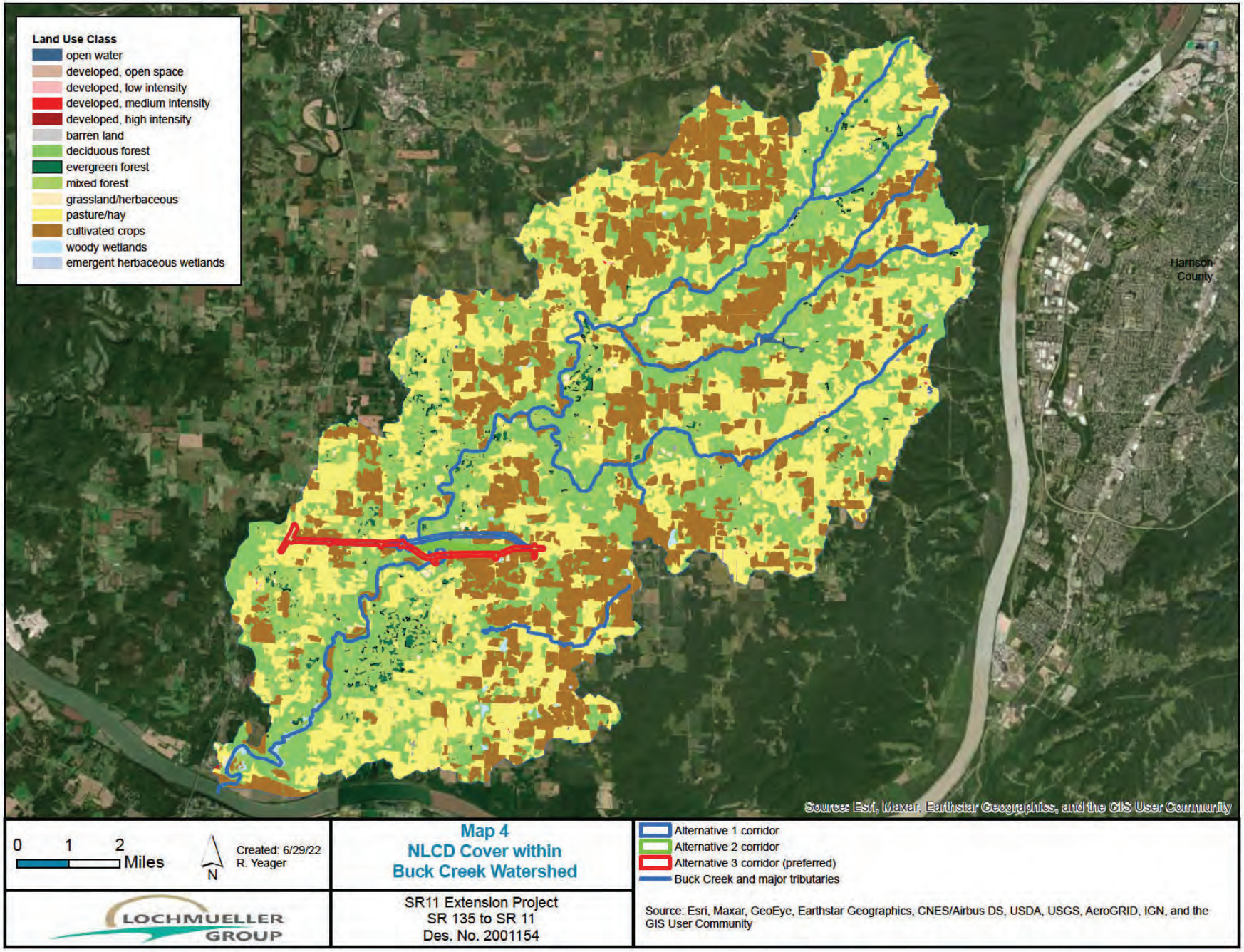
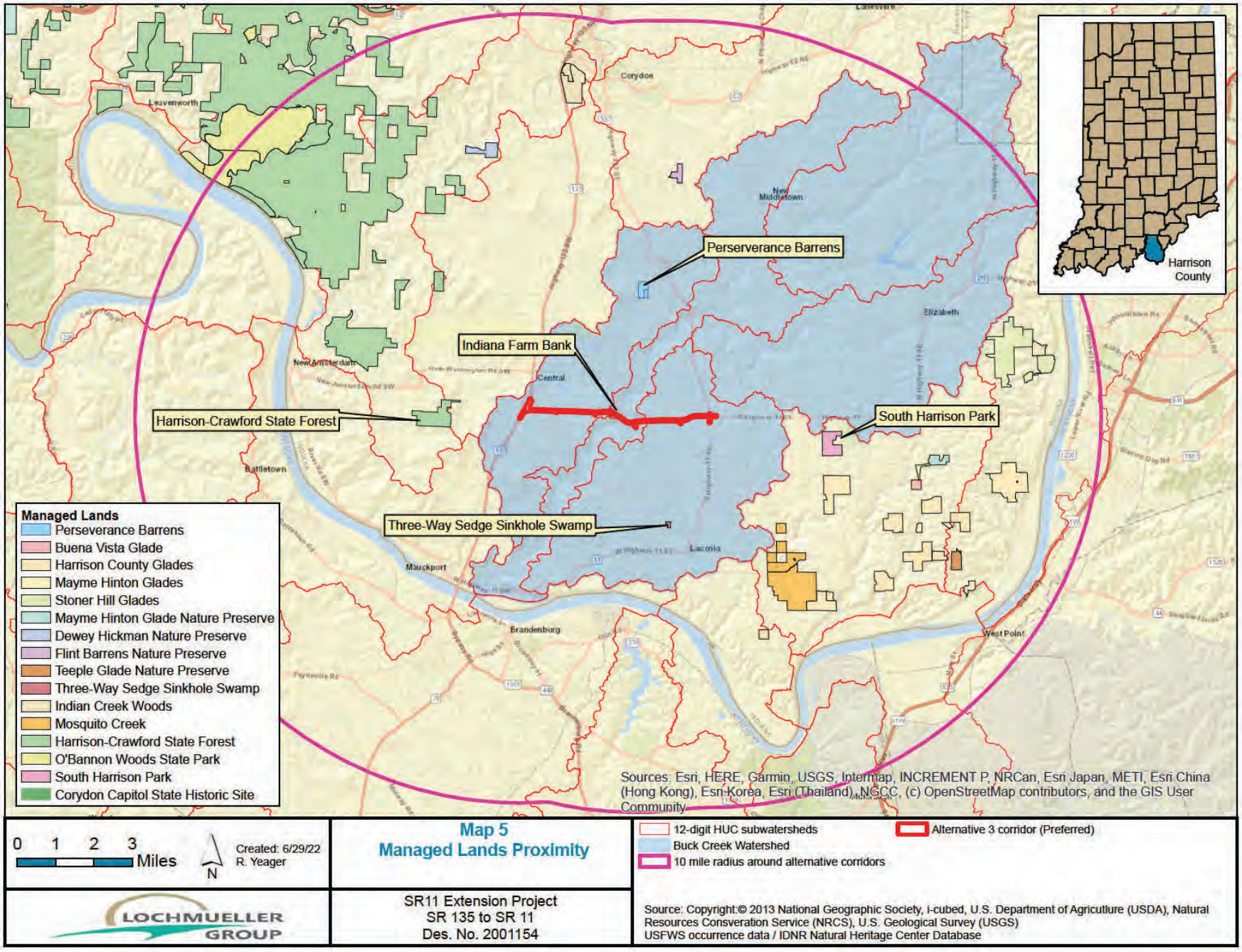
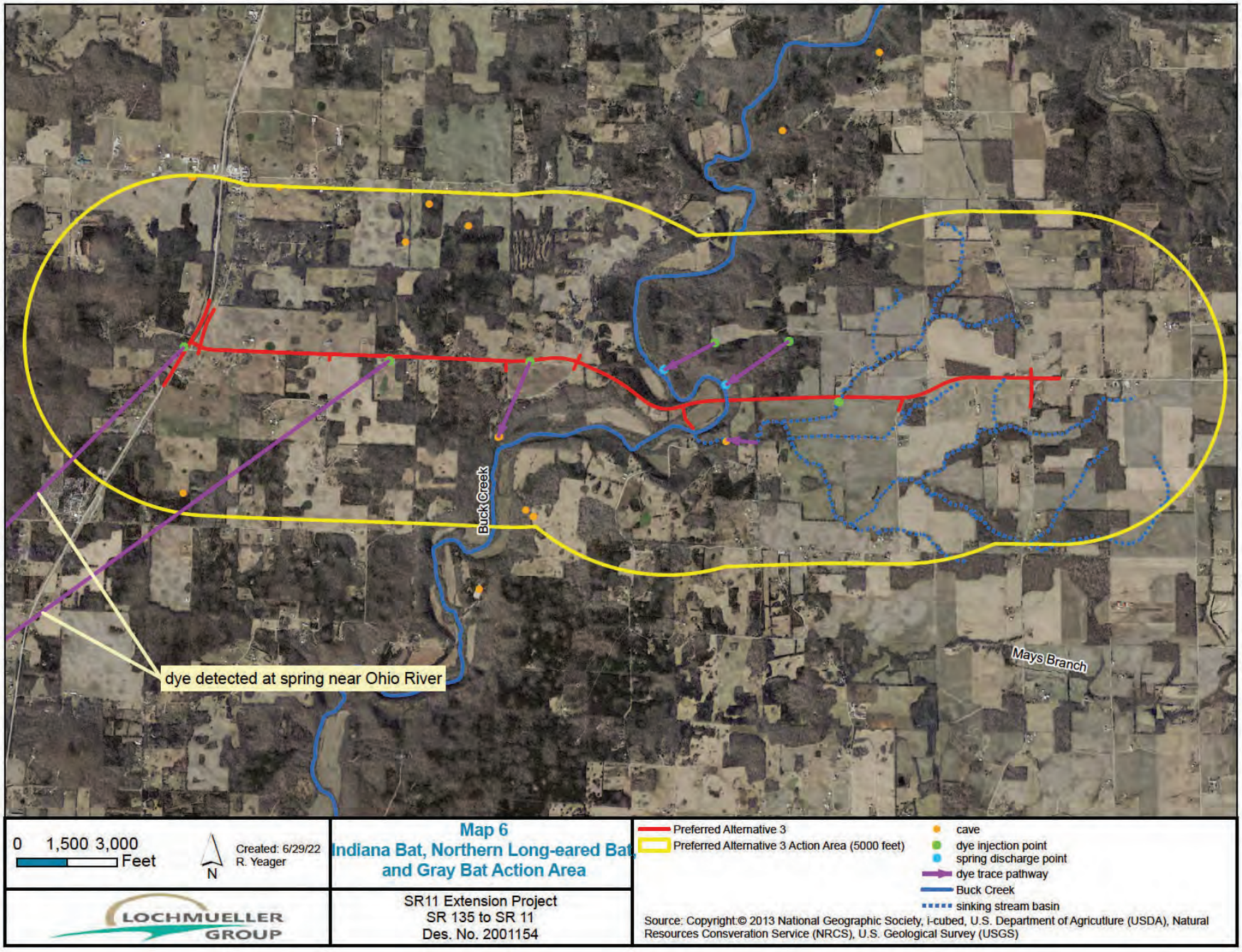
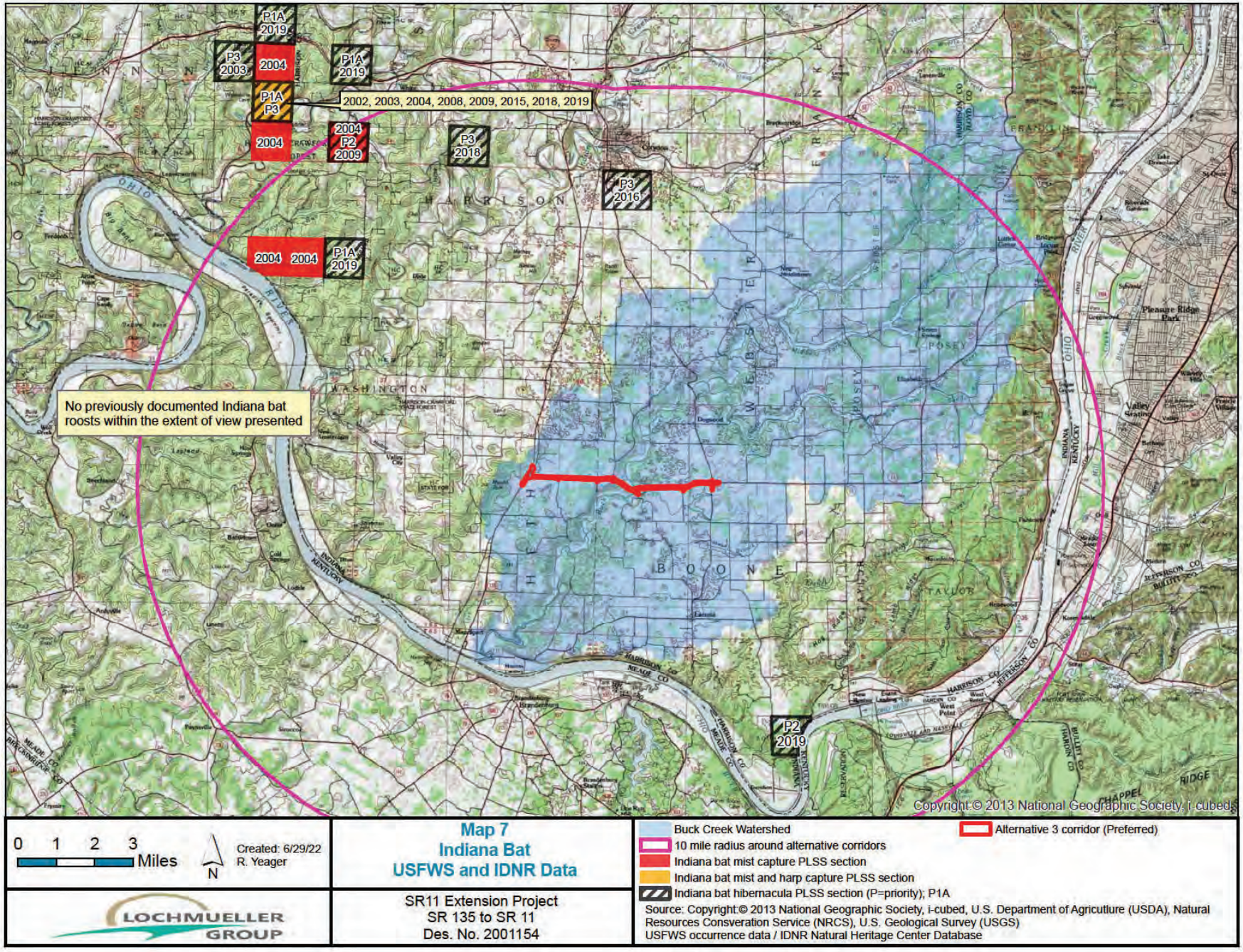
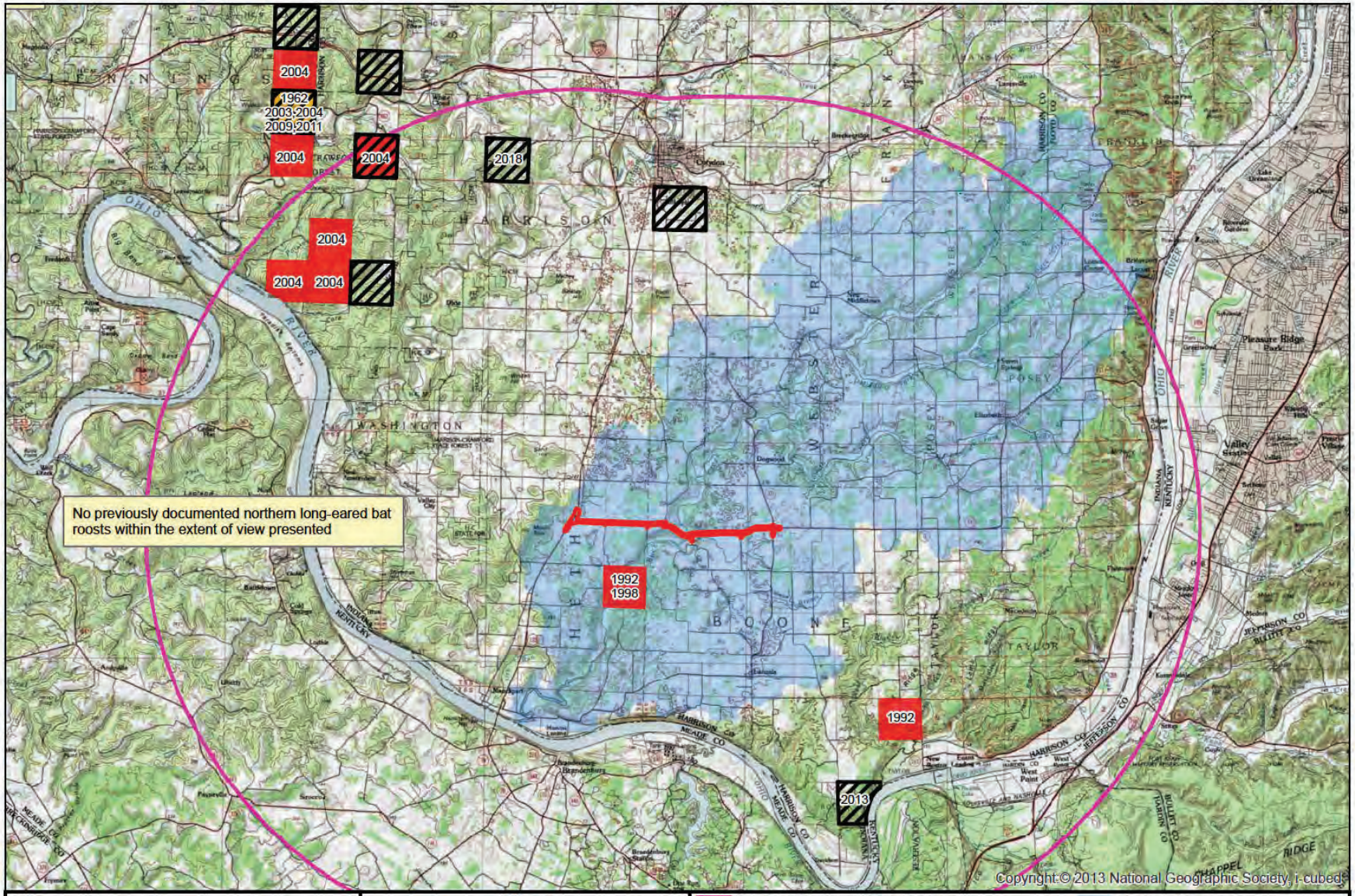
SR11 Extension Project
SR 135 to SR 11
Des. No. 2001154
Source: Copyright:© 2013 National Geographic Society, i-cubed, U.S. Department of Agriculture (USDA), Natural Resources Consveration Service (NRCS), U.S. Geological Survey (USGS)


Land Use Class
open water
developed, open space
developed, low intensity
developed, medium intensity
developed, high intensity
barren land
deciduous forest
evergreen forest
mixed forest
grassland/herbaceous
pasture/hay
cultivated crops
woody wetlands
emergent herbaceous wetlands
Harrison County
Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community
0 1 2 Miles
N
Created: 6/29/22
R. Yeager
Map 4
NLCD Cover within
Buck Creek Watershed
Alternative 1 corridor
Alternative 2 corridor
Alternative 3 corridor (preferred)
Buck Creek and major tributaries
LOCHMUELLER GROUP
SR11 Extension Project
SR 135 to SR 11
Des. No. 2001154
Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community


Perserverance Barrens
Indiana Farm Bank
Harrison-Crawford State Forest
South Harrison Park
Three-Way Sedge Sinkhole Swamp
Harrison County
Managed Lands
Perseverance Barrens
Buena Vista Glade
Harrison County Glades
Mayme Hinton Glades
Stoner Hill Glades
Mayme Hinton Glade Nature Preserve
Dewey Hickman Nature Preserve
Flint Barrens Nature Preserve
Teeple Glade Nature Preserve
Three-Way Sedge Sinkhole Swamp
Indian Creek Woods
Mosquito Creek
Harrison-Crawford State Forest
O'Bannon Woods State Park
South Harrison Park
Corydon Capitol State Historic Site
Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community
0 1 2 3 Miles
N
Created: 6/29/22
R. Yeager
Map 5
Managed Lands Proximity
12-digit HUC subwatersheds
Buck Creek Watershed
10 mile radius around alternative corridors
Alternative 3 corridor (Preferred)
LOCHMUELLER GROUP
SR11 Extension Project
SR 135 to SR 11
Des. No. 2001154
Source: Copyright:© 2013 National Geographic Society, i-cubed, U.S. Department of Agriculture (USDA), Natural Resources Conservation Service (NRCS), U.S. Geological Survey (USGS)
USFWS occurrence data / IDNR Natural Heritage Center Database


Buck Creek
Mays Branch
dye detected at spring near Ohio River
0 1,500 3,000
Feet
N
Created: 6/29/22
R. Yeager
Map 6
Indiana Bat, Northern Long-eared Bat, and Gray Bat Action Area
LOCHMUELLER GROUP
SR11 Extension Project
SR 135 to SR 11
Des. No. 2001154
Preferred Alternative 3
Preferred Alternative 3 Action Area (5000 feet)
cave
dye injection point
spring discharge point
dye trace pathway
Buck Creek
sinking stream basin
Source: Copyright:© 2013 National Geographic Society, i-cubed, U.S. Department of Agriculture (USDA), Natural Resources Consveration Service (NRCS), U.S. Geological Survey (USGS)


P1A 2019
P3 2003
2004
P1A 2019
P1A P3
2002, 2003, 2004, 2008, 2009, 2015, 2018, 2019
2004
2004 P2 2009
P3 2018
P3 2016
2004 2004
P1A 2019
No previously documented Indiana bat roosts within the extent of view presented
P2 2019
Copyright © 2013 National Geographic Society, i-cubed
0 1 2 3 Miles
N
Created: 6/29/22
R. Yeager
Map 7
Indiana Bat
USFWS and IDNR Data
LOCHMUELLER GROUP
SR11 Extension Project
SR 135 to SR 11
Des. No. 2001154
Buck Creek Watershed
10 mile radius around alternative corridors
Indiana bat mist capture PLSS section
Indiana bat mist and harp capture PLSS section
Indiana bat hibernacula PLSS section (P=priority); P1A
Alternative 3 corridor (Preferred)
Source: Copyright:© 2013 National Geographic Society, i-cubed, U.S. Department of Agriculture (USDA), Natural Resources Consveration Service (NRCS), U.S. Geological Survey (USGS)
USFWS occurrence data / IDNR Natural Heritage Center Database


2004
1962
2003-2004
2009-2011
2004
2004
2018
2004
2004
2004
No previously documented northern long-eared bat roosts within the extent of view presented
1992
1998
1992
2013
Copyright:© 2013 National Geographic Society, i-cubed
0 1 2 3 Miles
N
Created: 6/12/22
R. Yeager
Map 8
Northern Long-eared Bat
USFWS and IDNR Data
10 mile radius around alternative corridors
Northern long-eared mist capture PLSS section
Northern long-eared bat mist and harp capture PLSS section
Northern long-eared bat hibernacula PLSS section
Buck Creek Watershed
Alternative 3 corridor (Preferred)
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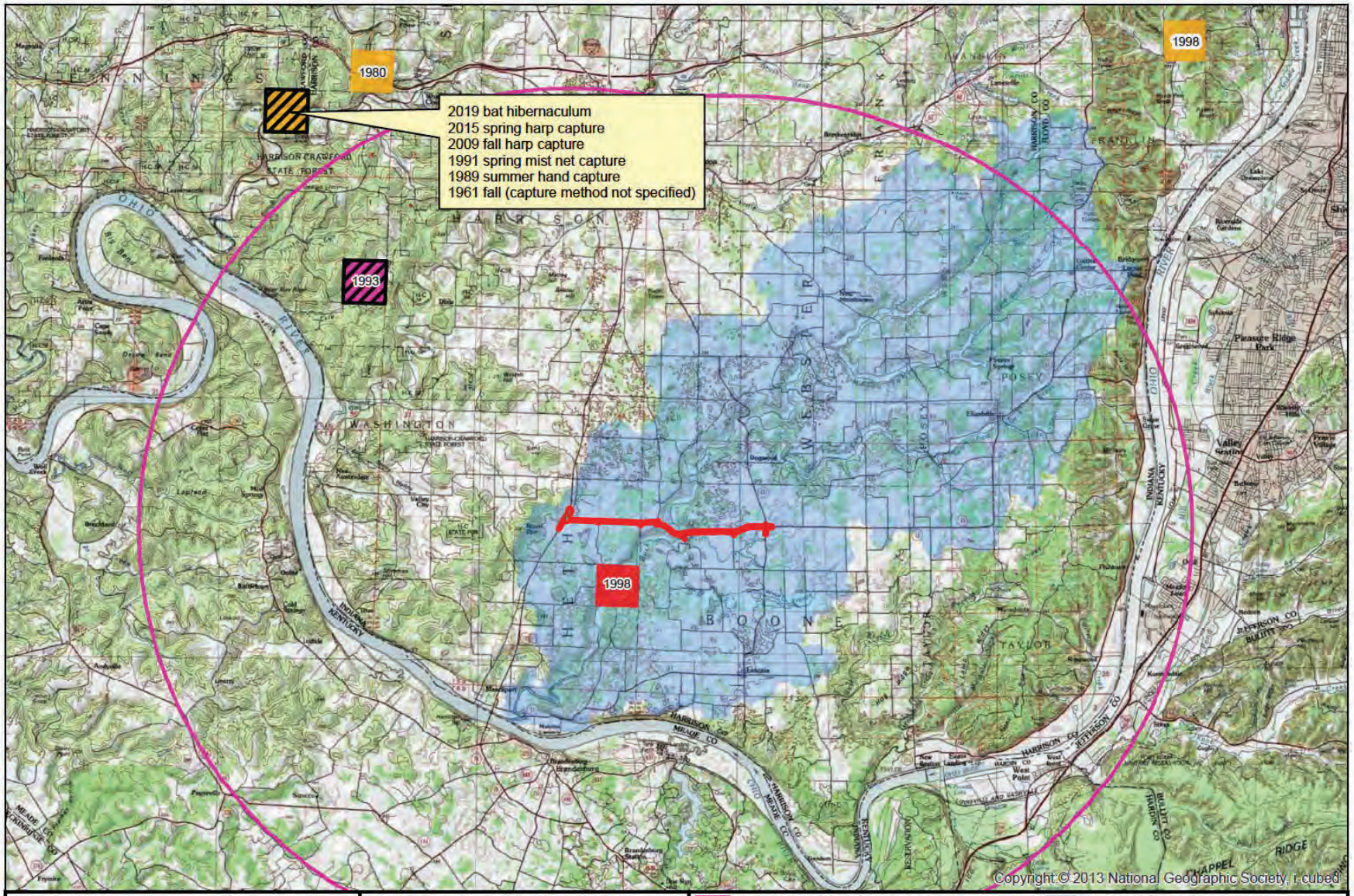
SR11 Extension Project
SR 135 to SR 11
Des. No. 2001154
Source: Copyright:© 2013 National Geographic Society, i-cubed, U.S. Department of Agriculture (USDA), Natural Resources Consveration Service (NRCS), U.S. Geological Survey (USGS)
USFWS occurrence data / IDNR Natural Heritage Center Database


1980
1998
2019 bat hibernaculum
2015 spring harp capture
2009 fall harp capture
1991 spring mist net capture
1989 summer hand capture
1961 fall (capture method not specified)
1993
1998
Copyright © 2013 National Geographic Society, i-cubed
0 1 2 3 Miles
N
Created: 6/29/22
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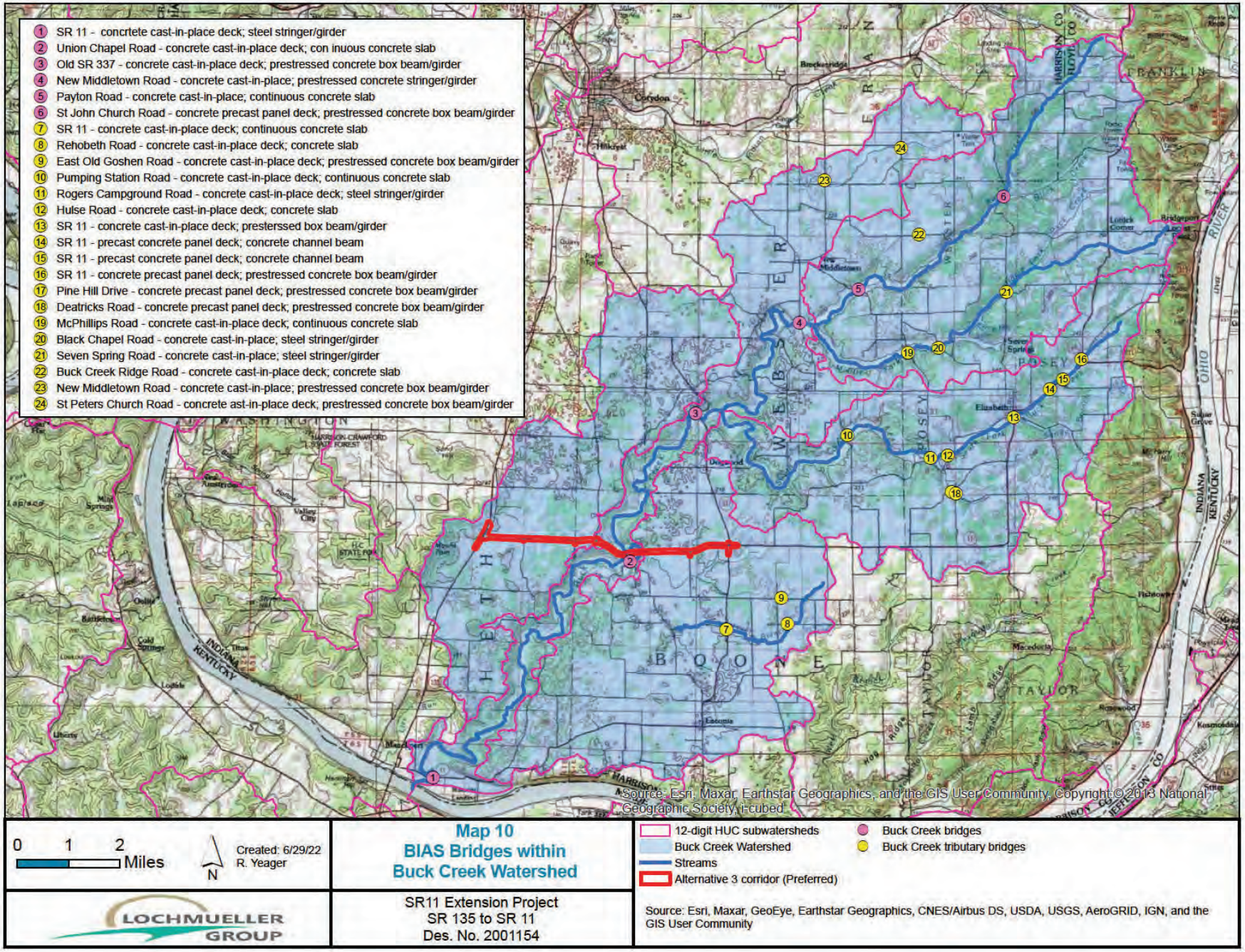
Map 9
Gray bat
USFWS and IDNR Data
LOCHMUELLER GROUP
SR11 Extension Project
SR 135 to SR 11
Des. No. 2001154
10 mile radius around alternative corridors
Gray bat summer mist capture PLSS section
Gray bat summer mist and hand capture PLSS section
Gray bat winter visual observation PLSS section
Gray bat hibernacula PLSS section
Buck Creek Watershed
Alternative 3 corridor (Preferred)
Source: Copyright:© 2013 National Geographic Society, i-cubed, U.S. Department of Agriculture (USDA), Natural Resources Conservation Service (NRCS), U.S. Geological Survey (USGS)
USFWS occurrence data / IDNR Natural Heritage Center Database


1 SR 11 - concrtete cast-in-place deck; steel stringer/girder
2 Union Chapel Road - concrete cast-in-place deck; con inuous concrete slab
3 Old SR 337 - concrete cast-in-place deck; prestressed concrete box beam/girder
4 New Middletown Road - concrete cast-in-place; prestressed concrete stringer/girder
5 Payton Road - concrete cast-in-place; continuous concrete slab
6 St John Church Road - concrete precast panel deck; prestressed concrete box beam/girder
7 SR 11 - concrete cast-in-place deck; continuous concrete slab
8 Rehobeth Road - concrete cast-in-place deck; concrete slab
9 East Old Goshen Road - concrete cast-in-place deck; prestressed concrete box beam/girder
10 Pumping Station Road - concrete cast-in-place deck; continuous concrete slab
11 Rogers Campground Road - concrete cast-in-place deck; steel stringer/girder
12 Hulse Road - concrete cast-in-place deck; concrete slab
13 SR 11 - concrete cast-in-place deck; presterssed box beam/girder
14 SR 11 - precast concrete panel deck; concrete channel beam
15 SR 11 - precast concrete panel deck; concrete channel beam
16 SR 11 - concrete precast panel deck; prestressed concrete box beam/girder
17 Pine Hill Drive - concrete precast panel deck; prestressed concrete box beam/girder
18 Deatricks Road - concrete precast panel deck; prestressed concrete box beam/girder
19 McPhillips Road - concrete cast-in-place deck; continuous concrete slab
20 Black Chapel Road - concrete cast-in-place; steel stringer/girder
21 Seven Spring Road - concrete cast-in-place; steel stringer/girder
22 Buck Creek Ridge Road - concrete cast-in-place deck; concrete slab
23 New Middletown Road - concrete cast-in-place; prestressed concrete box beam/girder
24 St Peters Church Road - concrete ast-in-place deck; prestressed concrete box beam/girder
Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community, Copyright © 2013 National Geographic Society, i-cubed
0 1 2 Miles
N
Created: 6/29/22
R. Yeager
Map 10
BIAS Bridges within
Buck Creek Watershed
12-digit HUC subwatersheds
Buck Creek Watershed
Streams
Alternative 3 corridor (Preferred)
Buck Creek bridges
Buck Creek tributary bridges
Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community
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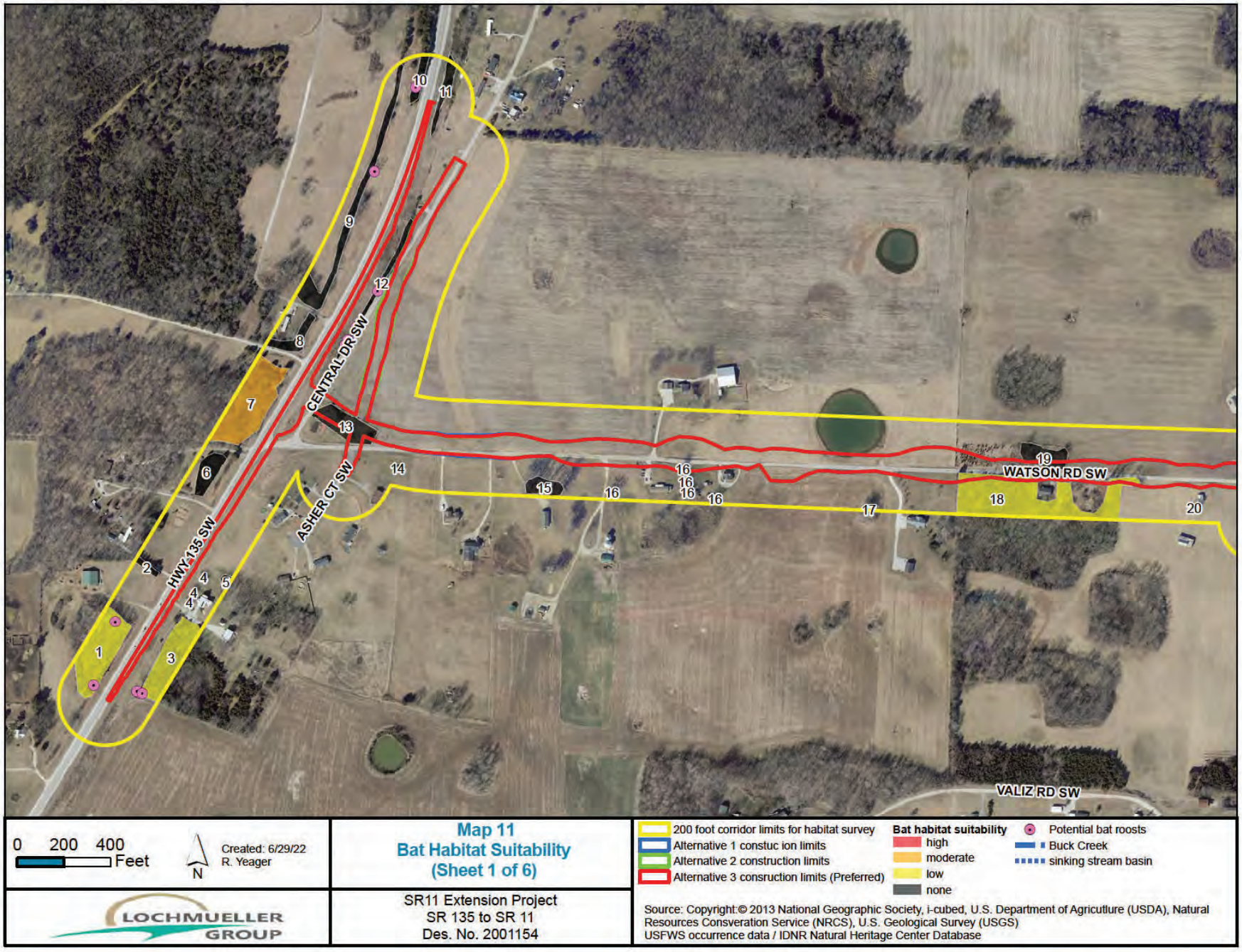
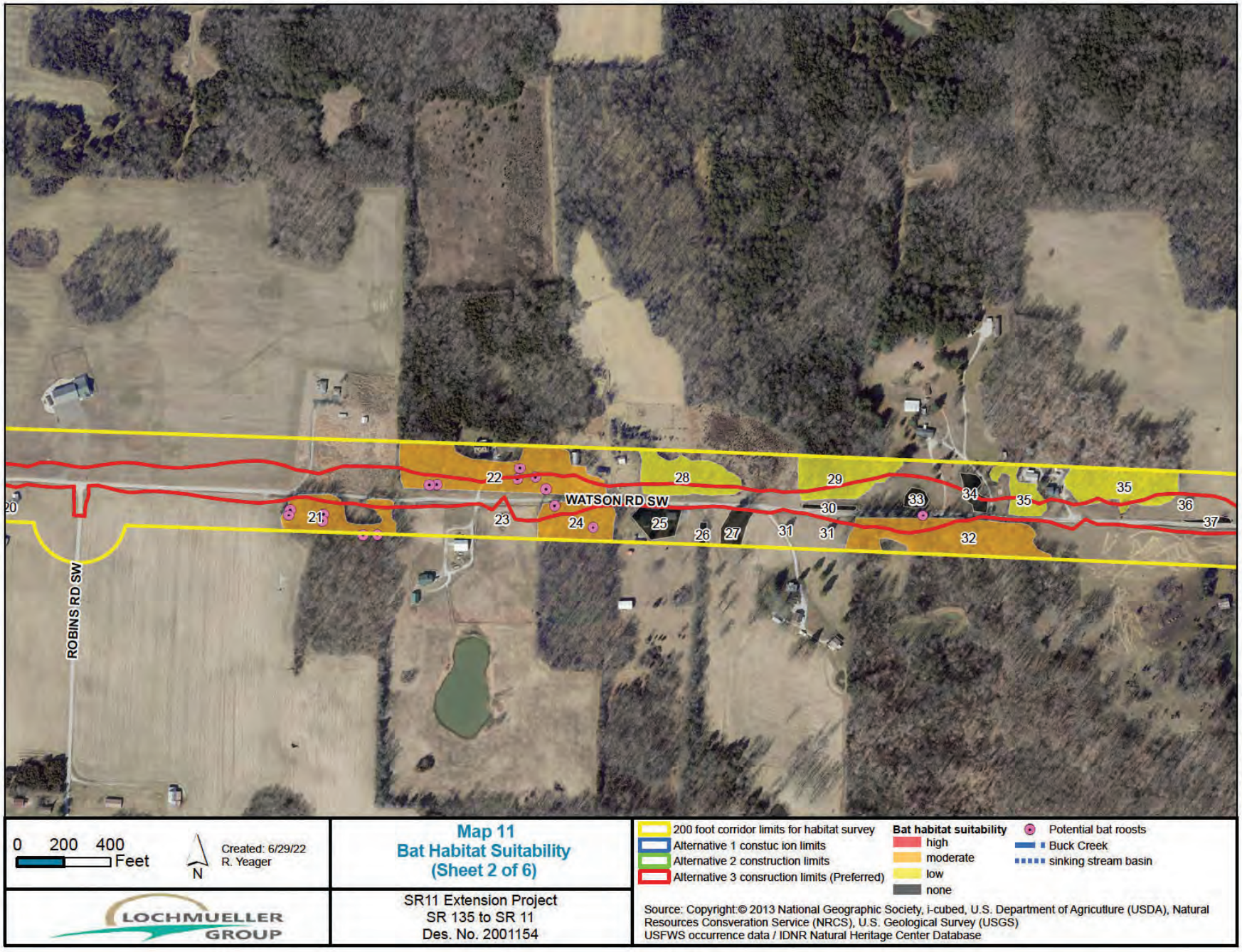
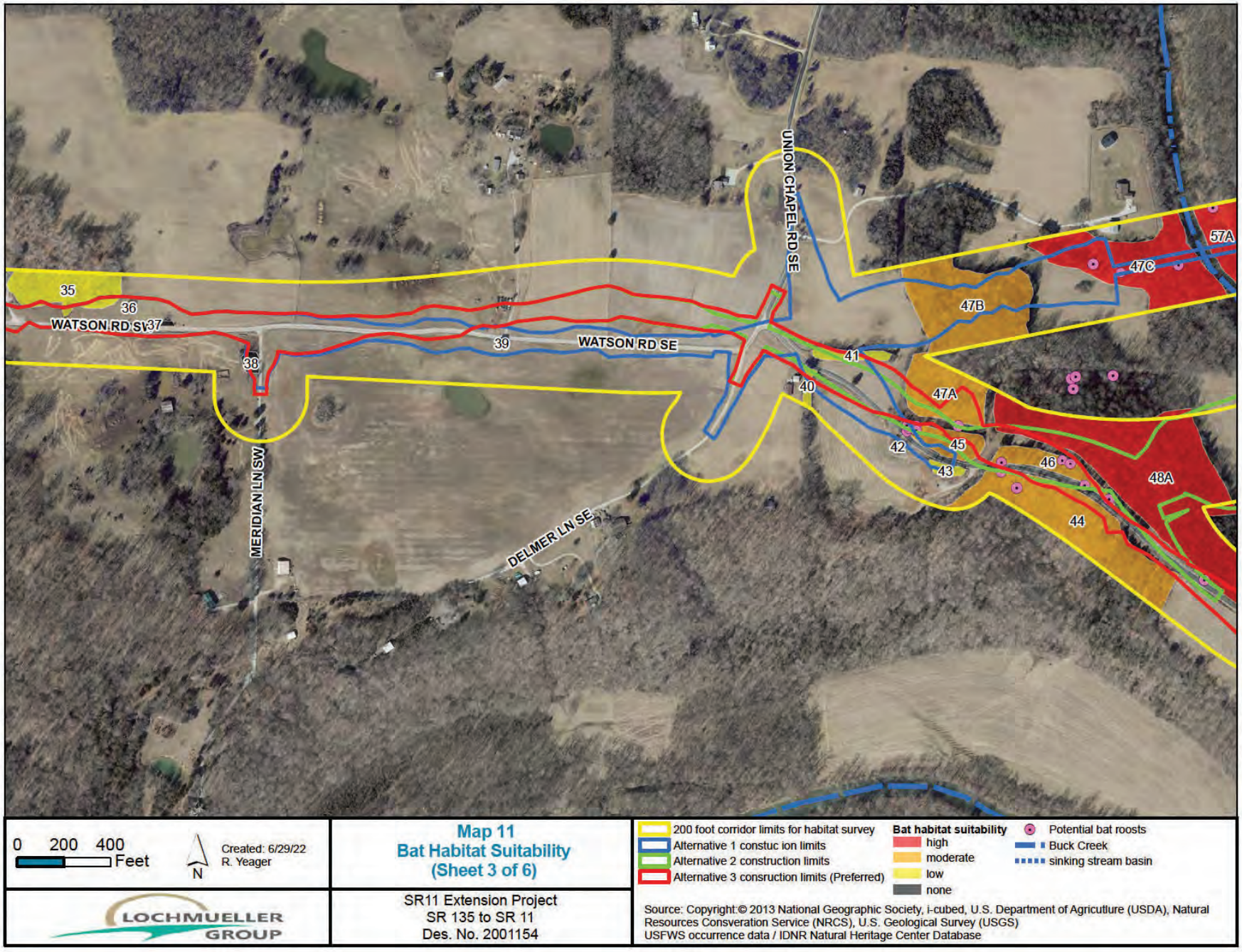
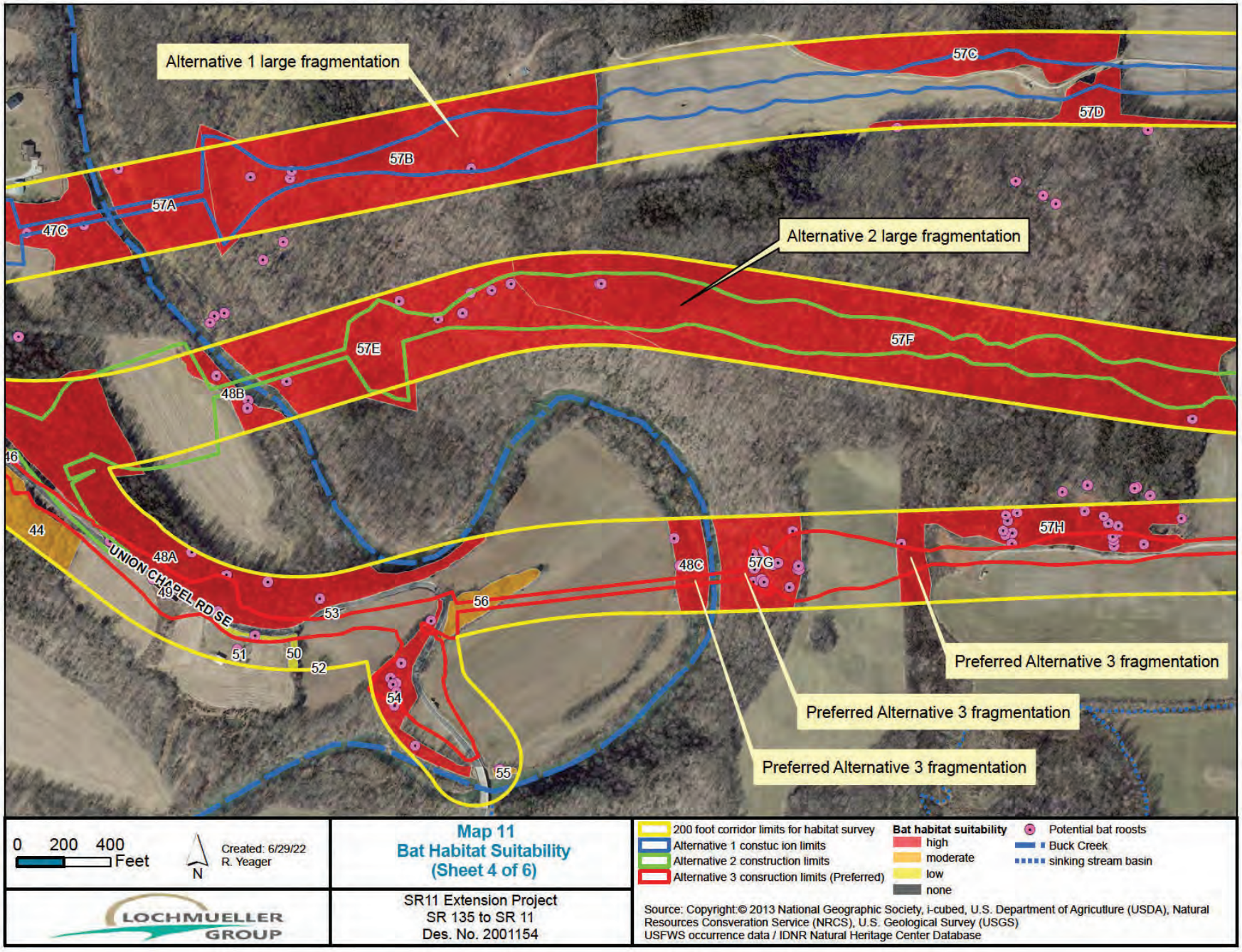
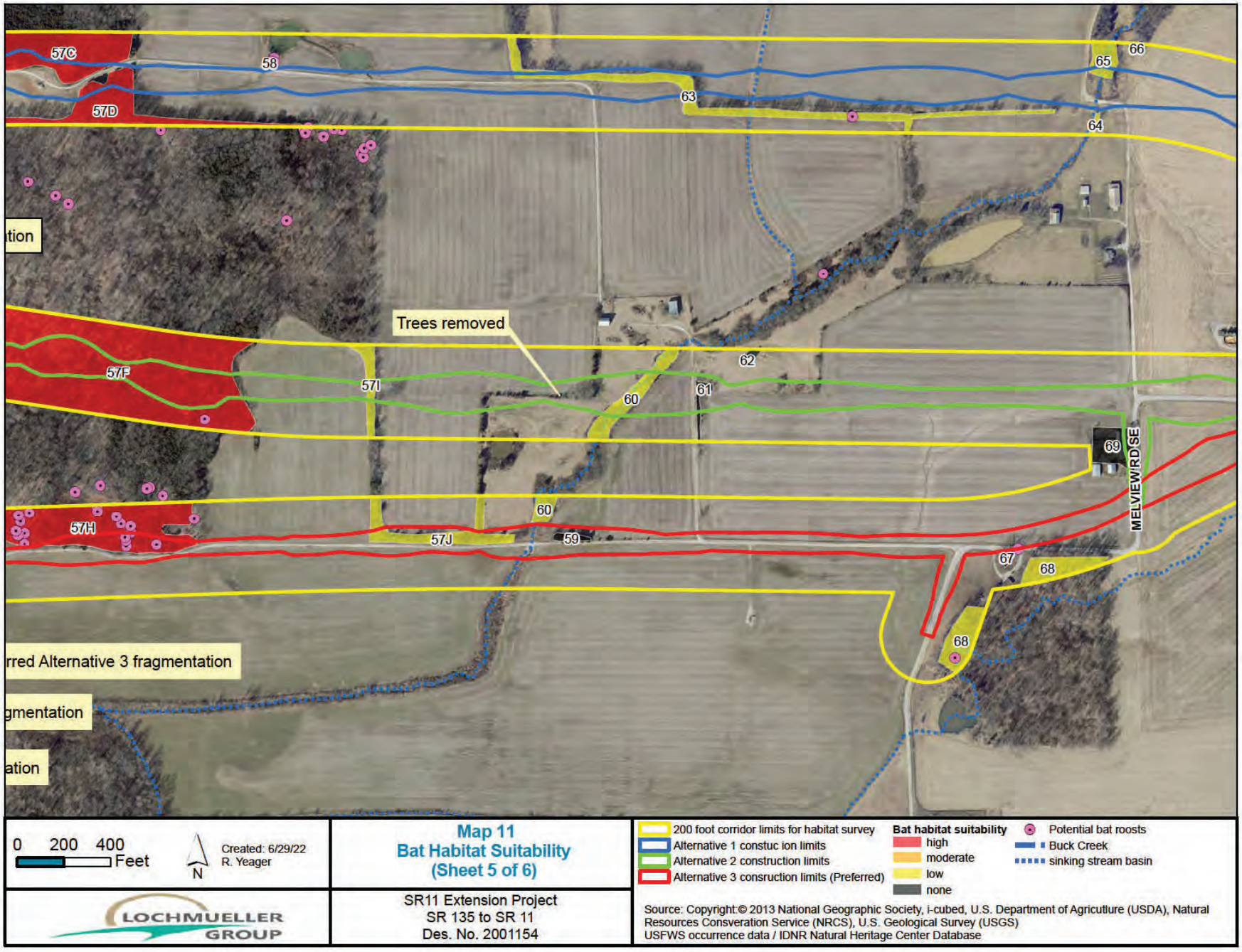
SR11 Extension Project
SR 135 to SR 11
Des. No. 2001154


CENTRAL DR SW
HWY 135 SW
ASHER CT SW
WATSON RD SW
VALIZ RD SW
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
0 200 400 Feet
N
Created: 6/29/22
R. Yeager
Map 11
Bat Habitat Suitability
(Sheet 1 of 6)
LOCHMUELLER GROUP
SR11 Extension Project
SR 135 to SR 11
Des. No. 2001154
200 foot corridor limits for habitat survey
Alternative 1 constuc ion limits
Alternative 2 construction limits
Alternative 3 consruction limits (Preferred)
Bat habitat suitability
high
moderate
low
none
Potential bat roosts
Buck Creek
sinking stream basin
Source: Copyright:© 2013 National Geographic Society, i-cubed, U.S. Department of Agriculture (USDA), Natural Resources Consveration Service (NRCS), U.S. Geological Survey (USGS)
USFWS occurrence data / IDNR Natural Heritage Center Database


WATSON RD SW
ROBINS RD SW
20
21
22
23
24
25
26
27
28
29
30
31
31
32
33
34
35
35
36
37
0 200 400 Feet
N
Created: 6/29/22
R. Yeager
Map 11
Bat Habitat Suitability
(Sheet 2 of 6)
LOCHMUELLER GROUP
SR11 Extension Project
SR 135 to SR 11
Des. No. 2001154
200 foot corridor limits for habitat survey
Alternative 1 constuc ion limits
Alternative 2 construction limits
Alternative 3 consruction limits (Preferred)
Bat habitat suitability
high
moderate
low
none
Potential bat roosts
Buck Creek
sinking stream basin
Source: Copyright:© 2013 National Geographic Society, i-cubed, U.S. Department of Agriculture (USDA), Natural Resources Consveration Service (NRCS), U.S. Geological Survey (USGS)
USFWS occurrence data / IDNR Natural Heritage Center Database


35
36
37
38
39
40
41
42
43
45
46
47A
47B
47C
48A
44
57A
WATSON RD SW
WATSON RD SE
UNION CHAPEL RD SE
MERIDIAN LN SW
DELMER LN SE
0 200 400 Feet
N
Created: 6/29/22
R. Yeager
Map 11
Bat Habitat Suitability
(Sheet 3 of 6)
LOCHMUELLER GROUP
SR11 Extension Project
SR 135 to SR 11
Des. No. 2001154
200 foot corridor limits for habitat survey
Alternative 1 constuc ion limits
Alternative 2 construction limits
Alternative 3 consruction limits (Preferred)
Bat habitat suitability
high
moderate
low
none
Potential bat roosts
Buck Creek
sinking stream basin
Source: Copyright:© 2013 National Geographic Society, i-cubed, U.S. Department of Agriculture (USDA), Natural Resources Consveration Service (NRCS), U.S. Geological Survey (USGS)
USFWS occurrence data / IDNR Natural Heritage Center Database


Alternative 1 large fragmentation
Alternative 2 large fragmentation
Preferred Alternative 3 fragmentation
Preferred Alternative 3 fragmentation
Preferred Alternative 3 fragmentation
57A
57B
57C
57D
57E
57F
57G
57H
47C
48A
48B
48C
44
46
49
50
51
52
53
54
55
56
UNION CHAPEL RD SE
0 200 400 Feet
N
Created: 6/29/22
R. Yeager
Map 11
Bat Habitat Suitability
(Sheet 4 of 6)
LOCHMUELLER GROUP
SR11 Extension Project
SR 135 to SR 11
Des. No. 2001154
200 foot corridor limits for habitat survey
Alternative 1 constuc ion limits
Alternative 2 construction limits
Alternative 3 consruction limits (Preferred)
Bat habitat suitability
high
moderate
low
none
Potential bat roosts
Buck Creek
sinking stream basin
Source: Copyright:© 2013 National Geographic Society, i-cubed, U.S. Department of Agriculture (USDA), Natural Resources Consveration Service (NRCS), U.S. Geological Survey (USGS)
USFWS occurrence data / IDNR Natural Heritage Center Database


57C
58
57D
63
65
66
64
tion
Trees removed
57F
57I
62
61
60
69
MELVIEW RD SE
57H
60
57J
59
67
68
68
rred Alternative 3 fragmentation
gmentation
ation
0 200 400 Feet
N
Created: 6/29/22
R. Yeager
Map 11
Bat Habitat Suitability
(Sheet 5 of 6)
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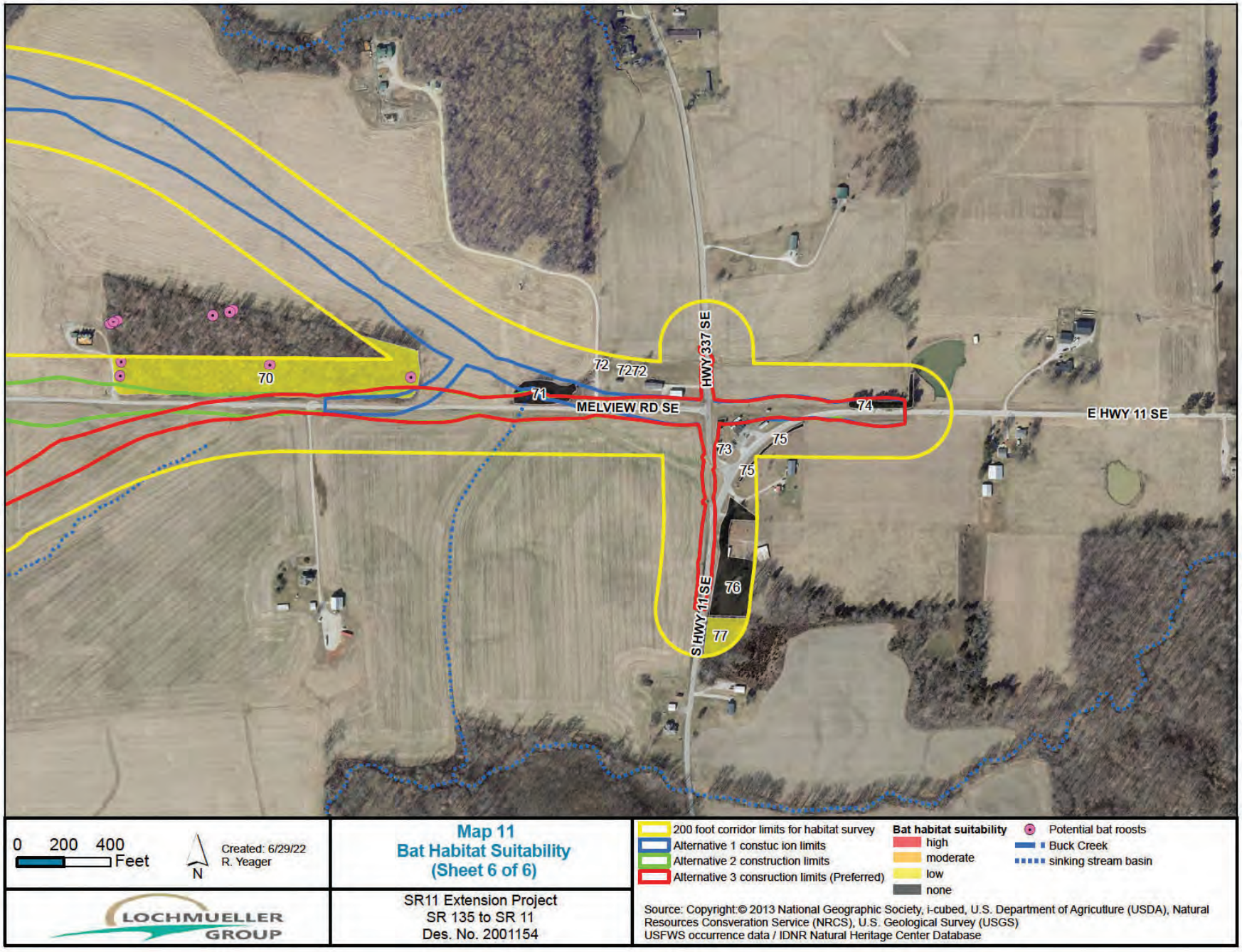
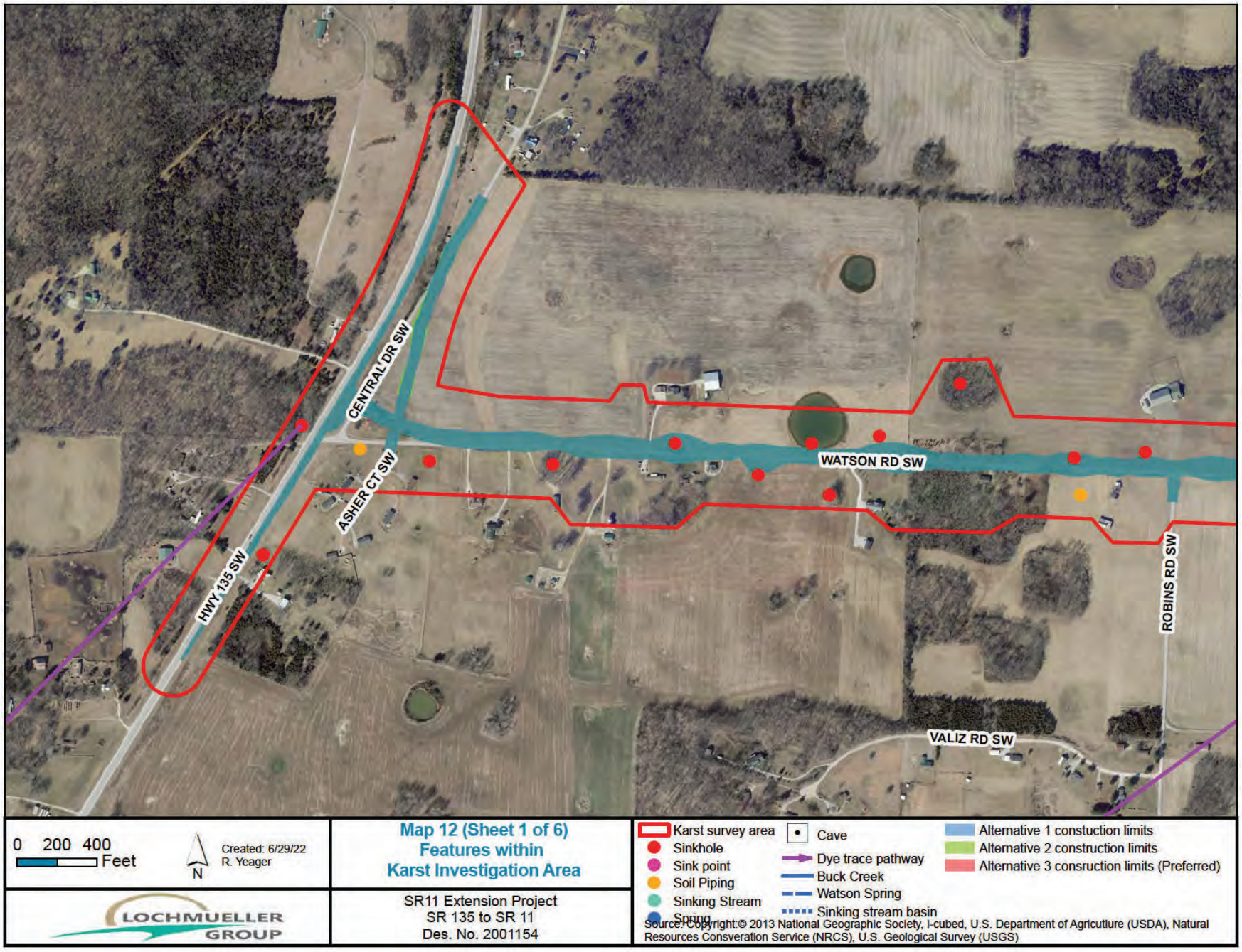
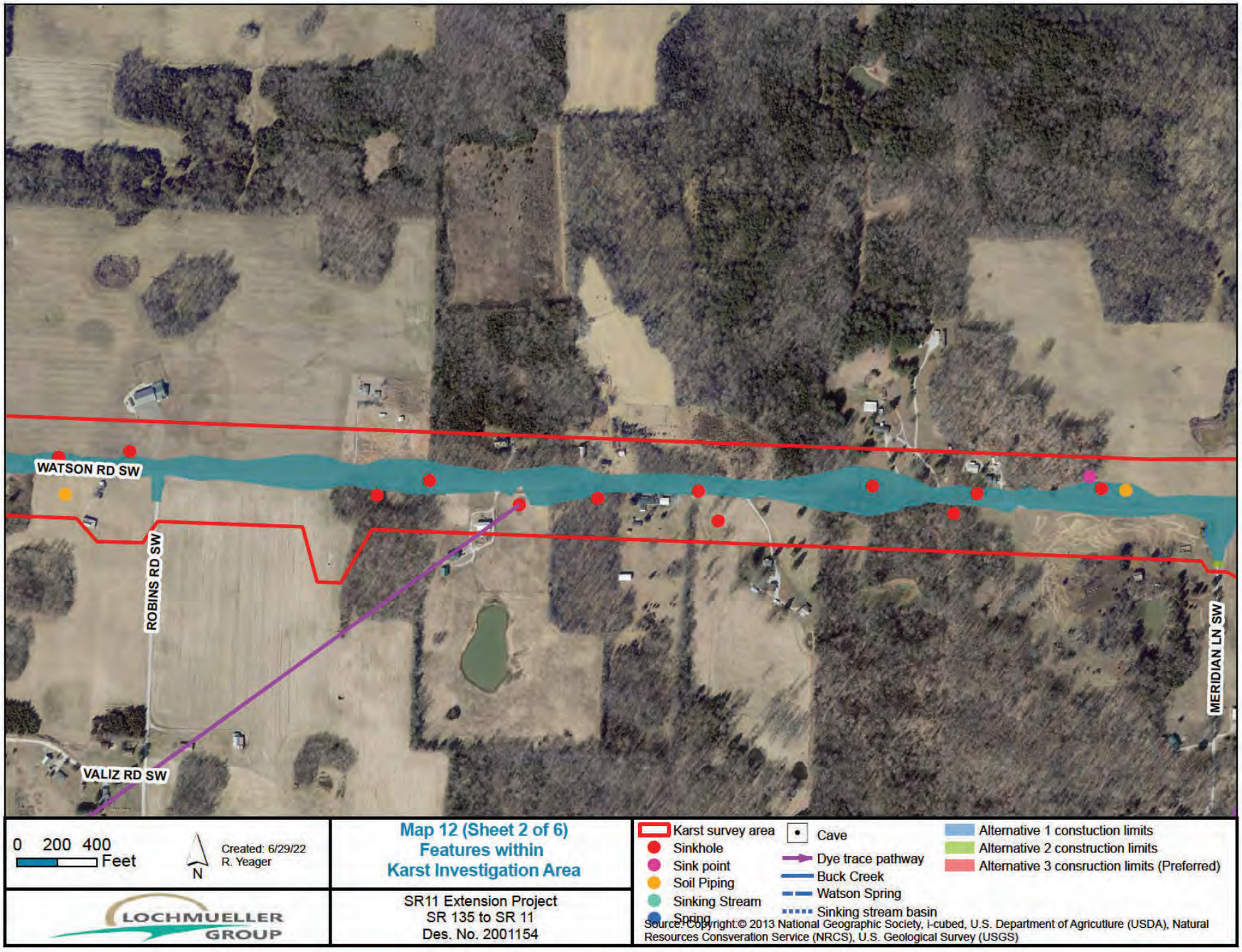
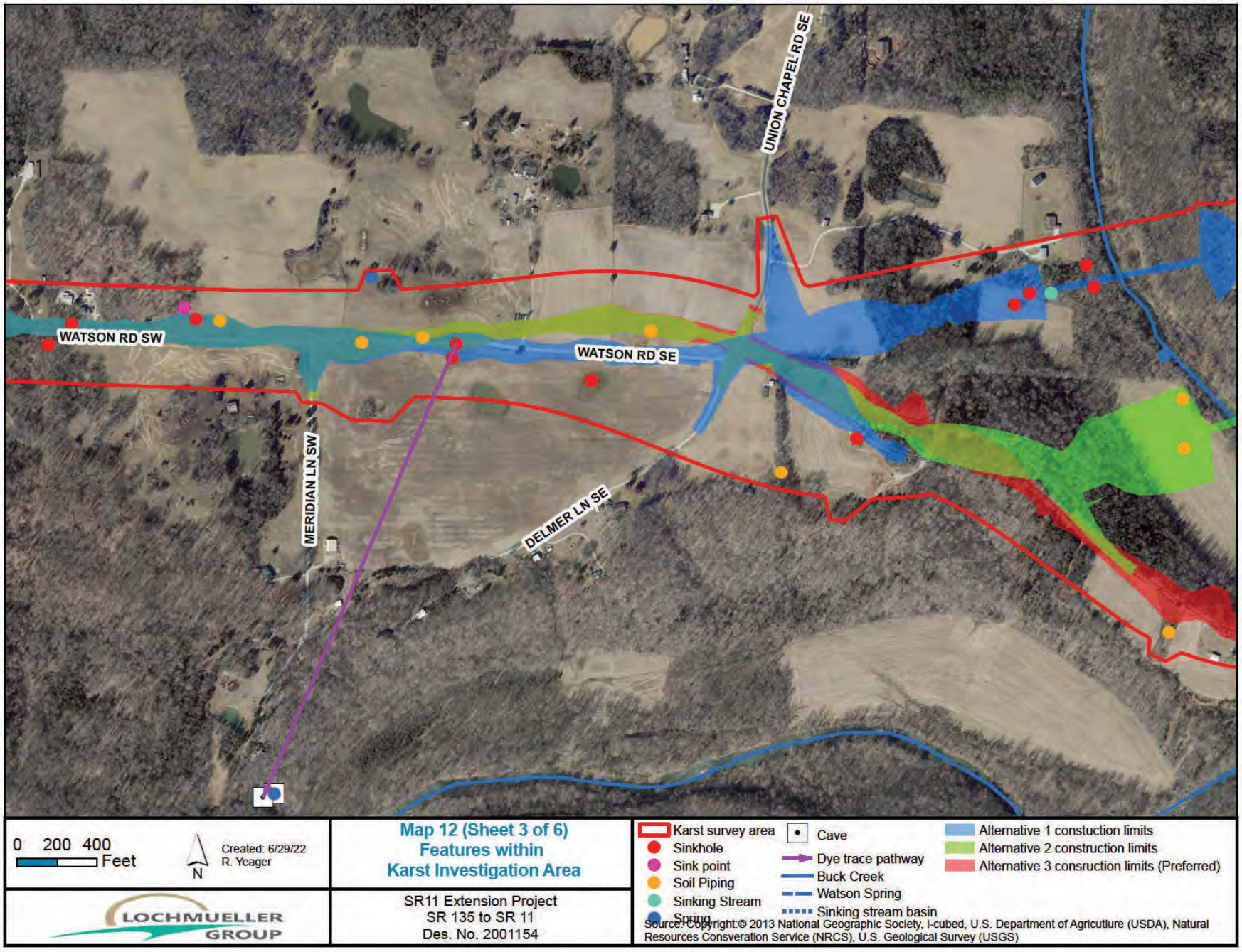
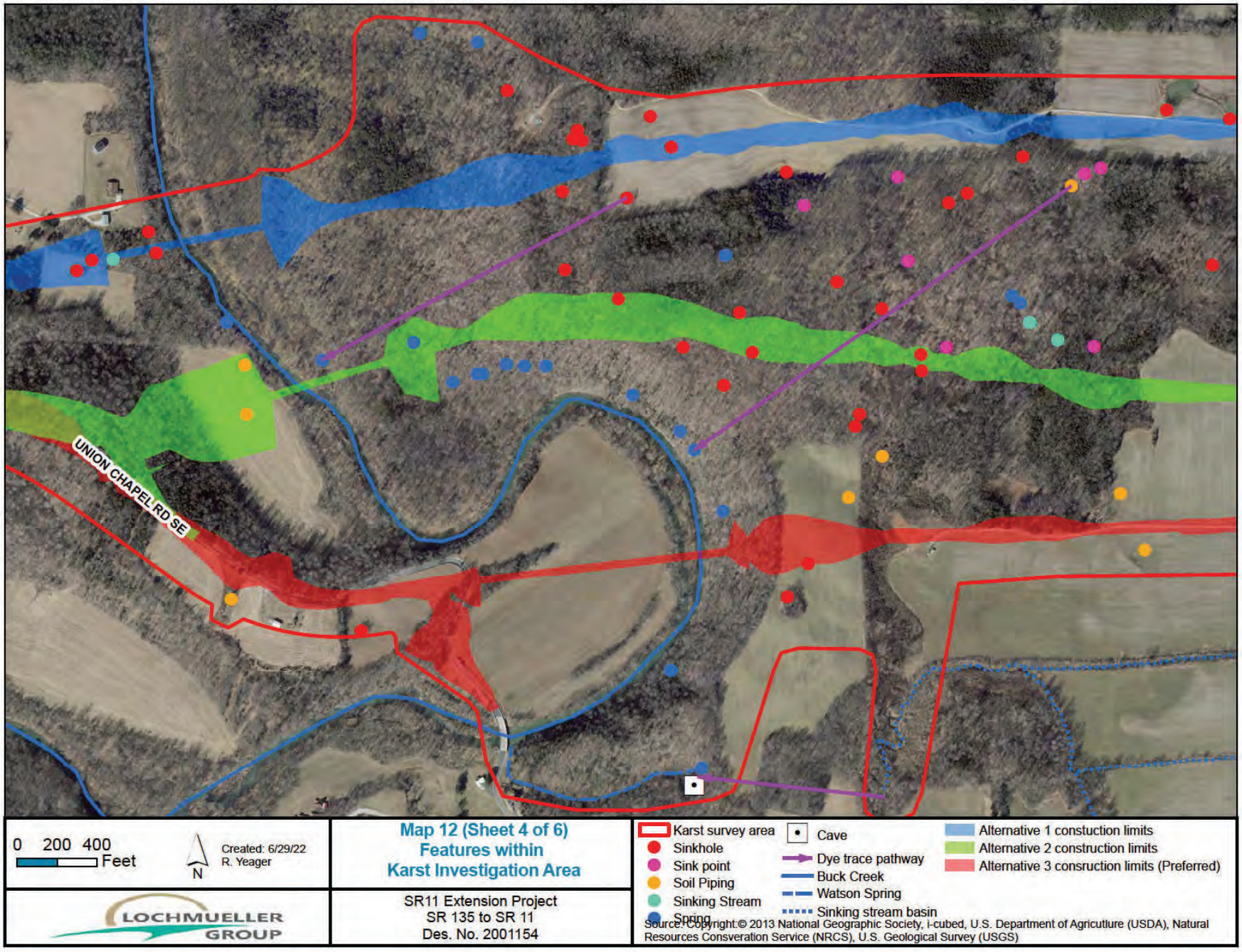
SR11 Extension Project
SR 135 to SR 11
Des. No. 2001154
200 foot corridor limits for habitat survey
Alternative 1 constuc ion limits
Alternative 2 construction limits
Alternative 3 consruction limits (Preferred)
Bat habitat suitability
high
moderate
low
none
Potential bat roosts
Buck Creek
sinking stream basin
Source: Copyright:© 2013 National Geographic Society, i-cubed, U.S. Department of Agriculture (USDA), Natural Resources Consveration Service (NRCS), U.S. Geological Survey (USGS)
USFWS occurrence data / IDNR Natural Heritage Center Database


70
71
72
7272
MELVIEW RD SE
HWY 337 SE
E HWY 11 SE
73
74
75
75
76
77
S HWY 11 SE
0 200 400
Feet
N
Created: 6/29/22
R. Yeager
Map 11
Bat Habitat Suitability
(Sheet 6 of 6)
LOCHMUELLER GROUP
SR11 Extension Project
SR 135 to SR 11
Des. No. 2001154
200 foot corridor limits for habitat survey
Alternative 1 constuc ion limits
Alternative 2 construction limits
Alternative 3 consruction limits (Preferred)
Bat habitat suitability
high
moderate
low
none
Potential bat roosts
Buck Creek
sinking stream basin
Source: Copyright:© 2013 National Geographic Society, i-cubed, U.S. Department of Agriculture (USDA), Natural Resources Consveration Service (NRCS), U.S. Geological Survey (USGS)
USFWS occurrence data / IDNR Natural Heritage Center Database


CENTRAL DR SW
ASHER CT SW
HWY 135 SW
WATSON RD SW
ROBINS RD SW
VALIZ RD SW
0 200 400 Feet
N
Created: 6/29/22
R. Yeager
Map 12 (Sheet 1 of 6)
Features within
Karst Investigation Area
LOCHMUELLER GROUP
SR11 Extension Project
SR 135 to SR 11
Des. No. 2001154
Karst survey area
Sinkhole
Sink point
Soil Piping
Sinking Stream
Spring
Cave
Dye trace pathway
Buck Creek
Watson Spring
Sinking stream basin
Alternative 1 constuction limits
Alternative 2 construction limits
Alternative 3 consruction limits (Preferred)
Source: Copyright:© 2013 National Geographic Society, i-cubed, U.S. Department of Agricutlure (USDA), Natural Resources Consveration Service (NRCS), U.S. Geological Survey (USGS)


WATSON RD SW
ROBINS RD SW
VALIZ RD SW
MERIDIAN LN SW
0 200 400
Feet
N
Created: 6/29/22
R. Yeager
Map 12 (Sheet 2 of 6)
Features within
Karst Investigation Area
LOCHMUELLER GROUP
SR11 Extension Project
SR 135 to SR 11
Des. No. 2001154
Karst survey area
Sinkhole
Sink point
Soil Piping
Sinking Stream
Spring
Cave
Dye trace pathway
Buck Creek
Watson Spring
Sinking stream basin
Alternative 1 constuction limits
Alternative 2 construction limits
Alternative 3 consruction limits (Preferred)
Source: Copyright:© 2013 National Geographic Society, i-cubed, U.S. Department of Agricutlure (USDA), Natural Resources Consveration Service (NRCS), U.S. Geological Survey (USGS)


UNION CHAPEL RD SE
WATSON RD SW
WATSON RD SE
MERIDIAN LN SW
DELMER LN SE
0 200 400
Feet
N
Created: 6/29/22
R. Yeager
Map 12 (Sheet 3 of 6)
Features within
Karst Investigation Area
SR11 Extension Project
SR 135 to SR 11
Des. No. 2001154
LOCHMUELLER GROUP
Karst survey area
Sinkhole
Sink point
Soil Piping
Sinking Stream
Spring
Cave
Dye trace pathway
Buck Creek
Watson Spring
Sinking stream basin
Alternative 1 constuction limits
Alternative 2 construction limits
Alternative 3 consruction limits (Preferred)
Source: Copyright © 2013 National Geographic Society, i-cubed, U.S. Department of Agricutlure (USDA), Natural Resources Consveration Service (NRCS), U.S. Geological Survey (USGS)


UNION CHAPEL RD SE
0 200 400
Feet
N
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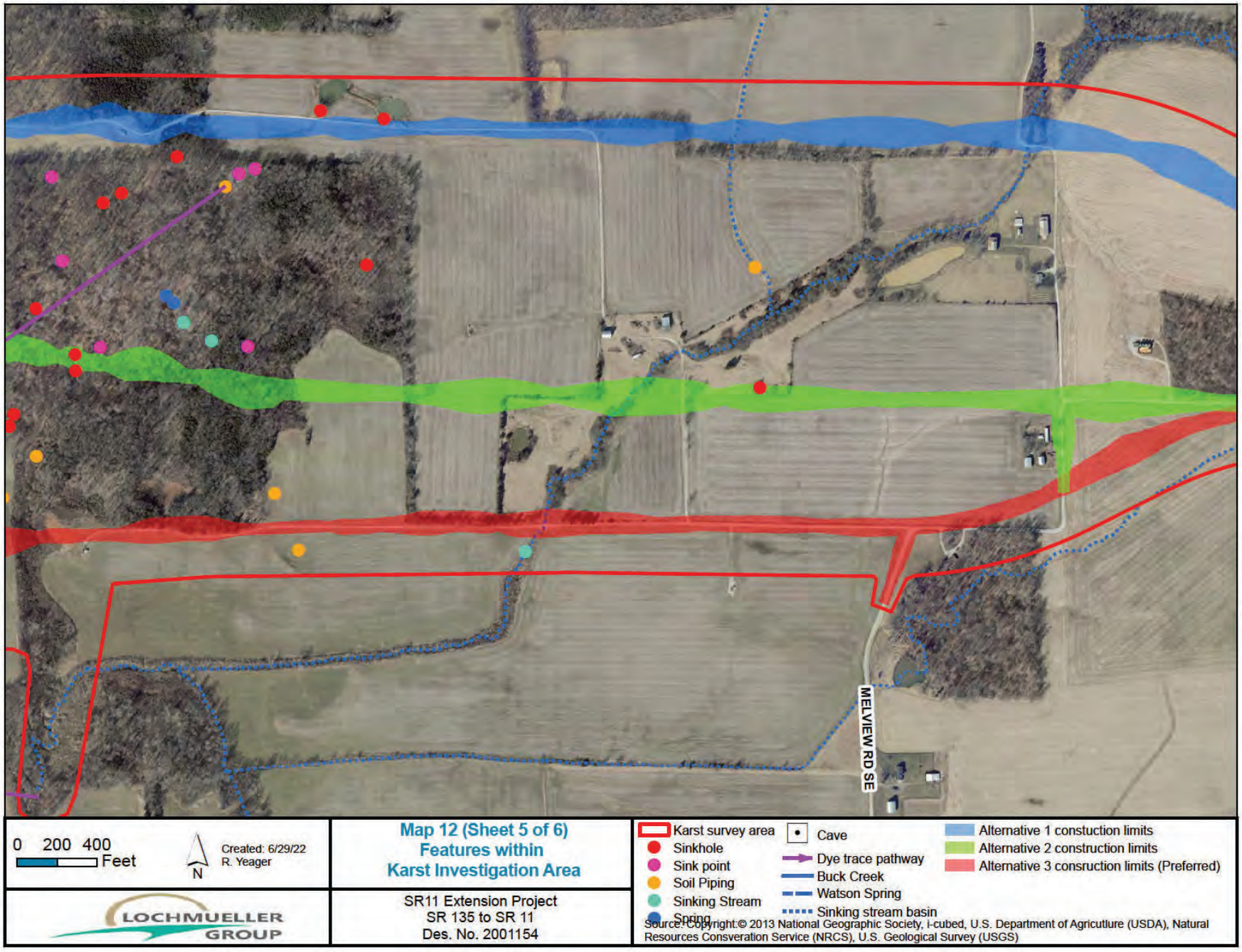
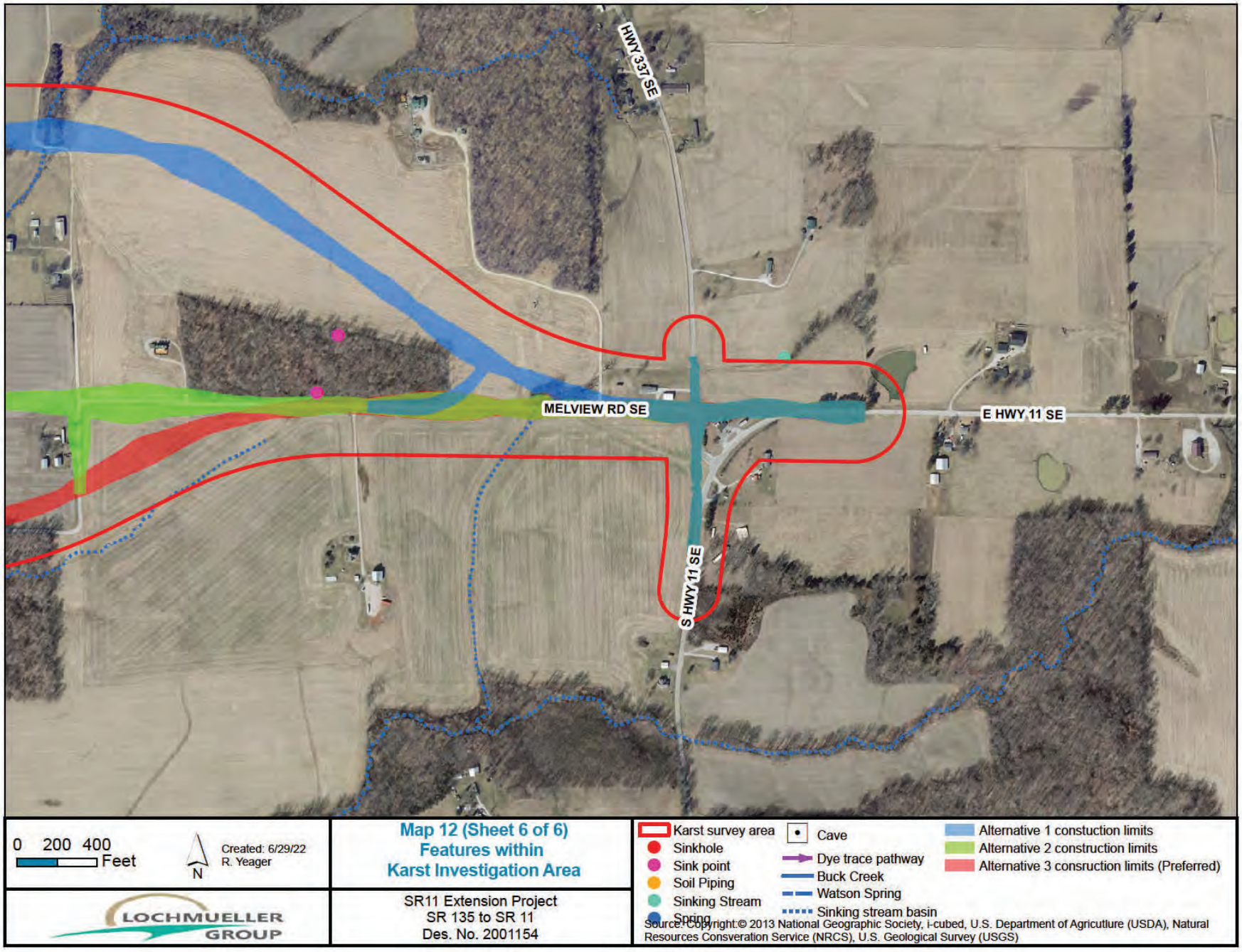
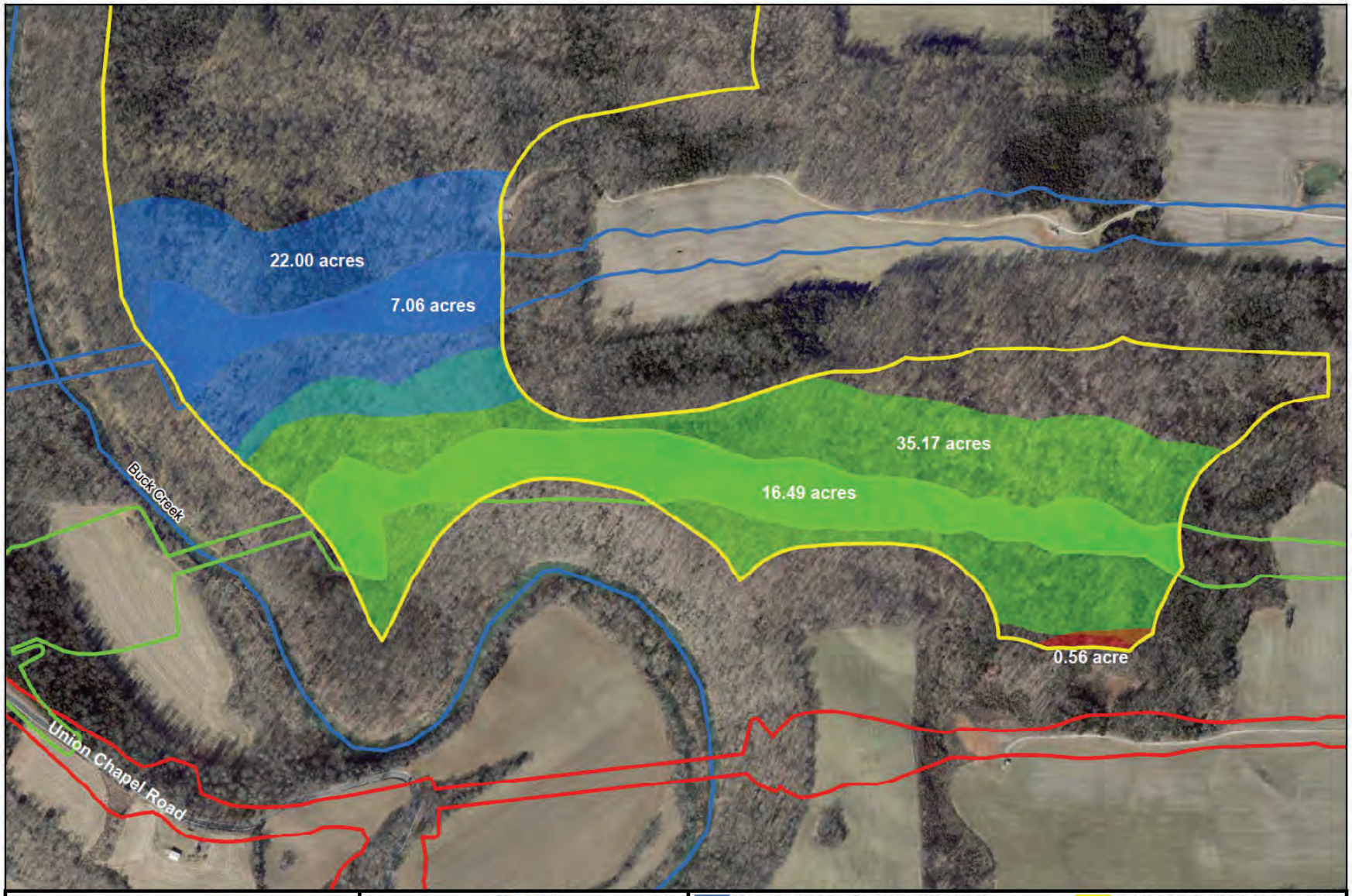
R. Yeager
Map 12 (Sheet 4 of 6)
Features within
Karst Investigation Area
LOCHMUELLER GROUP
SR11 Extension Project
SR 135 to SR 11
Des. No. 2001154
Karst survey area
Sinkhole
Sink point
Soil Piping
Sinking Stream
Spring
Cave
Dye trace pathway
Buck Creek
Watson Spring
Sinking stream basin
Alternative 1 constuction limits
Alternative 2 construction limits
Alternative 3 consruction limits (Preferred)
Source: Copyright:© 2013 National Geographic Society, i-cubed, U.S. Department of Agricutlure (USDA), Natural Resources Consveration Service (NRCS), U.S. Geological Survey (USGS)


MELVIEW RD SE
0 200 400
Feet
N
Created: 6/29/22
R. Yeager
Map 12 (Sheet 5 of 6)
Features within
Karst Investigation Area
SR11 Extension Project
SR 135 to SR 11
Des. No. 2001154
LOCHMUELLER GROUP
Karst survey area
Sinkhole
Sink point
Soil Piping
Sinking Stream
Spring
Cave
Dye trace pathway
Buck Creek
Watson Spring
Sinking stream basin
Alternative 1 constuction limits
Alternative 2 construction limits
Alternative 3 consruction limits (Preferred)
Source: Copyright:© 2013 National Geographic Society, i-cubed, U.S. Department of Agricutlure (USDA), Natural Resources Consveration Service (NRCS), U.S. Geological Survey (USGS)


HWY 337 SE
MELVIEW RD SE
E HWY 11 SE
S HWY 11 SE
0 200 400
Feet
N
Created: 6/29/22
R. Yeager
Map 12 (Sheet 6 of 6)
Features within
Karst Investigation Area
LOCHMUELLER GROUP
SR11 Extension Project
SR 135 to SR 11
Des. No. 2001154
Karst survey area
Sinkhole
Sink point
Soil Piping
Sinking Stream
Spring
Cave
Dye trace pathway
Buck Creek
Watson Spring
Sinking stream basin
Alternative 1 constuction limits
Alternative 2 construction limits
Alternative 3 consruction limits (Preferred)
Source: Copyright © 2013 National Geographic Society, i-cubed, U.S. Department of Agricutlure (USDA), Natural Resources Consveration Service (NRCS), U.S. Geological Survey (USGS)


22.00 acres
7.06 acres
35.17 acres
16.49 acres
0.56 acre
Buck Creek
Union Chapel Road
0 300 600 Feet
N
Created: 6/29/22
R. Yeager
Map 13
Direct and Indirect
Core Forest Impacts
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SR11 Extension Project
SR 135 to SR 11
Des. No. 2001154
Alternative 1 construction limits w/ 20 foot buffer
Alternative 2 construction limits w/ 20 foot buffer
Alternative 3 construction limits w/ 20 foot buffer (Preferred)
Buck Creek
sinking stream basin
Core forest limits (328 foot edge buffer)
Alterna ive 1 direct core forest impacts
Alterna ive 1 indirect core forest impacts
Alterna ive 2 direct core forest impacts
Alterna ive 2 indirect core forest impacts
Alterna ive 3 indirect core forest impacts
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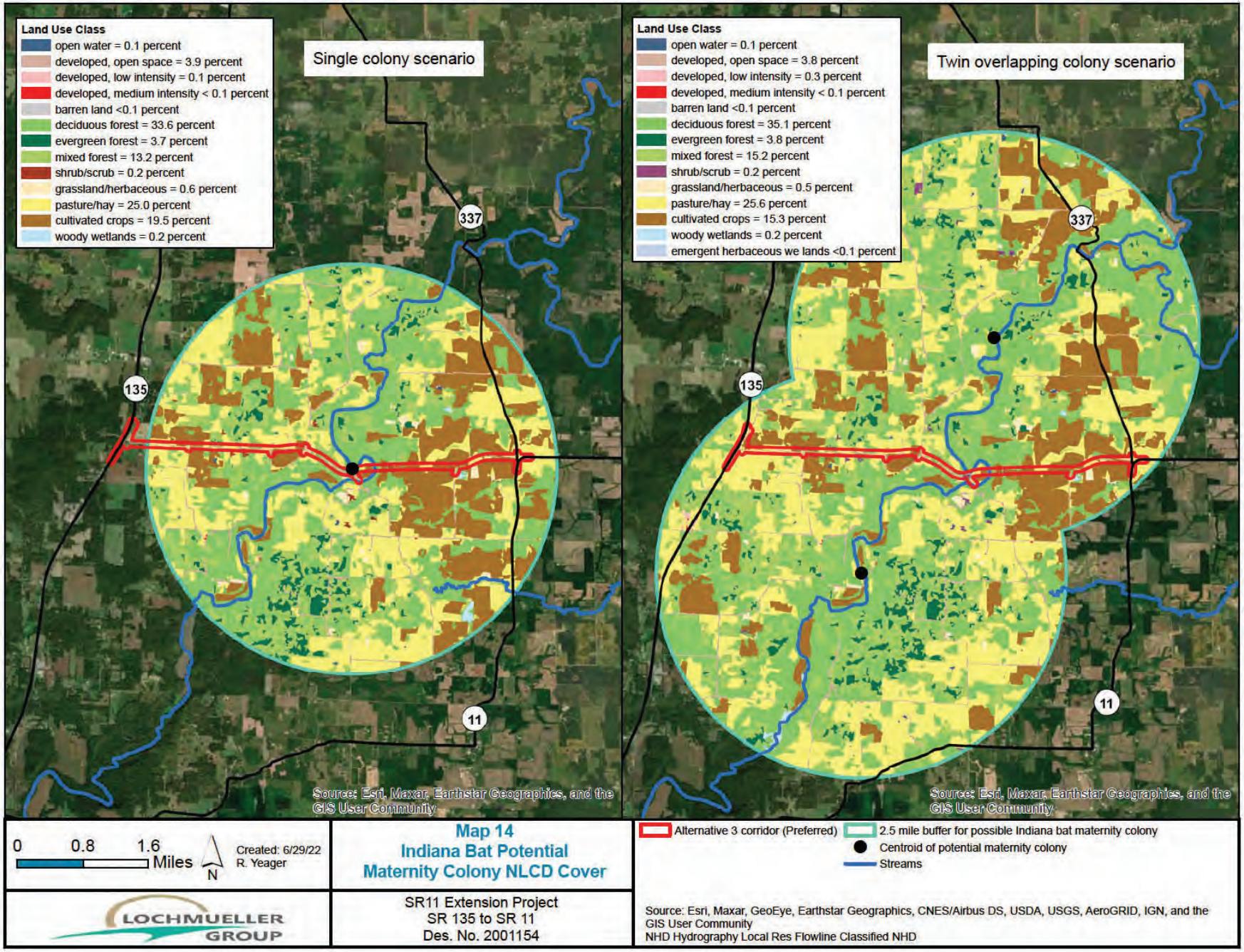
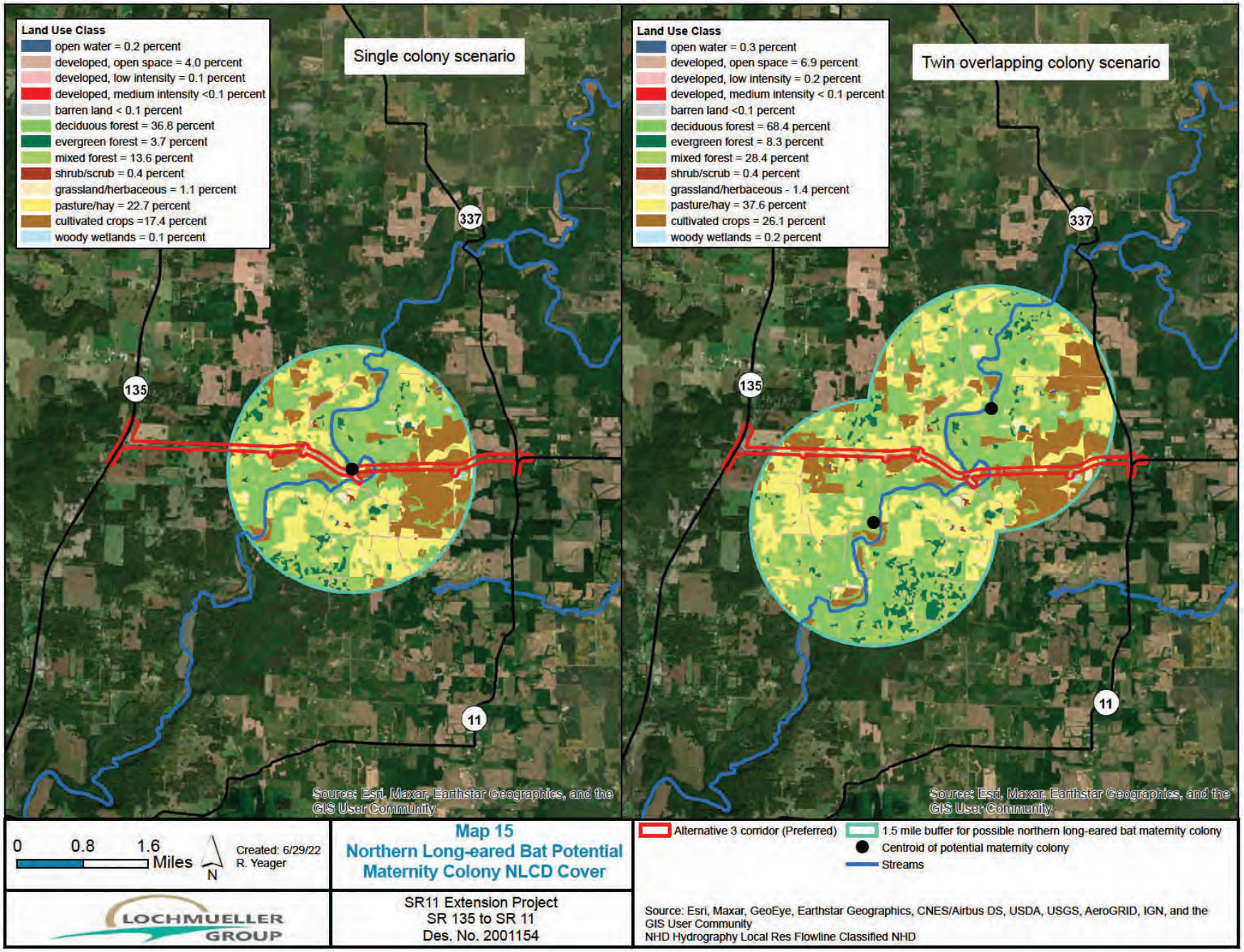
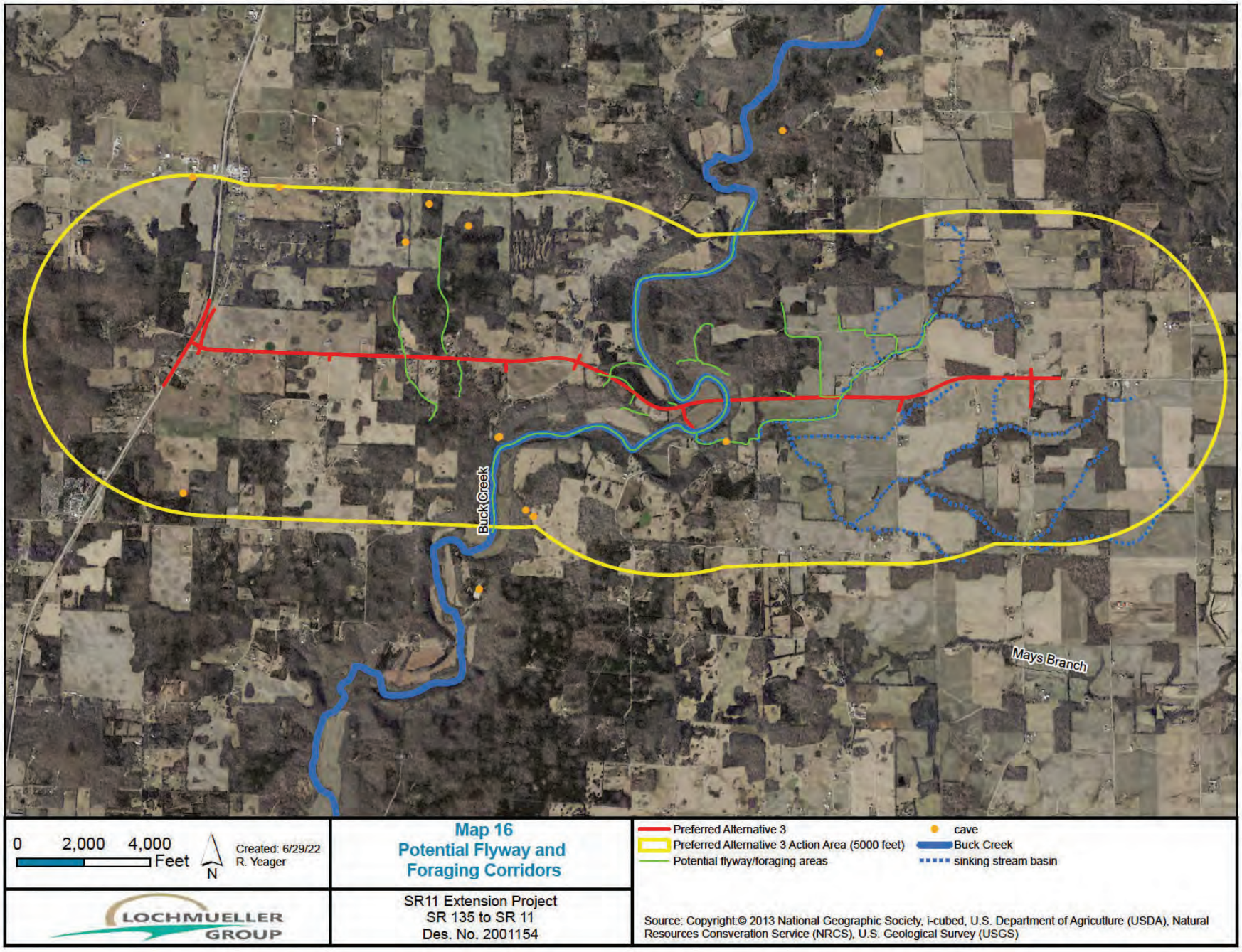

Land Use Class
open water = 0.1 percent
developed, open space = 3.9 percent
developed, low intensity = 0.1 percent
developed, medium intensity < 0.1 percent
barren land <0.1 percent
deciduous forest = 33.6 percent
evergreen forest = 3.7 percent
mixed forest = 13.2 percent
shrub/scrub = 0.2 percent
grassland/herbaceous = 0.6 percent
pasture/hay = 25.0 percent
cultivated crops = 19.5 percent
woody wetlands = 0.2 percent
Single colony scenario
337
135
11
Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community
Land Use Class
open water = 0.1 percent
developed, open space = 3.8 percent
developed, low intensity = 0.3 percent
developed, medium intensity < 0.1 percent
barren land <0.1 percent
deciduous forest = 35.1 percent
evergreen forest = 3.8 percent
mixed forest = 15.2 percent
shrub/scrub = 0.2 percent
grassland/herbaceous = 0.5 percent
pasture/hay = 25.6 percent
cultivated crops = 15.3 percent
woody wetlands = 0.2 percent
emergent herbaceous we lands <0.1 percent
Twin overlapping colony scenario
337
135
11
Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community
0 0.8 1.6 Miles
N
Created: 6/29/22
R. Yeager
Map 14
Indiana Bat Potential
Maternity Colony NLCD Cover
Alternative 3 corridor (Preferred)
2.5 mile buffer for possible Indiana bat maternity colony
Centroid of potential maternity colony
Streams
LOCHMUELLER GROUP
SR11 Extension Project
SR 135 to SR 11
Des. No. 2001154
Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community
NHD Hydrography Local Res Flowline Classified NHD


Land Use Class
open water = 0.2 percent
developed, open space = 4.0 percent
developed, low intensity = 0.1 percent
developed, medium intensity <0.1 percent
barren land < 0.1 percent
deciduous forest = 36.8 percent
evergreen forest = 3.7 percent
mixed forest = 13.6 percent
shrub/scrub = 0.4 percent
grassland/herbaceous = 1.1 percent
pasture/hay = 22.7 percent
cultivated crops =17.4 percent
woody wetlands = 0.1 percent
Single colony scenario
337
135
11
Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community
Land Use Class
open water = 0.3 percent
developed, open space = 6.9 percent
developed, low intensity = 0.2 percent
developed, medium intensity < 0.1 percent
barren land <0.1 percent
deciduous forest = 68.4 percent
evergreen forest = 8.3 percent
mixed forest = 28.4 percent
shrub/scrub = 0.4 percent
grassland/herbaceous - 1.4 percent
pasture/hay = 37.6 percent
cultivated crops = 26.1 percent
woody wetlands = 0.2 percent
Twin overlapping colony scenario
337
135
11
Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community
0 0.8 1.6 Miles
N
Created: 6/29/22
R. Yeager
Map 15
Northern Long-eared Bat Potential Maternity Colony NLCD Cover
Alternative 3 corridor (Preferred)
1.5 mile buffer for possible northern long-eared bat maternity colony
Centroid of potential maternity colony
Streams
LOCHMUELLER GROUP
SR11 Extension Project
SR 135 to SR 11
Des. No. 2001154
Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community
NHD Hydrography Local Res Flowline Classified NHD


Buck Creek
Mays Branch
0 2,000 4,000 Feet
N
Created: 6/29/22
R. Yeager
Map 16
Potential Flyway and
Foraging Corridors
Preferred Alternative 3
Preferred Alternative 3 Action Area (5000 feet)
Potential flyway/foraging areas
cave
Buck Creek
sinking stream basin
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SR 135 to SR 11
Des. No. 2001154
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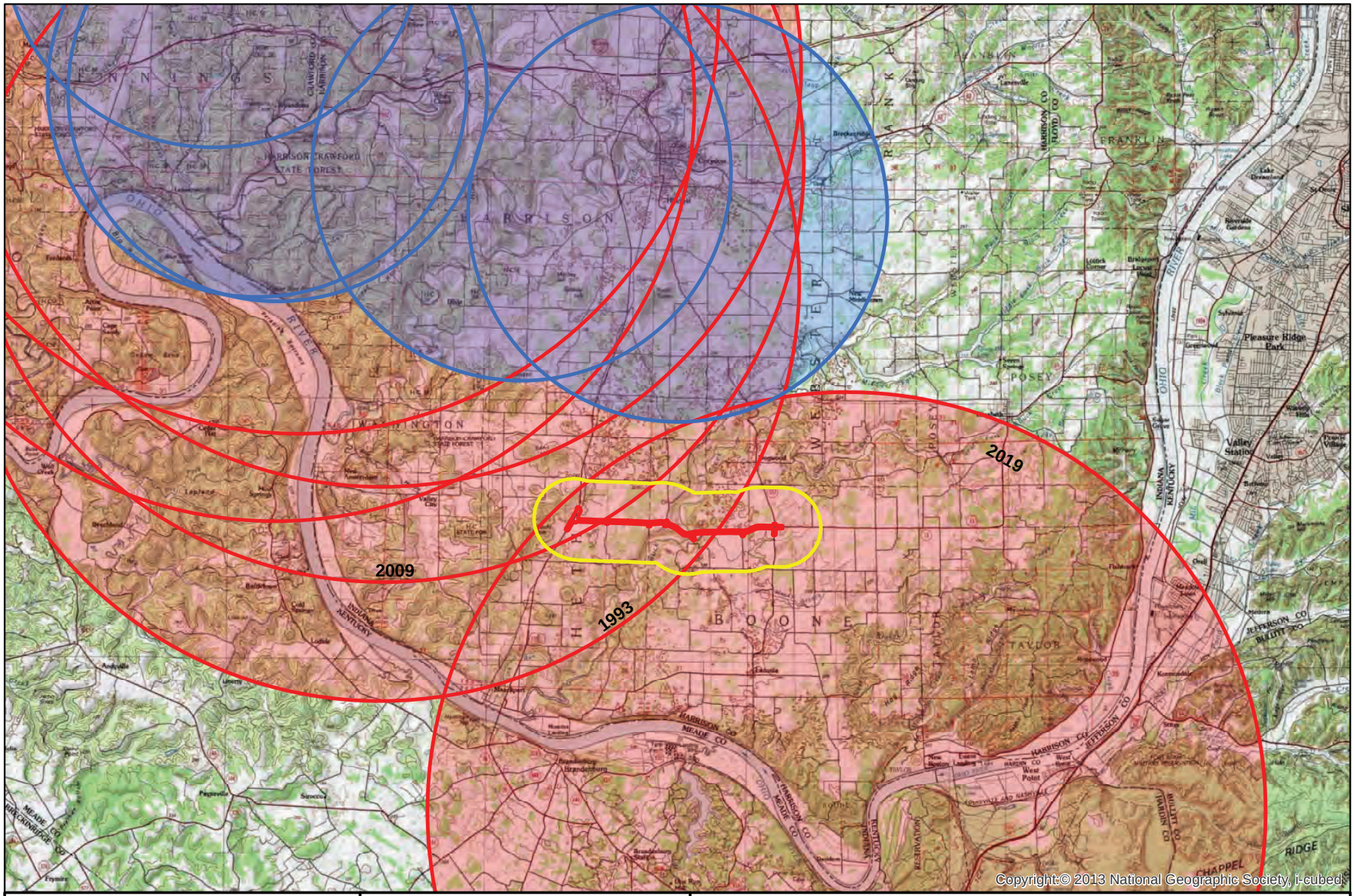

0 1 2 3 Miles

N

Created:6/29/22
R. Yeager

LOCHMUELLER GROUP

Map 17
Indiana Bat P1/P2 and P3/P6 Hibernacula Buffers

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Alternative 3 corridor (Preferred)
Alternative 3 Action Area (5000 feet)
Indiana bat P1 and P2 10-mile buffer
Indiana bat P3 and P4 5-mile buffer

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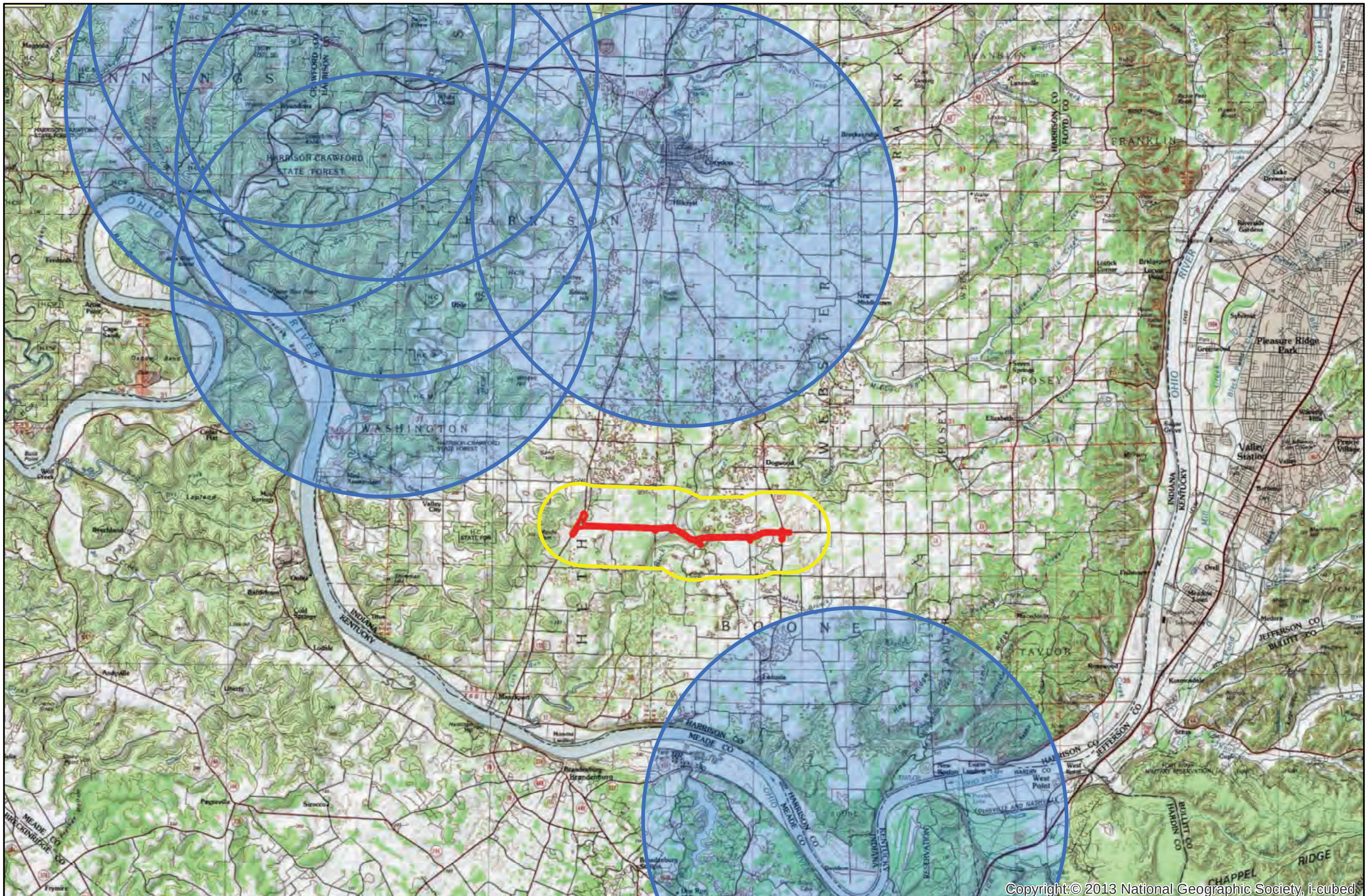
USFWS occurrence data / IDNR Natural Heritage Center Database



0 1 2 3 Miles
N

Created: 6/29/22
R. Yeager

Map 18
Northern Long-Eared Bat Hibernacula Buffers

Alternative 3 corridor (Preferred)
Alternative 3 Action Area (5000 feet)
NLEB hibernacula 5-mile buffer

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Des. No. 2001154

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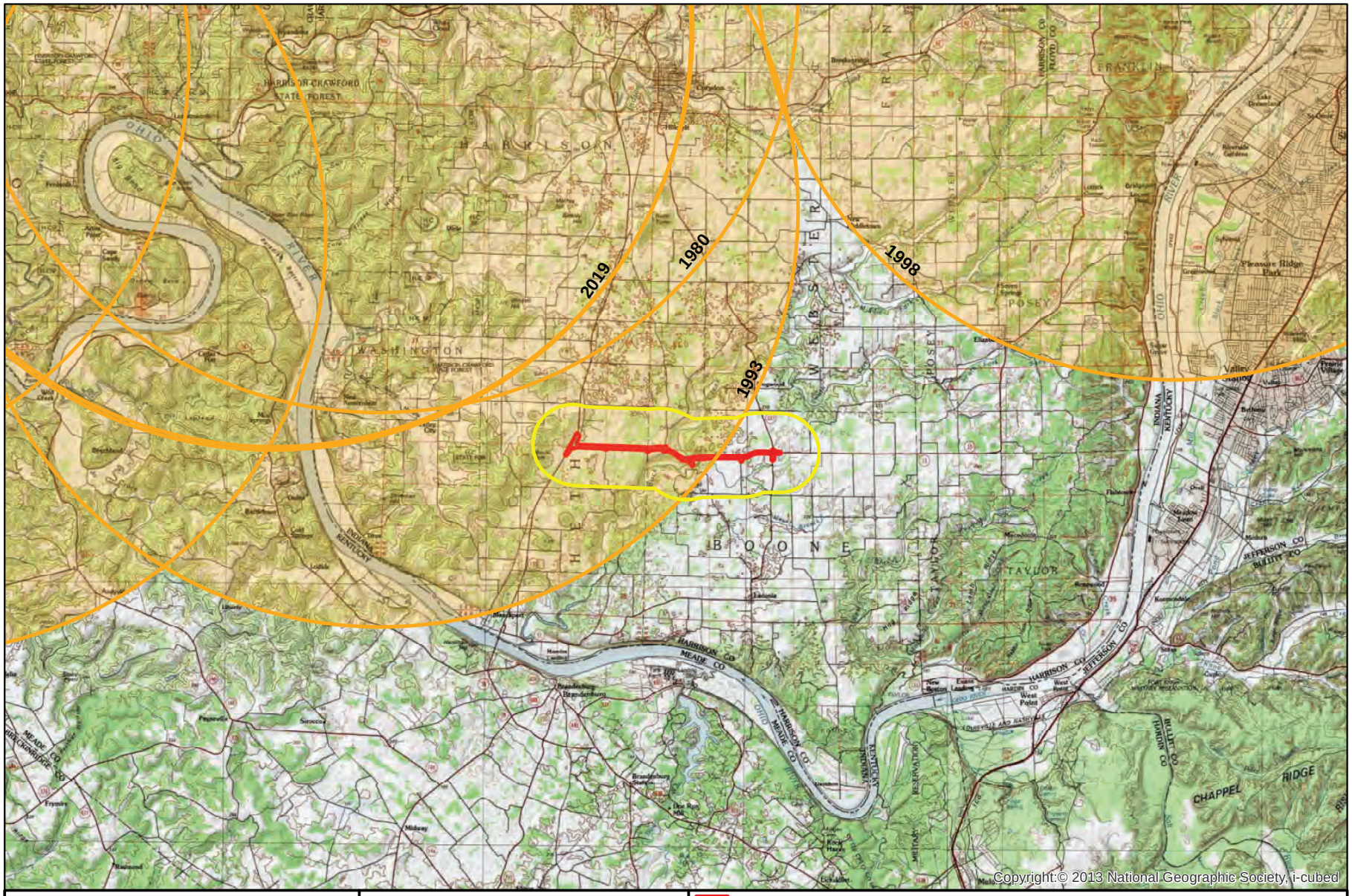
USFWS occurrence data / IDNR Natural Heritage Center Database



0 1 2 3 Miles

N

Created: 6/29/22
R. Yeager

Map 19
Gray Bat Summer and Winter Cave Capture Buffers

LOCHMUELLER GROUP

SR11 Extension Project
SR 135 to SR 11
Des. No. 2001154

- Alternative 3 corridor (Preferred)
- Preferred Alternative 3 Action Area (5000 feet)
- Gray bat summer and winter cave 10-mile buffer

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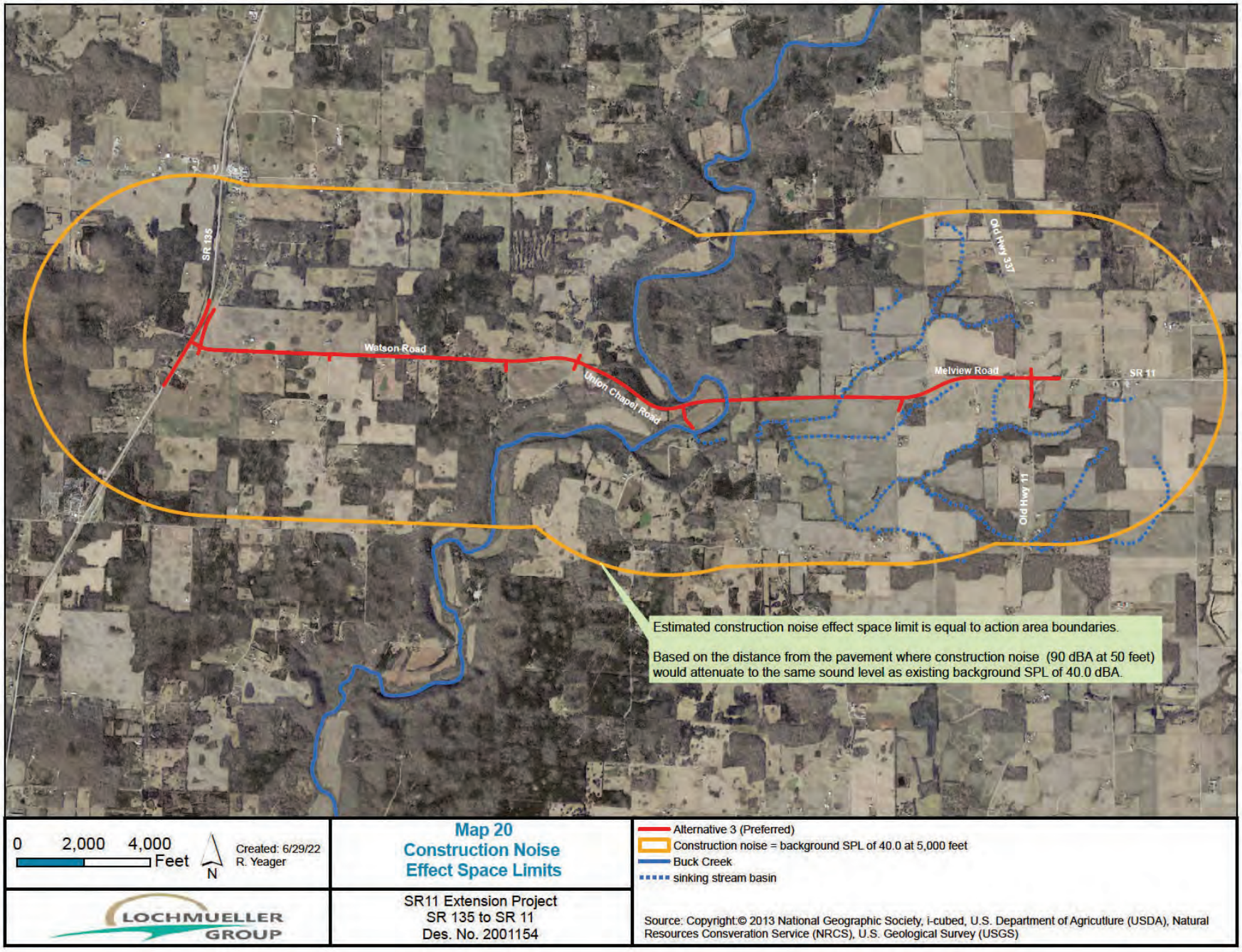
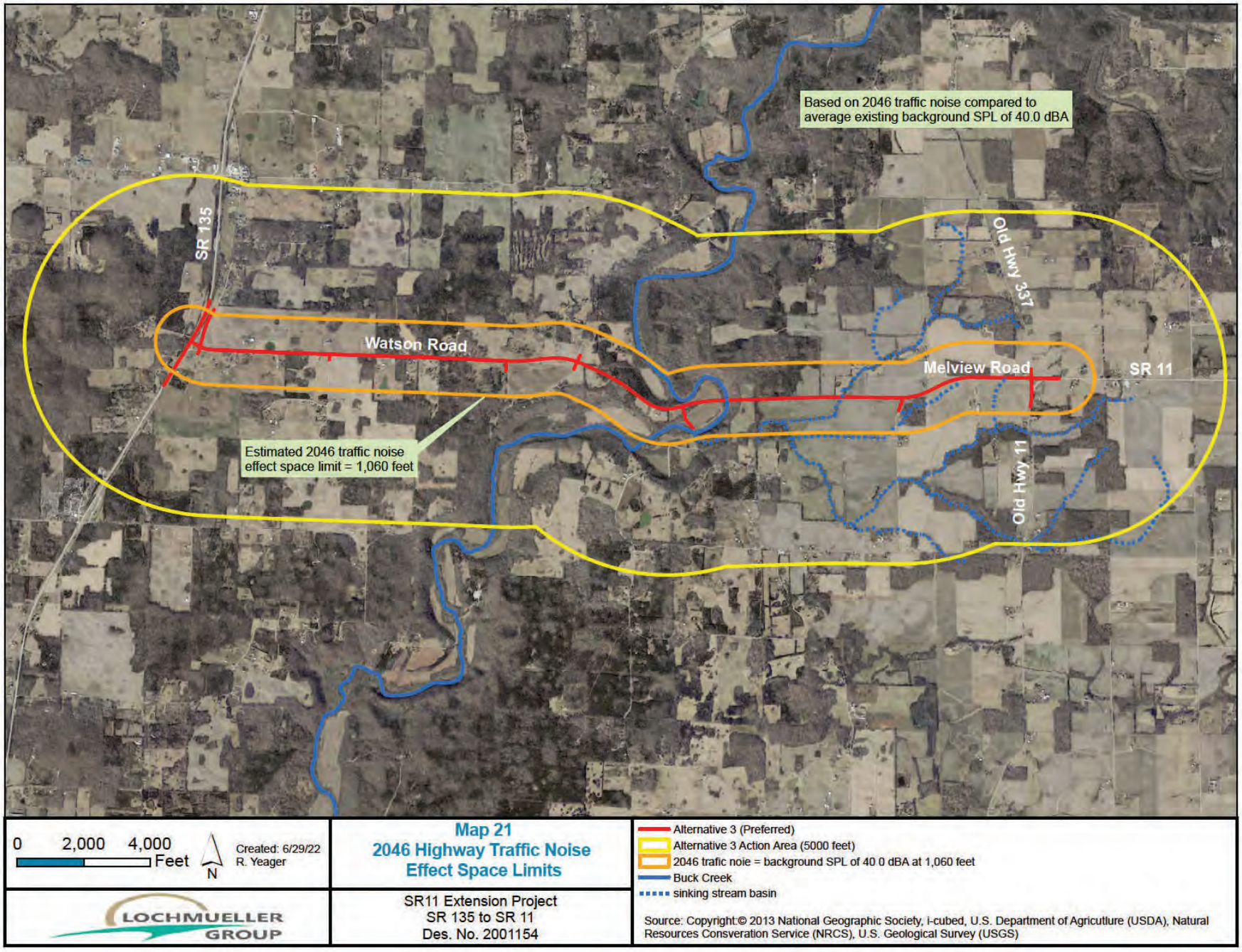
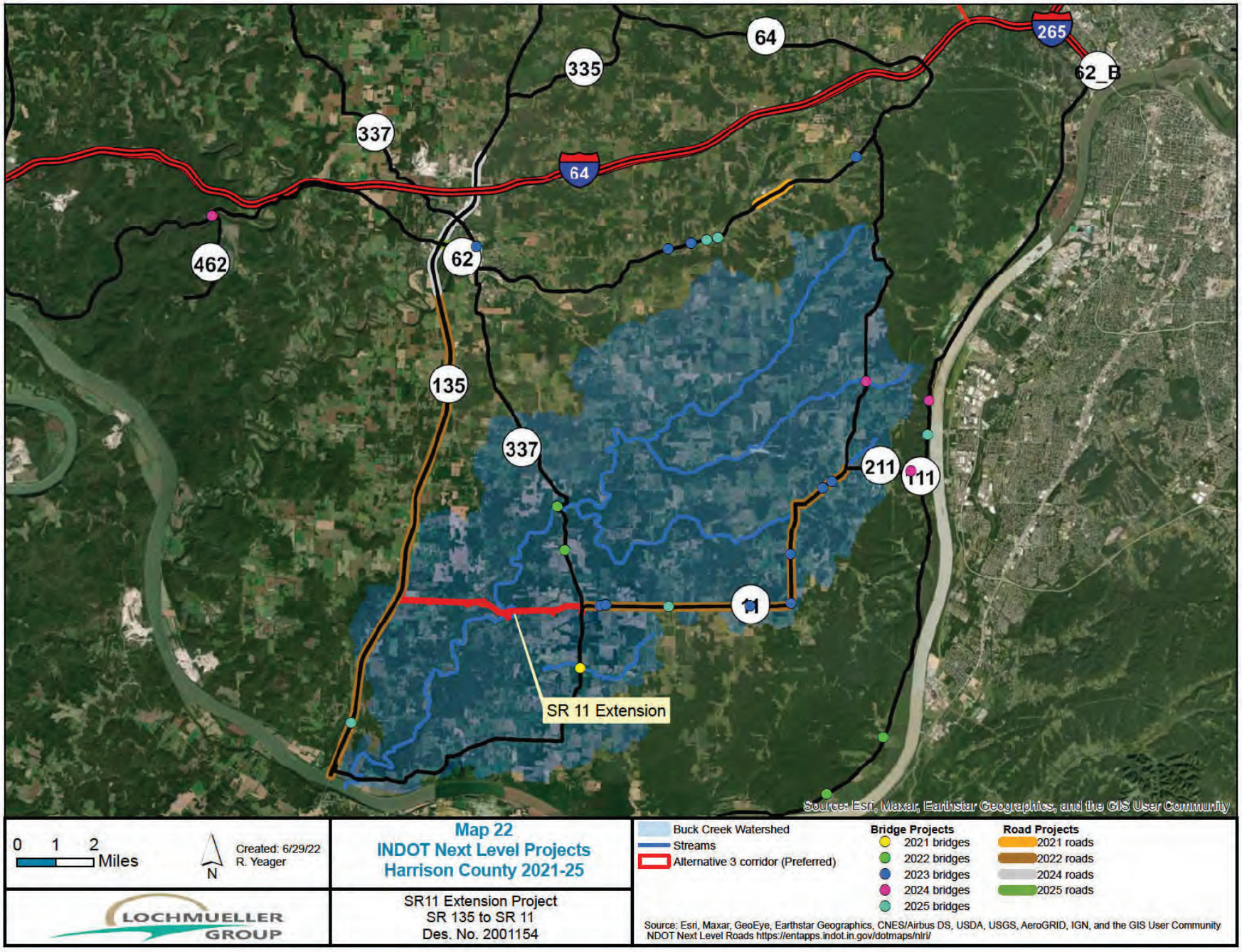
USFWS occurrence data / IDNR Natural Heritage Center Database


SR 135
Watson Road
Union Chapel Road
Melview Road
SR 11
Old Hwy 337
Old Hwy 11
Estimated construction noise effect space limit is equal to action area boundaries.
Based on the distance from the pavement where construction noise (90 dBA at 50 feet) would attenuate to the same sound level as existing background SPL of 40.0 dBA.
0 2,000 4,000 Feet
N
Created: 6/29/22
R. Yeager
Map 20
Construction Noise
Effect Space Limits
Alternative 3 (Preferred)
Construction noise = background SPL of 40.0 at 5,000 feet
Buck Creek
sinking stream basin
LOCHMUELLER GROUP
SR11 Extension Project
SR 135 to SR 11
Des. No. 2001154
Source: Copyright:© 2013 National Geographic Society, i-cubed, U.S. Department of Agriculture (USDA), Natural Resources Consveration Service (NRCS), U.S. Geological Survey (USGS)


Based on 2046 traffic noise compared to average existing background SPL of 40.0 dBA
SR 135
Watson Road
Old Hwy 337
Melview Road
SR 11
Old Hwy 11
Estimated 2046 traffic noise effect space limit = 1,060 feet
0 2,000 4,000 Feet
N
Created: 6/29/22
R. Yeager
Map 21
2046 Highway Traffic Noise Effect Space Limits
LOCHMUELLER GROUP
SR11 Extension Project
SR 135 to SR 11
Des. No. 2001154
Alternative 3 (Preferred)
Alternative 3 Action Area (5000 feet)
2046 trafic noie = background SPL of 40 0 dBA at 1,060 feet
Buck Creek
sinking stream basin
Source: Copyright:© 2013 National Geographic Society, i-cubed, U.S. Department of Agriculture (USDA), Natural Resources Consveration Service (NRCS), U.S. Geological Survey (USGS)


64
335
265
62_B
337
64
462
62
135
337
211
111
11
SR 11 Extension
Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community
0 1 2 Miles
N
Created: 6/29/22
R. Yeager
Map 22
INDOT Next Level Projects
Harrison County 2021-25
LOCHMUELLER GROUP
SR11 Extension Project
SR 135 to SR 11
Des. No. 2001154
Buck Creek Watershed
Streams
Alternative 3 corridor (Preferred)
Bridge Projects
2021 bridges
2022 bridges
2023 bridges
2024 bridges
2025 bridges
Road Projects
2021 roads
2022 roads
2024 roads
2025 roads
Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community
NDOT Next Level Roads https://entapps.indot.in.gov/dotmaps/nlri/

Appendix B

Tables

Table 1 Land cover within Buck Creek watershed

Land Use	Area (acres)	Percent
Forest (deciduous, evergreen, mixed and wetland)	32,868.1	44.9
Pasture /hay	20,374.5	27.8
Cultivated crops	15,871.5	21.7
Developed open space	3,217.6	4.4
Grassland/herbaceous	316.9	0.4
Open water	197.6	0.3
Developed land (low, medium, and high intensity)	179.8	0.2
Scrub/shrub	147.0	0.2
Barren land	9.5	<0.1
Emergent wetlands	6.6	<0.1
Total	**73,189.1**	**100.0**

Table 2 Land cover within the SR 11 Extension Action Area

Land Use	Area (acres)	Percent
Forest (deciduous, evergreen, mixed and wetland)	3,529.45	44.54
Pasture /hay	2,290.63	28.90
Cultivated crops	1,726.48	21.79
Developed open space	272.72	3.44
Grassland/herbaceous	48.17	0.61
Developed land (low and medium intensity)	28.35	0.36
Scrub/shrub	18.24	0.23
Open water	10.61	0.13
Barren land	0.22	<0.01
Total	**7,924.87**	**100.0**

Table 3 Buck Creek watershed bridge summary from BIAS

Map ID	Asset No.	Road	Bridge Type	Inspection Date	Bat Signs	Roosting Potential
1	31-06892	SR11	Concrete cast-in-place deck; steel stringer/girder	5/16/2022	NA	Low
2	31-00038	Union Chapel Road	Concrete cast-in-place deck; continuous concrete slab	8/21/2020	NA	Low
3	31-05752	Old Hwy 337	Concrete cast-in-place deck; prestressed concrete box beam/girder	5/16/2022	NA	Moderate
4	31-00036	New Middletown Road	Concrete cast-in-place; prestressed concrete stringer/girder	8/13/2020	NA	Moderate
5	31-00035	Payton road	Concrete cast-in-place; continuous concrete slab	8/21/2020	NA	Low
6	31-00043	St. John Church Road	Concrete precast panel deck; prestressed concrete box beam/girder	8/21/2020	NA	Mod-High
7	31-08570	SR 11	Concrete cast-in-place deck; continuous concrete slab	5/16/2022	NA	Low
8	31-00111	Rehobeth Road	Concrete cast-in-place deck; concrete slab	8/21/2020	NA	Low
9	31-00003	East Old Goshen Road	Concrete cast-in-place deck; prestressed concrete box beam/girder	8/21/2020	NA	Low-Mod
10	31-00062	Pumping Station Road	Concrete cast-in-place deck; continuous concrete slab	8/13/2020	NA	Low
11	31-00086	Rogers Campground Road	Concrete cast-in-place deck; steel stringer/girder	8/13/2020	NA	Low
12	31-00099	Hulse Road	Concrete cast-in-place deck; concrete slab	8/13/2020	NA	Low
13	011-031-06118B	SR 11	Concrete cast-in-place deck; prestersed box beam/girder	7/1/2020	NA	Low
14	011-031-06119	SR 11	Precast concrete panel deck; concrete channel beam	7/1/2020	NA	Low
15	011-031-06120	SR 11	Precast concrete panel deck; concrete channel beam	7/1/2020	NA	Low
16	011-031-06121B	SR 11	Concrete precast panel deck; prestressed concrete box beam/girder	7/1/2020	NA	Low
17	31-00097	Pine Hill Drive	Concrete precast panel deck; prestressed concrete box beam/girder	8/13/2020	NA	Low-Mod
18	31-00098	Deatricks Road	Concrete precast panel deck; prestressed concrete box beam/girder	8/13/2020	NA	Low-Mod
19	31-00064	McPhillips Road	Concrete cast-in-place deck; continuous concrete slab	8/13/2020	NA	Low-Mod
20	31-00087	Black Chapel Road	Concrete cast-in-place; steel stringer/girder	8/13/2020	NA	Low
21	31-00082	Seven Spring Road	Concrete cast-in-place; steel stringer/girder	8/13/2020	NA	Low
22	31-00034	Buck Creek Ridge Road	Concrete cast-in-place deck; concrete slab	8/13/2020	NA	Low
23	31-00030	New Middletown Road	Concrete cast-in-place; prestressed concrete box beam/girder	8/13/2020	NA	Low
24	31-00039	St. Peters Church Road	Concrete ast-in-place deck; prestressed concrete box beam/girder	8/13/2020	NA	Low

Blue highlighted bridges span Buck Creek
Green highlighted bridges span other Buck Creek tributaries

Table 4 Culvert bat presence inspection summary

Culvert ID	Description	Route/Facility Carried	Length (feet)	Latitude	Longitude	Evidence of Bats
1	24" CMP	SR 135	120	38.085565	-86.164094	No
2	12" CMP	Central Drive SW	70	38.085556	-86.164063	No
3	12" CMP	Watson Road	30	38.084641	-86.142724	No
4	18" CMP	Watson Road	30	38.084305	-86.132678	No
5	12" CMP	Watson Road	30	38.084077	-86.123898	No
6	18" CMP	Union Chapel Road	20	38.082818	-86.120899	No
7	12" CMP	Private Drive	30	38.083981	-86.122942	No
8	12" rubber	Private Drive	15	38.081177	-86.100948	No
9	12" Concrete Box Culvert	Private Drive	30	38.081283	-86.095911	No
10	12" Concrete Box Culvert	Private Drive	30	38.081283	-86.095911	No
11	18" CPP	Private Drive	15	38.018324	-86.094732	No
12	24" CMP	Private Drive	30	38.083702	-86.093408	No
13	24" CMP	Private Drive	30	38.083702	-86.093408	No
14	24" CMP	Private Drive	30	38.083702	-86.093408	No
15	12" rubber	Private Drive	15	38.084519	-86.094858	No
16	12" rubber	Private Drive	15	38.086807	-86.096015	No
17	12" rubber	Private Drive	15	38.086804	-86.098246	No
18	24" CPP	Private Drive	15	38.087044	-86.099836	No
19	24" CPP	Private Drive	25	38.081239	-86.090391	No
20	18" CMP	Private Drive	35	38.083091	-86.086936	No
21	18" CMP	Melview Road SE	30	38.082918	-86.08295	No
22	60" Metal	Melview Road SE	30	38.082849	-86.078919	No
23	12" CMP	Private Drive	50	38.082928	-86.077648	No
24	48" CMP	SR 337	40	38.08347	-86.076271	No

Table 5 Forest habitat impacts and bat habitat suitability analysis summary for alternatives

Habitat Area ID	Forest Habitat Area Size (acres)	Bat Habitat Suitability Rating	Alternative 1 (acres)	Alternative 2 (acres)	Preferred Alternative 3 (acres)
1	1.55	low			
2	0.08	none			
3	2.22	low			
4	0.02	none			
5	1.11	none			
6	0.33	none			
7	>10.00	moderate			
8	0.34	none			
9	1.26	none			
10	>0.25	none			
11	>0.25	none	<0.01	<0.01	<0.01
12	0.30	none	0.07	0.07	0.07
13	0.57	none	0.55	0.55	0.55
14	0.02	none			
15	0.23	none			
16	0.10	none	0.02	0.02	0.02
17	0.06	none			
18	6.05	low	0.44	0.44	0.44
19	0.39	none	0.17	0.17	0.17
20	0.02	none			
21	5.84	moderate	0.34	0.34	0.34
22	>10.00	moderate	1.68	1.68	1.68
23	0.02	none			
24	5.5.0	moderate	0.45	0.45	0.45
25	0.55	none	0.11	0.11	0.11
26	>0.25	none			
27	0.38	none	0.07	0.07	0.07
28	1.44	low	0.58	0.58	0.58
29	>10.00	low	0.06	0.60	0.60
30	0.11	none	0.11	0.11	0.11
31	0.04	none			
32	>10.00	moderate	0.73	0.73	0.73
33	0.17	none	0.17	0.17	0.17
34	0.27	none	0.16	0.16	0.16
35	8.00	low	0.66	0.66	0.66
36	0.02	none	0.02	0.02	0.02
37	0.09	none	0.09	0.09	0.09
38	0.14	none	0.14	0.14	0.14
39	0.02	none	0.02		
40	0.5.0	low	0.09	0.04	0.07
41	0.33	low	0.25	0.14	0.26
42	0.03	none	0.01		
43	0.16	low	0.12		
44	>50.00	moderate		0.23	0.81
45	0.71	moderate	0.23	0.57	0.31
46	0.78	moderate		0.76	0.77
47A	>1.75	moderate		0.27	0.97
47B	>3.88	moderate	2.43		
47C	>3.73	high	1.50		
48A	>12.99	high		5.01	2.27

Habitat Area ID	Forest Habitat Area Size (acres)	Bat Habitat Suitability Rating	Alternative 1 (acres)	Alternative 2 (acres)	Preferred Alternative 3 (acres)
48B	>0.95	high		0.29	
48C	>1.25	high			0.25
49	0.07	none			0.07
50	0.33	low			0.16
51	0.02	low			
52	0.02	none			
53	0.03	none			0.01
54	>2.47	high			1.13
55	>0.08	moderate			
56	0.95	low			0.52
57A	>3.74	high	1.01		
57B	>15.81	high	8.19		
57C	>4.91	high	1.72		
57D	>2.32	high	0.44		
57E	>12.63	high		6.07	
57F	>26.67	high		13.68	
57G	>3.22	high			1.60
57H	>5.14	high			1.56
57I	>0.39	low		0.10	
57J	>0.94	low			0.69
58	0.03	moderate	<0.01		
59	0.10	none			0.10
60	>0.95	low		0.41	0.02
61	0.15	none		0.11	
62	0.02	none			
63	>1.95	low	0.73		
64	>0.05	low	<0.01		
65	0.73	low	0.14		
66	>0.71	low			
67	0.06	none			0.03
68	9.90	low			
69	0.66	none		0.23	
70	10.83	low	0.17	0.93	0.55
71	0.53	none	0.43	0.33	0.33
72	0.06	none			
73	0.10	none	0.07	0.07	0.07
74	0.24	none	0.19	0.19	0.19
75	0.10	none	<0.01	<0.01	<0.01
76	1.26	none	0.01	0.01	0.01
77	>2.94	low			
High Suitability Total			12.86	25.05	6.81
Moderate Suitability Total			5.86	5.03	6.58
Low Suitability Total			3.78	3.90	4.03
No Suitability Total			2.41	2.62	2.49
Grand Total			**24.91**	**36.60**	**19.91**

Table 6 Distances from Preferred Alternative 3 to caves

	Cave	Cave Distance to Alternative 3 (miles)	Indiana Bat Cave Priority
Regional Priority Indiana bat and Northern Long-eared Bat Caves		13.5	P1A
		12.6	P3
	private	12.3	P3
		12.1	P1A
		11.5	P1A
		9.5	P2A
	private	8.2	P3
		7.4	P3
		7.2	P1A
		6.8	P2A
Local caves greater than 1 mile from Preferred Alternative 3 and beyond the Action Area		2.0	
		1.5	
		1.2	
Local caves greater than 0.5 mile from Preferred Alternative 3 and within the Action Area		0.9	
		0.9	
		0.8	
		0.8	
		0.7	
		0.7	
		0.6	
		0.6	
Local caves less than 0.5 mile from Preferred Alternative 3		0.4	
		0.2	

Table 7 Potential Roost Trees within Tier 2 Alternative Corridors and Alignments

Roost ID	Species	dbh	Stage of Decay	Feature	Alt 1	Alt 2	Alt 3
1.1	*Fraxinus sp.*	14	3	very few areas of detached bark			
1.2	*Acer saccharum*	13	3	upper cavity			
3.1	*Fraxinus sp.*	13	3	very few areas of detached bark			
3.2	*Fraxinus sp.*	14	3	very few areas of detached bark			
3.3	*Fraxinus sp.*	14	3	very few areas of detached bark			
9.1	*Populus deltoides*	20	2	dead limbs, but no peeling bark of use			
10.1	*Celtis occidentalis*	9	3	only one small patch of peeling bark			
12.1	*Fraxinus sp.*	7	3	loose bark but no peeling			
12.2	*Fraxinus sp.*	7	3	loose bark but no peeling			
12.3	*Fraxinus sp.*	9	3	loose bark but no peeling			
12.4	*Fraxinus sp.*	10	3	loose bark but no peeling			
12.5	*Fraxinus sp.*	9	3	loose bark but no peeling			
21.1	*Liriodendron tulipifera*	13	7	hollow snag, cavities			
21.2	*Sassafras albidum*	8	7	cavities, fissures			
21.3	*Carya sp.*	19.5	7	exfoliating bark, cavities, snag			
21.4	*Sassafras albidum*	9.5	6	hollow snag, cavities			
21.5	*Sassafras albidum*	11	6	cavities, snag			
21.6	*Unknown*	8.5	6	snag, cavities			
22.1	*Quercus rubra*	16	3	exfoliating bark			
22.2	*Quercus velutina*	22	3	exfoliating bark, snag			
22.3	*Quercus sp.*	27.5	6	cavities			
22.4	*Quercus velutina*	25	3	exfoliating bark, cavities, snag			
22.5	*Quercus alba*	14	6	cavities, fissure, exfoliating bark			
22.6	*Quercus velutina*	29	6	exfoliating bark, cavities			
24.1	*Sassafras albidum*	15.5	2	snag, cavities			
24.2	*Prunus serotina*	12.5	3	snag, cavities			
32.1	*Quercus velutina*	23.5	3	snag, exfoliating bark, cavities			
44.1	*Quercus alba*	14	7	cavities			
44.2	*Unknown*	12	7	hollow snag			
45.1	*Quercus alba*	12	3	exfoliating bark			
45.2	*Carya ovata*	18	1	exfoliating bark			
45.3	*Carya ovata*	13.5	1	exfoliating bark			
45.4	*Carya ovata*	15.5	1	exfoliating bark			
45.5	*Carya ovata*	11	1	exfoliating bark			
45.6	*Carya ovata*	13.5	1	exfoliating bark			
46.1	*Sassafras albidum*	7.5	2	exfoliating bark, minor cavities			
46.2	*Unknown*	11	3	exfoliating bark			
46.3	*Ulmus sp.*	6.5	3	exfoliating bark			
46.4	*Ulmus sp.*	10	3	exfoliating bark			
46.5	*Fraxinus sp.*	13	3	exfoliating bark			
47C.1	*Fraxinus sp.*	27.5	3/4	exfoliating bark, snag			
47C.2	*Fraxinus sp.*	19.5	3	exfoliating bark			
47C.3	*Quercus rubra*	31.5	5/6	cavities, snag split near base			
48A.1	*Fraxinus sp.*	15.5	3	exfoliating bark			
48A.2	*Prunus serotina*	24.5	2	large hollow snag, split			
48A.4	*Ulmus sp.*	6.5	6	cavities, fissures			
48A.5	*Fraxinus sp.*	15	3	exfoliating bark			
48A.6	*Fraxinus sp.*	13.5	3	exfoliating bark, snag, cavities			
48A.7	*Quercus alba*	13.5	6	snag, cavities			
48B.1	*Platanus occicendalis*	39.5	4	cavities high on trunk			

Roost ID	Species	dbh	Stage of Decay	Feature	Alt 1	Alt 2	Alt 3
48B.2	*Platanus occicendalis*	36	4	cavities, crevices			
48B.3	*Platanus occicendalis*	18	5	exfoliating bark			
48C.1	*Quercus rubra*	27.5	4/5	exfoliating bark, snag			
48C.2	*Quercus rubra*	25.5	4/5	exfoliating bark, snag			
49.1	*Carya ovata*	25	2	exfoliating bark, partially dead at top			
50.1	*Acer negundo*	7	3	exfoliating bark, cavities			
51.1	*Sassafras albidum*	23.5	3	cavities			
52.1	*Acer negundo*		2	minor exfoliating bark, but not good for roosting			
54.1	*Sassafras albidum*	18.5	2	minor exfoliating bark, dead limb with cavity			
54.2	*Diospyros virginiana*	18	4	exfoliating bark, cavities			
54.3	*Unknown*	12	5	no peeling bark or anomalies			
54.4	*Carya ovata*	13.5	1	exfoliating bark			
54.5	*Quercus sp.*	18	4	exfoliating bark			
54.6	*Carya ovata*	16	1	exfoliating bark			
54.7	*Carya ovata*	20	1	exfoliating bark			
54.8	*Unknown*	16.5	5	no peeling bark or anomalies			
55.1	*Unknown*	7	4	mostly clean some exfoliating bark			
57A.1	*Ulmus americana*	19.5	3	exfoliating bark, snag			
57B.1	*Fraxinus sp.*	17.5	3/4	exfoliating bark			
57B.2	*Fraxinus sp.*	17	3/4	exfoliating bark			
57B.3	*Unknown*	12	6	exfoliating bark, cavities			
57B.4	*Fraxinus sp.*	16	3/4	exfoliating bark			
57D.1	*Ulmus americana*	9	3	exfoliating bark			
57D.2	*Sassafras albidum*	7	7	hollow snag, cavities			
57D.3	*Sassafras albidum*	21	2	large hollow snag			
57D.4	*Carya ovata*	24	1	large sheets of exfoliated bark large, snag			
57D.5	*Diospyros virginiana*	23.5	2	snag, cavities			
57D.6	*Platanus occicendalis*	51.5	2	several large snags			
57D.7	*Acer saccharum*	9.5	2	snag, cavities			
57E.1	*Fraxinus sp.*	12	3	limited peeling bark except at bottom of trunk			
57E.2	*Fraxinus sp.*	13	3	peeling bark limited to lower portion of trunk			
57E.3	*Fraxinus sp.*	11.5+9	3	detached bark only at bottom of trunk			
57E.4	*Platanus occicendalis*	NA	2	exfoliating bark minor			
57E.5	*Fraxinus sp.*	9.5	3	exfoliating bark			
57E.6	*Quercus velutina*	29.5	6	snag, cavities			
57E.7	*Fraxinus sp.*	16	3	exfoliating bark			
57F.1	*Fraxinus sp.*		3	exfoliating bark			
57F.2	*Unknown*	5	5	numerous holes, past use			
57F.3	*Fraxinus sp.*	10	3	no detached bark yet			
57G.1	*Fagus grandifolia*	24.5	2	cavities			
57G.2	*Sassafras albidum*	8	5	exfoliating bark, cavities			
57G.3	*Sassafras albidum*	9	5	exfoliating bark, snag			
57G.4	*Sassafras albidum*	8	5	cavities, hollow throughout			
57G.5	*Fagus grandifolia*	17.5	2	cavities			
57G.6	*Quercus alba*	18.5	7	snag, exfoliating bark, fissures			
57G.7	*Quercus velutina*	31	2	main trunk is giant snag, hollow living branches			
57G.8	*Quercus alba*	17.5	7	exfoliating bark, snag, cavities			
57G.9	*Sassafras albidum*	13	2	cavities			
57G.10	*Sassafras albidum*	8	4	cavities, exfoliating bark			
57G.11	*Fraxinus sp.*	12	6	fissures, exfoliating bark			
57G.12	*Fraxinus sp.*	14	5	exfoliating bark, cavities			
57G.13	*Ulmus americana*	9	5	exfoliating bark			

LOCHMUELLER GROUP

Roost ID	Species	dbh	Stage of Decay	Feature	Alt 1	Alt 2	Alt 3
57H.1	*Robinia pseudoacacia*	15	4	fissures			
57H.2	*Robinia pseudoacacia*	15.5	5	fissures			
57H.3	*Robinia pseudoacacia*	18	4	fissures, cavities			
57H.4	*Robinia pseudoacacia*	26	5	fissures			
57H.5	*Fraxinus americana*	27.5	3	exfoliating bark			
57H.6	*Fraxinus americana*	12.5	3	exfoliating bark			
57H.7	*Fraxinus sp.*	6.5	4	exfoliating bark			
57H.8	*Fraxinus sp.*	11	6	exfoliating bark			
57H.9	*Fraxinus sp.*	14.5	3	exfoliating bark			
57H.10	*Robinia pseudoacacia*	10	4	fissures			
57H.11	*Robinia pseudoacacia*	17.5	4	fissures			
57H.12	*Fraxinus sp.*	12.5	3	exfoliating bark			
57H.13	*Fraxinus sp.*	10.5	6	exfoliating bark			
57H.14	*Fraxinus americana*	21	3	exfoliating bark			
57H.15	*Juniperus virginiana*	14	2	alive at top, deep cavities			
57H.16	*Fraxinus sp.*	17.5	6	exfoliating bark, cavities			
57H.17	*Unknown*	16.5	5	limited exfoliating bark, fissure, cavities			
57H.18	*Sassafras albidum*	12	5	cavities, exfoliating bark			
57H.19	*Quercus sp.*	15	6	cavities, exfoliating bark			
58.1	*Carya ovata*	16	1	exfoliating bark			
58.2	*Carya ovata*	14	1	exfoliating bark			
58.3	*Carya ovata*	9	1	exfoliating bark			
63.1	*Liriodendron tulipifera*	37	2	large lower trunk cavity			
65.1	*Populus deltoides*	36	5	large hollow cavity in lower operation of trunk			
67.1	*Carya ovata*	15	1	exfoliating bark			
68.1	*Fraxinus sp.*	15	2/3	exfoliating bark, but limited			
70.1	*Sassafras albidum*	8.5	2	large hollow snag			
70.2	*Sassafras albidum*	12.5	6	hollow snag, cavities			
70.3	*Unknown*	11	7	hollow, fissures			
70.4	*Sassafras albidum*	14	6	cavities			
72.1	*Platanus occicendalis*	47	2	large hollow cavity in lower trunk			

Blue shading: Potential roosts within Alternative 1 corridor
Green shading: Potential roosts within Alternative 2 corridor
Red shading: Potential roosts within Alternative 3 corridor
Cross hatching: Potential roosts within preliminary construction limits +20 feet

Table 8 Land cover within 2.5-mile radius of assumed Indiana bat maternity colony centroids.

Land Use Category	Single Maternity Colony Scenario		Two Maternity Colonies Scenario	
	Area (acres)	Percent	Area (acres)	Percent
Forest (deciduous, evergreen, mixed and wetland)	6,354.15	50.60	12,085.18	54.22
Pasture /hay	3,132.87	24.95	5,709.82	25.62
Cultivated crops	2,443.96	19.46	3,407.59	15.29
Developed open space	490.88	3.91	839.37	3.77
Grassland/herbaceous	80.28	0.64	110.11	0.49
Shrub/scrub	21.34	0.17	35.21	0.16
Open water	17.42	0.14	31.62	0.14
Developed land (low, medium, and high intensity)	16.85	0.13	68.82	0.31
Barren land	0.76	0.01	0.76	<0.01
Emergent wetlands	0.00	0.00	0.22	<0.01
Total	12,558.51	100.00	22,288.70	100.00

Table 9 Land cover within 1.5-mile radius of assumed northern long-eared bat maternity colony centroids.

Land Use Category	Single Maternity Colony Scenario		Two Maternity Colonies Scenario	
	Acres	Percent	Acres	Percent
Forest (deciduous, evergreen, mixed and wetland)	2449.65	54.23	4755.77	59.09
Pasture /hay	1026.45	22.72	1698.11	21.10
Cultivated crops	784.78	17.37	1178.41	14.64
Developed open space	178.8	3.96	309.62	3.85
Grassland/herbaceous	48.15	1.07	64.80	0.81
Shrub/scrub	16.04	0.36	17.37	0.22
Open water	7.1	7.1	12.87	0.16
Developed land (low, medium, and high intensity)	5.51	0.12	10.86	0.13
Barren land	0.89	0.02	0.76	0.01
Emergent wetlands	0.00	0.00	0.00	0.00
Total		100.00		100.00

Table 10 INDOT Next Level Roads projects programmed for 2021 through 2025 within southern Harrison County.

Road	Project Description	Location	Year / Quarter
Road Projects			
SR 11	HMA Overlay, Preventative Maintenance	SR 337 to SR 211	Q4 2022
SR 62	HMA Overlay, Preventative Maintenance	Lanesville	Q3 2020
SR 135	HMA Overlay, Preventative Maintenance	Mauckport to Corydon	Q3 2022
SR 337	Pavement Replacement	Corydon	Q4 2024
SR 135	HMA Overlay Preventative Maintenance	Corydon	Q4 2024
SR 62	Concrete Pavement Restoration	Corydon	Q4 2025
Bridge Projects			
SR 11	Small Structure Maintenance and Repair	South Fork Buck Creek tributary	Q1 2023
SR 11	Small Structure Replacement	Buck Creek tributary	Q1 2023
SR 11	Small Structure Replacement	Buck Creek tributary	Q1 2023
SR 11	Small Structure Replacement	Buck Creek tributary	Q1 2023
SR 11	Small Structure Replacement	Buck Creek tributary	Q1 2023
SR 11	Small Structure Replacement	Mays Branch tributary	Q4 2025
SR 11	Small Structure Replacement	Middle Fork Buck Creek tributary	Q4 2024
SR 111	Bridge Replacement	Four Mile Creek	Q3 2022
SR 111	Small Structure Paved Invert	Ohio River tributary	Q4 2025
SR 111	Small Structure Replacement	Ohio River tributary	Q4 2024
SR 111	Small Structure Replacement	Ohio River tributary	Q4 2024
SR 111	Small Structure Replacement	unnamed stream	Q3 2022
SR 135	Bridge Deck Replacement	Lick Run	Q4 2025
SR 211	Bridge Replacement	South Fork Buck Creek	Q1 2023
SR 211	Bridge Replacement	South Fork Buck Creek	Q1 2023
SR 337	Bridge Deck Overlay	Indian Creek	Q1 2023
SR 337	Bridge Thin Deck Overlay	Mays Creek	Q4 2019
SR 337	Replace Superstructure	Buck Creek	Q3 2022
SR 337	Small Structure Replacement	Buck Creek tributary	Q3 2022
SR 462	Bridge Deck Overlay	Blue River	Q4 2024
SR 62	Bridge Deck Overlay	Little Indian Creek	Q4 2025
SR 62	Small Structure Replacement	Little Indian Creek tributary	Q4 2025
SR 62	Small Structure Replacement	Little Indian Creek tributary	Q4 2023
SR 62	Small Structure Replacement	Little Indian Creek tributary	Q4 2023
SR 62	Small Structure Replacement	Woertz Creek tributary	Q4 2023

Appendix C

USFWS ECOS-IPaC Official Species List 14 October 2021

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Indiana Ecological Services Field Office
620 South Walker Street
Bloomington, IN 47403-2121
Phone: (812) 334-4261 Fax: (812) 334-4273
http://www.fws.gov/midwest/Endangered/section7/s7process/step1.html

In Reply Refer To: October 14, 2021
Consultation Code: 03E12000-2022-SLI-0117
Event Code: 03E12000-2022-E-00377
Project Name: Des 2001154; SR 11 Roadway Project; Harrison County

Subject: List of threatened and endangered species that may occur in your proposed project location or may be affected by your proposed project

To Whom It May Concern:

The attached species list identifies any federally threatened, endangered, proposed and candidate species that may occur within the boundary of your proposed project or may be affected by your proposed project. The list also includes designated critical habitat if present within your proposed project area or affected by your project. This list is provided to you as the initial step of the consultation process required under section 7(c) of the Endangered Species Act, also referred to as Section 7 Consultation.

Section 7 of the Endangered Species Act of 1973 requires that actions authorized, funded, or carried out by Federal agencies not jeopardize federally threatened or endangered species or adversely modify designated critical habitat. To fulfill this mandate, Federal agencies (or their designated non-federal representative) must consult with the Service if they determine their project "may affect" listed species or critical habitat.

Under 50 CFR 402.12(e) (the regulations that implement Section 7 of the Endangered Species Act) the accuracy of this species list should be verified after 90 days. This verification can be completed formally or informally. You may verify the list by visiting the ECOS-IPaC website http://ecos.fws.gov/ipac/ at regular intervals during project planning and implementation and completing the same process you used to receive the attached list. As an alternative, you may contact this Ecological Services Field Office for updates.

Please use the species list provided and visit the U.S. Fish and Wildlife Service's Region 3 Section 7 Technical Assistance website at - http://www.fws.gov/midwest/endangered/section7/s7process/index.html. This website contains step-by-step instructions which will help you determine if your project will have an adverse effect on listed species and will help lead you through the Section 7 process.

For all **wind energy projects** and **projects that include installing towers that use guy wires or are over 200 feet in height**, please contact this field office directly for assistance, even if no federally listed plants, animals or critical habitat are present within your proposed project or may be affected by your proposed project.

Although no longer protected under the Endangered Species Act, be aware that bald eagles are protected under the Bald and Golden Eagle Protection Act (16 U.S.C. 668 *et seq.*) and Migratory Bird Treaty Act *(*16 U.S.C. 703 *et seq*), as are golden eagles. Projects affecting these species may require measures to avoid harming eagles or may require a permit. If your project is near an eagle nest or winter roost area, see our Eagle Permits website at http://www.fws.gov/midwest/midwestbird/EaglePermits/index.html to help you determine if you can avoid impacting eagles or if a permit may be necessary.

We appreciate your concern for threatened and endangered species. Please include the Consultation Tracking Number in the header of this letter with any request for consultation or correspondence about your project that you submit to our office.

Attachment(s):

- Official Species List

Official Species List

This list is provided pursuant to Section 7 of the Endangered Species Act, and fulfills the requirement for Federal agencies to "request of the Secretary of the Interior information whether any species which is listed or proposed to be listed may be present in the area of a proposed action".

This species list is provided by:

Indiana Ecological Services Field Office
620 South Walker Street
Bloomington, IN 47403-2121
(812) 334-4261

Project Summary

Consultation Code: 03E12000-2022-SLI-0117
Event Code: Some(03E12000-2022-E-00377)
Project Name: Des 2001154; SR 11 Roadway Project; Harrison County
Project Type: TRANSPORTATION
Project Description: The Federal Highway Administration (FHWA) and Indiana Department of Transportation (INDOT) plan to proceed with a new road construction project located in Harrison County. The project is located between the State Road (SR) 135 and Watson Road junction in the west and the SR 11 and Melview Road/SR 337 junction in the east, 4.7 miles north of the existing junction between SR 135 and SR 11 and approximately 10 miles south of Corydon, Indiana along SR 135. The project involves upgrading existing county roads and building a new terrain road to create a new east-west SR 11 connection across Buck Creek. The project proposes the construction of a new bridge across Buck Creek and installation of additional culverts spanning smaller streams. The exact size of these new structures is not yet known. Once sizes are known, asset numbers will be created and used for final design. Twenty-four (24) small culverts, ranging in size from 12 inches to 5 feet in diameter, are present within the proposed study area. Adjacent land use is primarily agricultural fields and mature forests with scattered residences. The mature forests and adjacent edges of agricultural fields would be considered suitable summer habitat for the Indiana bat and northern long-eared bat. The project is anticipated to require up to 29 acres of tree clearing, including up to 9 acres within 100 feet of the existing roadway, up to 2 acres between 100 and 300 feet of the existing roadway, and up to 20 acres greater than 300 feet from the existing roadway. All tree clearing will occur during the inactive season (November 15 to March 31). Dominant species within the tree clearing areas include multiple oak species (Quercus sp.), tulip poplar (Liriodendron tulipifera), shagbark hickory (Carya ovata), American beech (Fagus grandifolia), black walnut (Juglans nigra), American elm (Ulmus americana), maples (Acer sp.), white pine (Pinus strobus), ash species (Fraxinus sp.), American sycamore (Platanus occidentalis), red cedar (Juniperus virginiana), tree of heaven (Alianthus altissima), and box elder (Acer negundo). Up to $28,062 is anticipated to be paid to the Range-wide In-lieu Fee Program, to be administered by The Conservation Fund. This amount was determined by the Habitat Block Method. The area of suitable habitat to be cleared, multiplied by the mitigation ratio for inactive season tree clearing for Harrison County, and the compensatory price per acre; 2 acres x 1.5 x $9,354.
Bat inspections for the 24 culverts were performed on April 22, 2021 and no evidence of bats was identified within any of the culverts. A review of the USFWS database by INDOT Seymour District environmental staff on May 4, 2021 did not indicate the presence of endangered bat species in or

within 0.5 mile of the project area; however, the project is located within the 10-mile MYSO hibernacula buffer. Tree removal dates for projects located within the hibernacula buffer are from November 15 to March 31 (instead of the standard October 1 to March 31) to allow for the conclusion of fall swarming around the hibernacula. No permanent or temporary lighting is anticipated for the project. It is likely that some buildings will need to be removed as part of the project; however, specific buildings have not yet been identified. Any buildings that are removed will need to be inspected for evidence of bat use prior to demolition. Please note, if bats or signs of bats are found during the inspection(s), coordination will need to occur with the appropriate INDOT District Environmental as soon as possible. Work is anticipated to begin in July 2025 and be completed by July 2028.

Project Location:

Approximate location of the project can be viewed in Google Maps: https://www.google.com/maps/@38.0848526,-86.12301182971167,14z

Counties: Harrison County, Indiana

Endangered Species Act Species

There is a total of 4 threatened, endangered, or candidate species on this species list.

Species on this list should be considered in an effects analysis for your project and could include species that exist in another geographic area. For example, certain fish may appear on the species list because a project could affect downstream species. Note that 1 of these species should be considered only under certain conditions.

IPaC does not display listed species or critical habitats under the sole jurisdiction of NOAA Fisheries[1], as USFWS does not have the authority to speak on behalf of NOAA and the Department of Commerce.

See the "Critical habitats" section below for those critical habitats that lie wholly or partially within your project area under this office's jurisdiction. Please contact the designated FWS office if you have questions.

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1. NOAA Fisheries, also known as the National Marine Fisheries Service (NMFS), is an office of the National Oceanic and Atmospheric Administration within the Department of Commerce.

Mammals

NAME	STATUS
Gray Bat *Myotis grisescens* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/6329	Endangered
Indiana Bat *Myotis sodalis* There is **final** critical habitat for this species. Your location overlaps the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/5949	Endangered
Northern Long-eared Bat *Myotis septentrionalis* No critical habitat has been designated for this species. This species only needs to be considered under the following conditions: ▪ Incidental take of the NLEB is not prohibited here. Federal agencies may consult using the 4(d) rule streamlined process. Transportation projects may consult using the programmatic process. See www.fws.gov/midwest/endangered/mammals/nleb/index.html Species profile: https://ecos.fws.gov/ecp/species/9045	Threatened

Insects

NAME	STATUS
Monarch Butterfly *Danaus plexippus* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/9743	Candidate

Critical habitats

There is 1 critical habitat wholly or partially within your project area under this office's jurisdiction.

NAME	STATUS
Indiana Bat *Myotis sodalis* https://ecos.fws.gov/ecp/species/5949#crithab	Final

Appendix D

USFWS Early Coordination response Letter 27 April 2022

United States Department of the Interior
Fish and Wildlife Service

Indiana Field Office (ES)
620 South Walker Street
Bloomington, IN 47403-2121
Phone: (812) 334-4261 Fax: (812) 334-4273

April 27, 2022

Peter Putzier
Lochmueller Group, Inc.
6200 Vogel Road
Evansville, IN 47715
Sent via email

Project: Des. 2001154 State Road (SR) 11 Extension from SR 135/Watson Rd to SR 11/SR 337/Melview Rd Intersection, Harrison County, Indiana

Dear Mr. Putzier:

This responds to your letter dated April 12, 2022, requesting U.S. Fish and Wildlife Service (Service) comments on the aforementioned project. The Service was inadvertently left off of the initial distribution list for early coordination.

These comments have been prepared under the authority of the Fish and Wildlife Coordination Act (l6 U.S.C. 661 et. seq.) and are consistent with the intent of the National Environmental Policy Act of l969, the Endangered Species Act of l973, as amended, and the U. S. Fish and Wildlife Service's Mitigation Policy.

The proposed project is located between the SR 135 and Watson Road junction to the west and the SR 11 and Melview Road/SR 337 junction to the east, 4.7 miles north of the existing junction between SR 135 and SR 11. The site is approximately 10 miles south of Corydon, Indiana along SR 135.

The proposed project will involve upgrading existing county roads and building a new terrain road to create a new east-west SR 11 connection across Buck Creek. The project proposes the construction of a new bridge across Buck Creek and installation of additional culverts spanning smaller streams. The exact size of these new structures is not yet known. Up to 29 acres of tree clearing may occur as part of the project. Construction is anticipated to begin in Summer 2025.

STUDY AREA

The topography in the area is generally rolling with a mix of forested areas, agricultural fields and scattered rural housing. Numerous tributaries to Buck Creek are located within the project area and a tall bluff is located along Buck Creek. Sinkholes and other karst features are also abundant in the region. This part of the state is typically underlain by karst limestone formations

which are often associated with an extensive network of subterranean caves, air passages, and waterways. Clusters of some of the most important caves in Indiana for bats and other cave fauna are found in Harrison and adjacent Crawford County.

ENDANGERED SPECIES

The proposed project is within the range of the federally endangered Indiana bat (*Myotis sodalis*) and gray bat (*Myotis grisescens*), and the federally threatened northern long-eared bat (*Myotis septentrionalis*). Indiana bats hibernate in caves then disperse to reproduce and forage in relatively undisturbed forested areas associated with water resources during spring and summer. Recent research has shown that they will inhabit fragmented landscapes with adequate forest for roosting and foraging. Young are raised in nursery colony roosts in trees, typically near drainage-ways in undeveloped areas. Like all other bat species in Indiana, the Indiana bat diet consists exclusively of insects.

There is suitable summer habitat for this species present throughout the area surrounding the project site, as well as multiple hibernacula approximately 9-13 miles northwest and southeast of the project. There are no current summer records of Indiana bats near the site but to our knowledge surveys have been limited in the area.

The northern long-eared bat was listed as threatened under the Endangered Species Act (ESA) (87 Stat. 884, as amended; 16 U.S.C. 1531 *et seq.*) in April 2015. The Service also developed a final 4(d) rule, which was published in the *Federal Register* on January 14, 2016. The 4(d) rule specifically defines the "take" prohibitions. At this time, no critical habitat has been proposed for the northern long-eared bat. Since the northern long-eared bat was not listed at the time of our original coordination, species-specific information is included below.

The entire state of Indiana is within the range of the northern long-eared bat. During the summer, northern long-eared bats typically roost singly or in colonies in cavities, underneath loose bark, in crevices, or in hollows of both live and dead trees and/or snags (typically ≥3 inches dbh). Males and non-reproductive females may also roost in cooler places, like caves and mines. The northern long-eared bat appears opportunistic in selecting roosts, using tree species based on presence of cavities or crevices or presence of peeling bark. It has also been occasionally found roosting in structures like barns and sheds (particularly when suitable tree roosts are unavailable). They forage for insects in upland and lowland woodlots and tree lined corridors. During the winter, northern long-eared bats predominately hibernate in caves and abandoned mine portals. Additional habitat types may be identified as new information is obtained.

There are a couple of capture records of the northern long-eared bat near the project area along Buck Creek. There are multiple hibernacula approximately 9-13 miles north/northwest and southeast of the project that are known to be used by northern long-eared bats.

Based on the information we have reviewed, there is suitable summer habitat present for **both** the Indiana bat and the northern long-eared bat throughout the area surrounding the project site, including wooded areas within the potential project boundary. Although portions of Harrison County are a heavily forested, we expect impacts may occur as a result of habitat loss and fragmentation. To avoid direct incidental take from removal of an occupied roost tree, tree-

clearing should be avoided during the period **April 1 – November 14.** This extended restricted timeframe is a result of the project being located within 10 miles of one Priority 1 and two Priority 2 Indiana bat hibernacula and the associated fall swarming habitat.

Please note that on March 23, 2022, the Service published a proposal to reclassify the northern long-eared bat as endangered under the Endangered Species Act. The U.S. District Court for the District of Columbia has ordered the Service to complete a new final listing determination for the NLEB by November 2022 (Case 1:15-cv-00477, March 1, 2021). The bat, currently listed as threatened, faces extinction due to the range-wide impacts of white-nose syndrome (WNS), a deadly fungal disease affecting cave-dwelling bats across the continent. The proposed reclassification, if finalized, would remove the current 4(d) rule for the NLEB, as these rules may be applied only to threatened species. Depending on the type of effects a project has on the NLEB, the change in the species' status may trigger the need to re-initiate consultation for any actions that are not completed and for which the Federal action agency retains discretion once the new listing determination becomes effective (anticipated to occur by December 30, 2022). If your project may result in incidental take of NLEBs after the new listing goes into effect this will need to be addressed in a consultation that includes an Incidental Take Statement.

The project is also within the range of the gray bat. Gray bats are year-round cave obligates, roosting in caves both during hibernation and the summer maternity season; they may also occasionally use structures for roosting. Foraging habitat of gray bats is generally correlated with rivers, streams, lakes or reservoirs and associated shorelines and riparian areas. They use forested corridors and tree cover to travel between caves and foraging areas. We have multiple records of gray bats in Harrison County, including summer captures along Buck Creek and winter and summer presence in several caves northwest of the project. Buck Creek is likely an important foraging and travelling route for this species based on the documented capture records along the stream, presence in nearby caves, and also the project's proximity to the Ohio River, another area of documented gray bat use.

OTHER SPECIES OF CONCERN

The following species have been found along Buck Creek downstream of the project area and are on the Service's National Listing Workplan. These species may require additional consideration depending on the listing outcomes and the project's construction timeframe. A species' inclusion in the Workplan does not mean it will be listed as endangered or threatened under the ESA. That determination would be made following a rigorous scientific assessment of the species' status to determine whether it meets the definition of an endangered or threatened species. If the Service determines a species warrants listing, we will undertake the appropriate rule-making process before the species receives protections under the ESA.

- Tri-colored bat (*Perimyotis subflavus*) – status assessment ongoing; National Listing Workplan date FY22
- Little brown bat (*Myotis lucifugus*) – status assessment ongoing; National Listing Workplan date FY23

POTENTIAL PROJECT IMPACTS/EFFECTS

Streams

There are multiple streams and wetlands in the study area, including Buck Creek and a known sinking stream area. Buck Creek is listed on the Natural Resource Commission's (NRC) Outstanding Rivers in Indiana list which identifies rivers and streams that have particular environmental or aesthetic interest.

Stream corridors like Buck Creek are important for food resources and animal movement, such as bats that use stream corridors for travelling and foraging. We anticipate that the proposed bridge over Buck Creek will be large enough to allow for bat movement beneath the structure and to help maintain some connectivity in the vicinity of the bridge; however, the introduction of noise and lights associated with new traffic could create barriers to bat movement.

Other small, headwater streams and springs in the vicinity are likely important habitat for aquatic insects, amphibians, and fish. Impacts to these features may have consequences for the conservation of biodiversity and should be minimized as much as possible.

Forest

Tree clearing will be required for the construction of the SR 11 Extension project. According to the early coordination letter, the project is anticipated to require up to 45 acres of permanent right-of-way (ROW), up to 5 acres of temporary ROW, and up to 29 acres of tree clearing. The new roadway may create a barrier to bats and other wildlife in this area as a result of habitat removal and increased noise and traffic.

Karst

According to your letter (and based on a recent site visit), multiple karst features have been identified in the project area. This includes several caves, numerous sinkholes, springs, and two sinking stream basin areas.

Excavation which intersects karst features or results in the rerouting of drainage can drastically alter underground water and air flow patterns, resulting in significant adverse impacts to karst ecosystems. Drainage containing contaminants from construction sites, highway ditches, or other sources can also have substantial impacts. Since karst groundwater systems receive very little filtering by soil percolation, subsurface water quality is very sensitive to pollutants in surface runoff.

Specific mitigation measures to address roadway run-off (including de-icing chemicals) and spills should be developed for any drainage features encountered. Grouting drainage features without fully understanding the surface and subsurface drainage patterns can result in additional problems, such as new sinkhole development. If applicable, road drainage should be prevented from entering any karst features by being directed away from them and sinkholes should be left undisturbed along with a minimum 25-foot buffer around the highest closed contour. Karst impacts will be evaluated and mitigated in accordance with the Indiana Department of

Transportation's procedures as outlined in their *Protection of Karst Features during Project Development and Construction* document. Impacts and treatment options should be coordinated with our office.

This review is provided as technical assistance only and **does not** preclude the need for further consultation on this project as required under Section 7 of the Endangered Species Act of 1973, as amended.

ADDITIONAL RECOMMENDATIONS

We recommend the following avoidance and minimization measures be included in the final project plans to minimize adverse impacts on fish and wildlife resources:

1. Revegetate all disturbed soil areas immediately upon project completion, using native trees and shrubs in the riparian zone wherever feasible. We recommend reforestation along riparian areas extend at least 30 meters perpendicular from the streambank**.**

2. Do not clear trees or understory vegetation outside the construction zone boundaries. (**This restriction is not related to the "tree clearing" restriction for potential Indiana Bat habitat.)**

3. Minimize the extent of artificial bank stabilization and use bioengineering methods wherever feasible.

4. If riprap is utilized for bank stabilization, extend it below low-water elevation to provide aquatic habitat (if applicable).

5. Use best methods to contain soil and sediment runoff during construction. Use silt curtains or other devices at the downstream end of the project to contain bottom sediment in the newly excavated channel and to prevent it from adding to the downstream sediment load. Maintain such devices by removal of accumulated sediment.

6. Restrict below low-water work in streams to placement of culverts, piers, pilings and/or footings, shaping of the spill slopes around the bridge abutments, and placement of riprap. Culverts should span the active stream channel, should be either embedded or a 3-sided or open-arch culvert, and be installed where practicable on an essentially flat slope. When an open-bottomed culvert or arch is used in a stream, which has a good natural bottom substrate, such as gravel, cobbles and boulders, the existing substrate should be left undisturbed beneath the culvert to provide natural habitat for the aquatic community.

7. Use project design and right-of-way control to prohibit or restrict secondary development in large forest blocks and near currently undeveloped forested waterways.

A permit under Section 404 of the Clean Water Act may be needed for the proposed project. Our recommendations to the U.S. Army Corps of engineers for permit conditions would be consistent with our comments here.

We appreciate the opportunity to comment at this stage of project planning. We look forward to continuing to coordinate as the project develops. If you have any questions about our recommendations, please contact Robin McWilliams Munson at (8l2) 334-426l (Ext. 207) or robin_mcwilliams@fws.gov.

Sincerely,

Scott E. Pruitt
Field Supervisor

Cc (via email):
Sandy Bowman, INDOT, Indianapolis, IN
Jeremy Kieffner, Lochmueller Group, Evansville, IN
Kari Carmany-George, FHWA, Indianapolis, IN

Appendix E

IDNR ER-24108 Early Coordination/Environmental Assessment Response 6 October 2021

THIS IS NOT A PERMIT

State of Indiana
DEPARTMENT OF NATURAL RESOURCES
Division of Fish and Wildlife
Early Coordination/Environmental Assessment

DNR #: ER-24108 **Request Received:** October 6, 2021

Requestor: Lochmueller Group Inc
Holly Hume
6200 Vogel Road
Evansville, IN 47715

Project: SR 11 new road connection from SR 135/Watson Road to SR 11/SR 337/Melview Road with a new bridge over Buck Creek and new culverts in other streams, 10 miles south of Corydon; Des #2001154

County/Site info: Harrison

The Indiana Department of Natural Resources has reviewed the above referenced project per your request. Our agency offers the following comments for your information and in accordance with the National Environmental Policy Act of 1969.

If our agency has regulatory jurisdiction over the project, the recommendations contained in this letter may become requirements of any permit issued. If we do not have permitting authority, all recommendations are voluntary.

Regulatory Assessment: This proposal will require the formal approval for construction in a floodway under the Flood Control Act, IC 14-28-1. Please submit a copy of this letter with the permit application.

Natural Heritage Database: The Natural Heritage Program's data have been checked.
The Nature Conservancy's Indiana Forest Bank is located within 1/2 mile northwest of the project area. Also, the Wavyrayed Lampmussel (Lampsilis fasciola) and Little Spectaclecase (Villosa lienosa), both state species of special concern, have been documented in Buck Creek within 1/2 mile of the project area.

Fish & Wildlife Comments: As long as in-stream impacts are minimized in Buck Creek, and standard erosion control measures are implemented, we do not foresee any impacts to the mussel species above as a result of this project.

New-terrain road alignments through previously undisturbed area such as the area proposed can result in significant direct and indirect impacts due to habitat destruction and degradation. The project study area contains large tracts of closed-canopy forested habitat located on high-density karst terrain (in the most karst feature-rich area of the state), with previously undisturbed forested floodways, rivers, creeks, and sensitive species such as karst ecosystem species.

Avoid and minimize impacts to fish, wildlife, and botanical resources to the greatest extent possible, and compensate for impacts. The following are recommendations that address potential impacts identified in the proposed project area:

1) Road Fragmentation:
Road corridor fragmentation is especially problematic compared to other types of forest fragmentation impacts. "Road edge habitat is unique in many respects from natural edges or edges produced by clearcuts. Whereas natural and clearcut edges will become progressively less defined as the forest regenerates to a patch, road edges tend to exist long-term and be disturbed more frequently. Road edges increase air pollution, soil erosion, noise, disturbance by human activity, and exotic species introductions, and may induce populations changes in the vegetation and animal

communities included in the areas of edge influence. These factors combine to create particularly deleterious habitat situations, and endanger the existence and perpetuation of all native species on the landscape" (Reed, R.A., Johnson-Barnard, J., and Baker, W.A. 1996. "Contribution of Roads to Forest Fragmentation in the Rocky Mountains." Conservation Biology 10: 1098-1106).

2) Alternatives:
We strongly recommend considering lower-impact alternatives. For example, an alignment along St. Michael's Road deflected to the south between St. Michael's Road and Heth-Washington Road SW would minimize forested habitat impacts associated with that crossing location. Other options should be investigated as potential connector alignments with consideration of using existing road corridors and previously disturbed areas to the greatest extent possible, and minimizing impacts to forested areas, creeks, forested creek valleys, karst terrain, etc.

3) Crossing Structures:
We recommend bridging as much of the creek valley as possible to avoid impacts to the steep, forested valley sides and to the forested margins along the creek listed as wetland by the National Wetland Inventory maps.

Maintaining or improving fish and wildlife passage at existing or proposed crossing locations is a priority for the Division of Fish & Wildlife (DFW) to reduce wildlife mortality along roadways. The DFW has outlined different requirements for different types of crossing structure impacts. For brand new crossings in areas that currently do not have a crossing, the new structure must accommodate white-tailed deer passage where appropriate. Minimum structure dimensions for white-tailed deer passage are 20 feet of width clearance (overall size of the structure span) and 8 feet of height clearance measured from the OHWM to the low chord elevation and where deer passage is provided. For crossing replacements, the new structure must include wildlife passage appropriate for the type of replacement structure being proposed. If the replacement structure is sized to accommodate white-tailed deer passage then it should be included in the design of the new structure. If white-tailed deer passage is not possible with the existing structure, deer passage still needs to be considered in the design and at minimum the bank lines must be restored within structures to allow for smaller wildlife passage above the ordinary high water mark. All wildlife passage designs must include a smooth level pathway a minimum of 1-2 feet in width composed of natural substrate (soil, sand, gravel, etc.) or compacted aggregate fill over riprap (#2, #53, #73, etc.) tied into existing elevations both upstream and downstream. The stream crossing repairs or modifications, and any bank stabilization under or around the structure, must not create conditions that are less favorable for wildlife passage when compared to existing conditions. Upgrading wildlife passage for rehabilitated/modified structures is encouraged whenever possible to improve wildlife/vehicle safety.

There are a number of techniques and materials for incorporating wildlife passage into the design of a crossing structure. Coordination with a Regional Environmental Biologist to address wildlife passage issues before submitting a permit application (if required) is encouraged to avoid delays in the permitting process. The following links are good resources to consider in the design of stream crossing structures to maintain fish and wildlife passage: http://www.fs.fed.us/wildlifecrossings/library/, https://roadecology.ucdavis.edu/files/content/projects/DOT-FHWA_Wildlife_Crossing_Structures_Handbook.pdf, https://www.fs.fed.us/biology/nsaec/fishxing/aop_pdfs.html, https://www.fhwa.dot.gov/engineering/hydraulics/pubs/11008/hif11008.pdf.

For purposes of maintaining fish and wildlife passage through a crossing structure, the Environmental Unit recommends bridges rather than culverts and bottomless culverts rather than box or pipe culverts. Wide culverts are better than narrow culverts, and

culverts with shorter through lengths are better than culverts with longer through lengths. If box or pipe culverts are used, the bottoms should be buried a minimum of 6" (or 20% of the culvert height/pipe diameter, whichever is greater up to a maximum of 2') below the stream bed elevation to allow a natural streambed to form within or under the crossing structure. Crossings should: span the entire channel width (a minimum of 1.2 times the OHWM width); maintain the natural stream substrate within the structure; and have stream depth, channel width, and water velocities during low-flow conditions that are approximate to those in the natural stream channel. Banklines should be restored within box and pipe structures to allow for wildlife passage above the ordinary highwater mark.

4) Riparian Habitat:
We recommend a mitigation plan be developed (and submitted with the permit application) for any unavoidable habitat impacts that will occur. The DNR's Habitat Mitigation Guidelines (and plant lists) can be found online at: http://iac.iga.in.gov/iac/20200527-IR-312200284NRA.xml.pdf.

Impacts to non-wetland forest of one (1) acre or more should be mitigated at a minimum 2:1 ratio. If less than one acre of non-wetland forest is removed in a rural setting, replacement should be at a 1:1 ratio based on area. Impacts to non-wetland forest under one (1) acre in an urban setting should be mitigated by planting five trees, 1 inch to 2 inches in diameter-at-breast height (dbh), for each tree which is removed that is 10" dbh or greater (5:1 mitigation based on the number of large trees) or by using the 1:1 replacement ratio based on area depending on the type of habitat impacted (individual canopy tree removal in an urban streetscape or park-like environment versus removal of habitat supporting a tree canopy, woody understory, and herbaceous layer). Impacts under 0.10 acre in an urban area may still involve the replacement of large diameter trees but typically do not require any additional mitigation or additional plantings beyond seeding and stabilizing disturbed areas. There are exceptions for high quality habitat sites however.

The mitigation site should be located in the floodway, downstream of the one (1) square mile drainage area of that stream (or another stream within the 8-digit HUC, preferably as close to the impact site as possible) and adjacent to existing forested riparian habitat.

5) Karst Features:
Construction activities that occur within the drainage area of active karst features could potentially cause significant impacts to sensitive karst ecosystems and biota. Should any karst features be located within the construction limits or that may receive drainage from the construction, we recommend that a karst assessment be conducted by a qualified geologist with experience in karst geology assessments and a determination made as to whether or not the karst feature/sinkhole is active. If a karst assessment is not done, any sinkhole that construction runoff may drain to should be assumed to be active. To protect active sinkholes (or those not assessed), the most protective erosion control methods should be implemented to avoid potentially impacting sensitive karst ecosystems (such as runoff containment and filtering prior to discharge).

Construction should be avoided within 25' of the topmost closed contour of any active karst features. Runoff from construction located outside of the drainage area of any karst feature should be directed away from any karst features. Where construction within the closed contours of a karst feature is unavoidable, runoff must be filtered prior to discharge.

INDOT's karst protection procedures should be followed during all phases of the project, which can be found at

https://www.in.gov/indot/engineering/files/KARST-PROTECTION-and-INDOT-Construction-7.15.2021.pdf.

The additional measures listed below should be implemented to avoid, minimize, or compensate for impacts to fish, wildlife, and botanical resources:
1. Revegetate all bare and disturbed areas with a mixture of native grasses, sedges, wildflowers, and also native hardwood trees and shrubs if any woody plants are disturbed during construction as soon as possible upon completion. Do not use any varieties of Tall Fescue or other non-native plants, including prohibited invasive species (see 312 IAC 18-3-25).
2. Minimize and contain within the project limits inchannel disturbance and the clearing of trees and brush.
3. Do not work in the waterway from April 1 through June 30 without the prior written approval of the Division of Fish and Wildlife.
4. Do not cut any trees suitable for Indiana bat or Northern Long-eared bat roosting (greater than 5 inches dbh, living or dead, with loose hanging bark, or with cracks, crevices, or cavities) from April 1 through September 30.
5. Do not excavate in the low flow area except for the placement of piers, foundations, and riprap, or removal of the old structure.
6. Do not construct any temporary runarounds, access bridges, causeways, cofferdams, diversions, or pumparounds.
7. Use minimum average 6 inch graded riprap stone extended below the normal water level to provide habitat for aquatic organisms in the voids.
8. Appropriately designed measures for controlling erosion and sediment must be implemented to prevent sediment from entering the stream or leaving the construction site; maintain these measures until construction is complete and all disturbed areas are stabilized.
9. Seed and protect all disturbed streambanks and slopes not protected by other methods that are 3:1 or steeper with erosion control blankets that are heavy-duty, biodegradable, and net free or that use loose-woven / Leno-woven netting to minimize the entrapment and snaring of small-bodied wildlife such as snakes and turtles (follow manufacturer's recommendations for selection and installation); seed and apply mulch on all other disturbed areas.

Contact Staff: Christie L. Stanifer, Environ. Coordinator, Fish & Wildlife
Our agency appreciates this opportunity to be of service. Please contact the above staff member at (317) 232-4080 if we can be of further assistance.

Christie L. Stanifer **Date:** November 10, 2021

Christie L. Stanifer
Environ. Coordinator
Division of Fish and Wildlife

Appendix F

Buck Creek Bridge/Structure Bat Assessment Form and Photographs

Bridge/Structure Bat Assessment Form

Date & Time of Assessment	DOT Project Number	Route/Facility Carried	County
April 1, 2022 5:45pm	2001154	Union Chapel Road	Harrison
Federal Structure ID 31-00038	**Structure Coordinates** (latitude and longitude) 38 07844 -86.111366	**Structure Height** (approximate) 10 feet	**Structure Length** 177 feet

Structure Type (check one)

Bridge Construction Style

- ○ Cast-in-place
- ○ Pre-stressed Girder
- ◉ Flat Slab/Box
- ○ Steel I-beam
- ○ Truss (Side View)
- ○ Covered
- ○ Parallel Box Beam
- ○ Other:

Culvert Type

- ○ Box
- ○ Pipe/Round
- ○ Other:

Other Structure

- ○

Structure Material (check all that apply)

Deck Material	*Beam Material*	*End/Back Wall Material*
☐ Metal	☒ None	☒ Concrete
☒ Concrete	☐ Concrete	☐ Timber
☐ Timber	☐ Steel	☐ Stone/Masonry
☐ Open grid	☐ Timber	☐ O her:
☐ Other:	☐ Other:	

Culvert Material

- ☐ Metal
- ☐ Concrete
- ☐ Plastic
- ☐ Stone/Masonry
- ☐ Other:

Creosote Evidence

- ○ Yes ○ No
- ○ Unknown

Notes:

Crossings Traversed (check all that apply)

☒ Bare ground	☐ Open vegetation
☒ Rip-rap	☐ Closed vegetation
☒ Flowing water	☐ Railroad
☐ Standing water	☐ Road/trail - Type:
☐ Seasonal water	☐ Other:

Surrounding Habitat (check all that apply)

☒ Agricultural	☐ Grassland
☐ Commercial	☐ Ranching
☐ Residential-urban	☐ Riparian/wetland
☒ Residential-rural	☐ Mixed use
☒ Woodland/forested	☐ O her:

Areas Assessed (check all that apply)

Check all areas that apply. If an area is not present in the structure, check the "not present" box.
Document all bat indicators observed during the assessment. Include the species present, if known, and provide photo documentation as indicated.

Area (check if assessed)	**Assessment Notes**	**Evidence of Bats** (include photos if present)
☒ All crevices and cracks: **Bridges/culverts:** rough surfaces or imperfections in concrete **Other structures:** soffits, rafters, attic areas	☐ Not present Bridge deck and piers only display natural concrete roughness with the exception of a few areas with chipped concrete.	☐ Visual - live # dead # ☐ Audible ☐ Species ☐ Guano ☐ Odor ☐ Staining ☐ Photos
☒ Concrete surfaces (open roosting on concrete)	☐ Not present	☐ Visual - live # dead # ☐ Audible ☐ Species ☐ Guano ☐ Odor ☐ Staining ☐ Photos
☐ Spaces between concrete end walls and the bridge deck	☒ Not present	☐ Visual - live # dead # ☐ Audible ☐ Species ☐ Guano ☐ Odor ☐ Staining ☐ Photos
☒ Crack between concrete railings on top of the bridge deck 	☐ Not present	☐ Visual - live # dead # ☐ Audible ☐ Species ☐ Guano ☐ Odor ☐ Staining ☐ Photos
☐ Vertical surfaces on concrete I-beams	☒ Not present	☐ Visual - live # dead # ☐ Audible ☐ Species ☐ Guano ☐ Odor ☐ Staining ☐ Photos
☐ Spaces between walls, ceiling joists	☒ Not present	☐ Visual - live # dead # ☐ Audible ☐ Species ☐ Guano ☐ Odor ☐ Staining ☐ Photos
☐ Weep holes, scupper drains, and inlets/pipes	☐ Not present	☐ Visual - live # dead # ☐ Audible ☐ Species ☐ Guano ☐ Odor ☐ Staining ☐ Photos
☐ All guiderails	☒ Not present	☐ Visual - live # dead # ☐ Audible ☐ Species ☐ Guano ☐ Odor ☐ Staining ☐ Photos
☐ All expansion joints	☒ Not present	☐ Visual - live # dead # ☐ Audible ☐ Species ☐ Guano ☐ Odor ☐ Staining ☐ Photos

Name: Rusty Yeager

Signature: Rusty Yeager

Last revised April 2020

Assessment Form

Mid-channel pier and slab deck of Union Chapel Road bridge at Buck Creek - 4/1/2022

Riprap bank protection and low hight abutment at Union Chapel Road bridge at Buck Creek - 4/1/2022

Appendix G

USFWS Phase 1 Summer Habitat Assessment Forms

PHASE 1 SUMMER HABITAT ASSESSMENTS

Use additional sheets to assess discrete habitat types at multiple sites in a project area
Include a map depicting locations of sample sites if assessing discrete habitats at multiple sites in a project area
A single sheet can be used for multiple sample sites if habitat is the same

Sample Site Description

Sample Site No.(s): HA-1
5/28/2022
The sample site is 1 acre of a 1.6-acre mesic woodland including a large sinkhole feature along the west side of SR 135

Water Resources at Sample Site

Stream Type (# and length)	Ephemeral	Intermittent	Perennial	Describe existing condition of water sources: No water in or adjacent to the assessment site. The nearest water source is a 0.2-acre farm pond located approximately 0.09 mile to the west.
	N/A	N/A	N/A	
Pools/Ponds (# and size)	N/A	Open and accessible to bats		
		N/A		
Wetlands (approx. ac.)	Permanent	Seasonal		
	N/A	N/A		

Forest Resources at Sample Site

Closure/Density	Canopy (>50')	Midstory (20-50')	Understory (<20')	1=1-10%, 2=11-20%, 3=21-40%, 4=41-60% 5=61-80%, 6=81-100%
	6	4	1	
Dominant Species of Mature Trees	*Quercus rubra, Quercus alba, Acer saccharum*			
% Trees w/ Exfoliating Bark	0	<1	0	
Size Composition of Live Trees (%)	Small (3-8 in)	Med (9-15 in)	Large (>15 in)	
	35	55	10	
No. of Suitable Snags	0	1	0	

Standing dead trees with exfoliating bark, cracks, crevices, or hollows.
Snags without these characteristics area not considered suitable.

IS THE HABITAT SUITABLE FOR INDIANA BATS? Yes
IS THE HABITAT SUITABLE FOR NORTHERN LONG-EARED BATS? Yes

Additional Comments:
This habitat is suitable for Indiana and northern long-eared bats. Understory is relatively open for foraging. Woodland is not directly connected, but is proximal to other larger woodland areas to the southwest. Additional species include *Juniperus virginiana*, *Quercus imbricaria*, *Carya ovata*, and *Fagus grandifolia*. Flight corridors exist to the larger tangent forest. Only a single dead snag was identified as a potential roost; however, shagbark hickories in the woods may provide roosting opportunities for bats.

Tree ID	Species	DBH (in)	Stage of Decay	Roost Features
1.1	*Fraxinus sp.*	14.0	3	very few areas of detached bark
1.2	*Acer saccharum*	13.0	3	upper cavity offers roost opportunity

Attach aerial photo or project site with all forested areas labeled and a general description of the habitat

Photographic Documentation: habitat shots at edge and interior from multiple locations; Understory/midstory/canopy; examples of potential suitable snags and live trees; water sources

PHASE 1 SUMMER HABITAT ASSESSMENTS

Use additional sheets to assess discrete habitat types at multiple sites in a project area
Include a map depicting locations of sample sites if assessing discrete habitats at multiple sites in a project area
A single sheet can be used for multiple sample sites if habitat is the same

Sample Site Description

Sample Site No.(s): HA-2
5/28/2022
The sample site is a narrow strip of white pine planted along the south side of a driveway west of SR 135. These plantings are connected to a large mesic woodland to the west beyond the survey limits.

Water Resources at Sample Site

Stream Type (# and length)	Ephemeral	Intermittent	Perennial	Describe existing condition of water sources: No water in or adjacent to the assessment site. The nearest water source is a 0.2-acre farm pond located approximately 0.14 mile to the southwest.
	N/A	N/A	N/A	
Pools/Ponds (# and size)	N/A	Open and accessible to bats		
		N/A		
Wetlands (approx. ac.)	Permanent	Seasonal		
	N/A	N/A		

Forest Resources at Sample Site

Closure/Density	Canopy (>50')	Midstory (20-50')	Understory (<20')	1=1-10%, 2=11-20%, 3=21-40%, 4=41-60% 5=61-80%, 6=81-100%
	0	5	0	
Dominant Species of Mature Trees	*Pinus strobus*			
% Trees w/ Exfoliating Bark	0	0	0	
Size Composition of Live Trees (%)	Small (3-8 in)	Med (9-15 in)	Large (>15 in)	
	0	90	10	
No. of Suitable Snags	0	0	0	

Standing dead trees with exfoliating bark, cracks, crevices, or hollows.
Snags without these characteristics area not considered suitable.

IS THE HABITAT SUITABLE FOR INDIANA BATS? No
IS THE HABITAT SUITABLE FOR NORTHERN LONG-EARED BATS? No

Additional Comments:
This single row of planted white pines offers no roosting opportunities for bats and is not likely a viable foraging edge. The large mesic woods to the northwest undoubtedly offers higher quality bat habitat and multiple roosting features.

Attach aerial photo or project site with all forested areas labeled and a general description of the habitat

Photographic Documentation: habitat shots at edge and interior from multiple locations; Understory/midstory/canopy; examples of potential suitable snags and live trees; water sources

PHASE 1 SUMMER HABITAT ASSESSMENTS

Use additional sheets to assess discrete habitat types at multiple sites in a project area
Include a map depicting locations of sample sites if assessing discrete habitats at multiple sites in a project area
A single sheet can be used for multiple sample sites if habitat is the same

Sample Site Description

Sample Site No.(s): HA-3
5/28/2022
The sample site is 0.9 acre of an isolated 3.0-acre mesic woodland fragment along the west side of SR 135 within a residential property parcel.

Water Resources at Sample Site

Stream Type (# and length)	Ephemeral	Intermittent	Perennial	Describe existing condition of water sources: No water in or adjacent to the assessment site. The nearest water source is a 0.44-acre sinkhole farm pond located approximately 0.17 mile to the east.
	N/A	N/A	N/A	
Pools/Ponds (# and size)	N/A	Open and accessible to bats		
		N/A		
Wetlands (approx. ac.)	Permanent	Seasonal		
	N/A	N/A		

Forest Resources at Sample Site

Closure/Density	Canopy (>50')	Midstory (20-50')	Understory (<20')	1=1-10%, 2=11-20%, 3=21-40%, 4=41-60% 5=61-80%, 6=81-100%
	1	6	5	
Dominant Species of Mature Trees	*Juglans nigra, Prunus serotina, Juniperus virginiana*			
% Trees w/ Exfoliating Bark	0	<1	0	
Size Composition of Live Trees (%)	Small (3-8 in)	Med (9-15 in)	Large (>15 in)	
	85	14	1	
No. of Suitable Snags	0	3	0	

Standing dead trees with exfoliating bark, cracks, crevices, or hollows.
Snags without these characteristics area not considered suitable.

IS THE HABITAT SUITABLE FOR INDIANA BATS? Yes
IS THE HABITAT SUITABLE FOR NORTHERN LONG-EARED BATS? Yes

Additional Comments:

This habitat is suitable for Indiana and northern long-eared bats. Areas where red cedar dominate have heavy understory clutter. Elsewhere where black walnut are dominant the understory is more open and available for bat movement. Additional species include *Sassafras albidum, Tilia Americana, Cercis Canadensis, Ulmus sp.,* and *Acer negundo.* There are no clear flight corridors within the woods. The two dead ash snags in the southwest corner display partial peeling bark that only provides a few small areas for bat access.

Tree ID	Species	DBH (in)	Stage of Decay	Roost Features
3.1	*Fraxinus sp.*	13.0	3	very few areas of detached bark
3.2	*Fraxixus sp.*	14.0	3	very few areas of detached bark
3.3	*Fraxinus sp.*	14.0	3	very few areas of detached bark

Attach aerial photo or project site with all forested areas labeled and a general description of the habitat

Photographic Documentation: habitat shots at edge and interior from multiple locations; Understory/midstory/canopy; examples of potential suitable snags and live trees; water sources

PHASE 1 SUMMER HABITAT ASSESSMENTS

Use additional sheets to assess discrete habitat types at multiple sites in a project area
Include a map depicting locations of sample sites if assessing discrete habitats at multiple sites in a project area
A single sheet can be used for multiple sample sites if habitat is the same

Sample Site Description

Sample Site No.(s): HA-4
5/28/2022
The sample site is includes three trees on a residential property parcel along the west side of SR 135.

Water Resources at Sample Site

Stream Type (# and length)	Ephemeral	Intermittent	Perennial	Describe existing condition of water sources: No water in or adjacent to the assessment site. The nearest water source is a 0.44-acre sinkhole farm pond located approximately 0.19 mile to the east.
	N/A	N/A	N/A	
Pools/Ponds (# and size)	N/A	Open and accessible to bats		
		N/A		
Wetlands (approx. ac.)	Permanent	Seasonal		
	N/A	N/A		

Forest Resources at Sample Site

Closure/Density	Canopy (>50')	Midstory (20-50')	Understory (<20')	1=1-10%, 2=11-20%, 3=21-40%, 4=41-60% 5=61-80%, 6=81-100%
	0	5	0	
Dominant Species of Mature Trees	*Acer saccharum*			
% Trees w/ Exfoliating Bark	0	0	0	
Size Composition of Live Trees (%)	Small (3-8 in)	Med (9-15 in)	Large (>15 in)	
	0	0	100	
No. of Suitable Snags	0	0	0	

Standing dead trees with exfoliating bark, cracks, crevices, or hollows.
Snags without these characteristics area not considered suitable.

IS THE HABITAT SUITABLE FOR INDIANA BATS? No
IS THE HABITAT SUITABLE FOR NORTHERN LONG-EARED BATS? No

Additional Comments:
Three large maples in front yard have been trimmed for overhead utility line clearance. The entire area of the residential property is regularly mowed.

Attach aerial photo or project site with all forested areas labeled and a general description of the habitat

Photographic Documentation: habitat shots at edge and interior from multiple locations;
Understory/midstory/canopy; examples of potential suitable snags and live trees; water sources

PHASE 1 SUMMER HABITAT ASSESSMENTS

Use additional sheets to assess discrete habitat types at multiple sites in a project area
Include a map depicting locations of sample sites if assessing discrete habitats at multiple sites in a project area
A single sheet can be used for multiple sample sites if habitat is the same

Sample Site Description

Sample Site No.(s): HA-5
5/28/2022
The sample site is the 0.05-acre northwestern tip of a 1.2-acre mesic woodland fragment in the northeast corner of a residential property parcel.

Water Resources at Sample Site

Stream Type (# and length)	Ephemeral	Intermittent	Perennial	Describe existing condition of water sources: No water in or adjacent to the assessment site. The nearest water source is a 0.44-acre sinkhole farm pond located approximately 0.17 mile to the east.
	N/A	N/A	N/A	
Pools/Ponds (# and size)	N/A	Open and accessible to bats		
		N/A		
Wetlands (approx. ac.)	Permanent	Seasonal		
	N/A	N/A		

Forest Resources at Sample Site

Closure/Density	Canopy (>50')	Midstory (20-50')	Understory (<20')	1=1-10%, 2=11-20%, 3=21-40%, 4=41-60% 5=61-80%, 6=81-100%
	0	6	0	
Dominant Species of Mature Trees	*Juglans nigra, Acer rubrum*			
% Trees w/ Exfoliating Bark	0	0	0	
Size Composition of Live Trees (%)	Small (3-8 in)	Med (9-15 in)	Large (>15 in)	
	10	90	0	
No. of Suitable Snags	0	0	0	

Standing dead trees with exfoliating bark, cracks, crevices, or hollows.
Snags without these characteristics area not considered suitable.

IS THE HABITAT SUITABLE FOR INDIANA BATS? No
IS THE HABITAT SUITABLE FOR NORTHERN LONG-EARED BATS? No

Additional Comments:
The assessment area was included approximately 13 trees within a maintained residential setting where regular mowing keeps the understory completely clear. The woods to the southeast has an active understory.

Attach aerial photo or project site with all forested areas labeled and a general description of the habitat

Photographic Documentation: habitat shots at edge and interior from multiple locations;
Understory/midstory/canopy; examples of potential suitable snags and live trees; water sources

PHASE 1 SUMMER HABITAT ASSESSMENTS

Use additional sheets to assess discrete habitat types at multiple sites in a project area
Include a map depicting locations of sample sites if assessing discrete habitats at multiple sites in a project area
A single sheet can be used for multiple sample sites if habitat is the same

Sample Site Description

Sample Site No.(s): HA-6
5/28/2022
The sample site is the 0.31-acre isolated woodlot fragment consists of young growth trees on a residential property parcel west of SR 135 between two driveways.

Water Resources at Sample Site

Stream Type (# and length)	Ephemeral	Intermittent	Perennial	Describe existing condition of water sources: No water in or adjacent to the assessment site. The nearest water source is a 0.23-acre farm pond located approximately 0.21 mile to the southwest.
	N/A	N/A	N/A	
Pools/Ponds (# and size)	N/A	Open and accessible to bats		
		N/A		
Wetlands (approx. ac.)	Permanent	Seasonal		
	N/A	N/A		

Forest Resources at Sample Site

Closure/Density	Canopy (>50')	Midstory (20-50')	Understory (<20')
	0	5	6
Dominant Species of Mature Trees	*Liriodendron tulipifera, Juniperus virginiana, Juglans nigra*		
% Trees w/ Exfoliating Bark	0	0	0
Size Composition of Live Trees (%)	Small (3-8 in)	Med (9-15 in)	Large (>15 in)
	95	5	0
No. of Suitable Snags	0	0	0

Standing dead trees with exfoliating bark, cracks, crevices, or hollows.
Snags without these characteristics area not considered suitable.

IS THE HABITAT SUITABLE FOR INDIANA BATS? No
IS THE HABITAT SUITABLE FOR NORTHERN LONG-EARED BATS? No

Additional Comments:
The assessment area is predominantly high density red cedar(>98 percent) with occasional mature mixed hardwood species. Additional trees included *Ulmus sp., Diospyros virginiana, Fraxinus sp., Cercis canadensis,* and *Acer saccharum*.

Attach aerial photo or project site with all forested areas labeled and a general description of the habitat

Photographic Documentation: habitat shots at edge and interior from multiple locations; Understory/midstory/canopy; examples of potential suitable snags and live trees; water sources

PHASE 1 SUMMER HABITAT ASSESSMENTS

Use additional sheets to assess discrete habitat types at multiple sites in a project area
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A single sheet can be used for multiple sample sites if habitat is the same

Sample Site Description

Sample Site No.(s): HA-7
5/6/2021
The sample site is a 1.4-acre portion of a large >20-acre mesic mature woods along the west side of SR 135.

Water Resources at Sample Site

Stream Type (# and length)	Ephemeral	Intermittent	Perennial	Describe existing condition of water sources: No water in or adjacent to the assessment site. The nearest water source is a farm pond located approximately 0.27 mile to the south across SR 135.
	N/A	N/A	N/A	
Pools/Ponds (# and size)	N/A	Open and accessible to bats		
		N/A		
Wetlands (approx. ac.)	Permanent	Seasonal		
	N/A	N/A		

Forest Resources at Sample Site

Closure/Density	Canopy (>50')	Midstory (20-50')	Understory (<20')	1=1-10%, 2=11-20%, 3=21-40%, 4=41-60% 5=61-80%, 6=81-100%
Dominant Species of Mature Trees	Canopy: *Populus deltoides, Ulmus americana* Mid-story: *Ulmus americana, Acer saccharum* Understory: *Ulmus americana, Acer saccharum*			
% Trees w/ Exfoliating Bark	0	0	1	
Size Composition of Live Trees (%)	Small (3-8 in)	Med (9-15 in)	Large (>15 in)	
	20	50	30	
No. of Suitable Snags	0	0	0	

Standing dead trees with exfoliating bark, cracks, crevices, or hollows.
Snags without these characteristics area not considered suitable.

IS THE HABITAT SUITABLE FOR INDIANA BATS? Yes
IS THE HABITAT SUITABLE FOR NORTHERN LONG-EARED BATS? Yes

Additional Comments:
Flight corridors exist to the larger adjacent forest. Additional trees include *Carya ovata*. The area features a dense canopy with relatively open mid and understories. No dead snags were identified; however, shagbark hickory may provide roosts opportunities for bats.

Attach aerial photo or project site with all forested areas labeled and a general description of the habitat

Photographic Documentation: habitat shots at edge and interior from multiple locations; Understory/midstory/canopy; examples of potential suitable snags and live trees; water sources

PHASE 1 SUMMER HABITAT ASSESSMENTS

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Sample Site Description

Sample Site No.(s): HA-8
5/29/2022
The sample site is a 2.5-acre isolated fragment of woodland on a residential property parcel along the west side of west side of SR 135.

Water Resources at Sample Site

Stream Type (# and length)	Ephemeral	Intermittent	Perennial	Describe existing condition of water sources: No water in or adjacent to the assessment site. The nearest water source is a farm pond located approximately 0.32 mile to the south across SR 135. There is a dry roadside concrete ditch along SR 135.
	N/A	N/A	N/A	
Pools/Ponds (# and size)	N/A	Open and accessible to bats		
		N/A		
Wetlands (approx. ac.)	Permanent	Seasonal		
	N/A	N/A		

Forest Resources at Sample Site

Closure/Density	Canopy (>50')	Midstory (20-50')	Understory (<20')	1=1-10%, 2=11-20%, 3=21-40%, 4=41-60% 5=61-80%, 6=81-100%
	3	4	3	
Dominant Species of Mature Trees	*Juglans nigra, Celtis occidentalis, Prunus serotina*			
% Trees w/ Exfoliating Bark	0	0	0	
Size Composition of Live Trees (%)	Small (3-8 in)	Med (9-15 in)	Large (>15 in)	
	90	10	<1	
No. of Suitable Snags	0	0	0	

Standing dead trees with exfoliating bark, cracks, crevices, or hollows.
Snags without these characteristics area not considered suitable.

IS THE HABITAT SUITABLE FOR INDIANA BATS? No
IS THE HABITAT SUITABLE FOR NORTHERN LONG-EARED BATS? No

Additional Comments:
Additional trees included *Morus sp., Sassafras albidum, Ulmus sp., Acer saccharum, Juniperus virginiana, and Albizia julibrissin.* This narrow band of trees is approximately 15 to 20 feet wide.

Attach aerial photo or project site with all forested areas labeled and a general description of the habitat

Photographic Documentation: habitat shots at edge and interior from multiple locations; Understory/midstory/canopy; examples of potential suitable snags and live trees; water sources

PHASE 1 SUMMER HABITAT ASSESSMENTS

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Sample Site Description

Sample Site No.(s): HA-9
5/29/2022
The sample site is a 0.89-acre linear strip of isolated woodland along the right-of-way edge on the west side of SR 135.

Water Resources at Sample Site

Stream Type (# and length)	Ephemeral	Intermittent	Perennial	Describe existing condition of water sources: No water in or adjacent to the assessment site. The nearest water source is a farm pond located approximately 0.34 mile to the south across SR 135. There is a dry roadside concrete ditch along SR 135.
	N/A	N/A	N/A	
Pools/Ponds (# and size)	N/A	Open and accessible to bats		
		N/A		
Wetlands (approx. ac.)	Permanent	Seasonal		
	N/A	N/A		

Forest Resources at Sample Site

Closure/Density	Canopy (>50')	Midstory (20-50')	Understory (<20')	1=1-10%, 2=11-20%, 3=21-40%, 4=41-60% 5=61-80%, 6=81-100%
	1	6	5	
Dominant Species of Mature Trees	*Juniperus virginiana, Sassafras albidum, Diospyros virginiana, Populus deltoides, Ulmus sp.*			
% Trees w/ Exfoliating Bark	0	0	0	
Size Composition of Live Trees (%)	Small (3-8 in)	Med (9-15 in)	Large (>15 in)	
	95	5	<1	
No. of Suitable Snags	0	0	0	

Standing dead trees with exfoliating bark, cracks, crevices, or hollows.
Snags without these characteristics area not considered suitable.

IS THE HABITAT SUITABLE FOR INDIANA BATS? No
IS THE HABITAT SUITABLE FOR NORTHERN LONG-EARED BATS? No

Additional Comments:
Additional trees included *Celtis occidentalis, Juglans nigra, Prunus serotina, Cercis canadensis, Fraxinus sp., Albizia julibrissin,* and *Cornus florida.* This narrow band of trees is approximately 15 to 20 feet wide. It is not likely this area serves as functional foraging habitat. A single large dead snag cottonwood is not considered a likely roost.

Tree ID	Species	DBH (in)	Stage of Decay	Roost Features
9.1	*Populus deltoides*	20	2	dead limbs, but no good roosting areas

Attach aerial photo or project site with all forested areas labeled and a general description of the habitat

Photographic Documentation: habitat shots at edge and interior from multiple locations; Understory/midstory/canopy; examples of potential suitable snags and live trees; water sources

PHASE 1 SUMMER HABITAT ASSESSMENTS

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Sample Site Description

Sample Site No.(s): HA-10
5/29/2022
The sample site is a 0.17-acre linear strip of a larger strip of red cedar within the right-of-way on a rock outcrop along the west side of SR 135.

Water Resources at Sample Site

Stream Type (# and length)	Ephemeral	Intermittent	Perennial	Describe existing condition of water sources: No water in or adjacent to the assessment site. There is a dry roadside concrete ditch along SR 135.
	N/A	N/A	N/A	
Pools/Ponds (# and size)	N/A	Open and accessible to bats		
		N/A		
Wetlands (approx. ac.)	Permanent	Seasonal		
	N/A	N/A		

Forest Resources at Sample Site

Closure/Density	Canopy (>50')	Midstory (20-50')	Understory (<20')	1=1-10%, 2=11-20%, 3=21-40%, 4=41-60% 5=61-80%, 6=81-100%
	0	1	4	
Dominant Species of Mature Trees	*Juniperus virginiana*			
% Trees w/ Exfoliating Bark	0	0	0	
Size Composition of Live Trees (%)	Small (3-8 in)	Med (9-15 in)	Large (>15 in)	
	99	1	0	
No. of Suitable Snags	0	0	0	

Standing dead trees with exfoliating bark, cracks, crevices, or hollows.
Snags without these characteristics area not considered suitable.

IS THE HABITAT SUITABLE FOR INDIANA BATS? No
IS THE HABITAT SUITABLE FOR NORTHERN LONG-EARED BATS? No

Additional Comments:
Additional trees included *Celtis occidentalis* and *Cercis canadensis.* This narrow band of trees is approximately 40 feet wide and is not maintained within the right-of-way. A single dead hackberry on the rock outcrop is not considered to provide roosting habitat.

Tree ID	Species	DBH (in)	Stage of Decay	Roost Features
10.1	*Celtis occidentalis*	9.0	3	only one small patch of peeling bark

Attach aerial photo or project site with all forested areas labeled and a general description of the habitat

Photographic Documentation: habitat shots at edge and interior from multiple locations; Understory/midstory/canopy; examples of potential suitable snags and live trees; water sources

PHASE 1 SUMMER HABITAT ASSESSMENTS

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Sample Site Description

Sample Site No.(s): HA-11
5/29/2022
The sample site is a 0.23-acre strip of mostly red cedar within the right-of-way on a rock outcrop along the east side of SR 135.

Water Resources at Sample Site

Stream Type (# and length)	Ephemeral	Intermittent	Perennial	Describe existing condition of water sources: No water in or adjacent to the assessment site. There is a dry roadside concrete ditch along SR 135.
	N/A	N/A	N/A	
Pools/Ponds (# and size)	N/A	Open and accessible to bats		
		N/A		
Wetlands (approx. ac.)	Permanent	Seasonal		
	N/A	N/A		

Forest Resources at Sample Site

Closure/Density	Canopy (>50')	Midstory (20-50')	Understory (<20')	1=1-10%, 2=11-20%, 3=21-40%, 4=41-60% 5=61-80%, 6=81-100%
	0	2	3	
Dominant Species of Mature Trees	*Juniperus virginiana, Prunus serotina*			
% Trees w/ Exfoliating Bark	0	0	0	
Size Composition of Live Trees (%)	Small (3-8 in)	Med (9-15 in)	Large (>15 in)	
	95	5	0	
No. of Suitable Snags	0	0	0	

Standing dead trees with exfoliating bark, cracks, crevices, or hollows.
Snags without these characteristics area not considered suitable.

IS THE HABITAT SUITABLE FOR INDIANA BATS? No
IS THE HABITAT SUITABLE FOR NORTHERN LONG-EARED BATS? No

Additional Comments:
Additional trees included *Sassafras albidum* and *Fraxinus sp.* This narrow band of trees and shrubs is as much as 40 feet wide and is not maintained within the right-of-way.

Attach aerial photo or project site with all forested areas labeled and a general description of the habitat

Photographic Documentation: habitat shots at edge and interior from multiple locations; Understory/midstory/canopy; examples of potential suitable snags and live trees; water sources

PHASE 1 SUMMER HABITAT ASSESSMENTS

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Sample Site Description

Sample Site No.(s): HA-12
5/29/2022
The sample site is a 0.30-acre strip of trees along the west side of Central Drive, between Central Drive and SR 135.

Water Resources at Sample Site

Stream Type (# and length)	Ephemeral	Intermittent	Perennial	Describe existing condition of water sources: No water in or adjacent to the assessment site. The nearest water source is a 1.6-acre sinkhole farm pond located approximately 0.37 mile to the east along Watson Road.
	N/A	N/A	N/A	
Pools/Ponds (# and size)	N/A	Open and accessible to bats		
		N/A		
Wetlands (approx. ac.)	Permanent	Seasonal		
	N/A	N/A		

Forest Resources at Sample Site

Closure/Density	Canopy (>50')	Midstory (20-50')	Understory (<20')	1=1-10%, 2=11-20%, 3=21-40%, 4=41-60% 5=61-80%, 6=81-100%
	1	5	6	
Dominant Species of Mature Trees	*Juniperus virginiana, Fraxinus sp., Morus sp., Populus deltoides, Sassafras albidum, Prunus serotine*			
% Trees w/ Exfoliating Bark	0	<1	0	
Size Composition of Live Trees (%)	Small (3-8 in)	Med (9-15 in)	Large (>15 in)	
	90	10	<1	
No. of Suitable Snags	0	0	0	

Standing dead trees with exfoliating bark, cracks, crevices, or hollows.
Snags without these characteristics area not considered suitable.

IS THE HABITAT SUITABLE FOR INDIANA BATS? No
IS THE HABITAT SUITABLE FOR NORTHERN LONG-EARED BATS? No

Additional Comments:
Additional trees included *Ailanthus altisssima, Celtis occidentalis, Acer sacchaum, Diospyros virginiana, Cornus florida, Cercis canadensis,* and *Fraxinus sp.* This narrow band of trees and shrubs is 12 to 15 feet wide. The understory has high clutter with a large number of various species trees with stems <3 inches in diameter. There are five dead snag ash trees along this strip of woods; however, each one has some detached bark, but it hasn't yet developed to a peeling state where bats could use the feature for cover.

Tree ID	Species	DBH (in)	Stage of Decay	Roost Features
12.1	*Fraxinus sp.*	7.0	3	loose bark, but no peeling
12.2	*Fraxinus sp.*	7.0	3	loose bark, but no peeling
12.3	*Fraxinus sp.*	9.0	3	loose bark, but no peeling
12.4	*Fraxinus sp.*	10.0	3	loose bark, but no peeling
12.5	*Fraxinus sp.*	9.0	3	loose bark, but no peeling

Attach aerial photo or project site with all forested areas labeled and a general description of the habitat

Photographic Documentation: habitat shots at edge and interior from multiple locations; Understory/midstory/canopy; examples of potential suitable snags and live trees; water sources

PHASE 1 SUMMER HABITAT ASSESSMENTS

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Sample Site Description

Sample Site No.(s): HA-13
5/28/2022
The assessment area is a 0.6-acre portion of a residential property that includes a cluster of trees adjacent and near the house along Central Drive and north of Watson Road.

Water Resources at Sample Site

Stream Type (# and length)	Ephemeral	Intermittent	Perennial	Describe existing condition of water sources: No water in or adjacent to the assessment site. The nearest water source is a 1.6-acre sinkhole farm pond located approximately 0.36 mile to the east along Watson Road.
	N/A	N/A	N/A	
Pools/Ponds (# and size)	N/A	Open and accessible to bats		
		N/A		
Wetlands (approx. ac.)	Permanent	Seasonal		
	N/A	N/A		

Forest Resources at Sample Site

Closure/Density	Canopy (>50')	Midstory (20-50')	Understory (<20')	1=1-10%, 2=11-20%, 3=21-40%, 4=41-60% 5=61-80%, 6=81-100%
	3	3	1	
Dominant Species of Mature Trees	*Acer saccharinum, Acer saccharum*			
% Trees w/ Exfoliating Bark	0	0	0	
Size Composition of Live Trees (%)	Small (3-8 in)	Med (9-15 in)	Large (>15 in)	
	20	40	40	
No. of Suitable Snags	0	0	0	

Standing dead trees with exfoliating bark, cracks, crevices, or hollows.
Snags without these characteristics area not considered suitable.

IS THE HABITAT SUITABLE FOR INDIANA BATS? No
IS THE HABITAT SUITABLE FOR NORTHERN LONG-EARED BATS? No

Additional Comments:
Additional trees included *Pinus virginiana* and *Pyrus sp.* There are no dead snags within this residential parcel that provide an isolated quality roost for bats.

Attach aerial photo or project site with all forested areas labeled and a general description of the habitat

Photographic Documentation: habitat shots at edge and interior from multiple locations; Understory/midstory/canopy; examples of potential suitable snags and live trees; water sources

PHASE 1 SUMMER HABITAT ASSESSMENTS

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Sample Site Description

Sample Site No.(s): HA-14
5/28/2022
A pair of mulberry trees within an open residential property parcel along the south side of Watson Road.

Water Resources at Sample Site

Stream Type (# and length)	Ephemeral	Intermittent	Perennial	Describe existing condition of water sources: No water in or adjacent to the assessment site. The nearest water source is a 0.45-acre sinkhole farm pond located approximately 0.22 mile to the south of Watson Road.
	N/A	N/A	N/A	
Pools/Ponds (# and size)	N/A	Open and accessible to bats		
		N/A		
Wetlands (approx. ac.)	Permanent	Seasonal		
	N/A	N/A		

Forest Resources at Sample Site

Closure/Density	Canopy (>50')	Midstory (20-50')	Understory (<20')	1=1-10%, 2=11-20%, 3=21-40%, 4=41-60% 5=61-80%, 6=81-100%
	0	0	2	
Dominant Species of Mature Trees	*Morus sp.*			
% Trees w/ Exfoliating Bark	0	0	0	
Size Composition of Live Trees (%)	Small (3-8 in)	Med (9-15 in)	Large (>15 in)	
	50	50	0	
No. of Suitable Snags	0	0	0	

Standing dead trees with exfoliating bark, cracks, crevices, or hollows.
Snags without these characteristics area not considered suitable.

IS THE HABITAT SUITABLE FOR INDIANA BATS? No
IS THE HABITAT SUITABLE FOR NORTHERN LONG-EARED BATS? No

Additional Comments:
This pair of mulberry trees in an open residential lawn do not offer any roosting or foraging habitat for bats.

Attach aerial photo or project site with all forested areas labeled and a general description of the habitat

Photographic Documentation: habitat shots at edge and interior from multiple locations;
Understory/midstory/canopy; examples of potential suitable snags and live trees; water sources

PHASE 1 SUMMER HABITAT ASSESSMENTS

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Sample Site Description

Sample Site No.(s): HA-15
5/28/2022
A cluster of mature trees on residential property parcel along the south side of Watson Road.

Water Resources at Sample Site

Stream Type (# and length)	Ephemeral	Intermittent	Perennial	Describe existing condition of water sources: No water in or adjacent to the assessment site. The nearest water source is a 0.45-acre sinkhole farm pond located approximately 0.23 mile to the southwest of Watson Road.
	N/A	N/A	N/A	
Pools/Ponds (# and size)	N/A	Open and accessible to bats		
		N/A		
Wetlands (approx. ac.)	Permanent	Seasonal		
	N/A	N/A		

Forest Resources at Sample Site

Closure/Density	Canopy (>50')	Midstory (20-50')	Understory (<20')	1=1-10%, 2=11-20%, 3=21-40%, 4=41-60% 5=61-80%, 6=81-100%
	5	0	0	
Dominant Species of Mature Trees	*Liriodendron tulipifera*			
% Trees w/ Exfoliating Bark	0	0	0	
Size Composition of Live Trees (%)	Small (3-8 in)	Med (9-15 in)	Large (>15 in)	
	0	0	100	
No. of Suitable Snags	0	0	0	

Standing dead trees with exfoliating bark, cracks, crevices, or hollows.
Snags without these characteristics area not considered suitable.

IS THE HABITAT SUITABLE FOR INDIANA BATS? No
IS THE HABITAT SUITABLE FOR NORTHERN LONG-EARED BATS? No

Additional Comments:
Includes 15 total tulip poplar trees within a residential lawn with no subcanopy or understory development. None of the tulip trees show deformations suitable for bat roosting. Ground cover is mowed regularly.

Attach aerial photo or project site with all forested areas labeled and a general description of the habitat

Photographic Documentation: habitat shots at edge and interior from multiple locations; Understory/midstory/canopy; examples of potential suitable snags and live trees; water sources

PHASE 1 SUMMER HABITAT ASSESSMENTS

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Sample Site Description

Sample Site No.(s): HA-16
5/28/2022
Widely scattered mature trees on a residential property parcel along the south side of Watson Road.

Water Resources at Sample Site

Stream Type (# and length)	Ephemeral	Intermittent	Perennial	Describe existing condition of water sources: No water in or adjacent to the assessment site. The nearest water source is a 1.5-acre sinkhole farm pond located approximately 0.12 mile to the northwest along Watson Road.
	N/A	N/A	N/A	
Pools/Ponds (# and size)	N/A	Open and accessible to bats		
		N/A		
Wetlands (approx. ac.)	Permanent	Seasonal		
	N/A	N/A		

Forest Resources at Sample Site

Closure/Density	Canopy (>50')	Midstory (20-50')	Understory (<20')	1=1-10%, 2=11-20%, 3=21-40%, 4=41-60% 5=61-80%, 6=81-100%
	1	3	3	
Dominant Species of Mature Trees	*Acer saccharinum, Acer saccharum, Quercus alba, Juglans nigra*			
% Trees w/ Exfoliating Bark	0	0	0	
Size Composition of Live Trees (%)	Small (3-8 in)	Med (9-15 in)	Large (>15 in)	
	60	32	8	
No. of Suitable Snags	0	0	0	

Standing dead trees with exfoliating bark, cracks, crevices, or hollows.
Snags without these characteristics area not considered suitable.

IS THE HABITAT SUITABLE FOR INDIANA BATS? No
IS THE HABITAT SUITABLE FOR NORTHERN LONG-EARED BATS? No

Additional Comments:
Additional trees include, *Prunus serotina, Fraxinus sp.,* and *Morus sp.* Trees are widely scattered on two residential properties. Single isolated large white oak at western end of assessment area.

Attach aerial photo or project site with all forested areas labeled and a general description of the habitat

Photographic Documentation: habitat shots at edge and interior from multiple locations; Understory/midstory/canopy; examples of potential suitable snags and live trees; water sources

PHASE 1 SUMMER HABITAT ASSESSMENTS

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A single sheet can be used for multiple sample sites if habitat is the same

Sample Site Description

Sample Site No.(s): HA-17
5/28/2022
Small sinkhole woods in an agricultural field adjacent to a residential property parcel south of Watson Road.

Water Resources at Sample Site

Stream Type (# and length)	Ephemeral	Intermittent	Perennial	Describe existing condition of water sources: No water in or adjacent to the assessment site. The nearest water source is a 1.5-acre sinkhole farm pond located approximately 0.04 mile to the north immediately north of Watson Road.
	N/A	N/A	N/A	
Pools/Ponds (# and size)	N/A	Open and accessible to bats		
		N/A		
Wetlands (approx. ac.)	Permanent	Seasonal		
	N/A	N/A		

Forest Resources at Sample Site

Closure/Density	Canopy (>50')	Midstory (20-50')	Understory (<20')	1=1-10%, 2=11-20%, 3=21-40%, 4=41-60% 5=61-80%, 6=81-100%
	5	3	2	
Dominant Species of Mature Trees	*Populus deltoides, Platanus occidentalis, Ailanthus altissima*			
% Trees w/ Exfoliating Bark	0	0	0	
Size Composition of Live Trees (%)	Small (3-8 in)	Med (9-15 in)	Large (>15 in)	
	55	30	15	
No. of Suitable Snags	0	0	0	

Standing dead trees with exfoliating bark, cracks, crevices, or hollows.
Snags without these characteristics area not considered suitable.

IS THE HABITAT SUITABLE FOR INDIANA BATS? No
IS THE HABITAT SUITABLE FOR NORTHERN LONG-EARED BATS? No

Additional Comments:
Sinkhole includes a lot of debris. Additional trees include, *Acer saccharum, Celtis occidentalis,* and *Prunus serotina.* Moderately open understory with few saplings and low limbs. No potential roost trees in this isolated landscape feature. Low potential for foraging use.

Attach aerial photo or project site with all forested areas labeled and a general description of the habitat

Photographic Documentation: habitat shots at edge and interior from multiple locations; Understory/midstory/canopy; examples of potential suitable snags and live trees; water sources

PHASE 1 SUMMER HABITAT ASSESSMENTS

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Sample Site Description

Sample Site No.(s): HA-18
5/6/2021
Assessment site is 2.2 acres of a 6.1-acre secondary growth forest with a dense canopy and mid-story, and sparse understory along the south side of Watson Road. The terrain is largely flat. The bat habitat assessment area is a portion of larger forested area, connected to additional forests by hedgerows. Flight corridors are limited to non-existent.

Water Resources at Sample Site

Stream Type (# and length)	Ephemeral	Intermittent	Perennial	Describe existing condition of water sources: No water in or adjacent to the assessment site. A large 1.5-acre sinkhole pond is located approximately 0.06 mile to the northwest.
	N/A	N/A	N/A	
Pools/Ponds (# and size)	N/A	Open and accessible to bats		
		N/A		
Wetlands (approx. ac.)	Permanent	Seasonal		
	N/A	N/A		

Forest Resources at Sample Site

Closure/Density	Canopy (>50')	Midstory (20-50')	Understory (<20')	1=1-10%, 2=11-20%, 3=21-40%, 4=41-60% 5=61-80%, 6=81-100%
	6	6	4	
Dominant Species of Mature Trees	Canopy: *Robinia psuedoacacia, Sassafras albidum* Mid-Story: *Sassafras albidum, Juniperus virginiana* Understory: *Robinia psuedoacacia, Acer saccharum, Juniperus virginiana, Sassafras albidum*			
% Trees w/ Exfoliating Bark	0	0	0	
Size Composition of Live Trees (%)	Small (3-8 in)	Med (9-15 in)	Large (>15 in)	
	30	60	10	
No. of Suitable Snags	0	0	0	

Standing dead trees with exfoliating bark, cracks, crevices, or hollows.
Snags without these characteristics area not considered suitable.

IS THE HABITAT SUITABLE FOR INDIANA BATS? Yes, edge foraging only
IS THE HABITAT SUITABLE FOR NORTHERN LONG-EARED BATS? Yes, edge foraging only

Additional Comments:
The bat habitat assessment area is possible but not ideal foraging habitat for the Indiana bat, northern long-eared bat, and gray bat due to the density of the young black locust, red cedar, and sassafras. No potential dead snag roosts were identified. The bat habitat assessment area is a portion of larger forested area, connected to other forest habitats by tree row corridorss. Flight corridors are limited to non-existent within the assessment area.

Attach aerial photo or project site with all forested areas labeled and a general description of the habitat

Photographic Documentation: habitat shots at edge and interior from multiple locations; Understory/midstory/canopy; examples of potential suitable snags and live trees; water sources

PHASE 1 SUMMER HABITAT ASSESSMENTS

Use additional sheets to assess discrete habitat types at multiple sites in a project area
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A single sheet can be used for multiple sample sites if habitat is the same

Sample Site Description

Sample Site No.(s): HA-19
5/6/2021
The bat habitat assessment area is a successional scrub shrub forest along the north side of Watson Road.

Water Resources at Sample Site

Stream Type (# and length)	Ephemeral	Intermittent	Perennial	Describe existing condition of water sources: No water in or adjacent to the assessment site. A large perennial pond is located approximately 0.06 mile west of the bat habitat assessment area. The pond was at a normal water level at the time of the survey.
	N/A	N/A	N/A	
Pools/Ponds (# and size)	N/A	Open and accessible to bats		
		N/A		
Wetlands (approx. ac.)	Permanent	Seasonal		
	N/A	N/A		

Forest Resources at Sample Site

Closure/Density	Canopy (>50')	Midstory (20-50')	Understory (<20')	1=1-10%, 2=11-20%, 3=21-40%, 4=41-60% 5=61-80%, 6=81-100%
	1	1	1	
Dominant Species of Mature Trees	Canopy: *Acer saccharum, Juglans nigra* Mid-Story: *Robina pseudoacacia, Juniperus virginiana* Understory: *Robina pseudoacacia, Juniperus virginiana*			
% Trees w/ Exfoliating Bark	0	0	0	
Size Composition of Live Trees (%)	Small (3-8 in)	Med (9-15 in)	Large (>15 in)	
	90	0	10	
No. of Suitable Snags	0	0	0	

Standing dead trees with exfoliating bark, cracks, crevices, or hollows.
Snags without these characteristics area not considered suitable.

IS THE HABITAT SUITABLE FOR INDIANA BATS? No
IS THE HABITAT SUITABLE FOR NORTHERN LONG-EARED BATS? No

Additional Comments:
Two mature sugar maples and one mature black walnut are present. The majority of the assessment area is covered with young black locust and red cedar. The bat habitat assessment area has poor foraging habitat for the Indiana bat and northern long-eared bat. There are no flight corridors present; however, the open nature of the canopy would not be prohibitive to flight. No potential roosts were identified within the assessment area. The bat habitat assessment area is separated from nearby forested areas by Watson Road and agricultural fields.

Attach aerial photo or project site with all forested areas labeled and a general description of the habitat

Photographic Documentation: habitat shots at edge and interior from multiple locations; Understory/midstory/canopy; examples of potential suitable snags and live trees; water sources

PHASE 1 SUMMER HABITAT ASSESSMENTS

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Sample Site Description

Sample Site No.(s): HA-20
5/28/2022
Isolated cluster of trees adjacent to farm outbuildings within old hay field south of Watson Road.

Water Resources at Sample Site

Stream Type (# and length)	Ephemeral	Intermittent	Perennial	Describe existing condition of water sources: No water in or adjacent to the assessment site. The nearest water source is a 1.5-acre sinkhole farm pond located approximately 0.26 mile to the northwest on the north side of Watson Road.
	N/A	N/A	N/A	
Pools/Ponds (# and size)	N/A	Open and accessible to bats		
		N/A		
Wetlands (approx. ac.)	Permanent	Seasonal		
	N/A	N/A		

Forest Resources at Sample Site

Closure/Density	Canopy (>50')	Midstory (20-50')	Understory (<20')	1=1-10%, 2=11-20%, 3=21-40%, 4=41-60% 5=61-80%, 6=81-100%
	4	0	0	
Dominant Species of Mature Trees	*Fraxinus sp.*			
% Trees w/ Exfoliating Bark	0	0	0	
Size Composition of Live Trees (%)	Small (3-8 in)	Med (9-15 in)	Large (>15 in)	
	0	0	100	
No. of Suitable Snags	0	0	0	

Standing dead trees with exfoliating bark, cracks, crevices, or hollows.
Snags without these characteristics area not considered suitable.

IS THE HABITAT SUITABLE FOR INDIANA BATS? No
IS THE HABITAT SUITABLE FOR NORTHERN LONG-EARED BATS? No

Additional Comments:
Single large ash tree has lower limb damage, but does not exhibit any quality roost features. Additional species include: *Juniperus virginiana* and *Prunus serotina*

Attach aerial photo or project site with all forested areas labeled and a general description of the habitat

Photographic Documentation: habitat shots at edge and interior from multiple locations;
Understory/midstory/canopy; examples of potential suitable snags and live trees; water sources

PHASE 1 SUMMER HABITAT ASSESSMENTS

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Sample Site Description

Sample Site No.(s):HA-21
5/6/2021
Assessment site is 1.3 acres of a 5.8-acre mature upland forest. The forest is connected to surrounding forested areas by a narrow hedgerow, which serve as a flight corridor to other surrounding forested areas associated with Buck Creek.

Water Resources at Sample Site

Stream Type (# and length)	Ephemeral	Intermittent	Perennial	Describe existing condition of water sources: No water in or adjacent to the assessment site. A pond is located approximately 0.10 mile southeast of the inspection area.
	N/A	N/A	N/A	
Pools/Ponds (# and size)	N/A	Open and accessible to bats		
		N/A		
Wetlands (approx. ac.)	Permanent	Seasonal		
	N/A	N/A		

Forest Resources at Sample Site

Closure/Density	Canopy (>50')	Midstory (20-50')	Understory (<20')	1=1-10%, 2=11-20%, 3=21-40%, 4=41-60% 5=61-80%, 6=81-100%
	4	4	3	
Dominant Species of Mature Trees	Canopy: *Liriodendron tulipifera, Carya tomentosa* Mid-Story: *Juniperus virginiana, Cornus florida, Sassfras albidum, Acer saccharum, Fagus grandifolia* Understory: *Cornus florida, Fagus grandifolia*			
% Trees w/ Exfoliating Bark	0	1	3	
Size Composition of Live Trees (%)	Small (3-8 in)	Med (9-15 in)	Large (>15 in)	
	30	30	40	
No. of Suitable Snags	2	3	1	

Standing dead trees with exfoliating bark, cracks, crevices, or hollows.
Snags without these characteristics area not considered suitable.

IS THE HABITAT SUITABLE FOR INDIANA BATS? Yes
IS THE HABITAT SUITABLE FOR NORTHERN LONG-EARED BATS? Yes

Additional Comments:
The assessment area has suitable roost and foraging habitat for the Indiana and northern long-eared bat. Gaps in the canopy and the mid-story, along with the open understory may serve as flight corridors to the larger forest adjacent to the assessment area. Flight corridors to nearby forested areas are limited to the tree row separating fields to the south. The forest is directly connected to the expansive forest habitat associated with Buck Creek. Six trees with high bat roost potential were identified within the assessment area. The intermediate stage sassafras trees have begun dying back, providing ideal roost habitat for the northern long-eared bat. Undergrowth is fairly sparse.

Tree ID	Species	DBH (in)	Stage of Decay	Roost Features
21.1	*Liridodendron tulipifera*	13.0	7	hollow snag, cavities
21.2	*Sassafras albidum*	8.0	7	fissures, cavities
21.3	*Carya sp.*	19.5	7	snag, cavities, exfoliating bark
21.4	*Sassafras albidum*	9.4	6	hollow snag, cavities
21.5	*Sassafras albidum*	11.0	6	snag, cavities
21.6	*Unknown*	8.5	6	snag, cavities

Attach aerial photo or project site with all forested areas labeled and a general description of the habitat

Photographic Documentation: habitat shots at edge and interior from multiple locations; Understory/midstory/canopy; examples of potential suitable snags and live trees; water sources

PHASE 1 SUMMER HABITAT ASSESSMENTS

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Sample Site Description

Sample Site No.(s): HA-22
5/6/2021
The assessment area is a 3.3-acre portion of a 15.3-acre mature upland forest on the north side of Watson Road associated with a residence. Additional residential properties are located immediately north, east, and south of the assessment area. Buildings on these properties may provide additional roost opportunities for bats.

Water Resources at Sample Site

Stream Type (# and length)	Ephemeral	Intermittent	Perennial	Describe existing condition of water sources: No water in or adjacent to the assessment site. A 1.9-acre sinkhole pond is located approximately 0.12 mile south of the assessment area on the south side of Watson Road.
	N/A	N/A	N/A	
Pools/Ponds (# and size)	N/A	Open and accessible to bats		
		N/A		
Wetlands (approx. ac.)	Permanent	Seasonal		
	N/A	N/A		

Forest Resources at Sample Site

Closure/Density	Canopy (>50')	Midstory (20-50')	Understory (<20')	1=1-10%, 2=11-20%, 3=21-40%, 4=41-60% 5=61-80%, 6=81-100%
	4	6	4	
Dominant Species of Mature Trees	Canopy: *Quercus velutina, Quercus rubra* Mid-Story: *Cornus florida, Juniperus virginiana* Understory: *Cornus florida*			
% Trees w/ Exfoliating Bark	1	1	2	
Size Composition of Live Trees (%)	Small (3-8 in)	Med (9-15 in)	Large (>15 in)	
	25	25	50	
No. of Suitable Snags	0	0	6	

Standing dead trees with exfoliating bark, cracks, crevices, or hollows.
Snags without these characteristics area not considered suitable.

IS THE HABITAT SUITABLE FOR INDIANA BATS? Yes
IS THE HABITAT SUITABLE FOR NORTHERN LONG-EARED BATS? Yes

Additional Comments:
The assessment area has potential foraging and roost habitat for both the Indiana and northern long-eared bat. Flight corridors and canopy space connect the assessment area with adjacent forests to the north via hedgerows. The mid-story is dense, predominantly consisting of flowering dogwood and red cedar. Woody vegetation in the understory is sparse, featuring the occasional flowering dogwood. Sapling ash are also present within the understory. Openings in the canopy and driveways transecting the forest may serve as corridors to adjacent forested areas. Six dying, dead, and decaying oaks exhibit high roost potential within the assessment area. A dead ash tree was identified on the west edge of the bat habitat assessment area but does not yet exhibit ideal roost qualities. Some of the outbuildings on the property may provide additional roost opportunities for bats.

Tree ID	Species	DBH (in)	Stage of Decay	Roost Features
22.1	*Quercus rubra*	16.0	3	exfoliating bark
22.2	*Quercus velutina*	22.0	3	snag, exfoliating bark
22.3	*Quercus sp.*	27.5	6	cavities
22.4	*Quercus velutina*	25.0	3	snag, cavities, exfoliating bark
22.5	*Quercus alba*	14.0	6	fissures, cavities, exfoliating bark
22.6	*Quercus velutina*	29.0	6	cavities, exfoliating bark

Attach aerial photo or project site with all forested areas labeled and a general description of the habitat

Photographic Documentation: habitat shots at edge and interior from multiple locations; Understory/midstory/canopy; examples of potential suitable snags and live trees; water sources

PHASE 1 SUMMER HABITAT ASSESSMENTS

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Sample Site Description

Sample Site No.(s): HA-23
5/28/2022
Isolated cluster of trees within a sinkhole in an agricultural field south of Watson Road approximately 0.03 mile west of a large upland woods.

Water Resources at Sample Site

Stream Type (# and length)	Ephemeral	Intermittent	Perennial	Describe existing condition of water sources: No water in or adjacent to the assessment site. The nearest water source is a 1.8-acre sinkhole farm pond located approximately 0.10 mile to the south on the south side of Watson Road.
	N/A	N/A	N/A	
Pools/Ponds (# and size)	N/A	Open and accessible to bats		
		N/A		
Wetlands (approx. ac.)	Permanent	Seasonal		
	N/A	N/A		

Forest Resources at Sample Site

Closure/Density	Canopy (>50')	Midstory (20-50')	Understory (<20')	1=1-10%, 2=11-20%, 3=21-40%, 4=41-60% 5=61-80%, 6=81-100%
	0	3	1	
Dominant Species of Mature Trees	*Liriodendron tulipifera, Acer negundo*			
% Trees w/ Exfoliating Bark	0	0	0	
Size Composition of Live Trees (%)	Small (3-8 in)	Med (9-15 in)	Large (>15 in)	
	35	65	0	
No. of Suitable Snags	0	0	0	

Standing dead trees with exfoliating bark, cracks, crevices, or hollows.
Snags without these characteristics area not considered suitable.

IS THE HABITAT SUITABLE FOR INDIANA BATS? No
IS THE HABITAT SUITABLE FOR NORTHERN LONG-EARED BATS? No

Additional Comments:
There are only four trees greater than 3 inches in diameter within this small sinkhole. Due to the availability of large woodland habitat to the west, north, and east, this small cluster of trees does not likely provide viable roosting or foraging habitat.

Attach aerial photo or project site with all forested areas labeled and a general description of the habitat

Photographic Documentation: habitat shots at edge and interior from multiple locations; Understory/midstory/canopy; examples of potential suitable snags and live trees; water sources

PHASE 1 SUMMER HABITAT ASSESSMENTS

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Sample Site Description

Sample Site No.(s): HA-24
5/6/2021
The assessment site is 1.2 acres on the north end of a 5.5-acre mature upland forest along the south side of Watson Road.

Water Resources at Sample Site

Stream Type (# and length)	Ephemeral	Intermittent	Perennial	Describe existing condition of water sources: No water in or adjacent to the assessment site. A pond is located approximately 0.10 mile southwest of the assessment area.
	N/A	N/A	N/A	
Pools/Ponds (# and size)	N/A	Open and accessible to bats		
		N/A		
Wetlands (approx. ac.)	Permanent	Seasonal		
	N/A	N/A		

Forest Resources at Sample Site

Closure/Density	Canopy (>50')	Midstory (20-50')	Understory (<20')	1=1-10%, 2=11-20%, 3=21-40%, 4=41-60% 5=61-80%, 6=81-100%
	4	4	3	
Dominant Species of Mature Trees	Canopy: *Quercus alba* Mid-Story: *Sassafras albidum, Prunus serotina, Acer saccharum* Understory: *Cornus florida, Sassafras albidum*			
% Trees w/ Exfoliating Bark	0	0	0	
Size Composition of Live Trees (%)	Small (3-8 in)	Med (9-15 in)	Large (>15 in)	
	10	30	60	
No. of Suitable Snags	0	1	1	

Standing dead trees with exfoliating bark, cracks, crevices, or hollows.
Snags without these characteristics area not considered suitable.

IS THE HABITAT SUITABLE FOR INDIANA BATS? Yes
IS THE HABITAT SUITABLE FOR NORTHERN LONG-EARED BATS? Yes

Additional Comments:
The assessment area is ideal forage and roost habitat for both the Indiana and northern long-eared bat. Flight corridors to adjacent forested areas are present in the form of maintained paths and canopy gaps. This forest is connected to a series of much larger forested areas. The mid-story is diverse, predominantly consisting of *Sassafras albidum, Prunus serotina,* and *Acer saccharum.* Juniperus virginiana is also present within the mid-story. The understory exhibits low density and is composed predominantly of *Cornus florida* and *Sassafras albidum*. Two trees exhibiting high roost potential were identified within the assessment area.

Tree ID	Species	DBH (in)	Stage of Decay	Roost Features
24.1	*Sassafras albidum*	15.5	2	snag, cavities
24.2	*Prunus serotina*	12.5	2	snag, cavities

Attach aerial photo or project site with all forested areas labeled and a general description of the habitat

Photographic Documentation: habitat shots at edge and interior from multiple locations; Understory/midstory/canopy; examples of potential suitable snags and live trees; water sources

PHASE 1 SUMMER HABITAT ASSESSMENTS

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Sample Site Description

Sample Site No.(s): HA-25
5/28/2022
The assessment area is cluster of scattered native and ornamental planted trees surrounding a residence south of Watson Road within an area of approximately 0.55-acre.

Water Resources at Sample Site

Stream Type (# and length)	Ephemeral	Intermittent	Perennial	Describe existing condition of water sources: No water in or adjacent to the assessment site. A 1.7-acre pond is located approximately 0.16 mile southwest of the assessment area.
	N/A	N/A	N/A	
Pools/Ponds (# and size)	N/A	Open and accessible to bats		
		N/A		
Wetlands (approx. ac.)	Permanent	Seasonal		
	N/A	N/A		

Forest Resources at Sample Site

Closure/Density	Canopy (>50')	Midstory (20-50')	Understory (<20')	1=1-10%, 2=11-20%, 3=21-40%, 4=41-60% 5=61-80%, 6=81-100%
	2	1	2	
Dominant Species of Mature Trees	*Juglans nigra*			
% Trees w/ Exfoliating Bark	75	20	5	
Size Composition of Live Trees (%)	Small (3-8 in)	Med (9-15 in)	Large (>15 in)	
	75	20	5	
No. of Suitable Snags	0	0	0	

Standing dead trees with exfoliating bark, cracks, crevices, or hollows.
Snags without these characteristics area not considered suitable.

IS THE HABITAT SUITABLE FOR INDIANA BATS? No
IS THE HABITAT SUITABLE FOR NORTHERN LONG-EARED BATS? No

Additional Comments:
Most of the trees on the residential property are planted and maintained as part of the residential setting. Additional trees include *Sassafras albidum, Acer negundo, Juniperus virginiana, Betula sp., Pyrus callaryana, Picea sp.*, and ornamental maple. No viable roosts occur on the property and due to the residential setting and security light, this location is not considered a potential foraging area.

Attach aerial photo or project site with all forested areas labeled and a general description of the habitat

Photographic Documentation: habitat shots at edge and interior from multiple locations; Understory/midstory/canopy; examples of potential suitable snags and live trees; water sources

PHASE 1 SUMMER HABITAT ASSESSMENTS

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Sample Site Description

Sample Site No.(s): HA-26
5/28/2022
The assessment area is the northern end of a tree row separating two residential property parcels on the south side of Watson Road.

Water Resources at Sample Site

Stream Type (# and length)	Ephemeral	Intermittent	Perennial	Describe existing condition of water sources: No water in or adjacent to the assessment site. A 1.7-acre pond is located approximately 0.19 mile southwest of the assessment area.
	N/A	N/A	N/A	
Pools/Ponds (# and size)	N/A	Open and accessible to bats		
		N/A		
Wetlands (approx. ac.)	Permanent	Seasonal		
	N/A	N/A		

Forest Resources at Sample Site

Closure/Density	Canopy (>50')	Midstory (20-50')	Understory (<20')	1=1-10%, 2=11-20%, 3=21-40%, 4=41-60% 5=61-80%, 6=81-100%
	2	2	1	
Dominant Species of Mature Trees	*Quercus rubra, Juglans nigra, Sassafras albidum*			
% Trees w/ Exfoliating Bark	0	0	0	
Size Composition of Live Trees (%)	Small (3-8 in)	Med (9-15 in)	Large (>15 in)	
	30	60	10	
No. of Suitable Snags	0	0	0	

Standing dead trees with exfoliating bark, cracks, crevices, or hollows.
Snags without these characteristics area not considered suitable.

IS THE HABITAT SUITABLE FOR INDIANA BATS? No
IS THE HABITAT SUITABLE FOR NORTHERN LONG-EARED BATS? No

Additional Comments:
Additional species include: *Platanus occidentalis, Juniperus virginiana, Carya sp.* This single row of trees continues to the south where it is connected to a larger forest tract associated with Buck Creek. Foraging potential along this single row of trees is minimal.

Attach aerial photo or project site with all forested areas labeled and a general description of the habitat

Photographic Documentation: habitat shots at edge and interior from multiple locations; Understory/midstory/canopy; examples of potential suitable snags and live trees; water sources

PHASE 1 SUMMER HABITAT ASSESSMENTS

Use additional sheets to assess discrete habitat types at multiple sites in a project area
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A single sheet can be used for multiple sample sites if habitat is the same

Sample Site Description

Sample Site No.(s): HA-27
5/28/2022
The assessment area consists of a scattered cluster of six trees within a field associated with a residential property parcel on the south side of Watson Road.

Water Resources at Sample Site

Stream Type (# and length)	Ephemeral	Intermittent	Perennial	Describe existing condition of water sources: Water resources limited to a small sinkhole pond within the field south of the trees.
	N/A	N/A	N/A	
Pools/Ponds (# and size)	0.02	Open and accessible to bats		
		Yes		
Wetlands (approx. ac.)	Permanent	Seasonal		
	N/A	N/A		

Forest Resources at Sample Site

Closure/Density	Canopy (>50')	Midstory (20-50')	Understory (<20')	1=1-10%, 2=11-20%, 3=21-40%, 4=41-60% 5=61-80%, 6=81-100%
	2	0	0	
Dominant Species of Mature Trees	*Liriodendron tulipifera*			
% Trees w/ Exfoliating Bark	0	0	0	
Size Composition of Live Trees (%)	Small (3-8 in)	Med (9-15 in)	Large (>15 in)	
	0	20	80	
No. of Suitable Snags	0	0	0	

Standing dead trees with exfoliating bark, cracks, crevices, or hollows.
Snags without these characteristics area not considered suitable.

IS THE HABITAT SUITABLE FOR INDIANA BATS? No
IS THE HABITAT SUITABLE FOR NORTHERN LONG-EARED BATS? No

Additional Comments:
Additional species include *Juniperus virginiana.* The healthy mature tulip poplars don't provide a roosting features for bats. A dead snag to the south of the assessment area and sinkhole pond exhibits potential roost possibilities.

Attach aerial photo or project site with all forested areas labeled and a general description of the habitat

Photographic Documentation: habitat shots at edge and interior from multiple locations; Understory/midstory/canopy; examples of potential suitable snags and live trees; water sources

PHASE 1 SUMMER HABITAT ASSESSMENTS

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Sample Site Description

Sample Site No.(s): HA-28
5/6/2021
The assessment area a 1.44-acre intermediate forest isolated from other nearby forested areas by agricultural fields, residential areas, and Watson Road.

Water Resources at Sample Site

Stream Type (# and length)	Ephemeral	Intermittent	Perennial	Describe existing condition of water sources: No water in or adjacent to the assessment site. A 0.02-acre sinkhole pond is located approximately 0.03 mile south of the assessment area and Watson Road.
	N/A	N/A	N/A	
Pools/Ponds (# and size)	N/A	Open and accessible to bats		
		N/A		
Wetlands (approx. ac.)	Permanent	Seasonal		
	N/A	N/A		

Forest Resources at Sample Site

Closure/Density	Canopy (>50')	Midstory (20-50')	Understory (<20')	1=1-10%, 2=11-20%, 3=21-40%, 4=41-60% 5=61-80%, 6=81-100%
	1	2	2	
Dominant Species of Mature Trees	Canopy: *Robinia psuedoacacia, Prunus serotina* Mid-Story: *Robinia psuedoacacia, Prunus serotina* Understory: N/A			
% Trees w/ Exfoliating Bark	0	0	0	
Size Composition of Live Trees (%)	Small (3-8 in)	Med (9-15 in)	Large (>15 in)	
	45	45	10	
No. of Suitable Snags	0	0	0	

Standing dead trees with exfoliating bark, cracks, crevices, or hollows.
Snags without these characteristics area not considered suitable.

IS THE HABITAT SUITABLE FOR INDIANA BATS? Yes
IS THE HABITAT SUITABLE FOR NORTHERN LONG-EARED BATS? Yes

Additional Comments:
The assessment area has potential foraging habitat for both the northern long-eared and Indiana bat. Virtually no woody vegetation occupies the understory. Overall forest density is thin and conducive to foraging. Flight corridors are present in the form of maintained trails. The forest is unlikely to provide roost habitat due to the age of trees and no trees exhibited roost potential qualities.

Attach aerial photo or project site with all forested areas labeled and a general description of the habitat

Photographic Documentation: habitat shots at edge and interior from multiple locations; Understory/midstory/canopy; examples of potential suitable snags and live trees; water sources

PHASE 1 SUMMER HABITAT ASSESSMENTS

Use additional sheets to assess discrete habitat types at multiple sites in a project area
Include a map depicting locations of sample sites if assessing discrete habitats at multiple sites in a project area
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Sample Site Description

Sample Site No.(s): HA-29
5/6/2021
The assessment area is 1.5 acres on the southern edge of a 200+ acre mature upland forest north of Watson Road. This site is directly opposite from a large forested tract south of Watson Road that extends south to Buck Creek.

Water Resources at Sample Site

Stream Type (# and length)	Ephemeral	Intermittent	Perennial	Describe existing condition of water sources: No water in or adjacent to the assessment site. A 0.02-acre sinkhole pond is located approximately 0.06 mile southwest of the assessment area and Watson Road. Buck Creek is located approximately 0.65 mile southeast of the assessment area.
	N/A	N/A	N/A	
Pools/Ponds (# and size)	N/A	Open and accessible to bats		
		N/A		
Wetlands (approx. ac.)	Permanent	Seasonal		
	N/A	N/A		

Forest Resources at Sample Site

Closure/Density	Canopy (>50')	Midstory (20-50')	Understory (<20')	1=1-10%, 2=11-20%, 3=21-40%, 4=41-60% 5=61-80%, 6=81-100%
	5	5	5	
Dominant Species of Mature Trees	Canopy: *Quercus velutina, Prunus serotina, Acer saccharum, Juniperus virginiana* Mid-Story: *Juniperus virginiana, Acer saccharum* Understory: *Acer saccharum*			
% Trees w/ Exfoliating Bark	0	0	0	
Size Composition of Live Trees (%)	Small (3-8 in)	Med (9-15 in)	Large (>15 in)	
	60	10	30	
No. of Suitable Snags	0	0	0	

Standing dead trees with exfoliating bark, cracks, crevices, or hollows.
Snags without these characteristics area not considered suitable.

IS THE HABITAT SUITABLE FOR INDIANA BATS? Yes
IS THE HABITAT SUITABLE FOR NORTHERN LONG-EARED BATS? Yes

Additional Comments:
The assessment area has foraging habitat for both the Indiana and northern long-eared bat. Scattered *Liriodendron tulipifera* were also present within the canopy. No trees exhibiting roost potential were observed in the assessment area; however, potential bat roosts are likely to exist in the extensive forest immediately north. A dead ash was identified on the western end of the bat habitat assessment area but did not currently exhibit features conducive to bat roosting. Flight corridors to adjacent forested areas are present.

Attach aerial photo or project site with all forested areas labeled and a general description of the habitat

Photographic Documentation: habitat shots at edge and interior from multiple locations; Understory/midstory/canopy; examples of potential suitable snags and live trees; water sources

PHASE 1 SUMMER HABITAT ASSESSMENTS

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Sample Site Description

Sample Site No.(s): HA-30
5/28/2022
The assessment area is a 0.11-acre narrow strip (approximately 15-20 feet wide) of trees between Watson Road and a utility easement clearing on the north side of Watson Road.

Water Resources at Sample Site

Stream Type (# and length)	Ephemeral	Intermittent	Perennial	Describe existing condition of water sources: No water in or adjacent to the assessment site. A 0.02-acre sinkhole pond is located approximately 0.06 mile southwest of the assessment area and Watson Road.
	N/A	N/A	N/A	
Pools/Ponds (# and size)	N/A	Open and accessible to bats		
		N/A		
Wetlands (approx. ac.)	Permanent	Seasonal		
	N/A	N/A		

Forest Resources at Sample Site

Closure/Density	Canopy (>50')	Midstory (20-50')	Understory (<20')	1=1-10%, 2=11-20%, 3=21-40%, 4=41-60% 5=61-80%, 6=81-100%
	0	0	1	
Dominant Species of Mature Trees	*Liriodendron tulipifera, Quercus muhlenbergii*			
% Trees w/ Exfoliating Bark	0	0	0	
Size Composition of Live Trees (%)	Small (3-8 in)	Med (9-15 in)	Large (>15 in)	
	100	0	0	
No. of Suitable Snags	0	0	0	

Standing dead trees with exfoliating bark, cracks, crevices, or hollows.
Snags without these characteristics area not considered suitable.

IS THE HABITAT SUITABLE FOR INDIANA BATS? No
IS THE HABITAT SUITABLE FOR NORTHERN LONG-EARED BATS? No

Additional Comments:
The utility easement clearing between the assessment area and the adjacent woods to the north may serve as foraging habitat for both the Indiana and northern long-eared bat. Additional species include *Juglans nigra, Fraxinus sp., Quercus stellata,* and *Prunus serotina.* No trees exhibiting roost potential were observed in the assessment area. Most woody steam are under 3-inch diameter with nothing over 5 inches. Heavy honeysuckle cover throughout.

Attach aerial photo or project site with all forested areas labeled and a general description of the habitat

Photographic Documentation: habitat shots at edge and interior from multiple locations; Understory/midstory/canopy; examples of potential suitable snags and live trees; water sources

PHASE 1 SUMMER HABITAT ASSESSMENTS

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Sample Site Description

Sample Site No.(s): HA-31
5/28/2022
The assessment area is residential lawn south of Watson Road with two native trees.

Water Resources at Sample Site

Stream Type (# and length)	Ephemeral	Intermittent	Perennial	Describe existing condition of water sources: No water in or adjacent to the assessment site. A 0.02-acre sinkhole pond is located approximately 0.03 mile west of the assessment area.
	N/A	N/A	N/A	
Pools/Ponds (# and size)	N/A	Open and accessible to bats		
		N/A		
Wetlands (approx. ac.)	Permanent	Seasonal		
	N/A	N/A		

Forest Resources at Sample Site

Closure/Density	Canopy (>50')	Midstory (20-50')	Understory (<20')	1=1-10%, 2=11-20%, 3=21-40%, 4=41-60% 5=61-80%, 6=81-100%
	0	1	0	
Dominant Species of Mature Trees	*Juniperus virginiana*			
% Trees w/ Exfoliating Bark	0	0	0	
Size Composition of Live Trees (%)	Small (3-8 in)	Med (9-15 in)	Large (>15 in)	
	0	100	0	
No. of Suitable Snags	0	0	0	

Standing dead trees with exfoliating bark, cracks, crevices, or hollows.
Snags without these characteristics area not considered suitable.

IS THE HABITAT SUITABLE FOR INDIANA BATS? No
IS THE HABITAT SUITABLE FOR NORTHERN LONG-EARED BATS? No

Additional Comments:
This area only includes two *Juniperus virginiana* trees and is periodically mowed . The assessment area is immediately adjacent to a large mature forest that extends south to Buck Creek.

Attach aerial photo or project site with all forested areas labeled and a general description of the habitat

Photographic Documentation: habitat shots at edge and interior from multiple locations;
Understory/midstory/canopy; examples of potential suitable snags and live trees; water sources

PHASE 1 SUMMER HABITAT ASSESSMENTS

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Sample Site Description

Sample Site No.(s): HA-32
5/6/2021
The assessment area is the 2.6-acre northern edge of a mature upland forest extending south from Watson Road to Buck Creek.

Water Resources at Sample Site

Stream Type (# and length)	Ephemeral	Intermittent	Perennial	Describe existing condition of water sources: No water in or adjacent to the assessment site. An emergent wetland is located on the eastern edge of the area. A pond is located approximately 0.05 mile south of the assessment area. Buck Creek is located approximately 0.57 mile southeast of the assessment area.
	N/A	N/A	N/A	
Pools/Ponds (# and size)	N/A	Open and accessible to bats		
		N/A		
Wetlands (approx. ac.)	Permanent	Seasonal		
	N/A	PEM1C, 031 acre		

Forest Resources at Sample Site

Closure/Density	Canopy (>50')	Midstory (20-50')	Understory (<20')	1=1-10%, 2=11-20%, 3=21-40%, 4=41-60% 5=61-80%, 6=81-100%
	4	5	6	
Dominant Species of Mature Trees	Canopy: *Quercus alba, Liriodendron tulipifera* Mid-Story: *Juniperus virginiana,* Understory: *Acer saccharum, Elaeagnus umbellata*			
% Trees w/ Exfoliating Bark	0	0	1	
Size Composition of Live Trees (%)	Small (3-8 in)	Med (9-15 in)	Large (>15 in)	
	10	20	70	
No. of Suitable Snags	0	0	1	

Standing dead trees with exfoliating bark, cracks, crevices, or hollows.
Snags without these characteristics area not considered suitable.

IS THE HABITAT SUITABLE FOR INDIANA BATS? Yes
IS THE HABITAT SUITABLE FOR NORTHERN LONG-EARED BATS? Yes

Additional Comments:
The assessment area has ideal forage and roost habitat for both the Indiana and northern long-eared bat. A maintained driveway provides a quality flight corridor to adjacent forested areas. A emergent wetland is mapped within the assessment area. *Lindera benzoin* and *Platanus occidentalis* saplings are also present within the understory. One oak with features conducive to bat use was identified within the assessment area. Several beehives and a clover field are located immediately south of the assessment area.

Tree ID	Species	DBH (in)	Stage of Decay	Roost Features
32.1	*Quercus velutina*	23.5	3	snags, cavities, exfoliating bark

Attach aerial photo or project site with all forested areas labeled and a general description of the habitat

Photographic Documentation: habitat shots at edge and interior from multiple locations;

PHASE 1 SUMMER HABITAT ASSESSMENTS

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Sample Site Description

Sample Site No.(s): HA-33
5/28/2022
The assessment area is a cluster of two weeping willows in a shallow sinkhole wetland north of Watson Road within a residential property parcel landscape.

Water Resources at Sample Site

Stream Type (# and length)	Ephemeral	Intermittent	Perennial	Describe existing condition of water sources: Shallow water emergent wetland within a sinkhole immediately north of Watson Road.
	N/A	N/A	N/A	
Pools/Ponds (# and size)	N/A	Open and accessible to bats		
		N/A		
Wetlands (approx. ac.)	Permanent	Seasonal		
	N/A	0.14 acre		

Forest Resources at Sample Site

Closure/Density	Canopy (>50')	Midstory (20-50')	Understory (<20')	1=1-10%, 2=11-20%, 3=21-40%, 4=41-60% 5=61-80%, 6=81-100%
	0	3	0	
Dominant Species of Mature Trees	*Salix babylonica*			
% Trees w/ Exfoliating Bark	0	0	0	
Size Composition of Live Trees (%)	Small (3-8 in)	Med (9-15 in)	Large (>15 in)	
	0	100	0	
No. of Suitable Snags	0	0	0	

Standing dead trees with exfoliating bark, cracks, crevices, or hollows.
Snags without these characteristics area not considered suitable.

IS THE HABITAT SUITABLE FOR INDIANA BATS? No
IS THE HABITAT SUITABLE FOR NORTHERN LONG-EARED BATS? No

Additional Comments:
The assessment site consists of only two planted weeping willows in a residential landscape. The assessment site is directly across Watson Road from a large contiguous forest that extends south to Buck Creek.

Attach aerial photo or project site with all forested areas labeled and a general description of the habitat

Photographic Documentation: habitat shots at edge and interior from multiple locations;

PHASE 1 SUMMER HABITAT ASSESSMENTS

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Sample Site Description

Sample Site No.(s): HA-34
5/28/2022
The assessment area is cluster of trees within a 0.27-acre residential lawn north of Watson Road between two driveways.

Water Resources at Sample Site

Stream Type (# and length)	Ephemeral	Intermittent	Perennial	Describe existing condition of water sources: No water in or adjacent to the assessment site. A 0.13-acre sinkhole wetland is located approximately 0.01 mile to the west on the north side of Watson Road.
	N/A	N/A	N/A	
Pools/Ponds (# and size)	N/A	Open and accessible to bats		
		N/A		
Wetlands (approx. ac.)	Permanent	Seasonal		
	N/A	N/A		

Forest Resources at Sample Site

Closure/Density	Canopy (>50')	Midstory (20-50')	Understory (<20')	1=1-10%, 2=11-20%, 3=21-40%, 4=41-60% 5=61-80%, 6=81-100%
	5	0	0	
Dominant Species of Mature Trees	*Liriodendron tulipifera, Pinus virginiana, Acer saccharum*			
% Trees w/ Exfoliating Bark	0	0	0	
Size Composition of Live Trees (%)	Small (3-8 in)	Med (9-15 in)	Large (>15 in)	
	10	30	60	
No. of Suitable Snags	0	0	0	

Standing dead trees with exfoliating bark, cracks, crevices, or hollows.
Snags without these characteristics area not considered suitable.

IS THE HABITAT SUITABLE FOR INDIANA BATS? No
IS THE HABITAT SUITABLE FOR NORTHERN LONG-EARED BATS? No

Additional Comments:
This area is routinely mowed as a lawn landscape with a completely open understory. Most of the trees are fully mature and include *Liriodendron tulipifera* (2), *Pinus virginiana* (5), *Acer saccharum* (3), *with Juglans nigra*, and *Cornus florida.* A single stage 7 *Liriodendron tulipifera* trunk next to a live tree exhibited exposed cavities in the top, but is not considered to have roost potential. The assessment site is directly across Watson Road from a large contiguous forest that extends south to Buck Creek.

Attach aerial photo or project site with all forested areas labeled and a general description of the habitat

Photographic Documentation: habitat shots at edge and interior from multiple locations;

PHASE 1 SUMMER HABITAT ASSESSMENTS

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Sample Site Description

Sample Site No.(s): HA-35
5/7/2021
The assessment area is the southern 2.4 acres of a 10+ acre mature upland forest north of Watson Road. Flight corridors to tangent forested areas are present in the form of maintained trails and canopy gaps.

Water Resources at Sample Site

Stream Type (# and length)	Ephemeral	Intermittent	Perennial	Describe existing condition of water sources: No water in or adjacent to the assessment site. A pond is located approximately 0.09 mile to the northwest. Two additional ponds are located approximately 0.09 and 0.11 mile to the south.
	N/A	N/A	N/A	
Pools/Ponds (# and size)	N/A	Open and accessible to bats		
		N/A		
Wetlands (approx. ac.)	Permanent	Seasonal		
	N/A	N/A		

Forest Resources at Sample Site

Closure/Density	Canopy (>50')	Midstory (20-50')	Understory (<20')	1=1-10%, 2=11-20%, 3=21-40%, 4=41-60% 5=61-80%, 6=81-100%
	4	5	6	
Dominant Species of Mature Trees	Canopy: *Liriodendron tulipifera, Quercus sp.* Mid-Story: *Fraxinus sp.* Understory: *Platanus occidentalis*			
% Trees w/ Exfoliating Bark	0	0	0	
Size Composition of Live Trees (%)	Small (3-8 in)	Med (9-15 in)	Large (>15 in)	
	20	20	60	
No. of Suitable Snags	0	0	0	

Standing dead trees with exfoliating bark, cracks, crevices, or hollows.
Snags without these characteristics area not considered suitable.

IS THE HABITAT SUITABLE FOR INDIANA BATS? Yes
IS THE HABITAT SUITABLE FOR NORTHERN LONG-EARED BATS? Yes

Additional Comments:
The assessment area has potential foraging habitat for both the Indiana and northern long-eared bat. No potential roost trees were identified within the assessment area; however, potential roost trees are likely present in the adjacent forested area to the north. Flight corridors to adjacent forested areas are present in the form of maintained trails and canopy gaps. The edge and rural residential habitat is more likely to be used by other bat species; however, given the presence of extensive forests, permanent water sources, and flight corridors to Buck Creek, presence of Indiana and northern long-eared bats is possible.

Attach aerial photo or project site with all forested areas labeled and a general description of the habitat

Photographic Documentation: habitat shots at edge and interior from multiple locations; Understory/midstory/canopy; examples of potential suitable snags and live trees; water sources

PHASE 1 SUMMER HABITAT ASSESSMENTS

Use additional sheets to assess discrete habitat types at multiple sites in a project area
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Sample Site Description

Sample Site No.(s): HA-36
4/29/2022
The assessment area consists of a single tree within an old pasture adjacent to a large upland woods north of Watson Road approximately 0.1 mile west of Meridian Lane.

Water Resources at Sample Site

Stream Type (# and length)	Ephemeral	Intermittent	Perennial	Describe existing condition of water sources: No water in or adjacent to the assessment site. The nearest water feature is a small 0.18-acre pond south of Watson Road, approximately 0.1 mile from the habitat area.
	N/A	N/A	N/A	
Pools/Ponds (# and size)	N/A	Open and accessible to bats		
		N/A		
Wetlands (approx. ac.)	Permanent	Seasonal		
	N/A	N/A		

Forest Resources at Sample Site

Closure/Density	Canopy (>50')	Midstory (20-50')	Understory (<20')	1=1-10%, 2=11-20%, 3=21-40%, 4=41-60% 5=61-80%, 6=81-100%
	0	0	6	
Dominant Species of Mature Trees	*Morus sp.*			
% Trees w/ Exfoliating Bark	0	0	0	
Size Composition of Live Trees (%)	Small (3-8 in)	Med (9-15 in)	Large (>15 in)	
	0	0	100	
No. of Suitable Snags	0	0	0	

Standing dead trees with exfoliating bark, cracks, crevices, or hollows.
Snags without these characteristics area not considered suitable.

IS THE HABITAT SUITABLE FOR INDIANA BATS? No
IS THE HABITAT SUITABLE FOR NORTHERN LONG-EARED BATS? No

Additional Comments:
This isolated pasture tree lacks roost potential and affords no suitable foraging habitat for both the Indiana and northern long-eared bat. The pasture is immediately adjacent to a large upland forest to the west and north of Watson Road.

Attach aerial photo or project site with all forested areas labeled and a general description of the habitat

Photographic Documentation: habitat shots at edge and interior from multiple locations; Understory/midstory/canopy; examples of potential suitable snags and live trees; water sources

PHASE 1 SUMMER HABITAT ASSESSMENTS

Use additional sheets to assess discrete habitat types at multiple sites in a project area
Include a map depicting locations of sample sites if assessing discrete habitats at multiple sites in a project area
A single sheet can be used for multiple sample sites if habitat is the same

Sample Site Description

Sample Site No.(s): HA-37
4/29/2022
The assessment area is a short narrow row of trees along the north edge of Watson Road within an old pasture less than 0.1 mile west of Meridian Lane.

Water Resources at Sample Site

Stream Type (# and length)	Ephemeral	Intermittent	Perennial	Describe existing condition of water sources: No water in or adjacent to the assessment site. The nearest water feature is a small 0.18-acre pond south of Watson Road, approximately 0.05 mile from the habitat area.
	N/A	N/A	N/A	
Pools/Ponds (# and size)	N/A	Open and accessible to bats		
		N/A		
Wetlands (approx. ac.)	Permanent	Seasonal		
	N/A	N/A		

Forest Resources at Sample Site

Closure/Density	Canopy (>50')	Midstory (20-50')	Understory (<20')	1=1-10%, 2=11-20%, 3=21-40%, 4=41-60% 5=61-80%, 6=81-100%
	0	1	2	
Dominant Species of Mature Trees	*Juglans nigra, Liriodendron tulipifera*			
% Trees w/ Exfoliating Bark	0	0	0	
Size Composition of Live Trees (%)	Small (3-8 in)	Med (9-15 in)	Large (>15 in)	
	80	20	0	
No. of Suitable Snags	0	0	0	

Standing dead trees with exfoliating bark, cracks, crevices, or hollows.
Snags without these characteristics area not considered suitable.

IS THE HABITAT SUITABLE FOR INDIANA BATS? No
IS THE HABITAT SUITABLE FOR NORTHERN LONG-EARED BATS? No

Additional Comments:
This isolated roadside strip of trees lacks roost potential and affords no suitable foraging habitat for either the Indiana bat of northern long-eared bat. Young *Liriodendron tulipifera* and *Juniperus virginiana* are present as young trees mostly under 3 inches diameter.

Attach aerial photo or project site with all forested areas labeled and a general description of the habitat

Photographic Documentation: habitat shots at edge and interior from multiple locations;
Understory/midstory/canopy; examples of potential suitable snags and live trees; water sources

PHASE 1 SUMMER HABITAT ASSESSMENTS

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Sample Site Description

Sample Site No.(s): HA-38
4/29/2022
This assessment area is a collection of various sized trees surrounding an abandoned old home immediately east of Meridian Lane and south of Watson Road surrounded by old pasture.

Water Resources at Sample Site

Stream Type (# and length)	Ephemeral	Intermittent	Perennial	Describe existing condition of water sources: No water in or adjacent to the assessment site. The nearest water feature is a small 0.18-acre pond 0.06 mile to the west.
	N/A	N/A	N/A	
Pools/Ponds (# and size)	N/A	Open and accessible to bats		
		N/A		
Wetlands (approx. ac.)	Permanent	Seasonal		
	N/A	N/A		

Forest Resources at Sample Site

Closure/Density	Canopy (>50')	Midstory (20-50')	Understory (<20')	1=1-10%, 2=11-20%, 3=21-40%, 4=41-60% 5=61-80%, 6=81-100%
	0	1	2	
Dominant Species of Mature Trees	Canopy: *Juglans nigra, Celtis occidentalis, Prunus serotina*			
% Trees w/ Exfoliating Bark	0	0	0	
Size Composition of Live Trees (%)	Small (3-8 in)	Med (9-15 in)	Large (>15 in)	
	80	20	0	
No. of Suitable Snags	0	0	0	

Standing dead trees with exfoliating bark, cracks, crevices, or hollows.
Snags without these characteristics area not considered suitable.

IS THE HABITAT SUITABLE FOR INDIANA BATS? No
IS THE HABITAT SUITABLE FOR NORTHERN LONG-EARED BATS? No

Additional Comments:
This clustered of mixed species residential property trees affords no suitable roost or foraging habitat for either the Indiana bat of northern long-eared bat. Additional species include *Ulmus sp., Juniperus virginiana,* and *Sassafras albidum.*

Attach aerial photo or project site with all forested areas labeled and a general description of the habitat

Photographic Documentation: habitat shots at edge and interior from multiple locations; Understory/midstory/canopy; examples of potential suitable snags and live trees; water sources

PHASE 1 SUMMER HABITAT ASSESSMENTS

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A single sheet can be used for multiple sample sites if habitat is the same

Sample Site Description

Sample Site No.(s): HA-39
4/29/2022
This assessment area is a single red cedar tree along the south edge of Watson Road surrounded by old pasture between Meridian Lane and Delmer Lane.

Water Resources at Sample Site

Stream Type (# and length)	Ephemeral	Intermittent	Perennial	Describe existing condition of water sources: No water in or adjacent to the assessment site. The nearest water feature is a 0.5-acre sinkhole pond 0.04 mile to the south in a pasture.
	N/A	N/A	N/A	
Pools/Ponds (# and size)	N/A	Open and accessible to bats		
		N/A		
Wetlands (approx. ac.)	Permanent	Seasonal		
	N/A	N/A		

Forest Resources at Sample Site

Closure/Density	Canopy (>50')	Midstory (20-50')	Understory (<20')	1=1-10%, 2=11-20%, 3=21-40%, 4=41-60% 5=61-80%, 6=81-100%
	0	0	1	
Dominant Species of Mature Trees	Canopy: *Juniperus virginiana*			
% Trees w/ Exfoliating Bark	0	0	0	
Size Composition of Live Trees (%)	Small (3-8 in)	Med (9-15 in)	Large (>15 in)	
	80	20	0	
No. of Suitable Snags	0	0	0	

Standing dead trees with exfoliating bark, cracks, crevices, or hollows.
Snags without these characteristics area not considered suitable.

IS THE HABITAT SUITABLE FOR INDIANA BATS? No
IS THE HABITAT SUITABLE FOR NORTHERN LONG-EARED BATS? No

Additional Comments:
The individual eastern red cedar is very isolated from other forest habitats and affords no suitable roost or foraging habitat for either the Indiana bat of northern long-eared bat.

Attach aerial photo or project site with all forested areas labeled and a general description of the habitat

Photographic Documentation: habitat shots at edge and interior from multiple locations; Understory/midstory/canopy; examples of potential suitable snags and live trees; water sources

PHASE 1 SUMMER HABITAT ASSESSMENTS

Use additional sheets to assess discrete habitat types at multiple sites in a project area
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Sample Site Description

Sample Site No.(s):HA-40
5/6/2021
The assessment area is a 0.5-acre hedgerow of trees approximately 35 feet wide extending north from a larger forest south of Union Chapel Road.

Water Resources at Sample Site

Stream Type (# and length)	Ephemeral	Intermittent	Perennial	Describe existing condition of water sources: No water in or adjacent to the assessment site. Buck Creek is located approximately 0.40 mile to the east A sinkhole pond is located approximately 0.26 mile to the west.
	N/A	N/A	N/A	
Pools/Ponds (# and size)	N/A	Open and accessible to bats		
		N/A		
Wetlands (approx. ac.)	Permanent	Seasonal		
	N/A	N/A		

Forest Resources at Sample Site

Closure/Density	Canopy (>50')	Midstory (20-50')	Understory (<20')	1=1-10%, 2=11-20%, 3=21-40%, 4=41-60% 5=61-80%, 6=81-100%
	4	4	5	
Dominant Species of Mature Trees	Canopy: *Ailanthus altissima* Mid-Story: *Ailanthus altissima* Understory: *Ailanthus altissima*			
% Trees w/ Exfoliating Bark	0	0	0	
Size Composition of Live Trees (%)	Small (3-8 in)	Med (9-15 in)	Large (>15 in)	
	60	30	10	
No. of Suitable Snags	0	0	0	

Standing dead trees with exfoliating bark, cracks, crevices, or hollows.
Snags without these characteristics area not considered suitable.

IS THE HABITAT SUITABLE FOR INDIANA BATS? Yes, foraging only
IS THE HABITAT SUITABLE FOR NORTHERN LONG-EARED BATS? Yes, foraging only

Additional Comments:
The area is not ideal, but the edge of the tree row may serve as possible foraging habitat for the Indiana and northern long-eared bat. The forest immediately south of the hedgerow is ideal roost and forage habitat for both species. No roost trees were identified in the assessment area.

Attach aerial photo or project site with all forested areas labeled and a general description of the habitat

Photographic Documentation: habitat shots at edge and interior from multiple locations; Understory/midstory/canopy; examples of potential suitable snags and live trees; water sources

PHASE 1 SUMMER HABITAT ASSESSMENTS

Use additional sheets to assess discrete habitat types at multiple sites in a project area
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Sample Site Description

Sample Site No.(s):HA-41
4/27/2022
The assessment area is a 0.3-acre tree row approximately 50 feet wide north of Union Chapel Road with a small break from a large contiguous forest that extends east to Buck Creek.

Water Resources at Sample Site

Stream Type (# and length)	Ephemeral	Intermittent	Perennial	Describe existing condition of water sources: No water in or adjacent to the assessment site. Buck Creek is located approximately 0.40 mile to the east A sinkhole pond is located approximately 0.26 mile to the west.
	N/A	N/A	N/A	
Pools/Ponds (# and size)	N/A	Open and accessible to bats		
		N/A		
Wetlands (approx. ac.)	Permanent	Seasonal		
	N/A	N/A		

Forest Resources at Sample Site

Closure/Density	Canopy (>50')	Midstory (20-50')	Understory (<20')	1=1-10%, 2=11-20%, 3=21-40%, 4=41-60% 5=61-80%, 6=81-100%
	2	3	6	
Dominant Species of Mature Trees	*Quercus rubra, Fraxinus sp., Juniperus virginiana, Prunus serotina, Liriodendron tulipifera*			
% Trees w/ Exfoliating Bark	0	0	0	
Size Composition of Live Trees (%)	Small (3-8 in)	Med (9-15 in)	Large (>15 in)	
	75	20	5	
No. of Suitable Snags	0	0	0	

Standing dead trees with exfoliating bark, cracks, crevices, or hollows.
Snags without these characteristics area not considered suitable.

IS THE HABITAT SUITABLE FOR INDIANA BATS? Yes, foraging only
IS THE HABITAT SUITABLE FOR NORTHERN LONG-EARED BATS? Yes, foraging only

Additional Comments:
Additional species include *Acer saccharum, Ulmus sp., Sassafras albidum, Diospyros virginiana, Celtis occidentalis*, and *Quercus palustris.* Thick cover of honeysuckle bush with too much clutter in understory. Edges of assessment area may serve as a foraging area due to its close proximity to a large forest tract to the east associated with Buck Creek.

Attach aerial photo or project site with all forested areas labeled and a general description of the habitat

Photographic Documentation: habitat shots at edge and interior from multiple locations; Understory/midstory/canopy; examples of potential suitable snags and live trees; water sources

PHASE 1 SUMMER HABITAT ASSESSMENTS

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Sample Site Description

Sample Site No.(s):HA-42
4/27/2022
The assessment area is a 0.03-acre isolated dry sinkhole immediately south of Union Chapel Road surrounded by agricultural field to the south.

Water Resources at Sample Site

Stream Type (# and length)	Ephemeral	Intermittent	Perennial	Describe existing condition of water sources: No water in or adjacent to the assessment site (dry sinkhole). Buck Creek is located approximately 0.40 mile to the east.
	N/A	N/A	N/A	
Pools/Ponds (# and size)	N/A	Open and accessible to bats		
		N/A		
Wetlands (approx. ac.)	Permanent	Seasonal		
	N/A	N/A		

Forest Resources at Sample Site

Closure/Density	Canopy (>50')	Midstory (20-50')	Understory (<20')	1=1-10%, 2=11-20%, 3=21-40%, 4=41-60% 5=61-80%, 6=81-100%
	5	1	2	
Dominant Species of Mature Trees	*Ulmus sp., Acer saccharum, Prunus serotina*			
% Trees w/ Exfoliating Bark	0	0	0	
Size Composition of Live Trees (%)	Small (3-8 in)	Med (9-15 in)	Large (>15 in)	
	20	30	50	
No. of Suitable Snags	0	0	0	

Standing dead trees with exfoliating bark, cracks, crevices, or hollows.
Snags without these characteristics area not considered suitable.

IS THE HABITAT SUITABLE FOR INDIANA BATS? No
IS THE HABITAT SUITABLE FOR NORTHERN LONG-EARED BATS? No

Additional Comments:
The entire sinkhole consists of 10 to 15 trees greater than 3-inch diameter. There is no direct connection to other suitable habitats; however, it is in the vicinity of several large tracts of forest that extend to Buck Creek. Additional species include *Catalpa speciosa, Celtis occidentalis,* and *Juniperus virginiana.* Honeysuckle bush and red cedar dominate the perimeter.

Attach aerial photo or project site with all forested areas labeled and a general description of the habitat

Photographic Documentation: habitat shots at edge and interior from multiple locations; Understory/midstory/canopy; examples of potential suitable snags and live trees; water sources

PHASE 1 SUMMER HABITAT ASSESSMENTS

Use additional sheets to assess discrete habitat types at multiple sites in a project area
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Sample Site Description

Sample Site No.(s): HA-43
5/6/2021
The assessment area is 0.16-acre fragment of a mature oak/hickory upland forest, immediately south of Union Chapel Road. A driveway and canopy openings serve as flight corridors in the immediate area.

Water Resources at Sample Site

Stream Type (# and length)	Ephemeral	Intermittent	Perennial	Describe existing condition of water sources: No water in or adjacent to the assessment site. Buck Creek is located approximately 0.20 mile east.
	N/A	N/A	N/A	
Pools/Ponds (# and size)	N/A	Open and accessible to bats		
		N/A		
Wetlands (approx. ac.)	Permanent	Seasonal		
	N/A	N/A		

Forest Resources at Sample Site

Closure/Density	Canopy (>50')	Midstory (20-50')	Understory (<20')	1=1-10%, 2=11-20%, 3=21-40%, 4=41-60% 5=61-80%, 6=81-100%
	4	4	4	
Dominant Species of Mature Trees	Canopy: *Quercus alba, Carya ovata* Mid-Story: *Fagus grandifolia, Cercis canadensis, Juniperus virginiana* Understory: *Cercis canadensis, Fagus grandifolia, Juniperus virginiana*			
% Trees w/ Exfoliating Bark	0	0	0	
Size Composition of Live Trees (%)	Small (3-8 in)	Med (9-15 in)	Large (>15 in)	
	20	30	50	
No. of Suitable Snags	0	1	1	

Standing dead trees with exfoliating bark, cracks, crevices, or hollows.
Snags without these characteristics area not considered suitable.

IS THERE HABITAT SUITABLE FOR INDIANA BATS? Yes
IS THE HABITAT SUITABLE FOR NORTHERN LONG-EARED BATS? Yes

Additional Comments:
The assessment area is possible foraging habitat for the Indiana and northern long-eared bat since it is in close proximity to neighboring large tracts of contiguous forest with Buck Creek. There are no dead snag potential roost trees identified within the assessment area. However, live hickories identified in the area may provide roost opportunities. A driveway and canopy openings serve as flight corridors in the immediate area.

Attach aerial photo or project site with all forested areas labeled and a general description of the habitat

Photographic Documentation: habitat shots at edge and interior from multiple locations; Understory/midstory/canopy; examples of potential suitable snags and live trees; water sources

PHASE 1 SUMMER HABITAT ASSESSMENTS

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Sample Site Description

Sample Site No.(s): HA-44
5/6/2021
The assessment area is a 4-acre area of a 50+ acre mature oak/hickory upland forest, immediately south of Union Chapel Road. The assessment area is located on a ridge, which slopes down to the south.

Water Resources at Sample Site

Stream Type (# and length)	Ephemeral	Intermittent	Perennial	Describe existing condition of water sources: No water in or adjacent to the assessment site. Buck Creek is located approximately 0.20 mile east.
	N/A	N/A	N/A	
Pools/Ponds (# and size)	N/A	N/A		
		N/A		
Wetlands (approx. ac.)	N/A	N/A		
	N/A	N/A		

Forest Resources at Sample Site

Closure/Density	Canopy (>50')	Midstory (20-50')	Understory (<20')	1=1-10%, 2=11-20%, 3=21-40%, 4=41-60% 5=61-80%, 6=81-100%
	4	4	4	
Dominant Species of Mature Trees	Canopy: *Quercus alba, Carya ovata* Mid-Story: *Fagus grandifolia, Cercis canadensis, Juniperus virginiana* Understory: *Cercis canadensis, Fagus grandifolia, Juniperus virginiana*			
% Trees w/ Exfoliating Bark	0	0	0	
Size Composition of Live Trees (%)	Small (3-8 in)	Med (9-15 in)	Large (>15 in)	
	20	30	50	
No. of Suitable Snags	0	1	1	

Standing dead trees with exfoliating bark, cracks, crevices, or hollows.
Snags without these characteristics area not considered suitable.

IS THERE HABITAT SUITABLE FOR INDIANA BATS? Yes
IS THE HABITAT SUITABLE FOR NORTHERN LONG-EARED BATS? Yes

Additional Comments:
The assessment area has foraging and roost habitat for the Indiana and northern long-eared bat since it is part of a large, contiguous forest associated with Buck Creek. Two potential dead snag roost trees were identified A dead ash that did not yet exhibit roost features was identified, but has potential as decay progresses and exfoliating bark, snags, etc. develop. Live hickories identified in the area may also provide roost opportunities. A driveway and canopy openings serve as flight corridors in the immediate area.

Tree ID	Species	DBH (in)	Stage of Decay	Roost Features
44.1	*Quercus alba*	14.0	7	cavities
44.2	Unknown	12.0	7	hollow snag

Attach aerial photo or project site with all forested areas labeled and a general description of the habitat

Photographic Documentation: habitat shots at edge and interior from multiple locations; Understory/midstory/canopy; examples of potential suitable snags and live trees; water sources

PHASE 1 SUMMER HABITAT ASSESSMENTS

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Sample Site Description

Sample Site No.(s): HA-45
4/27/2022
The assessment area is a 0.71-acre fragment of a mature upland forest on a hillside slope, immediately north of Union Chapel Road separated from a larger forested tract by a cleared utility easement.

Water Resources at Sample Site

Stream Type (# and length)	Ephemeral	Intermittent	Perennial	Describe existing condition of water sources: No water in or adjacent to the assessment site. Buck Creek is located approximately 0.20 mile east.
	N/A	N/A	N/A	
Pools/Ponds (# and size)	N/A	Open and accessible to bats		
		N/A		
Wetlands (approx. ac.)	Permanent	Seasonal		
	N/A	N/A		

Forest Resources at Sample Site

Closure/Density	Canopy (>50')	Midstory (20-50')	Understory (<20')	1=1-10%, 2=11-20%, 3=21-40%, 4=41-60% 5=61-80%, 6=81-100%
	3	6	6	
Dominant Species of Mature Trees	*Fagus grandifolia, Carya ovata, Sassafras albidum, Quercus rubra, Juniperus virginiana, Lirodendron tulipifera*			
% Trees w/ Exfoliating Bark	0	<1	<1	
Size Composition of Live Trees (%)	Small (3-8 in)	Med (9-15 in)	Large (>15 in)	
	78	20	2	
No. of Suitable Snags	0	4	2	

Standing dead trees with exfoliating bark, cracks, crevices, or hollows.
Snags without these characteristics area not considered suitable.

IS THERE HABITAT SUITABLE FOR INDIANA BATS? Yes
IS THE HABITAT SUITABLE FOR NORTHERN LONG-EARED BATS? Yes

Additional Comments:
The assessment area is possible foraging habitat for the Indiana and northern long-eared bat since it is in close proximity to neighboring large tracts of contiguous forest with Buck Creek. Moderately heavy understory clutter from young saplings and trees. Adjacent utility easement is possible flyway. Additional species include: *Prunus serotina, Acer saccharum, Platanus occidentalis,* and *Catalpa speciosa*. One dead oak and several live hickories identified in the area may provide roost opportunities.

Tree ID	Species	DBH (in)	Stage of Decay	Roost Features
45.1	*Quercus alba*	12.0	3	exfoliating bark
45.2	Carya ovata	18.0	1	exfoliating bark
45.3	Carya ovata	13.5	1	exfoliating bark
45.4	Carya ovata	15.5	1	exfoliating bark
45.5	Carya ovata	11.0	1	exfoliating bark
45.6	Carya ovata	13.5	1	exfoliating bark

Attach aerial photo or project site with all forested areas labeled and a general description of the habitat

Photographic Documentation: habitat shots at edge and interior from multiple locations; Understory/midstory/canopy; examples of potential suitable snags and live trees; water sources

PHASE 1 SUMMER HABITAT ASSESSMENTS

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Sample Site Description

Sample Site No.(s): HA-46
4/27/2022
The assessment area is a 0.78-acre fragment of a mature upland forest on a hillside slope, immediately north of Union Chapel Road separated from a larger forested tract by a cleared utility easement.

Water Resources at Sample Site

Stream Type (# and length)	Ephemeral	Intermittent	Perennial	Describe existing condition of water sources: No water in or adjacent to the assessment site. Buck Creek is located approximately 0.17 mile east.
	N/A	N/A	N/A	
Pools/Ponds (# and size)	N/A	Open and accessible to bats		
		N/A		
Wetlands (approx. ac.)	Permanent	Seasonal		
	N/A	N/A		

Forest Resources at Sample Site

Closure/Density	Canopy (>50')	Midstory (20-50')	Understory (<20')	1=1-10%, 2=11-20%, 3=21-40%, 4=41-60% 5=61-80%, 6=81-100%
	5	5	6	
Dominant Species of Mature Trees	*Acer saccharum, Quercus rubra, Juniperus virginiana, Lirodendron tulipifera, Platanus occidentalis*			
% Trees w/ Exfoliating Bark	<1	1	0	
Size Composition of Live Trees (%)	Small (3-8 in)	Med (9-15 in)	Large (>15 in)	
	55	42	3	
No. of Suitable Snags	1	4	0	

Standing dead trees with exfoliating bark, cracks, crevices, or hollows.
Snags without these characteristics area not considered suitable.

IS THERE HABITAT SUITABLE FOR INDIANA BATS? Yes
IS THE HABITAT SUITABLE FOR NORTHERN LONG-EARED BATS? Yes

Additional Comments:
The assessment area is possible foraging habitat for the Indiana and northern long-eared bat since it is in close proximity to neighboring large tracts of contiguous forest with Buck Creek. Moderately heavy understory clutter from young saplings and trees. Adjacent utility easement is possible flyway. Additional species include: *Sassafras albidum, Diospyros virginiana, Catalpa speciosa, Prunus serotina, Cornus florida, Gleditsia tricanthos,* and *Quercus alba*. One dead oak and several live hickories identified in the area may provide roost opportunities.

Tree ID	Species	DBH (in)	Stage of Decay	Roost Features
46.1	*Sassafras albidum*	7.5	2	exfoliating bark, minor cavities
46.2	*Unknown*	11.0	3	exfoliating bark
46.3	*Ulmus sp.*	6.5	3	exfoliating bark
46.4	*Ulmus sp.*	10.0	3	exfoliating bark
46.5	*Fraxinus sp.*	13.0	3	exfoliating bark

Attach aerial photo or project site with all forested areas labeled and a general description of the habitat

Photographic Documentation: habitat shots at edge and interior from multiple locations; Understory/midstory/canopy; examples of potential suitable snags and live trees; water sources

PHASE 1 SUMMER HABITAT ASSESSMENTS

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Sample Site Description

Sample Site No.(s): HA-47A
5/7/2021
The assessment area is a 1.75-acre section of a larger 17.2-acre mature upland forest on a hillside slope north of Union Chapel Road and west of Buck Creek. The tract is separated from larger adjacent tracts by an agricultural field access path.

Water Resources at Sample Site

Stream Type (# and length)	Ephemeral	Intermittent	Perennial	Describe existing condition of water sources: No water in or adjacent to the assessment site. Buck Creek is located approximately 0.21 mile east.
	N/A	N/A	N/A	
Pools/Ponds (# and size)	N/A	Open and accessible to bats		
		N/A		
Wetlands (approx. ac.)	Permanent	Seasonal		
	N/A	N/A		

Forest Resources at Sample Site

Closure/Density	Canopy (>50')	Midstory (20-50')	Understory (<20')	1=1-10%, 2=11-20%, 3=21-40%, 4=41-60% 5=61-80%, 6=81-100%
	4	3	3	
Dominant Species of Mature Trees	Canopy: *Acer saccharum, Fagus grandifolia, Liriodendron tulipifera, Platanus occidentalis* Mid-Story: *Acer saccharum, Fagus grandifolia*			
% Trees w/ Exfoliating Bark	0	0	0	
Size Composition of Live Trees (%)	Small (3-8 in)	Med (9-15 in)	Large (>15 in)	
No. of Suitable Snags	0	0	0	

Standing dead trees with exfoliating bark, cracks, crevices, or hollows.
Snags without these characteristics area not considered suitable.

IS THERE HABITAT SUITABLE FOR INDIANA BATS? Yes
IS THE HABITAT SUITABLE FOR NORTHERN LONG-EARED BATS? Yes

Additional Comments:
The assessment area has foraging habitat for the Indiana and northern long-eared bat since it is in close proximity to neighboring large tracts of contiguous forest with Buck Creek. Buck Creek and several gravel trails provide strong flight corridors. Several dead ash were observed in the area that did not exhibit roost potential qualities at the time of the survey, but have potential for roosting as decay progresses. Additionally, shagbark hickories present in the area (not mapped) may provide further roost opportunities.

Attach aerial photo or project site with all forested areas labeled and a general description of the habitat

Photographic Documentation: habitat shots at edge and interior from multiple locations; Understory/midstory/canopy; examples of potential suitable snags and live trees; water sources

PHASE 1 SUMMER HABITAT ASSESSMENTS

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Sample Site Description

Sample Site No.(s): HA-47B
5/7/2021
The assessment area is a 3.88-acre section of a larger 17.2-acre mature upland forest on a hillside slope north and east of Union Chapel Road and west of Buck Creek. The large tract is contiguous with Buck Creek.

Water Resources at Sample Site

Stream Type (# and length)	Ephemeral	Intermittent	Perennial	Describe existing condition of water sources: A small 0.04-acre pond is olocated within the assessment area. Buck Creek is located approximately 0.15 mile east of the assessment area
	N/A	N/A	N/A	
Pools/Ponds (# and size)	N/A	Open and accessible to bats		
		0.04-acre		
Wetlands (approx. ac.)	Permanent	Seasonal		
	N/A	N/A		

Forest Resources at Sample Site

Closure/Density	Canopy (>50')	Midstory (20-50')	Understory (<20')	1=1-10%, 2=11-20%, 3=21-40%, 4=41-60% 5=61-80%, 6=81-100%
	3	4	5	
Dominant Species of Mature Trees	Canopy: *Quercus rubra*, *Acer saccharum*, and *Pinus strobus* Mid-Story: *Juniperus virginiana* and *Acer saccharum* Understory: *Elaeagnus umbellata*			
% Trees w/ Exfoliating Bark	0	0	0	
Size Composition of Live Trees (%)	Small (3-8 in)	Med (9-15 in)	Large (>15 in)	
	20	40	40	
No. of Suitable Snags	0	0	0	

Standing dead trees with exfoliating bark, cracks, crevices, or hollows.
Snags without these characteristics area not considered suitable.

IS THERE HABITAT SUITABLE FOR INDIANA BATS? Yes
IS THE HABITAT SUITABLE FOR NORTHERN LONG-EARED BATS? Yes

Additional Comments:
The assessment area includes habitat suitable for both Indiana bats and northern long-eared bats. Flight corridors to adjacent forest areas are present. No potential roost trees were identified. This woodland tract is part of an Indiana Forest Bank property (The Nature Conservancy).

Attach aerial photo or project site with all forested areas labeled and a general description of the habitat

Photographic Documentation: habitat shots at edge and interior from multiple locations; Understory/midstory/canopy; examples of potential suitable snags and live trees; water sources

PHASE 1 SUMMER HABITAT ASSESSMENTS

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Sample Site Description

Sample Site No.(s): HA-47C
5/8/2021
The assessment area is a 3.73-acre section of a larger 17.2-acre mature upland forest is on a gently sloping bluff of Buck Creek.

Water Resources at Sample Site

Stream Type (# and length)	Ephemeral	Intermittent	Perennial	Describe existing condition of water sources: Buck Creek borders the east edge of the assessment area and was flooded at the time of the survey.
	N/A	N/A	425 feet	
Pools/Ponds (# and size)	N/A	Open and accessible to bats		
		N/A		
Wetlands (approx. ac.)	Permanent	Seasonal		
	N/A	N/A		

Forest Resources at Sample Site

Closure/Density	Canopy (>50')	Midstory (20-50')	Understory (<20')	1=1-10%, 2=11-20%, 3=21-40%, 4=41-60% 5=61-80%, 6=81-100%
	3	3	4	
Dominant Species of Mature Trees	Canopy: *Quercus rubra*, *Acer saccharum*, and *Fraxinus sp.* Mid-Story: *Ulmus americana*, *Fagus grandifolia*, and *Acer saccharum* Understory: *Elaeagnus umbellata*			
% Trees w/ Exfoliating Bark	0	0	1	
Size Composition of Live Trees (%)	Small (3-8 in)	Med (9-15 in)	Large (>15 in)	
	20	30	50	
No. of Suitable Snags	0	0	2	

Standing dead trees with exfoliating bark, cracks, crevices, or hollows.
Snags without these characteristics area not considered suitable.

IS THERE HABITAT SUITABLE FOR INDIANA BATS? Yes
IS THE HABITAT SUITABLE FOR NORTHERN LONG-EARED BATS? Yes

Additional Comments:
The assessment area includes habitat suitable for both Indiana bats and northern long-eared bats. Flight corridors, namely Buck Creek, are present. This woodland tract is part of an Indiana Forest Bank property (The Nature Conservancy). Three potential dead snag roosts were present.

Tree ID	Species	DBH	Stage of Decay	Roost Features
47C.1	*Fraxinus sp.*	27.5	3/4	exfoliating bark, snag
47C.2	Fraxinus sp.	19.5	3	exfoliating bark
47C.3	Quercus rubra	31.5	5/6	cavities, snag

Attach aerial photo or project site with all forested areas labeled and a general description of the habitat

Photographic Documentation: habitat shots at edge and interior from multiple locations; Understory/midstory/canopy; examples of potential suitable snags and live trees; water sources

PHASE 1 SUMMER HABITAT ASSESSMENTS

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Sample Site Description

Sample Site No.(s): HA-48A
5/6/2021
The assessment area is a 13-acre section of a larger 25.3-acre beech/maple mature upland slope and Buck Creek floodplain forest on the west side of the Buck Creek valley.

Water Resources at Sample Site

Stream Type (# and length)	Ephemeral	Intermittent	Perennial	Describe existing condition of water sources: Buck Creek borders the north edge of the assessment area and was flooded at the time of the survey.
	N/A	N/A	450 feet	
Pools/Ponds (# and size)	N/A	Open and accessible to bats		
		N/A		
Wetlands (approx. ac.)	Permanent	Seasonal		
	N/A	N/A		

Forest Resources at Sample Site

Closure/Density	Canopy (>50')	Midstory (20-50')	Understory (<20')	1=1-10%, 2=11-20%, 3=21-40%, 4=41-60% 5=61-80%, 6=81-100%
	6	5	3	
Dominant Species of Mature Trees	Canopy: *Acer saccharum, Fagus grandifolia* Mid-Story: *Fagus grandifolia*			
% Trees w/ Exfoliating Bark				
Size Composition of Live Trees (%)	Small (3-8 in)	Med (9-15 in)	Large (>15 in)	
	20	40	40	
No. of Suitable Snags	1	3	3	

Standing dead trees with exfoliating bark, cracks, crevices, or hollows.
Snags without these characteristics area not considered suitable.

IS THERE HABITAT SUITABLE FOR INDIANA BATS? Yes
IS THE HABITAT SUITABLE FOR NORTHERN LONG-EARED BATS? Yes

Additional Comments:
The assessment area includes habitat suitable for both Indiana bats and northern long-eared bats. Flight corridors include an old logging road and the woodland edge along the adjacent agricultural field. Seven potential roost trees were identified within the assessment area. Additionally, several dead ash were observed, but had not yet developed features suitable for bat roosts; however, as decay progresses exfoliating bark will likely develop. Several live shagbark hickories (not mapped) identified in the area may also provide further roost opportunities

Tree ID	Species	DBH (in)	Stage of Decay	Roost Features
48A.1	*Fraxinus sp.*	15.5	3	exfoliating bark
48A.2	*Prunus serotina*	24.5	2	large hollow snag
48A.3	*Liriodendron tulipifera*	14.0	1	snag, cavities, fissure
48A.4	*Ulmus sp.*	6.5	6	cavities, fissure
48A.5	*Fraxinus sp.*	15.0	3	exfoliating bark
48A.6	*Fraxinus sp.*	13.5	3	snag, cavities, exfoliating bark
48A.7	*Quercus alba*	13.5	6	snag, cavities

Attach aerial photo or project site with all forested areas labeled and a general description of the habitat

Photographic Documentation: habitat shots at edge and interior from multiple locations;
Understory/midstory/canopy; examples of potential suitable snags and live trees; water sources

PHASE 1 SUMMER HABITAT ASSESSMENTS

Use additional sheets to assess discrete habitat types at multiple sites in a project area
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Sample Site Description

Sample Site No.(s): HA-48B
4/27/2022
The assessment area is a 0.95-acre riparian strip along the west bank of Buck Creek. This is part of a larger 25.3-acre mature forest that includes upland slope and ridge habitats on the west side of the Buck Creek valley.

Water Resources at Sample Site

Stream Type (# and length)	Ephemeral	Intermittent	Perennial	Describe existing condition of water sources: Buck Creek borders the north edge of the assessment area.
	N/A	N/A	490 feet	
Pools/Ponds (# and size)	N/A	Open and accessible to bats		
		N/A		
Wetlands (approx. ac.)	Permanent	Seasonal		
	N/A	N/A		

Forest Resources at Sample Site

Closure/Density	Canopy (>50')	Midstory (20-50')	Understory (<20')
	1	2	3
Dominant Species of Mature Trees	*Populus deltoides, Platanus occidentalis, Acer saccharinum, Fraxinus pennsylvanica, Aesculus glabra*		
% Trees w/ Exfoliating Bark	0	0	0
Size Composition of Live Trees (%)	Small (3-8 in)	Med (9-15 in)	Large (>15 in)
	50	40	10
No. of Suitable Snags	0	0	3

Standing dead trees with exfoliating bark, cracks, crevices, or hollows.
Snags without these characteristics area not considered suitable.

IS THERE HABITAT SUITABLE FOR INDIANA BATS? Yes
IS THE HABITAT SUITABLE FOR NORTHERN LONG-EARED BATS? Yes

Additional Comments:
The assessment area includes habitat suitable for both Indiana bats and northern long-eared bats. Understory cover is sparse consisting of Lindera benzoin and Lonicera sp. which is heavy along the field edge. Understory has low clutter. Additional species include *Carya glabra, Acer negundo, Ulmus sp., Diospyros virginiana,* and *Quercus palustris.*

Tree ID	Species	DBH (in)	Stage od Decay	Roost Features
48B.1	*Platanus occidentalis*	39.5	4	cavities high on trunk
48B.2	*Platanus occidentalis*	36.0	4	cavities, crevices
48B.3	*Platanus occidentalis*	18.0	5	exfoliating bark

Attach aerial photo or project site with all forested areas labeled and a general description of the habitat

Photographic Documentation: habitat shots at edge and interior from multiple locations; Understory/midstory/canopy; examples of potential suitable snags and live trees; water sources

PHASE 1 SUMMER HABITAT ASSESSMENTS

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Sample Site Description

Sample Site No.(s): HA-48C
5/5/2021
The assessment area is a 1.25-acre riparian strip along the west bank of Buck Creek adjacent to a bottomland agricultural field. This is part of a larger 25.3-acre mature forest that includes upland slope and ridge habitats on the west side of the Buck Creek valley. A mid-channel island in Buck Creek includes riparian species similar to that on the west bank.

Water Resources at Sample Site

Stream Type (# and length)	Ephemeral	Intermittent	Perennial	Describe existing condition of water sources: Buck Creek borders the north edge of the assessment area and was flooded at the time of the survey.
	N/A	N/A	400 feet	
Pools/Ponds (# and size)	N/A	Open and accessible to bats		
		N/A		
Wetlands (approx. ac.)	Permanent	Seasonal		
	N/A	N/A		

Forest Resources at Sample Site

Closure/Density	Canopy (>50')	Midstory (20-50')	Understory (<20')
	4	5	4
Dominant Species of Mature Trees	Canopy: *Quercus rubra, Platanus occidentalis, Quercus prinus* Mid-Story: *Carpinus caroliniana, Aesculus glabra* Understory: *Aesculus glabra*		
% Trees w/ Exfoliating Bark	0	0	1
Size Composition of Live Trees (%)	Small (3-8 in)	Med (9-15 in)	Large (>15 in)
	20	30	50
No. of Suitable Snags	0	0	2

Standing dead trees with exfoliating bark, cracks, crevices, or hollows.
Snags without these characteristics area not considered suitable.

IS THERE HABITAT SUITABLE FOR INDIANA BATS? Yes
IS THE HABITAT SUITABLE FOR NORTHERN LONG-EARED BATS? Yes

Additional Comments:
The assessment area includes habitat suitable for both Indiana bats and northern long-eared bats. The Buck Creek riparian edge and the mid-channel island provide quality foraging and roosting habitat. Several sycamore snags are present, but did not include hollows or other characteristics favorable as roost features. Two potential roost trees were identified.

Tree ID	Species	DBH (in)	Stage of Decay	Roost Features
48C.1	*Quercus rubra*	27.5	4	snags, exfoliating bark
48C.2	*Quercus rubra*	25.5	4	snags, exfoliating bark

Attach aerial photo or project site with all forested areas labeled and a general description of the habitat

Photographic Documentation: habitat shots at edge and interior from multiple locations; Understory/midstory/canopy; examples of potential suitable snags and live trees; water sources

PHASE 1 SUMMER HABITAT ASSESSMENTS

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Sample Site Description

Sample Site No.(s): HA-49
4/27/2022
The assessment area is an isolated 0.07-acre cluster of trees along the south side of Union Chapel Road heading down to the Buck Creek bottoms.

Water Resources at Sample Site

Stream Type (# and length)	Ephemeral	Intermittent	Perennial	Describe existing condition of water sources: No waters in the assessment area. Buck Creek is approximately 0.15 mile to the northeast.
	N/A	N/A	N/A	
Pools/Ponds (# and size)	N/A	Open and accessible to bats		
		N/A		
Wetlands (approx. ac.)	Permanent	Seasonal		
	N/A	N/A		

Forest Resources at Sample Site

Closure/Density	Canopy (>50')	Midstory (20-50')	Understory (<20')
	0	5	2
Dominant Species of Mature Trees	*Carya ovata, Fraxinus sp., Acer sp., Juniperus virginiana*		
% Trees w/ Exfoliating Bark	0	0	30
Size Composition of Live Trees (%)	Small (3-8 in)	Med (9-15 in)	Large (>15 in)
	40	30	30
No. of Suitable Snags	0	0	1

Standing dead trees with exfoliating bark, cracks, crevices, or hollows.
Snags without these characteristics area not considered suitable.

IS THERE HABITAT SUITABLE FOR INDIANA BATS? No
IS THE HABITAT SUITABLE FOR NORTHERN LONG-EARED BATS? No

Additional Comments:
The few isolated trees that comprise this assessment area do not support habitat suitable for Indiana bats or northern long-eared bats due to the proximity to Union Chapel Road. Only three trees excluding the smaller *Juniperus virginiana* comprise this assessment area. The shagbark hickory is not considered a good roost candidate due to its surroundings and higher quality habitats immediately adjacent to the north of Union Chapel Road.

Tree ID	Species	DBH (in)	Stage of Decay	Roost Features
49.1	*Carya ovata*	25	2	exfoliating bark, partially dead in top

Attach aerial photo or project site with all forested areas labeled and a general description of the habitat

Photographic Documentation: habitat shots at edge and interior from multiple locations; Understory/midstory/canopy; examples of potential suitable snags and live trees; water sources

PHASE 1 SUMMER HABITAT ASSESSMENTS

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Sample Site Description

Sample Site No.(s): HA-50
4/27/2022
The assessment area is a 0.33-acre corridor of trees along south side of Union Chapel Road and a hillslope between two agricultural fields.

Water Resources at Sample Site

Stream Type (# and length)	Ephemeral	Intermittent	Perennial	Describe existing condition of water sources: No waters in the assessment area. Buck Creek is approximately 0.09 mile to the northeast.
	N/A	N/A	N/A	
Pools/Ponds (# and size)	N/A	Open and accessible to bats		
		N/A		
Wetlands (approx. ac.)	Permanent	Seasonal		
	N/A	N/A		

Forest Resources at Sample Site

Closure/Density	Canopy (>50')	Midstory (20-50')	Understory (<20')
	2	5	3
Dominant Species of Mature Trees	*Prunus serotina, Acer saccharum, Ulmus sp., Sassafras albidum*		
% Trees w/ Exfoliating Bark	<1	0	0
Size Composition of Live Trees (%)	Small (3-8 in)	Med (9-15 in)	Large (>15 in)
	85	14	1
No. of Suitable Snags	1	0	0

Standing dead trees with exfoliating bark, cracks, crevices, or hollows.
Snags without these characteristics area not considered suitable.

IS THERE HABITAT SUITABLE FOR INDIANA BATS? Yes
IS THE HABITAT SUITABLE FOR NORTHERN LONG-EARED BATS? Yes

Additional Comments:
The assessment area, particularly between the fields, has foraging potential but very limited roosting habitat for the Indiana bat and northern long-eared bat. Dense honeysuckle cover along the edges of the field. The single *Acer negundo* snag has poor roost characteristics and setting. Additional species include *Celtis occidentalis, Diospyros virginiana, Juglans nigra, Juniperus virginiana, Ulmus sp., Sassafras albidum*, and *Carya sp.*

Tree ID	Species	DBH (in)	Stage of Decay	Roost Features
50.1	*Acer negundo*	7	3	exfoliating bark, cavities

Attach aerial photo or project site with all forested areas labeled and a general description of the habitat

Photographic Documentation: habitat shots at edge and interior from multiple locations; Understory/midstory/canopy; examples of potential suitable snags and live trees; water sources

PHASE 1 SUMMER HABITAT ASSESSMENTS

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Sample Site Description

Sample Site No.(s): HA-51
4/27/2022
The assessment area is a single tree within an old field surrounded by agricultural fields and adjacent to an old out building.

Water Resources at Sample Site

Stream Type (# and length)	Ephemeral	Intermittent	Perennial	Describe existing condition of water sources: No waters within the assessment area. Buck Creek is approximately 0.13 mile to the northeast on the opposite side of Union Chapel Road.
	N/A	N/A	N/A	
Pools/Ponds (# and size)	N/A	Open and accessible to bats		
		N/A		
Wetlands (approx. ac.)	Permanent	Seasonal		
	N/A	N/A		

Forest Resources at Sample Site

Closure/Density	Canopy (>50')	Midstory (20-50')	Understory (<20')
	1	0	0
Dominant Species of Mature Trees	*Sassafras albidum*		
% Trees w/ Exfoliating Bark	0	0	100
Size Composition of Live Trees (%)	Small (3-8 in)	Med (9-15 in)	Large (>15 in)
	0	0	100
No. of Suitable Snags	0	0	1

Standing dead trees with exfoliating bark, cracks, crevices, or hollows.
Snags without these characteristics area not considered suitable.

IS THERE HABITAT SUITABLE FOR INDIANA BATS? Yes
IS THE HABITAT SUITABLE FOR NORTHERN LONG-EARED BATS? Yes

Additional Comments:
The isolated tree in this agricultural setting has structural elements (cavities) that may be suitable for roosting by the Indiana bat or the northern long-eared bat. Although it is not likely being used in this capacity, it is located within proximity to quality habitat associated with Buck Creek and old dead snags in fields/pastures are sometimes used for roosting by these species.

Tree ID	Species	DBH (in)	Stage of Decay	Roost Features
51.1	*Sassafras albidum*	23.5	3	cavities

Attach aerial photo or project site with all forested areas labeled and a general description of the habitat

Photographic Documentation: habitat shots at edge and interior from multiple locations; Understory/midstory/canopy; examples of potential suitable snags and live trees; water sources

PHASE 1 SUMMER HABITAT ASSESSMENTS

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Sample Site Description

Sample Site No.(s): HA-52
4/27/2022
The assessment area is a 0.02-acre dry sinkhole (30 feet diameter) feature with a few trees in an agricultural field south of Union Chapel Road and in the vicinity of assessment site HA-51.

Water Resources at Sample Site

Stream Type (# and length)	Ephemeral	Intermittent	Perennial	Describe existing condition of water sources: No waters in the assessment area. Buck Creek is approximately 0.10 mile to the northeast.
	N/A	N/A	N/A	
Pools/Ponds (# and size)	N/A	Open and accessible to bats		
		N/A		
Wetlands (approx. ac.)	Permanent	Seasonal		
	N/A	N/A		

Forest Resources at Sample Site

Closure/Density	Canopy (>50')	Midstory (20-50')	Understory (<20')
	0	6	1
Dominant Species of Mature Trees	*Acer negundo, Acer saccharum*		
% Trees w/ Exfoliating Bark	0	0	0
Size Composition of Live Trees (%)	Small (3-8 in)	Med (9-15 in)	Large (>15 in)
	40	30	30
No. of Suitable Snags	0	0	0

Standing dead trees with exfoliating bark, cracks, crevices, or hollows.
Snags without these characteristics area not considered suitable.

IS THERE HABITAT SUITABLE FOR INDIANA BATS? No
IS THE HABITAT SUITABLE FOR NORTHERN LONG-EARED BATS? No

Additional Comments:
The assessment area lacks roosting and foraging habitat for the Indiana bat and northern long-eared bat. The single *Acer negundo* snag has poor roost characteristics and is not considered a viable roost. No additional species of trees observed.

Tree ID	Species	DBH (in)	Stage of Decay	Roost Features
52.1	*Acer negundo*	N/A	2	minor bark, but not good for roosting

Attach aerial photo or project site with all forested areas labeled and a general description of the habitat

Photographic Documentation: habitat shots at edge and interior from multiple locations; Understory/midstory/canopy; examples of potential suitable snags and live trees; water sources

PHASE 1 SUMMER HABITAT ASSESSMENTS

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Sample Site Description

Sample Site No.(s): HA-53
4/27/2022
The assessment area is a 0.03-acre area consisting of four trees in a row along the south side of Union Chapel Road. This small stand of trees is surrounded by agricultural field to the south of an 80-acre forest tract to the east. The assessment area is surrounded by agricultural fields and is across the road from a large mature forest associated with Buck Creek.

Water Resources at Sample Site

Stream Type (# and length)	Ephemeral	Intermittent	Perennial	Describe existing condition of water sources: No waters within the assessment area. Buck Creek is approximately 0.05 mile to the northeast.
	N/A	N/A	N/A	
Pools/Ponds (# and size)	N/A	Open and accessible to bats		
		N/A		
Wetlands (approx. ac.)	Permanent	Seasonal		
	N/A	N/A		

Forest Resources at Sample Site

Closure/Density	Canopy (>50')	Midstory (20-50')	Understory (<20')
	5	2	0
Dominant Species of Mature Trees	*Liriodendron tulipifera, Acer saccharinum, Ulmus sp.*		
% Trees w/ Exfoliating Bark	0	0	0
Size Composition of Live Trees (%)	Small (3-8 in)	Med (9-15 in)	Large (>15 in)
	10	30	60
No. of Suitable Snags	0	0	0

Standing dead trees with exfoliating bark, cracks, crevices, or hollows.
Snags without these characteristics area not considered suitable.

IS THERE HABITAT SUITABLE FOR INDIANA BATS? No
IS THE HABITAT SUITABLE FOR NORTHERN LONG-EARED BATS? No

Additional Comments:
The assessment site does not include habitat features favorable as roosting foraging habitat for the Indiana bat and the northern long-eared bat. Although this remnant strip of trees is immediately across the road from quality roost and foraging habitat associated with Buck Creek, this is not considered a contributing element to that habitat. There are no dead snags within this roadside strip of trees.

Attach aerial photo or project site with all forested areas labeled and a general description of the habitat

Photographic Documentation: habitat shots at edge and interior from multiple locations; Understory/midstory/canopy; examples of potential suitable snags and live trees; water sources

PHASE 1 SUMMER HABITAT ASSESSMENTS

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Sample Site Description

Sample Site No.(s): HA-54
4/29/2022
The assessment area is a 1.77-acre of a larger (greater than 10-acre) hillside and bottomland mature woods west of Union Chapel Road between two agricultural fields.

Water Resources at Sample Site

Stream Type (# and length)	Ephemeral	Intermittent	Perennial	Describe existing condition of water sources: The southern edge of the assessment area is along Buck Creek
	N/A	N/A	365 feet	
Pools/Ponds (# and size)	N/A	Open and accessible to bats		
		N/A		
Wetlands (approx. ac.)	Permanent	Seasonal		
	N/A	N/A		

Forest Resources at Sample Site

Closure/Density	Canopy (>50')	Midstory (20-50')	Understory (<20')
	6	4	1
Dominant Species of Mature Trees	*Acer saccharum, Quercus sp., Carya ovata*		
% Trees w/ Exfoliating Bark	0	1	2
Size Composition of Live Trees (%)	Small (3-8 in)	Med (9-15 in)	Large (>15 in)
	45	30	15
No. of Suitable Snags	0	1	4

Standing dead trees with exfoliating bark, cracks, crevices, or hollows.
Snags without these characteristics area not considered suitable.

IS THERE HABITAT SUITABLE FOR INDIANA BATS? Yes
IS THE HABITAT SUITABLE FOR NORTHERN LONG-EARED BATS? Yes

Additional Comments:
The assessment area has roosting and foraging habitat for the Indiana bat and northern long-eared bat. The open understory has few young saplings under 3 inches diameter. Additional species include *Platanus occidentalis, Juniperus virginiana, Liriodendron tulipifera, Sassafras albidum, Prunus serotina, Acer negundo, Diospyros virginiana,* and *Populus deltoides.* The area includes several dead snags with suitable roost features and at least three *Carya ovata*.

Tree ID	Species	DBH (in)	Stage of Decay	Roost Features
54.1	*Sassafras albidum*	18.5	2	minor exfoliating bark, dead limb w/ cavity
54.2	*Diospyros virginiana*	18.0	4	exfoliating bark, cavities
54.3	*Unknown*	12.0	5	no peeling bark or anomalies
54.4	*Carya ovata*	13.5	1	exfoliating bark
54.5	*Quercus sp.*	18.0	4	exfoliating bark
54.6	*Carya ovata*	16.0	1	exfoliating bark
54.7	*Carya ovata*	20.0	1	exfoliating bark
54.8	*Unknown*	16.5	5	no peeling bark or anomalies

Attach aerial photo or project site with all forested areas labeled and a general description of the habitat

Photographic Documentation: habitat shots at edge and interior from multiple locations; Understory/midstory/canopy; examples of potential suitable snags and live trees; water sources

PHASE 1 SUMMER HABITAT ASSESSMENTS

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Sample Site Description

Sample Site No.(s): HA-55
4/29/2022
The assessment area is a small 0.08-acre end of a narrow Buck Creek riparian corridor immediately east of the Union Chapel Road bridge, adjacent to an agricultural field to the north.

Water Resources at Sample Site

Stream Type (# and length)	Ephemeral	Intermittent	Perennial	Describe existing condition of water sources: The southern edge of the assessment area is along Buck Creek
	N/A	N/A	145 feet	
Pools/Ponds (# and size)	N/A	Open and accessible to bats		
		N/A		
Wetlands (approx. ac.)	Permanent	Seasonal		
	N/A	N/A		

Forest Resources at Sample Site

Closure/Density	Canopy (>50')	Midstory (20-50')	Understory (<20')
	0	1	6
Dominant Species of Mature Trees	*Platanus occidentalis, Acer negundo*		
% Trees w/ Exfoliating Bark	0	0	0
Size Composition of Live Trees (%)	Small (3-8 in)	Med (9-15 in)	Large (>15 in)
	95	5	0
No. of Suitable Snags	1	0	0

Standing dead trees with exfoliating bark, cracks, crevices, or hollows.
Snags without these characteristics area not considered suitable.

IS THERE HABITAT SUITABLE FOR INDIANA BATS? Yes, foraging/flyway
IS THE HABITAT SUITABLE FOR NORTHERN LONG-EARED BATS? Yes, foraging/flyway

Additional Comments:
The assessment area has is part of a larger riparian habitat that offers roosting and foraging potential for the Indiana bat and northern long-eared bat. Additional species include *Prunus serotina* and *Aesculus glabra*

Tree ID	Species	DBH (in)	Stage of Decay	Roost Features
55.1	*Unknown*	7	4	mostly clean of bark, limited potential

Attach aerial photo or project site with all forested areas labeled and a general description of the habitat

Photographic Documentation: habitat shots at edge and interior from multiple locations; Understory/midstory/canopy; examples of potential suitable snags and live trees; water sources

PHASE 1 SUMMER HABITAT ASSESSMENTS

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Sample Site Description

Sample Site No.(s): HA-56
5/6/2021
The assessment area is a 0.95-acre strip of mesic woodland remnant east of Union Chapel Road and surrounded by agricultural fields.

Water Resources at Sample Site

Stream Type (# and length)	Ephemeral	Intermittent	Perennial	Describe existing condition of water sources: No waters in the assessment area. Buck Creek is 0.03 mile to the north.
	N/A	N/A	N/A	
Pools/Ponds (# and size)	N/A	Open and accessible to bats		
		N/A		
Wetlands (approx. ac.)	Permanent	Seasonal		
	N/A	N/A		

Forest Resources at Sample Site

Closure/Density	Canopy (>50')	Midstory (20-50')	Understory (<20')
	4	4	4
Dominant Species of Mature Trees	Canopy: *Ulmus americana, Quercus alba* Mid-Story: *Acer negundo, Ulmus americana* Understory: *Acer negundo, Ulmus americana*		
% Trees w/ Exfoliating Bark	0	0	0
Size Composition of Live Trees (%)	Small (3-8 in)	Med (9-15 in)	Large (>15 in)
	20	70	10
No. of Suitable Snags	0	0	0

Standing dead trees with exfoliating bark, cracks, crevices, or hollows.
Snags without these characteristics area not considered suitable.

IS THERE HABITAT SUITABLE FOR INDIANA BATS? Yes, foraging
IS THE HABITAT SUITABLE FOR NORTHERN LONG-EARED BATS? Yes, foraging

Additional Comments:
The assessment area offers foraging potential for the Indiana bat and northern long-eared bat due to its proximity to Buck Creek. No potential roost trees were identified within the assessment area; however, a dead ash was identified which has potential for a roost as decay progresses and exfoliating bark develops

Attach aerial photo or project site with all forested areas labeled and a general description of the habitat

Photographic Documentation: habitat shots at edge and interior from multiple locations; Understory/midstory/canopy; examples of potential suitable snags and live trees; water sources

PHASE 1 SUMMER HABITAT ASSESSMENTS

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Sample Site Description

Sample Site No.(s): HA-57A
5/7/2021
The assessment area is a 3.74-acre area of a larger (>400-acre) tract of bottomland and upland forest east of Buck Creek with several logging road clearings in the floodplain.

Water Resources at Sample Site

Stream Type (# and length)	Ephemeral	Intermittent	Perennial	Describe existing condition of water sources: The wester edge of the assessment area is along Buck Creek
	N/A	N/A	425 feet	
Pools/Ponds (# and size)	N/A	Open and accessible to bats		
		N/A		
Wetlands (approx. ac.)	Permanent	Seasonal		
	N/A	N/A		

Forest Resources at Sample Site

Closure/Density	Canopy (>50')	Midstory (20-50')	Understory (<20')
	3	4	4
Dominant Species of Mature Trees	Canopy: *Juglans nigra, Platanus occidentalis, Acer negundo,* and *Ulmus americana* Mid-Story: *Aesculus glabra* and *Acer negundo* Understory: *Aesculus glabra,*		
% Trees w/ Exfoliating Bark	0	0	1
Size Composition of Live Trees (%)	Small (3-8 in)	Med (9-15 in)	Large (>15 in)
	20	40	40
No. of Suitable Snags	0	0	1

Standing dead trees with exfoliating bark, cracks, crevices, or hollows.
Snags without these characteristics area not considered suitable.

IS THERE HABITAT SUITABLE FOR INDIANA BATS? Yes
IS THE HABITAT SUITABLE FOR NORTHERN LONG-EARED BATS? Yes

Additional Comments:
The assessment area has habitat that offers roosting and foraging potential for the Indiana bat and northern long-eared bat. Ground cover is predominantly *Lindera benzoin* and *Lonicera sp.* The logging roads provide multiple foraging/flyway avenues. One potential roost was observed in the assessment area.

Tree ID	Species	DBH (in)	Stage of Decay	Roost Features
57A.1	*Ulmus Americana*	19.5	3	exfoliating bark, snag

Attach aerial photo or project site with all forested areas labeled and a general description of the habitat

Photographic Documentation: habitat shots at edge and interior from multiple locations; Understory/midstory/canopy; examples of potential suitable snags and live trees; water sources

PHASE 1 SUMMER HABITAT ASSESSMENTS

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Sample Site Description

Sample Site No.(s): HA-57B
5/7/2021
The assessment area is a 15.8-acre area of a larger (>400-acre) tract of mature upland forest east of Buck Creek. Several logging and gas well roads are present within the assessment area.

Water Resources at Sample Site

Stream Type (# and length)	Ephemeral	Intermittent	Perennial	Describe existing condition of water sources: No waters in the assessment area. Buck Creek is approximately 0.08-mile to the west.
	N/A	N/A	N/A	
Pools/Ponds (# and size)	N/A	Open and accessible to bats		
		N/A		
Wetlands (approx. ac.)	Permanent	Seasonal		
	N/A	N/A		

Forest Resources at Sample Site

Closure/Density	Canopy (>50')	Midstory (20-50')	Understory (<20')
	5	5	5
Dominant Species of Mature Trees	Canopy: *Carya ovata, Fraxinus sp., Quercus velutina, Quercus rubra, Fagus grandifolia, Pinus strobus, Acer saccharum* Mid-Story: *Juniperus virginiana, Fagus grandifloia, Aesculus glabra, Cornus florida* Understory: *Aesculus glabra, Cornus florida,*		
% Trees w/ Exfoliating Bark	0	1	3
Size Composition of Live Trees (%)	Small (3-8 in)	Med (9-15 in)	Large (>15 in)
	10	20	70
No. of Suitable Snags	0	1	3

Standing dead trees with exfoliating bark, cracks, crevices, or hollows.
Snags without these characteristics area not considered suitable.

IS THERE HABITAT SUITABLE FOR INDIANA BATS? Yes
IS THE HABITAT SUITABLE FOR NORTHERN LONG-EARED BATS? Yes

Additional Comments:
The assessment area has habitat that offers roosting and foraging potential for the Indiana bat and northern long-eared bat. Pockets of declining white pine and red cedar are present. The mid-story and understory are fairly cluttered in the western portion of the habitat assessment area, but thins out on the eastern side. Subcanopy and understory clutter may favor the northern long-eared bat. The logging/well roads provide multiple foraging/flyway avenues. One potential roost was observed in the assessment area. In addition to dead snags, shagbark hickories provide additional roost opportunities. Several other dead ash trees are in this area but have not yet developed exfoliating bark characteristics favorable for bat roosting.

Tree ID	Species	DBH (in)	Stage of Decay	Roost Features
57B.1	*Fraxinus sp.*	17.5	3/4	exfoliating bark
57B.2	*Fraxinus sp.*	17.0	3/4	exfoliating bark
57B.3	*Unknown*	12.0	6	exfoliating bark, cavities
57B.4	*Fraxinus sp.*	16.0	3/4	exfoliating bark

Attach aerial photo or project site with all forested areas labeled and a general description of the habitat

Photographic Documentation: habitat shots at edge and interior from multiple locations; Understory/midstory/canopy; examples of potential suitable snags and live trees; water sources

PHASE 1 SUMMER HABITAT ASSESSMENTS

Use additional sheets to assess discrete habitat types at multiple sites in a project area
Include a map depicting locations of sample sites if assessing discrete habitats at multiple sites in a project area
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Sample Site Description

Sample Site No.(s): HA-57C
5/7/2021
The assessment area is a 4.91-acre area of a larger (>400-acre) tract of mature upland forest east of Buck Creek on the sinkhole plain. This area is immediately adjacent to a gas well access road to the south.

Water Resources at Sample Site

Stream Type (# and length)	Ephemeral	Intermittent	Perennial	Describe existing condition of water sources: No waters in the assessment area. Two sinkhole ponds are 0.11-mile to the east and a small wetland is included in the woodland. Buck Creek is approximately 0.5 mile to the west.
	N/A	N/A	N/A	
Pools/Ponds (# and size)	N/A	Open and accessible to bats		
		N/A		
Wetlands (approx. ac.)	Permanent	Seasonal		
	N/A	0.10 acre		

Forest Resources at Sample Site

Closure/Density	Canopy (>50')	Midstory (20-50')	Understory (<20')
	4	5	3
Dominant Species of Mature Trees	Canopy: *Quercus montana, Quercus alba, Carya ovata, Liriodendron tulipifera* Mid-Story: *Fagus grandifolia, Juniperus virginiana, Cornus florida* Understory: *Acer saccharum, Fagus grandifolia*		
% Trees w/ Exfoliating Bark	1	1	5
Size Composition of Live Trees (%)	Small (3-8 in)	Med (9-15 in)	Large (>15 in)
	10	20	70
No. of Suitable Snags	0	0	0

Standing dead trees with exfoliating bark, cracks, crevices, or hollows.
Snags without these characteristics area not considered suitable.

IS THERE HABITAT SUITABLE FOR INDIANA BATS? Yes
IS THE HABITAT SUITABLE FOR NORTHERN LONG-EARED BATS? Yes

Additional Comments:
The assessment area has habitat that offers roosting and foraging potential for the Indiana bat and northern long-eared bat. There are no dead snags currently suitable for roosting in the area; however, *Carya ovata* trees (not mapped) provide potential roost opportunities. Several other dead ash trees are in this area but have not yet developed exfoliating bark characteristics favorable for bat roosting.

Attach aerial photo or project site with all forested areas labeled and a general description of the habitat

Photographic Documentation: habitat shots at edge and interior from multiple locations; Understory/midstory/canopy; examples of potential suitable snags and live trees; water sources

PHASE 1 SUMMER HABITAT ASSESSMENTS

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Sample Site Description

Sample Site No.(s): HA-57D
5/7/2021
The assessment area is a 2.32-acre area of a larger (>400-acre) tract of mature upland forest east of Buck Creek on the sinkhole plain. This area is immediately adjacent to a gas well access road to the north.

Water Resources at Sample Site

Stream Type (# and length)	Ephemeral	Intermittent	Perennial	Describe existing condition of water sources: No waters in the assessment area. Two sinkhole ponds are 0.06-mile to the north Buck Creek is approximately 0.5 mile to the west.
	N/A	N/A	N/A	
Pools/Ponds (# and size)	N/A	Open and accessible to bats		
		N/A		
Wetlands (approx. ac.)	Permanent	Seasonal		
	N/A	N/A		

Forest Resources at Sample Site

Closure/Density	Canopy (>50')	Midstory (20-50')	Understory (<20')
	4	5	3
Dominant Species of Mature Trees	Canopy: *Quercus montana, Quercus alba, Carya ovata, Liriodendron tulipifera* Mid-Story: *Fagus grandifolia, Juniperus virginiana, Cornus florida* Understory: *Acer saccharum, Fagus grandifolia*		
% Trees w/ Exfoliating Bark	1	1	5
Size Composition of Live Trees (%)	Small (3-8 in)	Med (9-15 in)	Large (>15 in)
	10	20	70
No. of Suitable Snags	0	0	0

Standing dead trees with exfoliating bark, cracks, crevices, or hollows.
Snags without these characteristics area not considered suitable.

IS THERE HABITAT SUITABLE FOR INDIANA BATS? Yes
IS THE HABITAT SUITABLE FOR NORTHERN LONG-EARED BATS? Yes

Additional Comments:
The assessment area has habitat that offers roosting and foraging potential for the Indiana bat and northern long-eared bat. There are no dead snags currently suitable for roosting in the area; however, *Carya ovata* trees (not mapped) provide potential roost opportunities. Several other dead ash trees are in this area but have not yet developed exfoliating bark characteristics favorable for bat roosting.

Tree ID	Species	DBH (in)	Stage of Decay	Roost Features
57D.1	*Ulmus Americana*	9.0	3	exfoliating bark
57D.2	*Sassafras albidum*	7.0	7	hollow snag, cavities
57D.3	*Sassafras albidum*	21.0	2	large hollow snag
57D.4	*Carya ovata*	24.0	1	exfoliating bark, large snag
57D.5	*Diospyros virginiana*	23.5	2	snag, cavities
57D.6	*Platanus occidentalis*	51.5	2	several large snags
57D.7	*Acer saccharum*	9.5	2	snag, cavities

Attach aerial photo or project site with all forested areas labeled and a general description of the habitat

Photographic Documentation: habitat shots at edge and interior from multiple locations; Understory/midstory/canopy; examples of potential suitable snags and live trees; water sources

PHASE 1 SUMMER HABITAT ASSESSMENTS

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Sample Site Description

Sample Site No.(s): HA-57E
5/7/2021
The assessment area is a 12.6-acre area of a larger (>400-acre) tract of mature upland forest east of Buck Creek on the sinkhole plain. Old cleared access roads along the bluff and down the steep slope are present.

Water Resources at Sample Site

Stream Type (# and length)	Ephemeral	Intermittent	Perennial	Describe existing condition of water sources: Two dry ephemeral streams are located within this assessment area. Buck Creek is along the western edge of the assessment area.
	83 feet 350 feet	N/A	450 feet	
Pools/Ponds (# and size)	N/A	Open and accessible to bats		
		N/A		
Wetlands (approx. ac.)	Permanent	Seasonal		
	N/A	N/A		

Forest Resources at Sample Site

Closure/Density	Canopy (>50')	Midstory (20-50')	Understory (<20')
	5	3	2
Dominant Species of Mature Trees	Canopy: *Acer saccharum, Fagus grandifolia, Carya ovata, Fraxinus sp.* Mid-Story: *Fagus grandifolia, Acer saccharum* Understory: *Fagus grandifolia, Acer saccharum, Cornus florida*		
% Trees w/ Exfoliating Bark	0	1	1
Size Composition of Live Trees (%)	Small (3-8 in)	Med (9-15 in)	Large (>15 in)
	10	20	70
No. of Suitable Snags	0	4	3

Standing dead trees with exfoliating bark, cracks, crevices, or hollows.
Snags without these characteristics area not considered suitable.

IS THERE HABITAT SUITABLE FOR INDIANA BATS? Yes
IS THE HABITAT SUITABLE FOR NORTHERN LONG-EARED BATS? Yes

Additional Comments:
The assessment area is a beech/maple forest in various states of maturity and has habitat that offers roosting and foraging potential for the Indiana bat and northern long-eared bat. The canopy is dense but the subcanopy and understory are relatively open and conducive to bat flight and foraging. The old logging/well roads also provide flight corridors. Six potential roosts were identified in the assessment area; however, several *Carya ovata* trees (not mapped) in the upper portion of the bluff area also provide potential roost opportunities. There are several other dead ash trees are in this area that have not yet developed exfoliating bark characteristics favorable for bat roosting.

Tree ID	Species	DBH (in)	Stage of Decay	Roost Features
57E.1	*Fraxinus sp.*	12.0	3	exfoliating bark, mostly at bottom
57E.2	*Fraxinus sp.*	13.0	3	exfoliating bark, limited to lower trunk
57E.3	*Fraxinus sp.*	11.5+9.0	3	exfoliating bark, limited to lower trunk
57E.4	*Platanus occidentalis*	N/A	2	exfoliating bark, minor
57E.5	*Fraxinus sp.*	9.5	3	exfoliating bark
57E.6	*Quercus velutina*	29.5	6	snags, cavities
57E.7	*Fraxinus sp.*	16.0	3	exfoliating bark

Attach aerial photo or project site with all forested areas labeled and a general description of the habitat

Photographic Documentation: habitat shots at edge and interior from multiple locations;
Understory/midstory/canopy; examples of potential suitable snags and live trees; water sources

PHASE 1 SUMMER HABITAT ASSESSMENTS

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Sample Site Description

Sample Site No.(s): HA-57F
5/7/2021
The assessment area is a 26.7-acre area of a larger (>400-acre) tract of mature upland forest east of Buck Creek on the sinkhole plain. An abandoned house is present in the eastern end of the assessment area. The area includes various karst features.

Water Resources at Sample Site

Stream Type (# and length)	Ephemeral	Intermittent	Perennial	Describe existing condition of water sources: The nearest wetland is an aquatic bed ponded wetland within the woods immediately to the south of the assessment area. Buck Creek is located approximately 0.06 mile south of the assessment area at its closest point.
	N/A	N/A	N/A	
Pools/Ponds (# and size)	N/A	Open and accessible to bats		
		N/A		
Wetlands (approx. ac.)	Permanent	Seasonal		
	N/A	N/A		

Forest Resources at Sample Site

Closure/Density	Canopy (>50')	Midstory (20-50')	Understory (<20')
	6	3	1
Dominant Species of Mature Trees	Canopy: *Acer saccharum, Fagus grandifolia,* Mid-Story: *Acer saccharum, Fagus grandifolia, Juniperus virginiana* Understory: *Acer saccharum, Fagus grandifolia*		
% Trees w/ Exfoliating Bark	0	1	1
Size Composition of Live Trees (%)	Small (3-8 in)	Med (9-15 in)	Large (>15 in)
	20	30	50
No. of Suitable Snags	1	0	1

Standing dead trees with exfoliating bark, cracks, crevices, or hollows.
Snags without these characteristics area not considered suitable.

IS THERE HABITAT SUITABLE FOR INDIANA BATS? Yes
IS THE HABITAT SUITABLE FOR NORTHERN LONG-EARED BATS? Yes

Additional Comments:
The assessment area is a beech/maple forest in various states of maturity and has habitat that offers roosting and foraging potential for the Indiana bat and northern long-eared bat based on the presence of nearby wetlands, flight corridors, forest maturity, open sub-canopy and understory Two potential roosts were identified in the assessment area; however, several *Carya ovata* trees (not mapped) in the area also provide potential roost opportunities. There are several other dead ash trees in this area that have not yet developed exfoliating bark characteristics favorable for bat roosting. The abandoned house within this assessment area provides roosting potential for the Indiana bat and northern long-eared bat.

Tree ID	Species	DBH (in)	Stage of Decay	Roost Features
57F.1	*Fraxinus sp.*	8.0	3	exfoliating bark
57F.2	*Unknown*	5.0	5	numerous holes, past use
57F.3	*Fraxinus*	10.0	3	no detached bark yet

Attach aerial photo or project site with all forested areas labeled and a general description of the habitat

Photographic Documentation: habitat shots at edge and interior from multiple locations; Understory/midstory/canopy; examples of potential suitable snags and live trees; water sources

PHASE 1 SUMMER HABITAT ASSESSMENTS

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Sample Site Description

Sample Site No.(s): HA-57G
5/5/2021
The assessment area is a 3.2-acre area of a larger (>400-acre) tract of mature upland forest on the steep riparian bluff slope east of Buck Creek. The extreme western portion of this assessment area could not be assessed due to the vertical slope of the outcrops and the flooded state of Buck Creek.

Water Resources at Sample Site

Stream Type (# and length)	Ephemeral	Intermittent	Perennial	Describe existing condition of water sources: Buck Creek is located along the western edge of the assessment area.
	N/A	N/A	407 feet	
Pools/Ponds (# and size)	N/A	Open and accessible to bats		
		N/A		
Wetlands (approx. ac.)	Permanent	Seasonal		
	N/A	N/A		

Forest Resources at Sample Site

Closure/Density	Canopy (>50')	Midstory (20-50')	Understory (<20')
	6	3	2
Dominant Species of Mature Trees	Canopy: *Quercus velutina, Acer saccharum* Mid-Story: *Fagus grandifolia* Understory: *Fagus grandifolia, Cornus florida*		
% Trees w/ Exfoliating Bark	1	1	1
Size Composition of Live Trees (%)	Small (3-8 in)	Med (9-15 in)	Large (>15 in)
	10	20	70
No. of Suitable Snags	3	5	5

Standing dead trees with exfoliating bark, cracks, crevices, or hollows.
Snags without these characteristics area not considered suitable.

IS THERE HABITAT SUITABLE FOR INDIANA BATS? Yes
IS THE HABITAT SUITABLE FOR NORTHERN LONG-EARED BATS? Yes

Additional Comments:
The assessment area is a beech/maple forest in various states of maturity and has high quality habitat that offers roosting and foraging potential for the Indiana bat and northern long-eared bat. Bluff slopes range from 45 degrees in the eastern portion to 60 degrees in the west along Buck Creek within the assessment area. The upper reaches of the bluff are more favorable for the northern long-eared bat. The open sub-canopy and understory provide quality flight corridor throughout the entire woods beyond the assessment area. Thirteen potential roosts were identified in the assessment area; however, several *Carya ovata* trees (not mapped) in the area also provide potential roost opportunities. There are several other dead ash trees in this area that have not yet developed exfoliating bark characteristics favorable for bat roosting.

Tree ID	Species	DBH (in)	Stage of Decay	Roost Features
57G.1	*Fagus grandifolia*	24.5	2	cavities
57G.2	*Sassafras albidum*	8.0	5	cavities, exfoliating bark
57G.3	*Sassafras albidum*	9.0	5	snag, exfoliating bark
57G.4	*Sassafras albidum*	8.0	5	snag, cavities
57G.5	*Fagus grandifolila*	17.5	2	cavities
57G.6	*Quercus alba*	18.5	7	snag, fissures, exfoliating bark
57G.7	*Quercus velutina*	31.0	2	main trunk is large snag
57G.8	*Quercus alba*	17.5	7	snag, cavities, exfoliating bark
57G.9	*Sassafras albidum*	13.0	2	cavities
57G.10	*Sassafras albidum*	8.0	4	cavities, exfoliating bark
57G.11	*Fraxinus sp.*	12.0	6	fissures, exfoliating bark
57G.12	*Fraxinus sp.*	14.0	5	cavities, exfoliating bark
57G.13	*Ulmus Americana*	9.0	5	exfoliating bark

Attach aerial photo or project site with all forested areas labeled and a general description of the habitat

Photographic Documentation: habitat shots at edge and interior from multiple locations;
Understory/midstory/canopy; examples of potential suitable snags and live trees; water sources

PHASE 1 SUMMER HABITAT ASSESSMENTS

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Sample Site Description

Sample Site No.(s): HA-57H
5/5/2021
The assessment area is a 5.1-acre area of a larger (>400-acre) tract of mature upland forest east of Buck Creek on the sinkhole plain. This woodland edge habitat is bordered by a fallow agricultural field to the east, a petroleum well and fallow field to the south, a fallow field to the west, and a large contiguous upland forest to the north.

Water Resources at Sample Site

Stream Type (# and length)	Ephemeral	Intermittent	Perennial	Describe existing condition of water sources: A small emergent wetland is within the assessment area and a larger 0.8 aquatic bed wetland is located immediately north. Buck Creek is approximately 0.15 mile west of the assessment area.
	N/A	N/A	N/A	
Pools/Ponds (# and size)	N/A	Open and accessible to bats		
		N/A		
Wetlands (approx. ac.)	Permanent	Seasonal		
	N/A	0.06		

Forest Resources at Sample Site

Closure/Density	Canopy (>50')	Midstory (20-50')	Understory (<20')
	4	5	3
Dominant Species of Mature Trees	Canopy: *Fraxinus sp.* Mid-Story: *Juniperus virginiana, Robinia psuedoacacia, Carya ovata* Understory: *Juniperus virginiana, Cercis canadensis*		
% Trees w/ Exfoliating Bark	1	5	10
Size Composition of Live Trees (%)	Small (3-8 in)	Med (9-15 in)	Large (>15 in)
	30	40	30
No. of Suitable Snags	1	13	10

Standing dead trees with exfoliating bark, cracks, crevices, or hollows.
Snags without these characteristics area not considered suitable.

IS THERE HABITAT SUITABLE FOR INDIANA BATS? Yes
IS THE HABITAT SUITABLE FOR NORTHERN LONG-EARED BATS? Yes

Additional Comments:
The assessment area is a mature forest with a high degree of mortality and provides high quality habitat that offers roosting and foraging potential for the Indiana bat and northern long-eared bat. The open sub-canopy and understory provide quality flight corridor throughout the entire woods beyond the assessment area. Once an ash dominant forest, the majority of trees in the canopy and sub-canopy are either dead or dying resulting in high roost potential. There are several other dead ash trees in this area that have not yet developed exfoliating bark characteristics favorable for bat roosting. Roosting opportunities are provided by cedar cavities, locust fissures, and peeling ash bark. Many of the mature ash have only recently died and are not yet suitable roosts, but have potential as decay progresses and exfoliating bark develops. Nineteen potential roosts were identified in the assessment area; however, several *Carya ovata* trees (not mapped) in the area also provide potential roost opportunities.

Tree ID	Species	DBH (in)	Stage of Decay	Roost Features
57H.1	*Robinia pseudoacacia*	15.0	4	fissures
57H.2	*Robinia pseudoacacia*	15.5	5	fissures
57H.3	*Robinia pseudoacacia*	18.0	4	fissures, cavities
57H.4	*Robinia psuedoacacia*	26.0	5	fissures
57H.5	*Fraxinus americana*	27.5	3	exfoliating bark
57H.6	*Fraxinus americana*	12.5	3	exfoliating bark
57H.7	*Fraxinus sp.*	6.5	4	exfoliating bark
57H.8	*Fraxinus sp.*	11.0	6	exfoliating bark
57H.9	*Fraxinus sp.*	14.5	3	exfoliating bark
57H.10	*Robinia pseudoacacia*	10.0	4	fissures
57H.11	*Robinia pseudoacacia*	17.5	4	fissures
57H.12	*Fraxinus sp.*	12.5	3	exfoliating bark
57H.13	*Fraxinus sp.*	10.5	6	exfoliating bark
57H.14	*Fraxinus americana*	21.0	3	exfoliating bark
57H.15	*Juniperus virginiana*	14.0	2	cavities

57H.16	*Fraxinus sp.*	17.5	6	cavities, exfoliating bark
57H.17	Unknown	16.5	5	fissures, cavities, exfoliating bark
57H.18	*Sassafras albidum*	12.0	5	cavities, exfoliating bark
57H.19	*Quercus sp.*	15.0	6	cavities, exfoliating bark

Attach aerial photo or project site with all forested areas labeled and a general description of the habitat

Photographic Documentation: habitat shots at edge and interior from multiple locations; Understory/midstory/canopy; examples of potential suitable snags and live trees; water sources

PHASE 1 SUMMER HABITAT ASSESSMENTS

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Sample Site Description

Sample Site No.(s): HA-57I
4/23/2021
The assessment area is a 0.39-acre area tree row extension to the south a large (>400-acre) tract of mature upland forest east of Buck Creek on the sinkhole plain.

Water Resources at Sample Site

Stream Type (# and length)	Ephemeral	Intermittent	Perennial	Describe existing condition of water sources: No waters in the assessment area. A 0.26-acre pond is approximately 0.09 mile east of the assessment area in an old field.
	N/A	N/A	N/A	
Pools/Ponds (# and size)	N/A	Open and accessible to bats		
		N/A		
Wetlands (approx. ac.)	Permanent	Seasonal		
	N/A	N/A		

Forest Resources at Sample Site

Closure/Density	Canopy (>50')	Midstory (20-50')	Understory (<20')
	3	5	6
Dominant Species of Mature Trees	Canopy: *Fraxinus sp., Platanus occidentalis, Juniperus virginiana* Mid-Story: *Juniperus virginiana* Understory: *Juniperus virginiana*		
% Trees w/ Exfoliating Bark	0	0	0
Size Composition of Live Trees (%)	Small (3-8 in)	Med (9-15 in)	Large (>15 in)
	40	40	20
No. of Suitable Snags	0	0	0

Standing dead trees with exfoliating bark, cracks, crevices, or hollows.
Snags without these characteristics area not considered suitable.

IS THERE HABITAT SUITABLE FOR INDIANA BATS? Yes, flight corridor only
IS THE HABITAT SUITABLE FOR NORTHERN LONG-EARED BATS? Yes, flight corridor only

Additional Comments:
The open sub-canopy and understory of the tree row corridor is potential foraging habitat for the Indiana bat and northern long-eared bat, but of poor quality. The tree row corridor may serve as a connector between the large contiguous forest to the north and a sinking stream and sinkhole pond to the east. The understory is choked with *Rosa multiflora* and *Lonicera japonica*. No potential roosts were identified in the assessment area.

Attach aerial photo or project site with all forested areas labeled and a general description of the habitat

Photographic Documentation: habitat shots at edge and interior from multiple locations; Understory/midstory/canopy; examples of potential suitable snags and live trees; water sources

PHASE 1 SUMMER HABITAT ASSESSMENTS

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Sample Site Description

Sample Site No.(s): HA-57J
4/23/2021
The assessment area is a 0.94-acre area tree row extension to the south a large (>400-acre) tract of mature upland forest east of Buck Creek on the sinkhole plain.

Water Resources at Sample Site

Stream Type (# and length)	Ephemeral	Intermittent	Perennial	Describe existing condition of water sources: No waters in the assessment area. A 0.26-acre pond is approximately 0.09 mile east of the assessment area in an old field.
	N/A	N/A	N/A	
Pools/Ponds (# and size)	N/A	Open and accessible to bats		
		N/A		
Wetlands (approx. ac.)	Permanent	Seasonal		
	N/A	N/A		

Forest Resources at Sample Site

Closure/Density	Canopy (>50')	Midstory (20-50')	Understory (<20')
	3	5	6
Dominant Species of Mature Trees	Canopy: *Fraxinus sp., Platanus occidentalis, Juniperus virginiana* Mid-Story: *Juniperus virginiana* Understory: *Juniperus virginiana*		
% Trees w/ Exfoliating Bark	0	0	0
Size Composition of Live Trees (%)	Small (3-8 in)	Med (9-15 in)	Large (>15 in)
	40	40	20
No. of Suitable Snags	0	0	0

Standing dead trees with exfoliating bark, cracks, crevices, or hollows.
Snags without these characteristics area not considered suitable.

IS THERE HABITAT SUITABLE FOR INDIANA BATS? Yes, flight corridor only
IS THE HABITAT SUITABLE FOR NORTHERN LONG-EARED BATS? Yes, flight corridor only

Additional Comments:
The open sub-canopy and understory of the tree row corridor is potential foraging habitat for the Indiana bat and northern long-eared bat, but of poor quality. The open sub-canopy and understory of the tree row corridor is potential foraging habitat for the Indiana bat and northern long-eared bat, but of poor quality. The tree row corridor may serve as a connector between the large contiguous forest to the north and a sinking stream and sinkhole pond to the east. The understory is choked with *Rosa multiflora* and *Lonicera japonica.* No potential roosts were identified in the assessment area.

Attach aerial photo or project site with all forested areas labeled and a general description of the habitat

Photographic Documentation: habitat shots at edge and interior from multiple locations; Understory/midstory/canopy; examples of potential suitable snags and live trees; water sources

PHASE 1 SUMMER HABITAT ASSESSMENTS

Use additional sheets to assess discrete habitat types at multiple sites in a project area
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Sample Site Description

Sample Site No.(s): HA-58
5/30/2022
The assessment area is a 0.03-acre cluster of trees adjacent to two sinkhole ponds north of a gravel gas well access road surrounded by agricultural fields.

Water Resources at Sample Site

Stream Type (# and length)	Ephemeral	Intermittent	Perennial	Describe existing condition of water sources: Two connected sinkhole ponds are located immediately north and east of the assessment area.
	N/A	N/A	N/A	
Pools/Ponds (# and size)	0.62	Open and accessible to bats		
		Yes		
Wetlands (approx. ac.)	Permanent	Seasonal		
	N/A	N/A		

Forest Resources at Sample Site

Closure/Density	Canopy (>50')	Midstory (20-50')	Understory (<20')
	2	1	1
Dominant Species of Mature Trees	*Quercus palustis, Carya ovata*		
% Trees w/ Exfoliating Bark	0	50	50
Size Composition of Live Trees (%)	Small (3-8 in)	Med (9-15 in)	Large (>15 in)
	20	50	30
No. of Suitable Snags	0	2	1

Standing dead trees with exfoliating bark, cracks, crevices, or hollows.
Snags without these characteristics area not considered suitable.

IS THERE HABITAT SUITABLE FOR INDIANA BATS? Yes
IS THE HABITAT SUITABLE FOR NORTHERN LONG-EARED BATS? Yes

Additional Comments:
This small cluster of trees has an open understory available for bat flight and foraging. Although isolated, the assessment area in only 0.04 mile from the large (<400 acre) contiguous forest to the south, west, and north. The three *Carya ovata* display exfoliating bark available for bat roosting.

Tree ID	Species	DBH (in)	Stage of Decay	Roost Features
58.1	*Carya ovata*	16	1	exfoliating bark
58.2	*Carya ovata`*	14	1	exfoliating bark
58.3	*Carya ovata*	9	1	exfoliating bark

Attach aerial photo or project site with all forested areas labeled and a general description of the habitat

Photographic Documentation: habitat shots at edge and interior from multiple locations; Understory/midstory/canopy; examples of potential suitable snags and live trees; water sources

PHASE 1 SUMMER HABITAT ASSESSMENTS

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Sample Site Description

Sample Site No.(s): HA-59
4/1/2022
The assessment area is a 0.1-acre strip of trees along the north side of a gravel gas well access road surrounded by agricultural fields and east of a sinking stream.

Water Resources at Sample Site

Stream Type (# and length)	Ephemeral	Intermittent	Perennial	Describe existing condition of water sources: No waters in assessment area. An intermittent sinking stream is located immediately west of the assessment area.
	N/A	N/A	N/A	
Pools/Ponds (# and size)	N/A	Open and accessible to bats		
		N/A		
Wetlands (approx. ac.)	Permanent	Seasonal		
	N/A	N/A		

Forest Resources at Sample Site

Closure/Density	Canopy (>50')	Midstory (20-50')	Understory (<20')
	1	6	2
Dominant Species of Mature Trees	*Prunus serotina, Celtis occidentalis, Juniperus virginiana*		
% Trees w/ Exfoliating Bark	0	0	0
Size Composition of Live Trees (%)	Small (3-8 in)	Med (9-15 in)	Large (>15 in)
	10	90	0
No. of Suitable Snags	0	0	0

Standing dead trees with exfoliating bark, cracks, crevices, or hollows.
Snags without these characteristics area not considered suitable.

IS THERE HABITAT SUITABLE FOR INDIANA BATS? No
IS THE HABITAT SUITABLE FOR NORTHERN LONG-EARED BATS? No

Additional Comments:
Bats are likely to forage along the adjacent sinking stream feature but not expected to utilize this small stand of relatively young trees. The adjacent sinking stream feature lacks riparian cover for approximately 250 feet downstream of the gravel road crossing. No suitable roost trees were identified within the assessment area.

Attach aerial photo or project site with all forested areas labeled and a general description of the habitat

Photographic Documentation: habitat shots at edge and interior from multiple locations;
Understory/midstory/canopy; examples of potential suitable snags and live trees; water sources

PHASE 1 SUMMER HABITAT ASSESSMENTS

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Sample Site Description

Sample Site No.(s): HA-60
4/23/2021
The assessment area is a 0.95-acre area of riparian cover along a sinking stream through an agricultural field between two gravel gas well access roads.

Water Resources at Sample Site

Stream Type (# and length)	Ephemeral	Intermittent	Perennial	Describe existing condition of water sources: No waters in the assessment area. A 0.26-acre pond is approximately 0.06 mile east of the assessment area in an old field.
	N/A	N/A	N/A	
Pools/Ponds (# and size)	N/A	Open and accessible to bats		
		N/A		
Wetlands (approx. ac.)	Permanent	Seasonal		
	N/A	N/A		

Forest Resources at Sample Site

Closure/Density	Canopy (>50')	Midstory (20-50')	Understory (<20')
	3	5	6
Dominant Species of Mature Trees	Canopy: *Fraxinus sp., Platanus occidentalis, Juniperus virginiana* Mid-Story: *Juniperus virginiana* Understory: *Juniperus virginiana*		
% Trees w/ Exfoliating Bark	0	0	0
Size Composition of Live Trees (%)	Small (3-8 in)	Med (9-15 in)	Large (>15 in)
	40	40	20
No. of Suitable Snags	0	0	0

Standing dead trees with exfoliating bark, cracks, crevices, or hollows.
Snags without these characteristics area not considered suitable.

IS THERE HABITAT SUITABLE FOR INDIANA BATS? Yes, flight corridor only
IS THE HABITAT SUITABLE FOR NORTHERN LONG-EARED BATS? Yes, flight corridor only

Additional Comments:
The open sub-canopy and understory of the riparian corridor is potential foraging habitat for the Indiana bat and northern long-eared bat, but of poor quality. The open sub-canopy and understory of the tree row corridor is potential foraging habitat for the Indiana bat and northern long-eared bat, but of poor quality. The tree row corridor is part of a larger fragmented riparian cover between two large tracts of woodland habitat. No potential roosts were identified in the assessment area.

Attach aerial photo or project site with all forested areas labeled and a general description of the habitat

Photographic Documentation: habitat shots at edge and interior from multiple locations; Understory/midstory/canopy; examples of potential suitable snags and live trees; water sources

PHASE 1 SUMMER HABITAT ASSESSMENTS

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Sample Site Description

Sample Site No.(s): HA-61
5/30/2022
The assessment area is a 0.15-acre narrow woodland fragment along the east side of a gravel gas well access road through large agricultural fields and fallow fields.

Water Resources at Sample Site

Stream Type (# and length)	Ephemeral	Intermittent	Perennial	Describe existing condition of water sources: No waters in the assessment area. An intermittent sinking stream is approximately 0.03 mile to the west.
	N/A	N/A	N/A	
Pools/Ponds (# and size)	N/A	Open and accessible to bats		
		N/A		
Wetlands (approx. ac.)	Permanent	Seasonal		
	N/A	N/A		

Forest Resources at Sample Site

Closure/Density	Canopy (>50')	Midstory (20-50')	Understory (<20')
	1	4	1
Dominant Species of Mature Trees	*Juglans nigra*		
% Trees w/ Exfoliating Bark	0	0	0
Size Composition of Live Trees (%)	Small (3-8 in)	Med (9-15 in)	Large (>15 in)
	0	60	40
No. of Suitable Snags	0	0	0

Standing dead trees with exfoliating bark, cracks, crevices, or hollows.
Snags without these characteristics area not considered suitable.

IS THERE HABITAT SUITABLE FOR INDIANA BATS? No
IS THE HABITAT SUITABLE FOR NORTHERN LONG-EARED BATS? No

Additional Comments:
Additional species include: *Juniperus virginiana* and *Fraxinus sp.* This single row of trees is isolated but only 0.03 mile from the sinking stream with connections to large tracts for upland forest. Foraging potential along this single row of trees is minimal.

Attach aerial photo or project site with all forested areas labeled and a general description of the habitat

Photographic Documentation: habitat shots at edge and interior from multiple locations; Understory/midstory/canopy; examples of potential suitable snags and live trees; water sources

PHASE 1 SUMMER HABITAT ASSESSMENTS

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Sample Site Description

Sample Site No.(s): HA-62
5/30/2022
The assessment area is a 0.02-acre cluster of four trees in a fallow field surrounded by agricultural fields east of a gravel gas well access road and south of a sinking stream.

Water Resources at Sample Site

Stream Type (# and length)	Ephemeral	Intermittent	Perennial	Describe existing condition of water sources: No waters in the assessment area. An intermittent sinking stream is approximately 0.01 mile to the north.
	N/A	N/A	N/A	
Pools/Ponds (# and size)	N/A	Open and accessible to bats		
		N/A		
Wetlands (approx. ac.)	Permanent	Seasonal		
	N/A	N/A		

Forest Resources at Sample Site

Closure/Density	Canopy (>50')	Midstory (20-50')	Understory (<20')
	0	3	0
Dominant Species of Mature Trees	*Juniperus virginiana*		
% Trees w/ Exfoliating Bark	0	0	0
Size Composition of Live Trees (%)	Small (3-8 in)	Med (9-15 in)	Large (>15 in)
	0	100	0
No. of Suitable Snags	0	0	0

Standing dead trees with exfoliating bark, cracks, crevices, or hollows.
Snags without these characteristics area not considered suitable.

IS THERE HABITAT SUITABLE FOR INDIANA BATS? No
IS THE HABITAT SUITABLE FOR NORTHERN LONG-EARED BATS? No

Additional Comments:
This area only includes four *Juniperus virginiana* trees greater than 3 inches in diameter. Smaller saplings included *Prunus serotina*. This single row of trees is isolated but only 0.01 mile from the sinking stream with connections to large tracts for upland forest. Foraging potential around this isolated tree stand is not likely.

Attach aerial photo or project site with all forested areas labeled and a general description of the habitat

Photographic Documentation: habitat shots at edge and interior from multiple locations; Understory/midstory/canopy; examples of potential suitable snags and live trees; water sources

PHASE 1 SUMMER HABITAT ASSESSMENTS

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Sample Site Description

Sample Site No.(s): HA-63
5/30/2022
The assessment area is a 1.95-acre upland tree row approximately 2,500 feet long that separates agricultural fields on the sinkhole plain west of a sinking stream.

Water Resources at Sample Site

Stream Type (# and length)	Ephemeral	Intermittent	Perennial	Describe existing condition of water sources: No waters in the assessment area. An intermittent sinking stream is immediately east of the eastern end of the tree row.
	N/A	N/A	N/A	
Pools/Ponds (# and size)	N/A	Open and accessible to bats		
		N/A		
Wetlands (approx. ac.)	Permanent	Seasonal		
	N/A	N/A		

Forest Resources at Sample Site

Closure/Density	Canopy (>50')	Midstory (20-50')	Understory (<20')
	6	5	2
Dominant Species of Mature Trees	*Liquidambar styraciflua, Juglans nigra, Sassafras albidum, Prunus serotina, Quercus rubra, Ulmus sp., Celtis occidentalis*		
% Trees w/ Exfoliating Bark	0	0	0
Size Composition of Live Trees (%)	Small (3-8 in)	Med (9-15 in)	Large (>15 in)
	20	65	15
No. of Suitable Snags	0	0	1

Standing dead trees with exfoliating bark, cracks, crevices, or hollows.
Snags without these characteristics area not considered suitable.

IS THERE HABITAT SUITABLE FOR INDIANA BATS? Yes, foraging only
IS THE HABITAT SUITABLE FOR NORTHERN LONG-EARED BATS? Yes, foraging only

Additional Comments:
The assessment area has several trees with damaged limbs but no quality roost potential. The understory of this narrow (approximately 30 feet wide) tree row corridor has a high degree of clutter from shrubs, limbs, and scattered seedlings in the understory. Understory is considerably less dense toward the east end. Additional species include *Acer saccaharum, Juniperus virginiana, Quercus rubra, Diospyros virginiana, Liriodendron tulipifera, Morus sp., Juglans nigra,* and *Acer rubra.* Foraging would be limited to along the outer edge of the woods along the agricultural fields. A single large *Liriodendron tulipifera* was the only tree observed with potential roosting features.

Tree ID	Species	DBH (in)	Stage of Decay	Roost Features
63.1	*Liriodendron tulipifera*	37	2	cavity in lower portion of trunk

Attach aerial photo or project site with all forested areas labeled and a general description of the habitat

Photographic Documentation: habitat shots at edge and interior from multiple locations;
Understory/midstory/canopy; examples of potential suitable snags and live trees; water sources

PHASE 1 SUMMER HABITAT ASSESSMENTS

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Sample Site Description

Sample Site No.(s): HA-64
5/30/2022
The assessment area is a 0.05-acre riparian strip along a sinking stream reach bordered by pasture north of Melview Road.

Water Resources at Sample Site

Stream Type (# and length)	Ephemeral	Intermittent	Perennial	Describe existing condition of water sources: A shallow intermittent sinking stream flows through the pasture from a large woodland tract to the north. A 0.8-acre pond is approximately 0.09 mile to the southwest of the assessment area.
	N/A	100 feet	N/A	
Pools/Ponds (# and size)	N/A	Open and accessible to bats		
		N/A		
Wetlands (approx. ac.)	Permanent	Seasonal		
	N/A	N/A		

Forest Resources at Sample Site

Closure/Density	Canopy (>50')	Midstory (20-50')	Understory (<20')
	2	3	0
Dominant Species of Mature Trees	*Populus deltoides, Salix nigra*		
% Trees w/ Exfoliating Bark	0	0	0
Size Composition of Live Trees (%)	Small (3-8 in)	Med (9-15 in)	Large (>15 in)
	85	0	15
No. of Suitable Snags	0	0	0

Standing dead trees with exfoliating bark, cracks, crevices, or hollows.
Snags without these characteristics area not considered suitable.

IS THERE HABITAT SUITABLE FOR INDIANA BATS? Yes, foraging
IS THE HABITAT SUITABLE FOR NORTHERN LONG-EARED BATS? Yes, foraging

Additional Comments:
The assessment area includes just a few scattered trees along this stream reach but is more heavily vegetated downstream to the southwest. Although a defined canopy confined flyway does not exist, this stream reach may still be used by foraging bats moving from northern woodland areas to woodland areas to the southwest associated with Buck Creek. Additional species include *Fraxinus sp.,* and *Maculra pomifera.* There are no dead snag trees on this property that display characteristics suitable for roosting.

Attach aerial photo or project site with all forested areas labeled and a general description of the habitat

Photographic Documentation: habitat shots at edge and interior from multiple locations; Understory/midstory/canopy; examples of potential suitable snags and live trees; water sources

PHASE 1 SUMMER HABITAT ASSESSMENTS

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Sample Site Description

Sample Site No.(s): HA-65
5/30/2022
The assessment area is a 0.36-acre portion of a 0.73-acre riparian woods fragment along a sinking stream reach bordered by agricultural fields to the west and a utility easement to the east.

Water Resources at Sample Site

Stream Type (# and length)	Ephemeral	Intermittent	Perennial	Describe existing condition of water sources: A shallow intermittent sinking stream flows through this woodland tract. A small cattail/willow wetland is present within the channel immediately to the south. A 0.8-acre pond is approximately 0.1 mile to the southwest of the assessment area.
	N/A	100 feet	N/A	
Pools/Ponds (# and size)	N/A	Open and accessible to bats		
		N/A		
Wetlands (approx. ac.)	Permanent	Seasonal		
	<0.1	N/A		

Forest Resources at Sample Site

Closure/Density	Canopy (>50')	Midstory (20-50')	Understory (<20')
	1	5	3
Dominant Species of Mature Trees	*Salix nigra, Acer saccharum, Platanus occidentalis, Prunus serotina*		
% Trees w/ Exfoliating Bark	0	0	0
Size Composition of Live Trees (%)	Small (3-8 in)	Med (9-15 in)	Large (>15 in)
	70	25	5
No. of Suitable Snags	0	0	1

Standing dead trees with exfoliating bark, cracks, crevices, or hollows.
Snags without these characteristics area not considered suitable.

IS THERE HABITAT SUITABLE FOR INDIANA BATS? Yes
IS THE HABITAT SUITABLE FOR NORTHERN LONG-EARED BATS? Yes

Additional Comments:
The assessment area has habitat suitable for the Indiana bat and northern long-eared bat. The riparian areas are relatively cluttered; however, the stream channel presents a viable foraging flyway for bats. Additional species include *Catalpa speciosa, Juniperus virginiana,* and *Robinia pseudoacacia.* The single dead snag within the assessment area provides a possible bat roost.

Tree ID	Species	DBH (in)	Stage of Decay	Roost Features
65.1	*Populus deltoides*	36	5	large hollow cavity in lower truck

Attach aerial photo or project site with all forested areas labeled and a general description of the habitat

Photographic Documentation: habitat shots at edge and interior from multiple locations;
Understory/midstory/canopy; examples of potential suitable snags and live trees; water sources

PHASE 1 SUMMER HABITAT ASSESSMENTS

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Sample Site Description

Sample Site No.(s): HA-66
5/30/2022
The assessment area is the 0.03 acre tip of a larger (<10-acre) contiguous woodland tract to the north. The area is bordered by agricultural fields to the east and a utility easement to the west.

Water Resources at Sample Site

Stream Type (# and length)	Ephemeral	Intermittent	Perennial	Describe existing condition of water sources: A shallow intermittent sinking stream flows through this woodland tract immediately to the north of the assessment area tip. A 0.8-acre pond is approximately 0.1 mile to the southwest of the assessment area.
	N/A	N/A	N/A	
Pools/Ponds (# and size)	N/A	Open and accessible to bats		
		N/A		
Wetlands (approx. ac.)	Permanent	Seasonal		
	N/A	N/A		

Forest Resources at Sample Site

Closure/Density	Canopy (>50')	Midstory (20-50')	Understory (<20')
	4	5	1
Dominant Species of Mature Trees	*Acer saccharum, Prunus serotina, Fagus grandifolia*		
% Trees w/ Exfoliating Bark	0	0	0
Size Composition of Live Trees (%)	Small (3-8 in)	Med (9-15 in)	Large (>15 in)
	70	20	10
No. of Suitable Snags	0	0	0

Standing dead trees with exfoliating bark, cracks, crevices, or hollows.
Snags without these characteristics area not considered suitable.

IS THERE HABITAT SUITABLE FOR INDIANA BATS? Yes
IS THE HABITAT SUITABLE FOR NORTHERN LONG-EARED BATS? Yes

Additional Comments:
The assessment area has habitat suitable for the Indiana bat and northern long-eared bat foraging along the woodland edge. The woodland and riparian corridor within the woods to the north likely contains habitat suitable for roosting. The understory is relatively uncluttered and accessible for flight under the canopy. Additional species include *Catalpa speciosa* and *Juglans nigra.* There are no dead snags or other trees within this small portion of the woods suitable for roosting.

Attach aerial photo or project site with all forested areas labeled and a general description of the habitat

Photographic Documentation: habitat shots at edge and interior from multiple locations; Understory/midstory/canopy; examples of potential suitable snags and live trees; water sources

PHASE 1 SUMMER HABITAT ASSESSMENTS

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Sample Site Description

Sample Site No.(s): HA-67
5/30/2022
The assessment area is a small 0.06-acre cluster of 12 trees in a rural residential setting within a driveway loop along the south side of Melview Road. Agricultural fields occur to the north and a 10-acre isolated wood lot is located to the east and south.

Water Resources at Sample Site

Stream Type (# and length)	Ephemeral	Intermittent	Perennial	Describe existing condition of water sources: No waters in the assessment area. A 0.4-acre pond is 0.1 mile to the south.
	N/A	N/A	N/A	
Pools/Ponds (# and size)	N/A	Open and accessible to bats		
		N/A		
Wetlands (approx. ac.)	Permanent	Seasonal		
	N/A	N/A		

Forest Resources at Sample Site

Closure/Density	Canopy (>50')	Midstory (20-50')	Understory (<20')
	3	4	0
Dominant Species of Mature Trees	*Quercus rubra, Carya ovata*		
% Trees w/ Exfoliating Bark	10	0	0
Size Composition of Live Trees (%)	Small (3-8 in)	Med (9-15 in)	Large (>15 in)
	10	70	30
No. of Suitable Snags	0	0	1

Standing dead trees with exfoliating bark, cracks, crevices, or hollows.
Snags without these characteristics area not considered suitable.

IS THERE HABITAT SUITABLE FOR INDIANA BATS? No
IS THE HABITAT SUITABLE FOR NORTHERN LONG-EARED BATS? No

Additional Comments:
The assessment area includes 12 trees in a residential setting where the understory is regularly mowed. Additional species include *Liquidambar styraciflua, Fraxinus sp., Fagus grandifolia,* and *Quercus palustris.* A single large *Carya ovata* represents the only tree observed with potential roosting features; however, due to the residential setting immediately along the roadway, potential use of this feature as a roost is low.

Tree ID	Species	DBH (in)	Stage of Decay	Roost Features
67.1	*Carya ovata*	15	1	exfoliating bark

Attach aerial photo or project site with all forested areas labeled and a general description of the habitat

Photographic Documentation: habitat shots at edge and interior from multiple locations; Understory/midstory/canopy; examples of potential suitable snags and live trees; water sources

PHASE 1 SUMMER HABITAT ASSESSMENTS

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Sample Site Description

Sample Site No.(s): HA-68
5/30/2022
The assessment area is two areas totaling 1.36 acres of a 10-acre isolated wood lot located south and east of Melview Road. Agricultural fields surround the forest and a single residential property is located along the northwestern edge.

Water Resources at Sample Site

Stream Type (# and length)	Ephemeral	Intermittent	Perennial	Describe existing condition of water sources: No waters in the assessment area. A 0.4-acre pond is immediately south of the western portion of the assessment area.
	N/A	N/A	N/A	
Pools/Ponds (# and size)	N/A	Open and accessible to bats		
		N/A		
Wetlands (approx. ac.)	Permanent	Seasonal		
	N/A	N/A		

Forest Resources at Sample Site

Closure/Density	Canopy (>50')	Midstory (20-50')	Understory (<20')
	5	6	4
Dominant Species of Mature Trees	*Fagus grandifolia, Acer saccharum, Liquidambar styraciflua, Quercus sp., Diospyros virginiana*		
% Trees w/ Exfoliating Bark	0	<1	<1
Size Composition of Live Trees (%)	Small (3-8 in)	Med (9-15 in)	Large (>15 in)
	38	55	7
No. of Suitable Snags	0	>5	>1

Standing dead trees with exfoliating bark, cracks, crevices, or hollows.
Snags without these characteristics area not considered suitable.

IS THERE HABITAT SUITABLE FOR INDIANA BATS? Yes
IS THE HABITAT SUITABLE FOR NORTHERN LONG-EARED BATS? Yes

Additional Comments:
The assessment area is presumed to represent the entire 10 acres of the isolated wood lot. There is a network of ATV trails through the woods that provide quality flight corridors for bats. Portions of the woods have moderate clutter with low branches, while other areas display a relatively open understory available for free flight under the canopy. Only one dead snag was suitable as a roost was observed; however, at least six Carya ovata within the assessment area may also serve as potential roosts. Additional species include *Fraxinus sp.*, *Prunus serotina*, *Celtis occidentalis*, and *Ulmus sp.* A single *Fraxinus sp.* but it is mostly clean of exfoliating bark and is considered to have low potential. Other high quality snag trees likely occur elsewhere in the wood lot beyond the assessment area limits.

Tree ID	Species	DBH (in)	Stage of Decay	Roost Features
68.1	*Fraxinus sp.*	15	2/3	exfoliating bark, but limited

Attach aerial photo or project site with all forested areas labeled and a general description of the habitat

Photographic Documentation: habitat shots at edge and interior from multiple locations; Understory/midstory/canopy; examples of potential suitable snags and live trees; water sources

PHASE 1 SUMMER HABITAT ASSESSMENTS

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Sample Site Description

Sample Site No.(s): HA-69
5/30/2022
The assessment area includes trees on a 0.66-acre residential farm property west of Melview Road surrounded by agricultural fields.

Water Resources at Sample Site

Stream Type (# and length)	Ephemeral	Intermittent	Perennial	Describe existing condition of water sources: No waters in the assessment area. A 0.4-acre pond is approximately 0.5 mile to the southwest of the assessment area.
	N/A	N/A	N/A	
Pools/Ponds (# and size)	N/A	Open and accessible to bats		
		N/A		
Wetlands (approx. ac.)	Permanent	Seasonal		
	N/A	N/A		

Forest Resources at Sample Site

Closure/Density	Canopy (>50')	Midstory (20-50')	Understory (<20')
	2	3	1
Dominant Species of Mature Trees	*Acer saccharum*		
% Trees w/ Exfoliating Bark	0	0	0
Size Composition of Live Trees (%)	Small (3-8 in)	Med (9-15 in)	Large (>15 in)
	10	50	40
No. of Suitable Snags	0	0	0

Standing dead trees with exfoliating bark, cracks, crevices, or hollows.
Snags without these characteristics area not considered suitable.

IS THERE HABITAT SUITABLE FOR INDIANA BATS? No
IS THE HABITAT SUITABLE FOR NORTHERN LONG-EARED BATS? No

Additional Comments:
The assessment area includes approximately 12 trees scattered throughout the property. The residential landscape is routinely mowed. Due to the isolated setting and residential disturbance, this area does not represent viable foraging habitat. Additional species include *Fraxinus sp., and Juniperus virginiana.* There are no dead snag trees on this property that display characteristics suitable for roosting.

Attach aerial photo or project site with all forested areas labeled and a general description of the habitat

Photographic Documentation: habitat shots at edge and interior from multiple locations; Understory/midstory/canopy; examples of potential suitable snags and live trees; water sources

PHASE 1 SUMMER HABITAT ASSESSMENTS

Use additional sheets to assess discrete habitat types at multiple sites in a project area
Include a map depicting locations of sample sites if assessing discrete habitats at multiple sites in a project area
A single sheet can be used for multiple sample sites if habitat is the same

Sample Site Description

Sample Site No.(s): HA-70
4/23/2021
The assessment area is the southern 5-acre portion of an isolated 10.8-acre tip woodland tract along the north side of Melview Road surrounded by agricultural fields and a petroleum storage facility to the west.

Water Resources at Sample Site

Stream Type (# and length)	Ephemeral	Intermittent	Perennial	Describe existing condition of water sources: No waters within the assessment area. A sinkhole pond is located approximately 0.3 mile to the east.
	N/A	N/A	N/A	
Pools/Ponds (# and size)	N/A	Open and accessible to bats		
		N/A		
Wetlands (approx. ac.)	Permanent	Seasonal		
	N/A	N/A		

Forest Resources at Sample Site

Closure/Density	Canopy (>50')	Midstory (20-50')	Understory (<20')
	1	3	4
Dominant Species of Mature Trees	Canopy: *Quercus alba, Carya ovata* Mid-Story: *Fagus granifolia, Cercis canadensis, Sasssafras albidum*		
% Trees w/ Exfoliating Bark	20	20	10
Size Composition of Live Trees (%)	Small (3-8 in)	Med (9-15 in)	Large (>15 in)
	30	30	40
No. of Suitable Snags	2	7	2

Standing dead trees with exfoliating bark, cracks, crevices, or hollows.
Snags without these characteristics area not considered suitable.

IS THERE HABITAT SUITABLE FOR INDIANA BATS? Yes
IS THE HABITAT SUITABLE FOR NORTHERN LONG-EARED BATS? Yes

Additional Comments:
The assessment area includes roost and foraging habitat suitable for the Indiana bat and northern long-eared bat despite its relative isolation from other larger forest tracts. Four potential roost trees are within the assessment area with additional potential roosts in the other northern half of the woods. Additionally, *Carya ovata* (not mapped) within the assessment area also provide roosting opportunities.

Tree ID	Species	DBH (in)	Stage of Decay	Roost Features
70.1	*Sassafras albidum*	8.5	2	large hollow snag
70.2	*Sassafras albidum*	12.5	6	hollow snag, cavities
70.3	*Unknown*	11.0	7	hollow, fissures
70.4	*Sassafras albidum*	14.0	5/6	cavities

Attach aerial photo or project site with all forested areas labeled and a general description of the habitat

Photographic Documentation: habitat shots at edge and interior from multiple locations;
Understory/midstory/canopy; examples of potential suitable snags and live trees; water sources

PHASE 1 SUMMER HABITAT ASSESSMENTS

Use additional sheets to assess discrete habitat types at multiple sites in a project area
Include a map depicting locations of sample sites if assessing discrete habitats at multiple sites in a project area
A single sheet can be used for multiple sample sites if habitat is the same

Sample Site Description

Sample Site No.(s): HA-71
4/23/2021
The assessment area is a small 0.5-acre isolated wood lot stand along the north side of Melview Road surrounded by agricultural fields and a gravel driveway to the east.

Water Resources at Sample Site

Stream Type (# and length)	Ephemeral	Intermittent	Perennial	Describe existing condition of water sources: A shallow ephemeral stream flows through the wood lot and under Melview Road. South of the road there is no riparian cover. A 0.8-acre pond is approximately 0.1 mile to the southwest of the assessment area.
	N/A	N/A	N/A	
Pools/Ponds (# and size)	N/A	Open and accessible to bats		
		N/A		
Wetlands (approx. ac.)	Permanent	Seasonal		
	N/A	N/A		

Forest Resources at Sample Site

Closure/Density	Canopy (>50')	Midstory (20-50')	Understory (<20')
	1	3	4
Dominant Species of Mature Trees	Canopy: *Platanus occidentalis, Fraxinus sp.* Mid-Story: *Fraxinus sp., Acer negundo* Understory: *Acer negundo*		
% Trees w/ Exfoliating Bark	0	0	0
Size Composition of Live Trees (%)	Small (3-8 in)	Med (9-15 in)	Large (>15 in)
	70	20	10
No. of Suitable Snags	0	0	0

Standing dead trees with exfoliating bark, cracks, crevices, or hollows.
Snags without these characteristics area not considered suitable.

IS THERE HABITAT SUITABLE FOR INDIANA BATS? No
IS THE HABITAT SUITABLE FOR NORTHERN LONG-EARED BATS? No

Additional Comments:
The assessment area has limited potential for Indiana bat and northern long-eared bat foraging and roosting habitat due to small size, isolated nature, lack of connection to other suitable habitat.

Attach aerial photo or project site with all forested areas labeled and a general description of the habitat

Photographic Documentation: habitat shots at edge and interior from multiple locations; Understory/midstory/canopy; examples of potential suitable snags and live trees; water sources

PHASE 1 SUMMER HABITAT ASSESSMENTS

Use additional sheets to assess discrete habitat types at multiple sites in a project area
Include a map depicting locations of sample sites if assessing discrete habitats at multiple sites in a project area
A single sheet can be used for multiple sample sites if habitat is the same

Sample Site Description

Sample Site No.(s): HA-72
5/30/2022
The assessment area is consists of three mature trees along the north edge of a residential property north of Melview Road and immediately west of Old Hwy 337. The assessment area is surrounded by agricultural fields.

Water Resources at Sample Site

Stream Type (# and length)	Ephemeral	Intermittent	Perennial	Describe existing condition of water sources: No waters at assessment site. A 0.8-acre pond is approximately 0.2 mile to the east of the assessment area.
	N/A	N/A	N/A	
Pools/Ponds (# and size)	N/A	Open and accessible to bats		
		N/A		
Wetlands (approx. ac.)	Permanent	Seasonal		
	N/A	N/A		

Forest Resources at Sample Site

Closure/Density	Canopy (>50')	Midstory (20-50')	Understory (<20')
	0	1	5
Dominant Species of Mature Trees	*Acer rubra, Liriodendron tulipiera, Populus deltoides*		
% Trees w/ Exfoliating Bark	0	0	0
Size Composition of Live Trees (%)	Small (3-8 in)	Med (9-15 in)	Large (>15 in)
	0	65	35
No. of Suitable Snags	0	0	1

Standing dead trees with exfoliating bark, cracks, crevices, or hollows.
Snags without these characteristics area not considered suitable.

IS THERE HABITAT SUITABLE FOR INDIANA BATS? No
IS THE HABITAT SUITABLE FOR NORTHERN LONG-EARED BATS? No

Additional Comments:
The assessment site does not include suitable roosting or foraging habitat for the Indiana bat or northern long-eared bat due to the isolation of the trees on the residential property from other suitable forest habitats in the area. A single large snag tree has a large cavity in the lower trunk but this is not considered to represent a viable roost because of the setting.

Tree ID	Species	DBH (in)	Stage of Decay	Roost Features
72.1	*Populus deltoides*	47	2	large hollow cavity in lower truck

Attach aerial photo or project site with all forested areas labeled and a general description of the habitat

Photographic Documentation: habitat shots at edge and interior from multiple locations; Understory/midstory/canopy; examples of potential suitable snags and live trees; water sources

PHASE 1 SUMMER HABITAT ASSESSMENTS

Use additional sheets to assess discrete habitat types at multiple sites in a project area
Include a map depicting locations of sample sites if assessing discrete habitats at multiple sites in a project area
A single sheet can be used for multiple sample sites if habitat is the same

Sample Site Description
Sample Site No.(s): HA-73 4/1/2022 The assessment area is a small 0.07-acre stand of planted trees on a residential (former business) in the northeast corner of SR 11 and Old Hwy 337. The site is surrounded by agricultural fields.

Water Resources at Sample Site				
Stream Type (# and length)	Ephemeral	Intermittent	Perennial	Describe existing condition of water sources: No waters at assessment site. A 0.8-acre pond is approximately 0.15 mile to the east of the assessment area.
	N/A	N/A	N/A	
Pools/Ponds (# and size)	N/A	Open and accessible to bats		
		N/A		
Wetlands (approx. ac.)	Permanent	Seasonal		
	N/A	N/A		

Forest Resources at Sample Site			
Closure/Density	Canopy (>50')	Midstory (20-50')	Understory (<20')
	0	1	6
Dominant Species of Mature Trees	*Acer rubrum, Picea sp.*		
% Trees w/ Exfoliating Bark	0	0	0
Size Composition of Live Trees (%)	Small (3-8 in)	Med (9-15 in)	Large (>15 in)
	100	0	0
No. of Suitable Snags	0	0	0

Standing dead trees with exfoliating bark, cracks, crevices, or hollows.
Snags without these characteristics area not considered suitable.

IS THERE HABITAT SUITABLE FOR INDIANA BATS? No
IS THE HABITAT SUITABLE FOR NORTHERN LONG-EARED BATS? No

Additional Comments:
The ornamental tree plantings in this assessment area do not provide roost or foraging habitat for the Indiana bat and northern long-eared bat.

Attach aerial photo or project site with all forested areas labeled and a general description of the habitat

Photographic Documentation: habitat shots at edge and interior from multiple locations;
Understory/midstory/canopy; examples of potential suitable snags and live trees; water sources

PHASE 1 SUMMER HABITAT ASSESSMENTS

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A single sheet can be used for multiple sample sites if habitat is the same

Sample Site Description

Sample Site No.(s): HA-74
4/1/2022
The assessment area is a small 0.24-acre strip of trees along the north side of SR 11 east of the Old Hwy 337 intersection. The site is surrounded by agricultural fields.

Water Resources at Sample Site

Stream Type (# and length)	Ephemeral	Intermittent	Perennial	Describe existing condition of water sources: No waters at assessment site. A 0.8-acre pond is immediately adjacent to the assessment area to the northeast.
	N/A	N/A	N/A	
Pools/Ponds (# and size)	N/A	Open and accessible to bats		
		N/A		
Wetlands (approx. ac.)	Permanent	Seasonal		
	N/A	N/A		

Forest Resources at Sample Site

Closure/Density	Canopy (>50')	Midstory (20-50')	Understory (<20')
	0	6	1
Dominant Species of Mature Trees	*Pinus virginiana, Acer sp., Juniperus virginiana*		
% Trees w/ Exfoliating Bark	0	0	0
Size Composition of Live Trees (%)	Small (3-8 in)	Med (9-15 in)	Large (>15 in)
	10	90	0
No. of Suitable Snags	0	0	0

Standing dead trees with exfoliating bark, cracks, crevices, or hollows.
Snags without these characteristics area not considered suitable.

IS THERE HABITAT SUITABLE FOR INDIANA BATS? No
IS THE HABITAT SUITABLE FOR NORTHERN LONG-EARED BATS? No

Additional Comments:
The assessment site includes approximately 50 planted pine trees along the right-of-way. Although a water source is immediately adjacent to the assessment site, the isolation and composition of this stand of trees is not suitable roosting or foraging habitat for the Indiana bat or northern long-eared bat.

Attach aerial photo or project site with all forested areas labeled and a general description of the habitat

Photographic Documentation: habitat shots at edge and interior from multiple locations; Understory/midstory/canopy; examples of potential suitable snags and live trees; water sources

PHASE 1 SUMMER HABITAT ASSESSMENTS

Use additional sheets to assess discrete habitat types at multiple sites in a project area
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A single sheet can be used for multiple sample sites if habitat is the same

Sample Site Description

Sample Site No.(s): HA-75
4/1/2022
The assessment area is a row of ornamental trees on residential property along the southern edge of SR 11 right-of-way immediately east of Old Hwy 337 intersection. The residential property is surrounded by agricultural fields.

Water Resources at Sample Site

Stream Type (# and length)	Ephemeral	Intermittent	Perennial	Describe existing condition of water sources: No waters at assessment site. A 0.8-acre pond is 0.1 mile to the northeast of assessment area.
	N/A	N/A	N/A	
Pools/Ponds (# and size)	N/A	Open and accessible to bats		
		N/A		
Wetlands (approx. ac.)	Permanent	Seasonal		
	N/A	N/A		

Forest Resources at Sample Site

Closure/Density	Canopy (>50')	Midstory (20-50')	Understory (<20')
	0	0	4
Dominant Species of Mature Trees	*Pyrus calleryana*		
% Trees w/ Exfoliating Bark	0	0	0
Size Composition of Live Trees (%)	Small (3-8 in)	Med (9-15 in)	Large (>15 in)
	100	0	0
No. of Suitable Snags	0	0	0

Standing dead trees with exfoliating bark, cracks, crevices, or hollows.
Snags without these characteristics area not considered suitable.

IS THERE HABITAT SUITABLE FOR INDIANA BATS? No
IS THE HABITAT SUITABLE FOR NORTHERN LONG-EARED BATS? No

Additional Comments:
The assessment site includes approximately 25 planted Bradford pear trees on a residential property along the SR 11 right-of-way. This collection of ornamental plantings does not provide any suitable roosting or foraging habitat for the Indiana bat or northern long-eared bat.

Attach aerial photo or project site with all forested areas labeled and a general description of the habitat

Photographic Documentation: habitat shots at edge and interior from multiple locations; Understory/midstory/canopy; examples of potential suitable snags and live trees; water sources

PHASE 1 SUMMER HABITAT ASSESSMENTS

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Include a map depicting locations of sample sites if assessing discrete habitats at multiple sites in a project area
A single sheet can be used for multiple sample sites if habitat is the same

Sample Site Description

Sample Site No.(s): HA-76
4/1/2022
The assessment area is a scattered collection of trees on a residential property east of Old Hwy 11 south of the SR 11 intersection. The residential property is bordered by a woodland fragment to the south and surrounded by agricultural fields elsewhere.

Water Resources at Sample Site

Stream Type (# and length)	Ephemeral	Intermittent	Perennial	Describe existing condition of water sources: No waters at assessment site. A sinkhole wetland is approximately 0.02 mile to the south of the assessment area in the adjacent woodland fragment.
	N/A	N/A	N/A	
Pools/Ponds (# and size)	N/A	Open and accessible to bats		
		N/A		
Wetlands (approx. ac.)	Permanent	Seasonal		
	N/A	N/A		

Forest Resources at Sample Site

Closure/Density	Canopy (>50')	Midstory (20-50')	Understory (<20')
	0	6	0
Dominant Species of Mature Trees	*Pinus strobus, Liriodendron tulipifera, Pyrus calleryana*		
% Trees w/ Exfoliating Bark	0	0	0
Size Composition of Live Trees (%)	Small (3-8 in)	Med (9-15 in)	Large (>15 in)
	0	30	70
No. of Suitable Snags	0	0	0

Standing dead trees with exfoliating bark, cracks, crevices, or hollows.
Snags without these characteristics area not considered suitable.

IS THERE HABITAT SUITABLE FOR INDIANA BATS? No
IS THE HABITAT SUITABLE FOR NORTHERN LONG-EARED BATS? No

Additional Comments:
The assessment site includes approximately 25 mature trees including planted *Pinus strobus and Pytus calleryana*. Additional species include *Acer saccarhum* and *Acer rubra*. This residential habitat lacks understory components and the ground cover is regularly mowed as a lawn. There are no dead snags within the residential property and the isolated setting of this landscape does not provide any suitable roosting or foraging habitat for the Indiana bat or northern long-eared bat.

Attach aerial photo or project site with all forested areas labeled and a general description of the habitat

Photographic Documentation: habitat shots at edge and interior from multiple locations; Understory/midstory/canopy; examples of potential suitable snags and live trees; water sources

PHASE 1 SUMMER HABITAT ASSESSMENTS

Use additional sheets to assess discrete habitat types at multiple sites in a project area
Include a map depicting locations of sample sites if assessing discrete habitats at multiple sites in a project area
A single sheet can be used for multiple sample sites if habitat is the same

Sample Site Description

Sample Site No.(s): HA-77
5/29/2022
The assessment area is a 0.5-acre portion of an 80-acre forest tract to the east. The assessment area is surrounded by agricultural fields and bordered by a residential property to the north.

Water Resources at Sample Site

Stream Type (# and length)	Ephemeral	Intermittent	Perennial	Describe existing condition of water sources: A small sinkhole wetland approximately 0.15-acre in size is within the southeast extent of the assessment area. A sinkhole pond is located approximately 0.15 mile to the east of the assessment area in the associated forest.
	N/A	N/A	N/A	
Pools/Ponds (# and size)	N/A	Open and accessible to bats		
		N/A		
Wetlands (approx. ac.)	Permanent	Seasonal		
	N/A	0.15		

Forest Resources at Sample Site

Closure/Density	Canopy (>50')	Midstory (20-50')	Understory (<20')
	4	6	2
Dominant Species of Mature Trees	*Liriodendron tulipifera, Prunus serotina, Juglans nigra, Sassafras albidum, Juniperus virginiana, Acer rubrum*		
% Trees w/ Exfoliating Bark	0	0	0
Size Composition of Live Trees (%)	Small (3-8 in)	Med (9-15 in)	Large (>15 in)
	93	7	<1
No. of Suitable Snags	0	0	0

Standing dead trees with exfoliating bark, cracks, crevices, or hollows.
Snags without these characteristics area not considered suitable.

IS THERE HABITAT SUITABLE FOR INDIANA BATS? Yes
IS THE HABITAT SUITABLE FOR NORTHERN LONG-EARED BATS? Yes

Additional Comments:
The assessment site has a direct connection to other larger tracts of forest and includes water resources favorable as foraging habitat for the Indiana bat and the northern long-eared bat. Additional species include *Acer saccarhum, Ulmus sp., Platanus occidentalis, Acer rubrum, and Liquidambar styraciflua.* There are no dead snags within the small area of the forest tract within the assessment area; however, suitable roost snags area most likely present within the larger forest tract to the east.

Attach aerial photo or project site with all forested areas labeled and a general description of the habitat

Photographic Documentation: habitat shots at edge and interior from multiple locations; Understory/midstory/canopy; examples of potential suitable snags and live trees; water sources

Appendix H

Habitat Area Photographs

Habitat Area HA-01 : Preferred Alternative 3 Corridor - 5/28/2022

Habitat Area HA-01 : Preferred Alternative 3 Corridor - 5/28/2022

Habitat Area HA-02 : Preferred Alternative 3 Corridor - 5/28/2022

Habitat Area HA-03 : Preferred Alternative 3 Corridor - 5/28/2022

Habitat Area HA-04 : Preferred Alternative 3 Corridor - 5/28/2022

Habitat Area HA-05 : Preferred Alternative 3 Corridor - 5/28/2022

Habitat Area HA-06 : Preferred Alternative 3 Corridor - 5/28/2022

Habitat Area HA-06 : Preferred Alternative 3 Corridor - 5/28/2022

Habitat Area HA-07 : Preferred Alternative 3 Corridor - 5/6/2021

Habitat Area HA-07 : Preferred Alternative 3 Corridor - 5/6/2021

Habitat Area HA-08 : Preferred Alternative 3 Corridor - 5/29/2022

Habitat Area HA-09 : Preferred Alternative 3 Corridor - 5/29/2022

Habitat Area HA-10 : Preferred Alternative 3 Corridor - 5/29/2022

Habitat Area HA-11 : Preferred Alternative 3 Corridor - 5/29/2022

Habitat Area HA-12 : Preferred Alternative 3 Corridor - 5/29/2022

Habitat Area HA-13 : Preferred Alternative 3 Corridor - 5/28/2022

Habitat Area HA-14 : Preferred Alternative 3 Corridor - 5/28/2022

Habitat Area HA-15 : Preferred Alternative 3 Corridor - 5/28/2022

Habitat Area HA-16 : Preferred Alternative 3 Corridor - 5/28/2022

Habitat Area HA-16 : Preferred Alternative 3 Corridor - 5/28/2022

Habitat Area HA-17 : Preferred Alternative 3 Corridor - 5/28/2022

Habitat Area HA-18 : Preferred Alternative 3 Corridor - 5/6/2021

Habitat Area HA-18 : Preferred Alternative 3 Corridor - 5/6/2021

Habitat Area HA-19 : Preferred Alternative 3 Corridor - 5/6/2021

Habitat Area HA-19 : Preferred Alternative 3 Corridor - 5/6/2021

Habitat Area HA-20 : Preferred Alternative 3 Corridor - 5/28/2022

Habitat Area HA-21 : Preferred Alternative 3 Corridor - 5/6/2021

Habitat Area HA-21 : Preferred Alternative 3 Corridor - 5/6/2021

Habitat Area HA-21 : Preferred Alternative 3 Corridor - 5/6/2021

Habitat Area HA-22 : Preferred Alternative 3 Corridor - 5/6/2021

Habitat Area HA-22 : Preferred Alternative 3 Corridor - 5/6/2021

Habitat Area HA-22 : Preferred Alternative 3 Corridor - 5/6/2021

Habitat Area HA-22 : Preferred Alternative 3 Corridor - 5/6/2021

Habitat Area HA-23 : Preferred Alternative 3 Corridor - 5/28/2022

Habitat Area HA-24 : Preferred Alternative 3 Corridor - 5/6/2021

Habitat Area HA-24 : Preferred Alternative 3 Corridor - 5/6/2021

Habitat Area HA-24 : Preferred Alternative 3 Corridor - 5/6/2021

Habitat Area HA-25 : Preferred Alternative 3 Corridor - 5/28/2022

Habitat Area HA-26 : Preferred Alternative 3 Corridor - 5/28/2022

Habitat Area HA-27 : Preferred Alternative 3 Corridor - 5/28/2022

Habitat Area HA-28 : Preferred Alternative 3 Corridor - 5/6/2021

Habitat Area HA-28 : Preferred Alternative 3 Corridor - 5/6/2021

Habitat Area HA-28 : Preferred Alternative 3 Corridor - 5/6/2021

Habitat Area HA-28 : Preferred Alternative 3 Corridor - 5/6/2021

Habitat Area HA-29 : Preferred Alternative 3 Corridor - 5/6/2021

Habitat Area HA-29 : Preferred Alternative 3 Corridor - 5/6/2021

Habitat Area HA-29 : Preferred Alternative 3 Corridor - 5/6/2021

Habitat Area HA-30 : Preferred Alternative 3 Corridor - 5/28/2022

Habitat Area HA-31 : Preferred Alternative 3 Corridor - 5/28/2022

Habitat Area HA-32 : Preferred Alternative 3 Corridor - 5/6/2021

Habitat Area HA-32 : Preferred Alternative 3 Corridor - 5/6/2021

Habitat Area HA-32 : Preferred Alternative 3 Corridor - 5/6/2021

Habitat Area HA-32 : Preferred Alternative 3 Corridor - 5/6/2021

Habitat Area HA-33 : Preferred Alternative 3 Corridor - 5/28/2022

Habitat Area HA-34 : Preferred Alternative 3 Corridor - 5/28/2022

Habitat Area HA-34 : Preferred Alternative 3 Corridor - 5/28/2022

Habitat Area HA-35 : Preferred Alternative 3 Corridor - 5/7/2021

Habitat Area HA-35 : Preferred Alternative 3 Corridor - 5/7/2021

Habitat Area HA-36 : Preferred Alternative 3 Corridor - 4/29/2022

Habitat Area HA-37 : Preferred Alternative 3 Corridor - 4/29/2022

Habitat Area HA-38 : Preferred Alternative 3 Corridor - 4/29/2022

Habitat Area HA-39 : Preferred Alternative 3 Corridor - 4/29/2022

Habitat Area HA-40 : Preferred Alternative 3 Corridor - 5/6/2021

Habitat Area HA-40 : Preferred Alternative 3 Corridor - 5/6/2021

Habitat Area HA-41 : Preferred Alternative 3 Corridor - 4/27/2022

Habitat Area HA-42 : Preferred Alternative 3 Corridor - 4/27/2022

Habitat Area HA-43 : Preferred Alternative 3 Corridor - 5/6/2021

Habitat Area HA-45 : Preferred Alternative 3 Corridor - 4/27/2022

Habitat Area HA-46 : Preferred Alternative 3 Corridor - 4/27/2022

Habitat Area HA-47A : Preferred Alternative 3 Corridor - 5/7/2021

Habitat Area HA-47B : Preferred Alternative 3 Corridor - 5/7/2021

Habitat Area HA-47B : Preferred Alternative 3 Corridor - 5/7/2021

Habitat Area HA-47C - 5/7/2021

Habitat Area HA-47C - 5/7/2021

Habitat Area HA-48A : Preferred Alternative 3 Corridor - 5/7/2021

Habitat Area HA-48B - 4/27/2022

Habitat Area HA-48B - 4/27/2022

Habitat Area HA-48C : Preferred Alternative 3 Corridor - 5/5/2021

Habitat Area HA-48C : Preferred Alternative 3 Corridor - 5/5/2021

Habitat Area HA-48C : Preferred Alternative 3 Corridor - 5/5/2021

Habitat Area HA-48C : Preferred Alternative 3 Corridor - 5/5/2021

Habitat Area HA-48C : Preferred Alternative 3 Corridor - 5/5/2021

Habitat Area HA-48C : Preferred Alternative 3 Corridor - 5/5/2021

Habitat Area HA-49 : Preferred Alternative 3 Corridor - 4/27/2022

Habitat Area HA-50 : Preferred Alternative 3 Corridor - 4/27/2022

Habitat Area HA-52 : Preferred Alternative 3 Corridor - 4/27/2022

Habitat Area HA-53 : Preferred Alternative 3 Corridor - 4/27/2022

Habitat Area HA-54 : Preferred Alternative 3 Corridor - 4/29/2022

Habitat Area HA-55 : Preferred Alternative 3 Corridor - 4/29/2022

Habitat Area HA-57A - 5/7/2021

Habitat Area HA-57A - 5/7/2021

Habitat Area HA-57A - 5/7/2021

Habitat Area HA-57B - 5/7/2021

Habitat Area HA-57B - 5/7/2021

Habitat Area HA-57B - 5/7/2021

Habitat Area HA-57D - 5/7/2021

Habitat Area HA-57D - 5/7/2021

Habitat Area HA-57E - 5/30/2022

Habitat Area HA-57E - 5/30/2022

Habitat Area HA-57E - 5/30/2022

Habitat Area HA-57E - 5/7/2021

Habitat Area HA-57E - 5/7/2021

Habitat Area HA-57F - 5/7/2021

Habitat Area HA-57F - 5/7/2021

Habitat Area HA-57F - 5/7/2021

Habitat Area HA-57F - 5/7/2021

Habitat Area HA-57F - 5/7/2021

Habitat Area HA-57F - 5/7/2021

Habitat Area HA-57F - 5/7/2021

Habitat Area HA-57H : Preferred Alternative 3 Corridor - 4/23/2021

Habitat Area HA-57H : Preferred Alternative 3 Corridor - 4/23/2021

Habitat Area HA-57H : Preferred Alternative 3 Corridor - 4/23/2021

Habitat Area HA-57H : Preferred Alternative 3 Corridor - 4/23/2021

Habitat Area HA-57H : Preferred Alternative 3 Corridor - 4/23/2021

Habitat Area HA-57H : Preferred Alternative 3 Corridor - 4/23/2021

Habitat Area HA-57H : Preferred Alternative 3 Corridor - 4/23/2021

Habitat Area HA-57H : Preferred Alternative 3 Corridor - 4/23/2021

Habitat Area HA-57H : Preferred Alternative 3 Corridor - 4/23/2021

Habitat Area HA-57H : Preferred Alternative 3 Corridor - 4/23/2021

Habitat Area HA-57I - 4/23/2021

Habitat Area HA-57J : Preferred Alternative 3 Corridor - 4/23/2021

Habitat Area HA-57J : Preferred Alternative 3 Corridor - 4/23/2021

Habitat Area HA-58 - 5/30/2022

Habitat Area HA-59 : Preferred Alternative 3 Corridor - 4/1/2022

Habitat Area HA-60 : Preferred Alternative 3 Corridor - 4/23/2021

Habitat Area HA-61 - 5/30/2022

Habitat Area HA-62 - 5/30/2022

Habitat Area HA-63 - 5/30/2022

Habitat Area HA-63 - 5/30/2022

Habitat Area HA-63 - 5/30/2022

Habitat Area HA-64 - 5/30/2022

Habitat Area HA-64 - 5/30/2022

Habitat Area HA-65 - 5/30/2022

Habitat Area HA-66 - 5/30/2022

Habitat Area HA-66 - 5/30/2022

Habitat Area HA-67 : Preferred Alternative 3 Corridor - 5/30/2022

Habitat Area HA-68 : Preferred Alternative 3 Corridor - 5/30/2022

Habitat Area HA-68 : Preferred Alternative 3 Corridor - 5/30/2022

Habitat Area HA-69 : Preferred Alternative 3 Corridor - 5/30/2022

Habitat Area HA-72 : Preferred Alternative 3 Corridor - 5/29/2022

Habitat Area HA-73 : Preferred Alternative 3 Corridor - 4/1/2022

Habitat Area HA-74 : Preferred Alternative 3 Corridor - 4/1/2022

Habitat Area HA-75 : Preferred Alternative 3 Corridor - 4/1/2022

Habitat Area HA-76 : Preferred Alternative 3 Corridor - 4/1/2022

Habitat Area HA-76 : Preferred Alternative 3 Corridor - 5/29/2022

Habitat Area HA-77 : Preferred Alternative 3 Corridor - 5/29/2022

Habitat Area HA-77 : Preferred Alternative 3 Corridor - 5/29/2022

Appendix I

Potential Roost Photographs

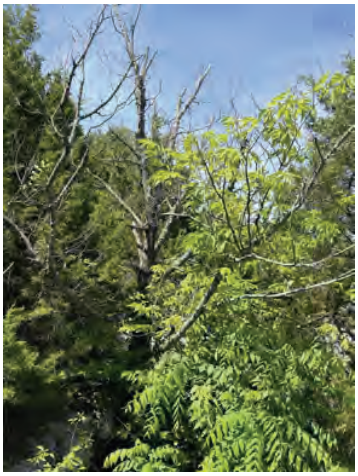
Habitat Area 1: Tree 1.1 - ash, 14-in dia., Stage 3, very few areas of detached bark - Alternative 3 Corridor 5/28/2022

Habitat Area 1: Tree 1.2 - sugar maple, 13-in dia., Stage 3, upper cavity - Alternative 3 Corridor 5/28/2022

Habitat Area 3: Tree 3.1 - ash, 13-in dia., Stage 3, very few areas of detached bark - Alternative 3 Corridor 5/28/2022

Habitat Area 3: Tree 3.2 - ash, 14-in dia., Stage 3, very few areas of detached bark - Alternative 3 Corridor 5/28/2022

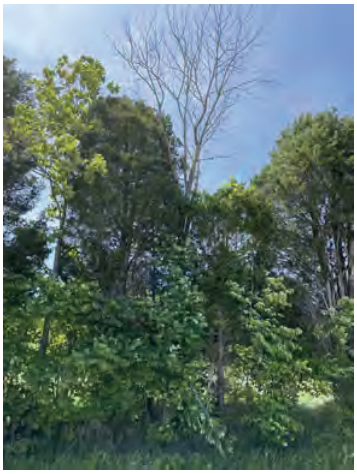
Habitat Area 9: Tree 9.1 - eastern cottonwood, 20-in dia., Stage 2, dead limbs, but no peeling bark of use - Alternative 3 Corridor 5/29/2022



Habitat Area 10: Tree 10.1 - hackberry, 9-in dia., Stage 3, only one small patch of pee bark - Alternative 3 Corridor 5/29/2022

Habitat Area 12: Tree 12.1 - ash, 7-in dia., Stage 3, loose bark but no peeling - Alternative 3 Corridor 5/29/2022

Habitat Area 12: Tree 12.2 - ash, 7-in dia., Stage 3, loose bark but no peeling - Alternative 3 Corridor 5/29/2022



Habitat Area 12: Tree 12.3 - ash, 9-in dia., Stage 3, loose bark but no peeling - Alternative 3 Corridor 5/29/2022

Habitat Area 12: Tree 12.4 - ash, 10-in dia., Stage 3, loose bark but no peeling - Alternative 3 Corridor 5/29/2022

Habitat Area 12: Tree 12.5 - ash, 9-in dia., Stage 3, loose bark but no peeling - Alternative 3 Corridor 5/29/2022

Habitat Area 21: Tree 21.1 - tulip poplar, 13-in dia., Stage 7, hollow snag, cavities - Alternative 3 Corridor 5/6/2021

Habitat Area 21: Tree 21.2 - sassafras, 8-in dia., Stage 7, cavities, fissures - Alternati 3 Corridor 5/6/2021

Habitat Area 21: Tree 21.3 - hickory, 19.5-in dia., Stage 7, exfoliating bark, cavities, snag - Alternative 3 Corridor 5/6/2021

Habitat Area 21: Tree 21.4 - sassafras, 9.5-in dia., Stage 6, hollow snag, cavities - Alternative 3 Corridor 5/6/2021

Habitat Area 21: Tree 21.5 - sassafras, 11-in dia., Stage 6, cavities, snag - Alternative Corridor 5/6/2021

Habitat Area 21: Tree 21.6 - unknown, 8.5-in dia., Stage 6, snag, cavities - Alternative Corridor 5/6/2021

Habitat Area 22: Tree 22.1 - red oak, 16-in dia., Stage 3, exfoliating bark - Alternative Corridor and Preliminary Right-of-Way 5/6/2021

Habitat Area 22: Tree 22.3 - oak, 27.5-in dia., Stage 6, cavities - Alternative 3 Corrido and Preliminary Right-of-Way 5/6/2021

Habitat Area 22: Tree 22.4 - black oak, 25-in dia., Stage 3, exfoliating bark, cavities, snag - Alternative 3 Corridor 5/6/2021

Habitat Area 22: Tree 22.5 - white oak, 14-in dia., Stage 6, cavities, fissure, exfoliating bark - Alternative 3 Corridor and Preliminary Right-of-Way 5/6/2021

Habitat Area 22: Tree 22.6 - black oak, 29-in dia., Stage 6, exfoliating bark, cavities - Alternative 3 Corridor and Preliminary Right-of-Way 5/6/2021

Habitat Area 24: Tree 24.1 - sassafras, 12.5-in dia., Stage 3, snag, cavities - Alternati 3 Corridor and Preliminary Right-of-Way 5/6/2021

Habitat Area 24: Tree 24.2 - black cherry, 15.5-in dia., Stage 2, snag, cavities - Alternative 3 Corridor 5/6/2021

Habitat Area 32: Tree 32.1 - black oak, 23.5-in dia., Stage 3, snag, exfoliating bark, cavities - Alternative 3 Corridor and Preliminary Right-of-Way 5/6/2021

Habitat Area 44: Tree 44.1 - white oak, 14-in dia., Stage 7, cavities - Alternative 3 Corridor and Preliminary Right-of-Way 5/6/2021

Habitat Area 44: Tree 44.2 - unknown, 12-in dia., Stage 7, hollow snag - Alternative 3 Corridor 5/6/2021

Habitat Area 45: Tree 45.1 - white oak, 12-in dia., Stage 3, exfoliating bark - Alternativ Corridor and Preliminary Right-of-Way 5/6/2021

Habitat Area 45: Tree 45.2 - shagbark hickory, 18-in dia., Stage 1, exfoliating bark - Alternative 3 Corridor 4/27/2022

Habitat Area 45: Tree 45.3 - shagbark hickory, 13.5-in dia., Stage 1, exfoliating bark - Alternative 3 Corridor 4/27/2022

Habitat Area 45: Tree 45.4 - shagbark hickory, 13.5-in dia., Stage 1, exfoliating bark - Alternative 3 Corridor and Preliminary Right-of-Way 4/27/2022

Habitat Area 45: Tree 45.5 - shagbark hickory, 11-in dia., Stage 1, exfoliating bark - Alternative 3 Corridor 4/27/2022

Habitat Area 45: Tree 45.6 - shagbark hickory, 13.5-in dia., Stage 1, exfoliating bark - Alternative 3 Corridor and Preliminary Right-of-Way 4/27/2022

Habitat Area 46: Tree 46.1 - sassafras, 7.5-in dia., Stage 2, exfoliating bark, minor cavities - Alternative 3 Corridor and Preliminary Right-of-Way 4/27/2022

Habitat Area 46: Tree 46.2 - unknown, 11-in dia., Stage 3, exfoliating bark - Alternativ Corridor and Preliminary Right-of-Way 4/27/2022

Habitat Area 46: Tree 46.3 - elm, 6.5-in dia., Stage 3, exfoliating bark - Alternative 3 Corridor and Preliminary Right-of-Way 4/27/2022

Habitat Area 46: Tree 46.4 - elm, 10-in dia., Stage 3, exfoliating bark - Alternative 3 Corridor and Preliminary Right-of-Way 4/27/2022

Habitat Area 46: Tree 46.5 - ash, 13-in dia., Stage 3, exfoliating bark - Alternative 3 Corridor and Preliminary Right-of-Way 4/27/2022

Habitat Area 47C: Tree 47C.1 - ash, 27.5-in dia., Stage 3/4, exfoliating bark, snag - 5/7/2021

Habitat Area 47C: Tree 47C.2 - ash, 19.5-in dia., Stage 3, exfoliating bark - 5/7/2021

Habitat Area 47C: Tree 47C.3 - red oak, 31 5-in dia., Stage 5/6, cavities, snag split ne base - 5/7/2021

Habitat Area 48A: Tree 48A.1 - ash, 15.5-in dia., Stage 3, exfoliating bark - Alternative Corridor 5/6/2021

Habitat Area 48A: Tree 48A.2 - black cherry, 24.5-in dia., Stage 2, large hollow snag, split - Alternative 3 Corridor and Preliminary Right-of-Way 5/6/2021

Habitat Area 48A: Tree 48A.4 - elm, 6.5-in dia., Stage 6, cavities, fissures - Alternative Corridor 5/6/2021

Habitat Area 48A: Tree 48A.5 - ash, 15-in dia., Stage 3, exfoliating bark - Alternative 3 Corridor and Preliminary Right-of-Way 5/6/2021

Habitat Area 48A: Tree 48A.6 - ash, 13.5-in dia., Stage 3, exfoliating bark, snag, cavities - Alternative 3 Corridor and Preliminary Right-of-Way 5/6/2021

Habitat Area 48A: Tree 48A.7 - white oak, 13.5-in dia., Stage 6, snag, cavities - Alternative 3 Corridor 5/6/2021

Habitat Area 48B: Tree 48B.1 - sycamore, 39.5-in dia., Stage 4, snag, cavities - 4/27/2022

Habitat Area 48B: Tree 48B.2 - sycamore, 36-in dia., Stage 4, cavities, crevices - 4/27/2022

Habitat Area 48B: Tree 48B.3 - sycamore, 18-in dia., Stage 5, exfoliating bark - 4/27/2022

Habitat Area 48C: Tree 48C.1 - red oak, 27.5-in dia., Stage 4/5, exfoliating bark, snag Alternative 3 Corridor 5/5/2021

Habitat Area 48C: Tree 48C.2 - red oak, 25.5-in dia., Stage 4/5, exfoliating bark, snag Alternative 3 Corridor 5/5/2021

Habitat Area 49: Tree 49.1 - shagbark hickory, 25-in dia., Stage 2, exfoliating bark, partially dead at top - Alternative 3 Corridor and Preliminary Right-of-Way 4/27/2022

Habitat Area 50: Tree 50.1 - ash-leaf maple, 7-in dia., Stage 3, exfoliating bark, partia dead at top - Alternative 3 Corridor and Preliminary Right-of-Way 4/27/2022

Habitat Area 51: Tree 51.1 - sassafras, 23.5-in dia., Stage 3, cavities - Alternative 3 Corridor 4/27/2022

Habitat Area 52: Tree 52.1 - ash-leaf maple, Stage 2, minor exfoliating bark, but not g for roosting - Alternative 3 Corridor 4/27/2022

Habitat Area 54: Tree 54.1 - sassafras, 18.5-in dia., Stage 2, cavities - Alternative 3 Corridor and Preliminary Right-of-Way 4/29/2022

Habitat Area 54: Tree 54.2 - persimmon, 18-in dia., Stage 4, cavities - Alternative 3 Corridor and Preliminary Right-of-Way 4/29/2022

Habitat Area 54: Tree 54.3 - unknown, 12-in dia., Stage 5, no peeling bark or anomali Alternative 3 Corridor and Preliminary Right-of-Way 4/29/2022

Habitat Area 54: Tree 54.4 - shagbark hickory, 13.5-in dia., Stage 1, exfoliating bark - Alternative 3 Corridor and Preliminary Right-of-Way 4/29/2022

Habitat Area 54: Tree 54.5 - oak, 18-in dia., Stage 4, exfoliating bark - Alternative 3 Corridor and Preliminary Right-of-Way 4/29/2022

Habitat Area 54: Tree 54.6 - shagbark hickory, 16-in dia., Stage 1, exfoliating bark - Alternative 3 Corridor and Preliminary Right-of-Way 4/29/2022

Habitat Area 54: Tree 54.7 - shagbark hickory, 20-in dia., Stage 1, exfoliating bark - Alternative 3 Corridor and Preliminary Right-of-Way 4/29/2022

Habitat Area 54: Tree 54.8 - unknown, 16.5-in dia., Stage 5, no peeling bark or anomalies - Alternative 3 Corridor 4/29/2022

Habitat Area 55: Tree 55.1 - unknown, 7-in dia., Stage 4, mostly clean some exfoliatin bark - Alternative 3 Corridor 4/29/2022

Habitat Area 57A: Tree 57A.1 - American elm, 19.5-in dia., Stage 3, exfoliating bark, snag - 5/7/2021

Habitat Area 57B: Tree 57B.1 - ash, 17.5-in dia., Stage 3/4, exfoliating bark - 5/7/202

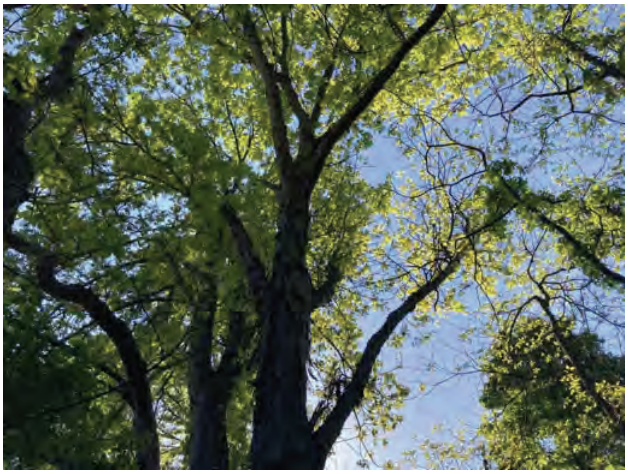
Habitat Area 57B: Tree 57B.2 - ash, 17 in dia., Stage 3/4, exfoliating bark - 5/7/2021

Habitat Area 57B: Tree 57B.3 - unknown, 12-in dia., Stage 6, exfoliating bark, cavities 5/7/2021

Habitat Area 57B: Tree 57B.4 - ash, 16 in dia., Stage 3/4, exfoliating bark - 5/7/2021

Habitat Area 57D: Tree 57D.1 - American elm, 9-in dia., Stage 3, exfoliating bark - 5/7/2021

Habitat Area 57D: Tree 57D.3 - sassafras, 21-in dia., Stage 2, large hollow snag - 5/7/2021



Habitat Area 57D: Tree 57D.4 - shagbark hickory, 24-in dia., Stage 1, large sheets of exfoliated bark large, snag - 5/7/2021

Habitat Area 57D: Tree 57D.5 - persimmon, 23.5-in dia., Stage 2, snag, cavities - 5/7/2021

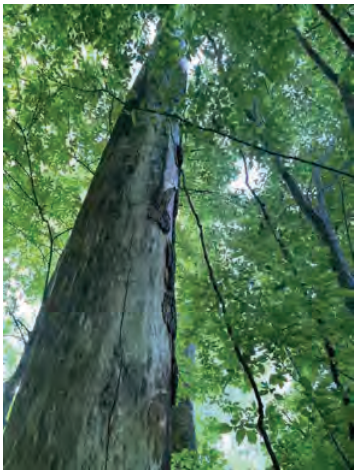
Habitat Area 57D: Tree 57D.6 - sycamore, 51.5-in dia., Stage 2, several large snags - 5/7/2021

Habitat Area 57D: Tree 57D.7 - sugar maple, 9.5-in dia., Stage 2, snag, cavities - 5/7/2021

Habitat Area 57E: Tree 57E.1 - ash, 12-in dia., Stage 3, limited peeling bark except at bottom of trunk - 5/30/2022

Habitat Area 57E: Tree 57E.2 - ash, 13-in dia., Stage 3, peeling bark limited to lower portion of trunk - 5/30/2022

Habitat Area 57E: Tree 57E.3 - ash, 11.5 + 9-in dia., Stage 3, detached bark only at bottom of trunk - 5/30/2022



Habitat Area 57F: Tree 57E.4 - sycamore, NA, Stage 2, exfoliating bark minor - 5/30/2022

Habitat Area 57E: Tree 57E.7 - ash, 16-in dia., Stage 3,exfoliating bark - 5/7/2021

Habitat Area 57F: Tree 57F.1 - ash, NA, Stage 3,exfoliating bark - 5/7/2021

Habitat Area 57F: Tree 57F 2 - unknown, 5-in dia., Stage 5, numerous holes, past use 5/30/2022

Habitat Area 57F: Tree 57F.3 - ash, 10-in dia., Stage 3, no detached bark yet - 5/30/2

Habitat Area 57G: Tree 57G.1 - American beech, 24.5-in dia., Stage 2, cavities - Alternative 3 Corridor and Preliminary Right-of-Way 5/5/2021

Habitat Area 57G: Tree 57G.3 - sassafras, 9-in dia., Stage 5, exfoliating bark, cavities Alternative 3 Corridor and Preliminary Right-of-Way 5/5/2021

Habitat Area 57G: Tree 57G.4 - sassafras, 8-in dia., Stage 5, exfoliating bark, cavities Alternative 3 Corridor and Preliminary Right-of-Way 5/5/2021

Habitat Area 57G: Tree 57G.5 - American beech, 17.5-in dia., Stage 2, cavities - Alternative 3 Corridor and Preliminary Right-of-Way 5/5/2021

Habitat Area 57G: Tree 57G.6 - white oak, 18 5-in dia., Stage 7, snag, exfoliating bark fissures - Alternative 3 Corridor and Preliminary Right-of-Way 5/5/2021

Habitat Area 57G: Tree 57G.7 - black oak, 31-in dia., Stage 2, snag, main trunk is gia snag, hollow living branches - Alternative 3 Corridor and Preliminary Right-of-Way 5/5/2021

Habitat Area 57G: Tree 57G.8 - white oak, 17.5-in dia., Stage 7, exfoliating bark, snag cavities - Alternative 3 Corridor and Preliminary Right-of-Way 5/5/2021

Habitat Area 57G: Tree 57G.9 - sassafras, 13-in dia., Stage 2, cavities - Alterna ive 3 Corridor and Preliminary Right-of-Way 5/5/2021

Habitat Area 57G: Tree 57G.10 - sassafras, 8-in dia., Stage 4, no detached bark yet - Alternative 3 Corridor and Preliminary Right-of-Way 5/5/2021

Habitat Area 57G: Tree 57G.11 - ash, 12-in dia., Stage 6, exfoliating bark - 5/5/2021

Habitat Area 57G: Tree 57G.12 - ash, 14-in dia., Stage 5, exfoliating bark, cavities - 5/5/2021

Habitat Area 57G: Tree 57G.13 - American elm, 9-in dia., Stage 5, exfoliating bark - 5/5/2021

Habitat Area 57H: Tree 57H.1 - black locust, 15-in dia., Stage 4, fissures - 4/22/2021

Habitat Area 57H: Tree 57H.2 - black locust, 15.5-in dia., Stage 5, fissures - Alternativ Corridor 4/22/2021

Habitat Area 57H: Tree 57H.3 - black locust, 18-in dia., Stage 4, fissures, cavities - Alternative 3 Corridor and Preliminary Right-of-Way 4/23/2021

Habitat Area 57H: Tree 57H.5 - white ash, 27.5-in dia., Stage 3, exfoliating bark - Alternative 3 Corridor and Preliminary Right-of-Way 4/23/2021

Habitat Area 57H: Tree 57H.6 - white ash, 12.5-in dia., Stage 3, exfoliating bark - Alternative 3 Corridor 4/23/2021

Habitat Area 57H: Tree 57H.7 - ash, 6.5-in dia., Stage 4, exfoliating bark - Alternative Corridor 4/23/2021

Habitat Area 57H: Tree 57H.8 - ash, 11-in dia., Stage 6, exfoliating bark - Alternative 3 Corridor 4/23/2021

Habitat Area 57H: Tree 57H.9 - ash, 14.5-in dia., Stage 3, exfoliating bark - Alternative Corridor 4/23/2021

Habitat Area 57H: Tree 57H.10 - black locust, 10-in dia., Stage 4, fissures - Alternativ Corridor 4/23/2021

Habitat Area 57H: Tree 57H.11 - black locust, 17.5-in dia., Stage 4, fissures - Alternat 3 Corridor and Preliminary Right-of-Way 4/23/2021

Habitat Area 57H: Tree 57H.12 - ash, 12.5-in dia., Stage 3, exfoliating bark - Alternati 3 Corridor 4/23/2021

Habitat Area 57H: Tree 57H.13 - ash, 10.5-in dia., Stage 6, exfoliating bark - Alternati 3 Corridor 4/23/2021

Habitat Area 57H: Tree 57H.14 - white ash, 21-in dia., Stage 3, exfoliating bark - Alternative 3 Corridor 4/23/2021

Habitat Area 57H: Tree 57H.15 - red cedar, 14-in dia., Stage 2, alive at top, deep cavities - Alternative 3 Corridor 4/23/2021

Habitat Area 57H: Tree 57H.16 - ash, 17.5-in dia., Stage 6, exfoliating bark, cavities - Alternative 3 Corridor 4/23/2021

Habitat Area 57H: Tree 57H.17 - unknown, 16.5-in dia., Stage 5, limited exfoliating ba fissure, cavities - Alternative 3 Corridor 4/23/2021

Habitat Area 57H: Tree 57H.18 - sassafras, 12-in dia., Stage 5, cavities, exfoliating ba Alternative 3 Corridor and Preliminary Right-of-Way 4/23/2021

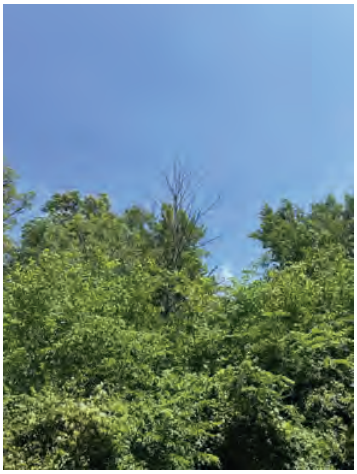
Habitat Area 57H: Tree 57H.19 - oak, 15-in dia., Stage 6, cavities, exfoliating bark - Alternative 3 Corridor and Preliminary Right-of-Way 4/23/2021

Habitat Area 58: Tree 58.2 - shagbark hickory, 14-in dia., Stage 1, exfoliating bark - 5/30/2022

Habitat Area 58: Tree 58.3 - shagbark hickory, 9-in dia., Stage 1, exfoliating bark - 5/30/2022

Habitat Area 65: Tree 65.1 - eastern cottonwood, 36-in dia., Stage 5, large hollow cav in lower operation of trunk - 5/30/2022

Habitat Area 67: Tree 67.1 - shagbark hickory, 15-in dia., Stage 1, exfoliating bark - Alternative 3 Corridor and Preliminary Right-of-Way 5/30/2022



Habitat Area 68: Tree 68.1 - ash, 15-in dia., Stage 2/3, exfoliating bark, but limited - Alternative 3 Corridor 5/30/2022

Habitat Area 70: Tree 70.1 - sassafras, 8.5-in dia., Stage 2, large hollow snag - 4/23/2021

Habitat Area 70: Tree 70.2 - sassafras, 8.5-in dia., Stage 2, large hollow snag - 4/23/2021

Habitat Area 70: Tree 70.3 - unknown, 11-in dia., Stage 7, large hollow snag - Alterna 3 Corridor 4/23/2021

Habitat Area 70: Tree 70.4 - sassafras, 14-in dia., Stage 6, large hollow snag - Alternative 3 Corridor 4/23/2021

Habitat Area 72: Tree 72.1 - sycamore, 17-in dia., Stage 5, large hollow cavity in lowe trunk - Alternative 3 Corridor 5/29/2022

Appendix J

[redacted] and [redacted] Photographs

[redacted] entrance - 4/29/2022

[redacted] crawl way from cave entrance - 4/29/2022

[redacted] entrance - 4/29/2022

Inside [redacted] entrance facing crawl way entrance - 4/29/2022

[redacted] crawl way at back of cave entrance - 4/29/2022

SR 11 Extension Project
SR 135 to SR 11 / Old Hwy 337
Indiana Bat, Northern Long-Eared Bat, and Gray Bat
Biological Assessment Addendum
Harrison County, Indiana

March 20, 2023

Prepared for:

Project No.: 120002401E
INDOT Des. No.: 2001154

Lochmueller Group, Inc.
6200 Vogel Road
Evansville, Indiana 47715
Phone: 812.479.6200

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SR 11 Extension Project
SR 135 to SR 11 / Old Hwy 337
Harrison County, Indiana
Des. No. 2001154

Indiana Department of Transportation
Federal Highway Administration

1 Background

A draft Biological Assessment (BA) for the SR 11 Extension Project was submitted to the U.S. Fish and Wildlife Service (USFWS) on August 12, 2022 for review. Comments received from the USFWS were addressed in a revised version of the BA dated November 15, 2022 and resubmitted to USFWS on November 15, 2023.

Subsequent to submittal of the November 15, 2022 BA, design engineers have made additional minor modifications to Preferred Alternative 3 and further refined the construction limits based on more detailed development of this alternative. As a result of the minor alignment shift and construction limit adjustments, tree clearing impacts anticipated for the proposed action identified in the BA also changed. On March 8, 2023, USFWS inquired as to if tree clearing estimates for utility relocations required for the new proposed roadway were included in the November 15, 2022 BA, and if so how much acreage was anticipated. Since design information on utility relocations was not available at the time of the forest impact assessment for the BA, potential tree clearing impacts for this associated activity were not included in the November 15, 2022 BA.

Given the aforementioned alignment changes resulting in Refined Preferred Alternative 3 (RPA 3) and the USFWS request for inclusion of utility relocation forest impact data, the purpose of this addendum is to provide updated tree clearing information for the SR 11 Extension Project based on reassessment of current construction limit boundaries and anticipated power/water utility relocations.

2 Forest Loss

Tree clearing estimates previously provided for Alternative 1, Alternative 2, and Preferred Alternative 3 were determined using a 20-foot buffer of the construction limits provided. The 20-foot buffer was used to calculate impacts due to the preliminary nature of the construction limits provided and to include additional contingency tree clearing for any future alternative development changes. Using this approach, the BA reported that Preferred Alternative 3 was expected to clear 19.91 acres of trees ranging from individual and small clusters of trees to portions of large tracts of forest. The BA also indicated that 17.42 acres of the 19.91 acres was considered suitable bat habitat (low, moderate, or high suitability), while the remaining 2.49 acres was not considered to be suitable.

The minor changes in alignment from Preferred Alternative 3 to RPA 3 are focused on the section along Union Chapel Road from Watson Road down into the Buck Creek floodplain. In general, the centerline was shifted slightly to the south from the Preferred Alternative 3 alignment that was assessed in the BA. Because additional design work was completed to better define the anticipated cut-and-fill boundaries for the construction limits, a 20-foot buffer was not used to calculate

anticipated forest impacts for the RPA 3. The reassessment of forest impacts for the RPA 3 yielded 17.14 acres of anticipated tree clearing. Of this, 15.39 acres is considered suitable bat habitat, while the remaining 1.75 aces is not.

There is currently an overhead power line along the south side of Watson Road that crosses Delmar Lane, then crosses Union Chapel Road and follows along the north side of Union Chapel Road through a cleared utility easement before crossing back to the south side of Union Chapel Road to provide electric service to a pole barn. It is anticipated that this utility line will be relocated entirely to the south side of Union Chapel Road east of Delmar Lane down to the pole barn. Much of the utility line relocation would not require tree clearing with the exception of an 840-foot long segment along the south side of the construction limits (additional 30-foot easement). Additional tree clearing for the power easement is estimated at approximately 0.58 acres. Specific utility relocation placement determined by the respective utility companies will not be determined until later in project development.

There is currently an underground waterline along the north side of Watson Road throughout the entire length of the road from SR 135 to Union Chapel Road. It is anticipated that the waterline would be shifted to the north and follow along the north side of the RPA 3 construction limits. To estimate the additional area of tree clearing anticipated for the waterline relocation, the right-of-way limits were buffered 10-foot to the north and all forest areas between the construction limits and the 10-foot right-of-way buffer were considered to provide sufficient space for the relocation. Additional minor strips of tree clearing from five tracts of forest totaled 1.47 acres.

Collectively, anticipated tree clearing for the RPA 3 construction limits, power line relocation, and waterline relocation is estimated at 19.19 acres. This estimate is still slightly less that the 19.91 total acres estimated in the November 15, 2022 BA. Suitable bat habitat tree clearing for RPA 3 is estimated at 17.39 acres, which is comparable to the 17.42 acres estimated for Preferred Alternative 3 in the November 15, 2022 BA. Figure 1 compares the bat habitat suitability for the three alternatives assessed in the November 15, 2022 BA to RPA 3 (no utilities) and total for RPA 3 with utility relocations. Addendum Map 1 illustrates the bat habitat suitability forest areas for RPA 3 including the tree clearing locations for the roadway, power line relocation, and waterline relocation.

3 Core Forest

A slight shift in the RPA 3 alignment and construction limit widening east of Buck Creek would result in slightly increased impacts to core forest acreage as defined in the November 15, 2022 BA. Core forest impacts associated with Preferred Alternative 3 and RPA 3 do not result from direct loss of core forest, but both alignments would result in indirect loss by redefining the southern edge of habitat area 57 (HA-57). Preferred Alternative 3 had a reported indirect loss of 0.56 acre. In comparison, RPA 3 would have in estimated indirect loss of 1.36 acres. Figure 2 summarizes the comparison for all alternatives.

Figure 1 Bat Forest habitat impact summary for Tier 2 alternatives and RPA 3

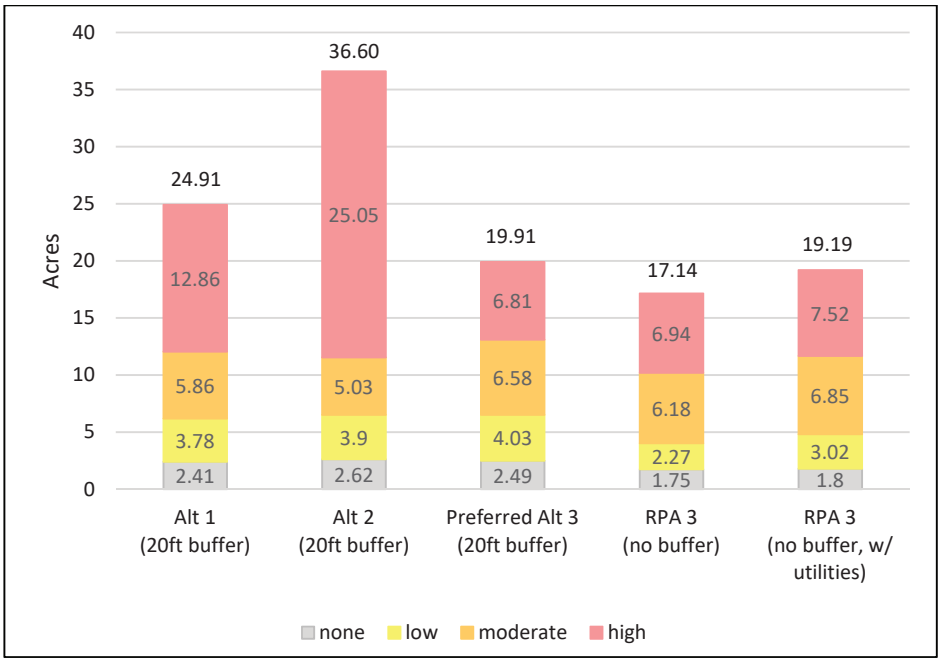
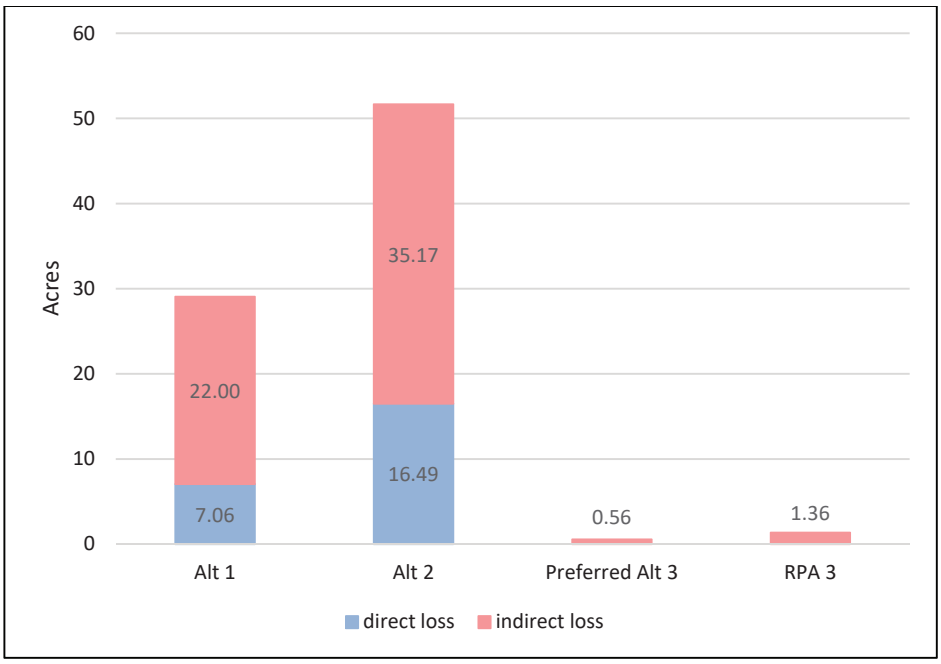


Figure 2 Core forest impact summary for Tier 2 alternatives and RPA 3



4 Indiana Bat and Northern Long-Eared Bat In-Lieu Fee Conservation Fund

Although the total forest area and suitable bat habitat area for RPA 3 (including utility relocation tree clearing estimates) have only changed slightly from that previously documented for Preferred Alternative 3, the estimated in-lieu fee conservation fund mitigation has been recalculated using the most recent (January 2023 to December 2023) "cost per acre land value" provided for Indiana ($11,350/acre). The estimate provided has not been adjusted for stacked species mitigation (Indiana bat and northern long-eared bat).

Figure 3 In-lieu fee summary for SR 11 bat habitat loss compensation for RPA 3

Tree removal location	Acreage	Ratio	Per acre cost	In-Lieu Fee
Impacts <300 feet	9.69 acres	1.5:1	$11,350	$164,972
Impacts >300 feet	7.70 acres	3:1		$262,185
Total				$427,157

Appendix A

Maps

0 200 400 Feet

N

Created: 3/17/2023
R. Yeager

LOCHMUELLER GROUP

Addendum Map 1
Bat Habitat Suitability
(Sheet 1 of 6)

SR11 Extension Project
SR 135 to SR 11
Des. No. 2001154

- Alt 1 constuction limits (20 ft buffer)
- Alt 2 construction limits (20 ft buffer)
- RPA 3 construction limits (no buffer)
- RPA 3 right-of-way
- RPA 3 roadway tree clearing
- RPA 3 power reloation tree clearing
- RPA 3 water relocation tree clearing

Bat habitat suitability
- high
- moderate
- low
- none

- Potential bat roosts
- Buck Creek
- sinking stream basin

Source: Copyright:© 2013 National Geographic Society, i-cubed, U.S. Department of Agricutlure (USDA), Natural Resources Conservation Service (NRCS), U.S. Geological Survey (USGS) USFWS occurrence data / IDNR Natural Heritage Center Database

0 200 400 Feet

N

Created: 3/17/2023
R. Yeager

LOCHMUELLER GROUP

Addendum Map 1
Bat Habitat Suitability
(Sheet 2 of 6)

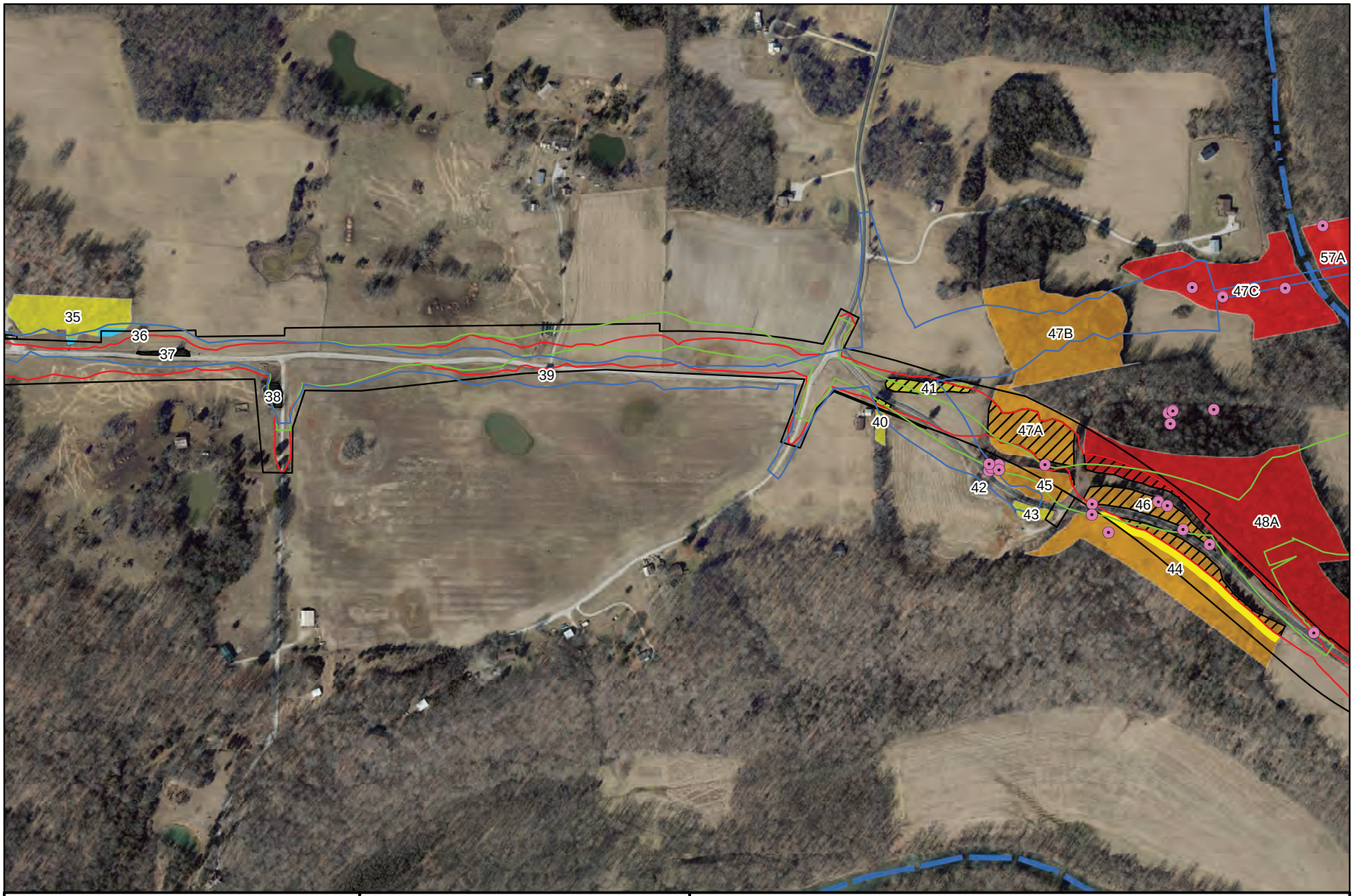
SR11 Extension Project
SR 135 to SR 11
Des. No. 2001154

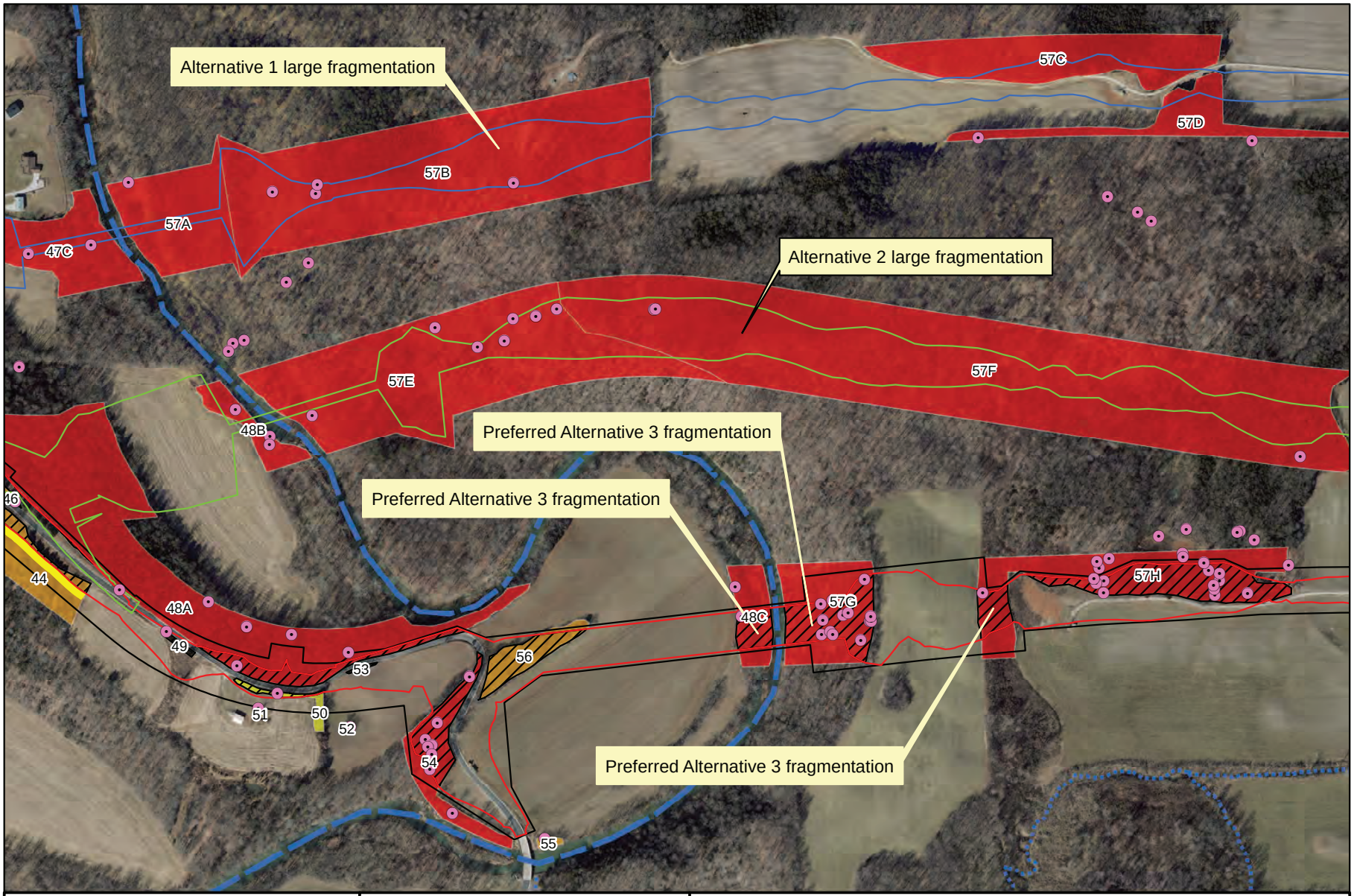
- Alt 1 constuction limits (20 ft buffer)
- Alt 2 construction limits (20 ft buffer)
- RPA 3 construction limits (no buffer)
- RPA 3 right-of-way
- RPA 3 roadway tree clearing
- RPA 3 power reloation tree clearing
- RPA 3 water relocation tree clearing

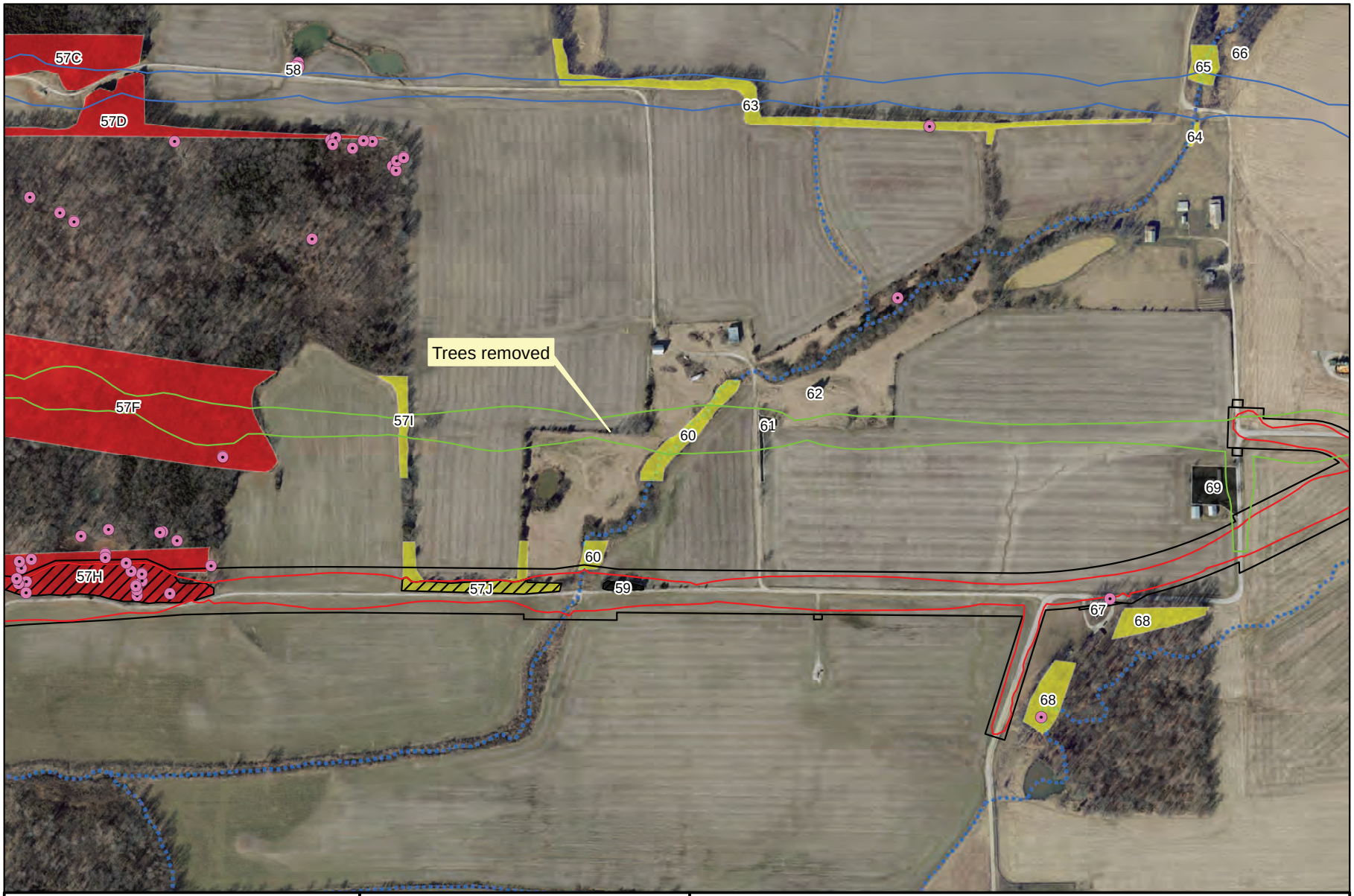
Bat habitat suitability
- high
- moderate
- low
- none

- Potential bat roosts
- Buck Creek
- sinking stream basin

Source: Copyright:© 2013 National Geographic Society, i-cubed, U.S. Department of Agricutlure (USDA), Natural Resources Consveration Service (NRCS), U.S. Geological Survey (USGS) USFWS occurrence data / IDNR Natural Heritage Center Database


35
36
37
38
39
40
41
42
43
45
46
47A
47B
47C
48A
44
57A
0 200 400
Feet
N
Created: 3/17/2023
R. Yeager
Addendum Map 1
Bat Habitat Suitability
(Sheet 3 of 6)
LOCHMUELLER GROUP
SR11 Extension Project
SR 135 to SR 11
Des. No. 2001154
Alt 1 constuction limits (20 ft buffer)
Alt 2 construction limits (20 ft buffer)
RPA 3 construction limits (no buffer)
RPA 3 right-of-way
RPA 3 roadway tree clearing
RPA 3 power reloation tree clearing
RPA 3 water relocation tree clearing
Bat habitat suitability
high
moderate
low
none
Potential bat roosts
Buck Creek
sinking stream basin
Source: Copyright:© 2013 National Geographic Society, i-cubed, U.S. Department of Agricutlure (USDA), Natural Resources Consveration Service (NRCS), U.S. Geological Survey (USGS) USFWS occurrence data / IDNR Natural Heritage Center Database


Alternative 1 large fragmentation
Alternative 2 large fragmentation
Preferred Alternative 3 fragmentation
Preferred Alternative 3 fragmentation
Preferred Alternative 3 fragmentation
57A
57B
57C
57D
57E
57F
57G
57H
47C
48A
48B
48C
44
46
49
50
51
52
53
54
55
56
0 200 400 Feet
N
Created: 3/17/2023
R. Yeager
Addendum Map 1
Bat Habitat Suitability
(Sheet 4 of 6)
LOCHMUELLER GROUP
SR11 Extension Project
SR 135 to SR 11
Des. No. 2001154
Alt 1 constuction limits (20 ft buffer)
Alt 2 construction limits (20 ft buffer)
RPA 3 construction limits (no buffer)
RPA 3 right-of-way
RPA 3 roadway tree clearing
RPA 3 power reloation tree clearing
RPA 3 water relocation tree clearing
Bat habitat suitability
high
moderate
low
none
Potential bat roosts
Buck Creek
sinking stream basin
Source: Copyright:© 2013 National Geographic Society, i-cubed, U.S. Department of Agricutlure (USDA), Natural Resources Consveration Service (NRCS), U.S. Geological Survey (USGS) USFWS occurrence data / IDNR Natural Heritage Center Database



0 200 400 Feet

N

Created: 3/17/2023
R. Yeager

LOCHMUELLER GROUP

Addendum Map 1
Bat Habitat Suitability
(Sheet 5 of 6)

SR11 Extension Project
SR 135 to SR 11
Des. No. 2001154

- Alt 1 constuction limits (20 ft buffer)
- Alt 2 construction limits (20 ft buffer)
- RPA 3 construction limits (no buffer)
- RPA 3 right-of-way
- RPA 3 roadway tree clearing
- RPA 3 power reloation tree clearing
- RPA 3 water relocation tree clearing

Bat habitat suitability
- high
- moderate
- low
- none

- Potential bat roosts
- Buck Creek
- sinking stream basin

Source: Copyright:© 2013 National Geographic Society, i-cubed, U.S. Department of Agricutlure (USDA), Natural Resources Consveration Service (NRCS), U.S. Geological Survey (USGS) USFWS occurrence data / IDNR Natural Heritage Center Database

0 200 400 Feet

N

Created: 3/17/2023
R. Yeager

LOCHMUELLER GROUP

Addendum Map 1
Bat Habitat Suitability
(Sheet 6 of 6)

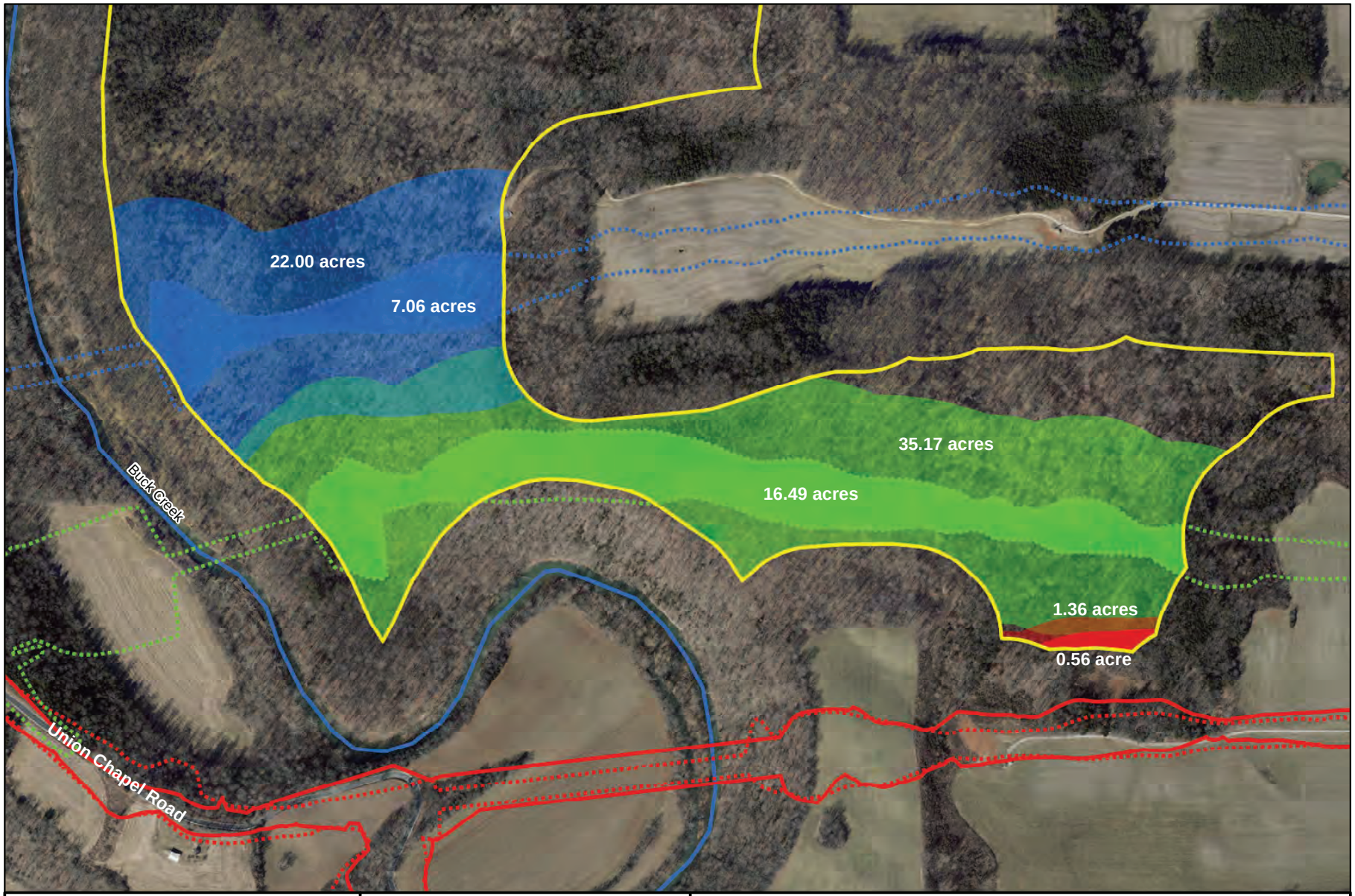
SR11 Extension Project
SR 135 to SR 11
Des. No. 2001154

- Alt 1 constuction limits (20 ft buffer)
- Alt 2 construction limits (20 ft buffer)
- RPA 3 construction limits (no buffer)
- RPA 3 right-of-way
- RPA 3 roadway tree clearing
- RPA 3 power reloation tree clearing
- RPA 3 water relocation tree clearing

Bat habitat suitability
- high
- moderate
- low
- none

- Potential bat roosts
- Buck Creek
- sinking stream basin

Source: Copyright:© 2013 National Geographic Society, i-cubed, U.S. Department of Agricutlure (USDA), Natural Resources Consveration Service (NRCS), U.S. Geological Survey (USGS) USFWS occurrence data / IDNR Natural Heritage Center Database


22.00 acres
7.06 acres
35.17 acres
16.49 acres
1.36 acres
0.56 acre
Buck Creek
Union Chapel Road
0 300 600
Feet
N
Created: 3/20/2023
R. Yeager
Addendum Map 2
Direct and Indirect
Core Forest Impacts
LOCHMUELLER GROUP
SR11 Extension Project
SR 135 to SR 11
Des. No. 2001154
Alternative 1 construction limits w/ 20 foot buffer
Alternative 2 construction limits w/ 20 foot buffer
Alternative 3 construction limits w/ 20 foot buffer (Preferred)
RPA 3 construction limits (no buffer)
Buck Creek
sinking stream basin
Source: Copyright© 2013 National Geographic Society, i-cubed, U.S. Department of Agriculture (USDA), Natural Resources Consveration Service (NRCS), U.S. Geological Survey (USGS)
Core forest limits (328 foot edge buffer)
Alternative 1 direct core forest impacts
Alternative 1 indirect core forest impacts
Alternative 2 direct core forest impacts
Alternative 2 indirect core forest impacts
Alternative 3 indirect core forest impacts
RPA 3 indirect core forest impacts

United States Department of the Interior
Fish and Wildlife Service

Indiana Field Office (ES)
620 South Walker Street
Bloomington, IN 47403-2121
Phone: (812) 334-4261 Fax: (812) 334-4273

April 20, 2023

In reply refer to:
SR 11 Extension Project
2023-0001105

Mr. Jermaine Hannon
Division Administrator
Federal Highway Administration-Indiana Division
575 North Pennsylvania Street, Room 254
Indianapolis, Indiana 46204
(sent via email)

Subject: Formal Consultation for Potential Impacts of the SR 11 Extension Project on the Indiana bat (*Myotis sodalis*), northern long-eared bat (*Myotis septenrionalis*), and gray bat (*Myotis grisescens*) in Harrison County, Indiana.

Dear Mr. Hannon:

Thank you for your letter dated December 21, 2022, requesting the U.S. Fish and Wildlife Service (Service) consult on the impacts of the project on the federally endangered Indiana bat (*Myotis sodalis*), northern long-eared bat (*Myotis septenrionalis*), and gray bat (*Myotis grisescens*). We prepared this response in accordance with section 7 of the Endangered Species Act of l973, as amended (16 U.S.C. 1531, *et seq.*). A complete administrative record of this consultation is on file at the Service's Indiana Field Office.

The enclosed biological opinion addresses effects of the proposed project. The proposed project involves development of a federal-aid transportation project (Des. 2001154) which includes the construction, operation, and maintenance of a new roadway that will extend existing SR 11 west to SR 135 across Buck Creek in Harrison County to improve safety and connectivity in the area. The overall project length is around 5 miles and includes approximately 19 acres of tree-clearing and 300 feet of stream impacts. A new bridge across Buck Creek, approximately 1,325 feet long and up to 115 feet tall is also proposed. The Federal Highway Administration (FHWA) determined the project may affect and was likely to adversely affect the Indiana bat and northern long-eared bat. No critical habitat will be affected.

In addition, the FHWA determined the project may affect, but would not likely adversely affect the gray bat. Based on information in the Biological Assessment and our review of occurrence data, and habitat and life history information, we concur with your determination. While there are a few mist-net records of the gray bat downstream of the Action Area, there are no known summer or winter colonies nearby; the nearest winter hibernacula and summer roosting habitat

are approximately 7 miles from the project site. We expect gray bats that forage along Buck Creek will continue to do so after the roadway is constructed. Any effects on gray bats are likely to be insignificant or discountable.

We based this biological opinion on information provided in your letter; the biological assessment; project-related correspondence; interagency section 7 consultation regulations in 50 CFR Part 402; scientific publications, articles, and reports; and our files. A complete project file of this consultation is available in the Service's Indiana Field Office in Bloomington. If you have any questions or concerns about this consultation or the consultation process in general, please contact Robin McWilliams Munson at 812-334-4261 ext. 207 or Robin_McWilliams@fws.gov.

Sincerely,

Susan E. Cooper
Field Supervisor

Enclosure

Cc (via email):
Kari Carmany-George, FHWA, Indianapolis, IN
Laura Hilden, INDOT, Indianapolis, IN
Sandy Bowman, INDOT, Indianapolis, IN
Jason DuPont, Lochmueller Group, Evansville, IN

Biological Opinion

Effects of Construction, Operation, and Maintenance of the State Road 11 Extension Project Harrison County, Indiana (Des. No. 2001154) on the Indiana Bat, Northern Long-eared Bat, and Gray Bat

Prepared By:
U.S. Fish and Wildlife Service
Indiana Field Office
620 South Walker Street
Bloomington, IN 47403

USFWS Project Code: 2023-0001105
April 19, 2023

Table of Contents

Introduction

A biological opinion (BO) is the document that states the findings of the United States Fish and Wildlife Service (Service) required under section 7 of the Endangered Species Act of 1973, as amended (16 U.S.C. 1531 et seq. [ESA]), as to whether a Federal action is likely to:

- jeopardize the continued existence of species listed as endangered or threatened; or
- result in the destruction or adverse modification of designated critical habitat.

As defined in the ESA section 7 regulations (50 C.F.R. §402.02), "action" means "all activities or programs of any kind authorized, funded, or carried out, in whole or in part, by federal agencies in the United States or upon the high seas."

We base this BO on our review of the Federal Highway Administration (FHWA) and Indiana Department of Transportation's (INDOT) State Road (SR) 11 Extension Project located in Harrison County, Indiana, and its effects on the federally listed Indiana bat (*Myotis sodalis*) and northern long-eared bat (*Myotis septenrionalis*; NLEB), per section 7(a)(2) of the ESA. Both species are assumed to be present at the project site based on database records and the availability of suitable maternity roosting and foraging habitat. The project proposes to construct, operate, and maintain a new roadway approximately 5 miles in length, including a new crossing over Buck Creek. FHWA/INDOT determined the project may adversely affect Indiana bats and NLEBs and may affect but is not likely to adversely gray bats (*Myotis grisescens*). We received your request for consultation on December 21, 2022. We concur the project is not likely to adversely affect the gray bat.

Consultation History

A complete administrative record of the consultation is on file in the Indiana Ecological Services Field Office (INFO) in Bloomington, Indiana. The following is the coordination chronology for the SR 11 Extension Project.

Date	Summary of Activity
25 October 2021	Section 7 consultation kick-off meeting
12 April 2022	Early Coordination request sent out to the Service
12 April 2022	Service, INDOT, and Lochmueller Group field visit
27 April 2022	Service Early Coordination response received
12 August 2022	Draft Biological Assessment submitted to the Service for review
16 September 2022	Service provides comments on Draft Biological Assessment
5 October 2022	Service provides additional comments on Draft Biological Assessment
20 March 2023	Addendum provided to the Service to update impact information

Biological Opinion

Analytical Framework for Jeopardy Determinations

In accordance with policy and regulation, the jeopardy analysis in this BO relies on four components: (1) the Status of the Species, which evaluates the Indiana bat and NLEB rangewide condition, the factors responsible for that condition, and its survival and recovery needs; (2) the Environmental Baseline, which evaluates the condition of the Indiana bat and NLEB in the Action Area, the factors responsible for that condition, and the relationship of the Action Area to the survival and recovery of these species; (3) the Effects of the Action, which determines the direct and indirect impacts of the proposed Federal action and the effects of any interrelated or interdependent activities on the Indiana bat and NLEB; and (4) Cumulative Effects, which evaluates the effects of future, non-Federal activities in the Action Area on the Indiana bat and NLEB.

In accordance with policy and regulation, the jeopardy determination is made by evaluating the effects of the proposed Federal action in the context of the bats' current status, taking into account any cumulative effects, to determine if implementation of the proposed action is likely to cause an appreciable reduction in the likelihood of both the survival and recovery of the Indiana bat and NLEB in the wild. The jeopardy analysis in this BO places an emphasis on consideration of the rangewide survival and recovery needs of the Indiana bat and NLEB and the role of the Action Area in the survival and recovery of the bats as the context for evaluating the significance of the effects of the proposed Federal action, taken together with cumulative effects, for purposes of making the jeopardy determination.

1.0 Description of the Proposed Action

As defined above, "action" refers to all activities or programs authorized, funded, or carried out by federal agencies in the United States (U.S.). The "Action Area" is defined as "all areas to be affected directly or indirectly by the federal action and not merely the immediate area involved in the action."

INDOT, in partnership with FHWA, is developing a federal-aid road project (Des. 2001154) which includes the construction, operation, and maintenance of a new roadway that will extend existing SR 11 west to SR 135 across Buck Creek to improve safety and connectivity in the area. The new road segment will begin on the western end at the present intersection of SR 135 and Watson Road and continuing along the north side of the existing road to Union Chapel Road where a new intersection will be created. The alignment will continue approximately 0.6 miles southeast paralleling the existing Union Chapel Road until the existing road turns south. At that point the new road will cross bottomland cropland and a new bridge spanning Buck Creek and its floodplain will be constructed. East of Buck Creek the new roadway will continue through a steep forested bluff, across cropland, and then east to a newly configured interchange with SR 11, Old Highway 11, and Old Highway 337. The overall length is about 5 miles and includes approximately 19 acres of tree-clearing and 300 feet of stream impacts; no wetland impacts are expected. Some areas of existing pavement will be incorporated into the project. The design speed is 55 mph with an anticipated posted speed of 45 mph. The roadway will include two 12-

foot lanes, 4-foot paved and variable width compacted aggregate shoulders. Cut and fill sections will be required throughout the length of the roadway due to the rolling terrain.

The preliminary design estimates the new bridge will be approximately 1,325 feet in length from the west side of Buck Creek to the bluff on the east side of the creek. The bridge is anticipated to include nine spans, potentially less depending on the beam type chosen. Most of the bridge length will span the floodplain west of Buck Creek. It is anticipated that two spans will be required to cross the channel, with a pier placed on the mid-channel island. Maximum height of the bridge would be approximately 115 feet from the ground to the bottom of the beams. Deep cuts into the limestone bluff on the east side of Buck Creek are expected. The cut into the bluff is needed to keep the height of the bridge from approaching 200 feet, to control the grade of the roadway across the valley, and to provide the desired gradient for drainage control on the bridge.

The project will begin in fall/winter 2025 and be completed fall/winter 2027. Construction will span two active/summer bat seasons; all tree clearing is expected to occur during the first winter construction season. More detailed information can be found in the BA.

INDOT incorporated the following unique measures as part of the proposed action to avoid, minimize, and mitigate impacts of the action on the Indiana bat and NLEB. We analyzed the effects of the proposed action based on the assumption that INDOT will implement all measures. A summary of the measures follows.

Proposed Avoidance and Minimization Measures

- Avoid tree-clearing from April 1st through November 15th. This will be incorporated into the project construction contract as a special provision to avoid potential impacts to Indiana bat and NLEB roosting during the summer maternity season and within fall swarming zones associated with Priority 1 and Priority 2 caves in Harrison and Crawford counties.

- Incorporate routine inspections of the bridge for bats during construction. If bats are found to be using portions of the bridge for roosting during construction, an avoidance or minimization measure for physical exclusion techniques (Styrofoam sheets, foam backer rolls, expansion foam) to seal off gaps and crevices will be evaluated and implemented if considered appropriate.

- Prohibit or limit night construction and the use of temporary lighting during active season bridge construction within the Buck Creek valley.

- Develop an erosion control plan sensitive to the unique challenges of protecting karst groundwater in accordance with INDOT standards and Indiana Department of Environmental Management requirements. The erosion plan will include, but not necessarily be limited to, silt fences, and temporary seed mix to control migration of sediment into Buck Creek, contributing surface water features, and sinkholes.

- Incorporate measures into the design to intercept contaminants leaving the roadway prior to discharge into Buck Creek and develop measures to protect the underground karst system. This will include detention basins along the roadway and a system to control drainage runoff from the new Buck Creek Bridge. The bridge design will either eliminate drop drains on the bridge deck directly above Buck Creek or will capture the bridge runoff within an enclosed drainage system and direct the discharge onto the floodplain to the west of the channel where the runoff water can be filtered via the floodplain soils and vegetation.

Conservation/Mitigation Measures

- Compensate for unavoidable and irreversible loss of roosting, swarming, and foraging bat habitat associated with construction of the project via payment into the Range-Wide Indiana Bat and Northern Long-eared Bat In Lieu Fee Program (amended in 2022 to include the NLEB).

1.1 Action Area

The Action Area is defined as "all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action" (50 CFR §402.02). The Action Area is not limited to the "footprint" of the action, nor is it limited by the Federal agency's authority. Rather, it is a biological determination of the reach of the proposed action on listed species. Delineating the Action Area is necessary for the Federal action agency to determine what species and critical habitats may occur in that area.

For the purposes of this BO, the Action Area (Figure 1) was established using a uniform 5,000-foot buffer from the centerline of the proposed project. This zone will incorporate all areas directly impacted by the construction and realignment of the roadway, including affects related to noise, vibration, lighting, and potential water quality changes, as well as indirect effects related to traffic and maintenance.

2.0 Status of the Species

This section presents the biological or ecological information relevant to formulating this BO. Appropriate information on the species' life history, its habitat and distribution, and other data on factors necessary to its survival are included to provide background for analysis in later sections. This analysis documents the effects of past human and natural activities or events that have led to the current rangewide status of the species. Portions of this information are also presented in listing documents, recovery plans, status assessments, five-year reviews, among others, and are referenced accordingly.

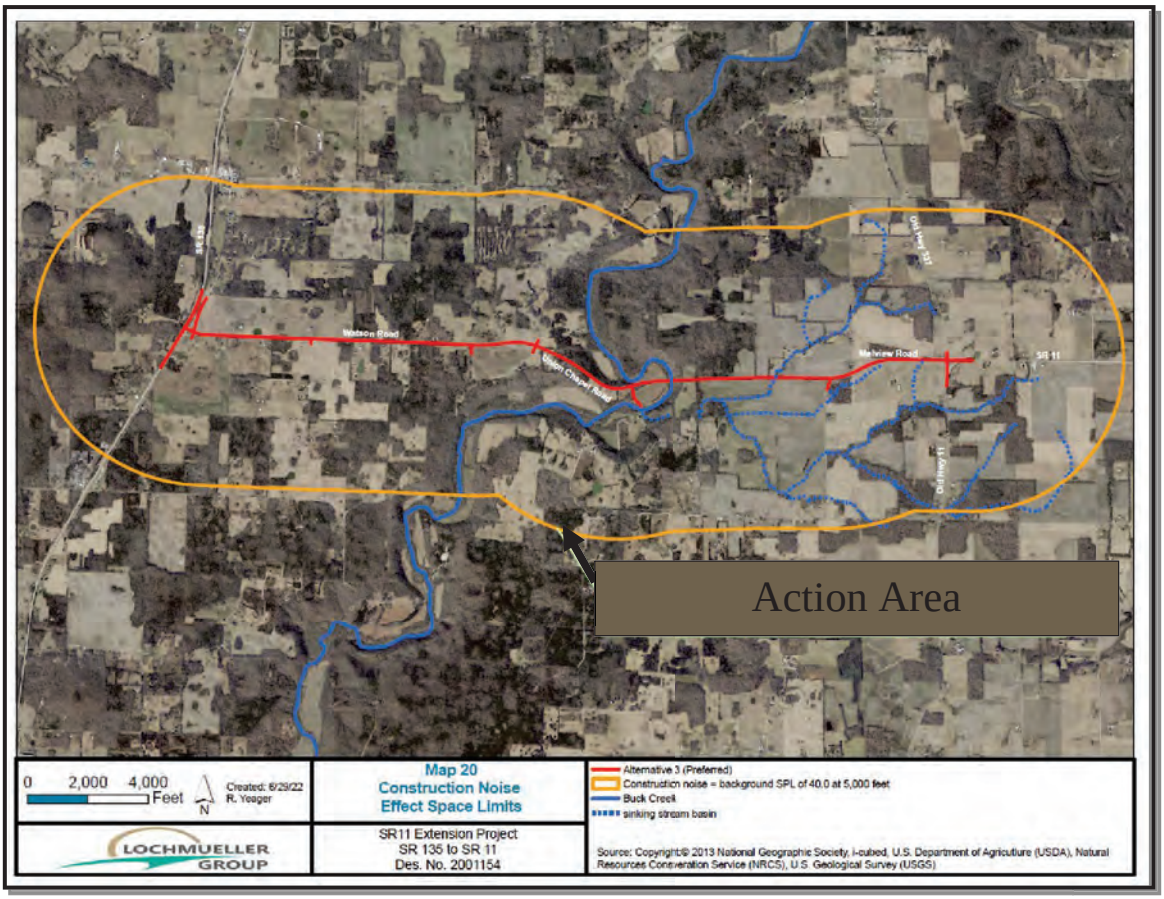


Figure 1. Proposed Action Area (yellow) for the SR 11 Extension Project (from BA).

2.1 Indiana bat

Species and Critical Habitat Description

The Indiana bat was listed as an endangered species on March 11, 1967 (Federal Register 32[48]:4001), under the Endangered Species Preservation Act of October 15, 1966 (80 Stat. 926; 16 U.S.C. 668aa[c]). In 1973, the Endangered Species Preservation Act was subsumed by the ESA and the Indiana bat was extended full protection under this law. Critical habitat was designated for the species on September 24, 1976 (41 FR 14914). Thirteen hibernacula, including 11 caves and two mines in six states, were listed as critical habitat; however, this action does not affect any of these areas.

The Indiana bat is a medium-sized bat in the genus *Myotis*. It is a temperate, insectivorous, migratory bat that hibernates in caves and mines in the winter and spends the summer in wooded areas. Thogmortin et al., 2013, found a mean lifespan of 5.7 years and some individuals live more than 20 years, according to LaVal and LaVal, 1980. A detailed description of the species physical appearance and a discussion of taxonomy can be found in the *Indiana Bat Draft Recovery Plan: First Revision* (2007 Recovery Plan) (USFWS 2007).

Life History and Biology

The 2007 Plan provides a comprehensive discussion of Indiana bat life history. A summary of the life history follows (citation for information in the summary is USFWS 2007 unless otherwise noted).

In winter Indiana bats hibernate in caves or mines, often with other species. The period of hibernation varies across the range of the species, among years, and among individuals. On a rangewide basis, the months of October through April capture the hibernation period of most individuals. Indiana bats typically return to the same hibernacula each year and often hibernate in dense clusters. They can often be found in the same hibernacula as other species such as gray bats, little brown bats (*Myotis lucifugus*), and NLEBs.

In the spring female Indiana bats emerge from hibernation first. Timing for emergence can vary depending on location and weather. In Indiana, peak emergence for females is in April, while males often lag into May. Female bats are thought to move to summer habitat soon after emergence and arrive at their maternity habitat pregnant. They become pregnant via delayed fertilization from sperm stored in their reproductive tract over winter. Females migrate to their traditional roost sites, where they find other members of their maternity colony. Members of the same maternity colony may come from many different hibernacula. Most documented maternity colonies have 50 to 100 adult female bats; average colony size of 80 adult females was noted in Indiana (Whitaker and Brack 2002) and is a widely used estimate. Less is known about male migration patterns.

Female Indiana bats exhibit strong site fidelity to summer roosting and foraging areas and return to the same summer range annually to form colonies and bear their young. Maternity colony habitats include riparian forests, bottomland and floodplain habitats, wooded wetlands, and upland forest communities. Maternity roost sites are most often under the exfoliating bark of dead trees that retain peeling bark. Live trees, especially shagbark hickory, are also used if they have flaking bark under which the bats can roost. Primary roosts, those used frequently by large numbers of female bats and their young, are usually large diameter snags (dead trees). Roost trees are often in mature mostly closed-canopy forests, but in trees with solar exposure (i.e., sunlight on the roost area for at least part of the day) - these may be in canopy gaps in the forest, in a fence-line, or along a wooded edge. Maternity colonies typically use 10 to 20 trees each year, but only one to three of these are primary roosts used by most bats for some or all of the summer (Callahan 1993, Callahan et al. 1997).

Fecundity is low with female Indiana bats producing only one pup per year in late June to early July. Young bats can fly at about four weeks of age. Cohesiveness of maternity colonies begins to decline after young bats become volant and bats tend to roost together in the same roosts less frequently and at lower densities. A few bats from maternity colonies may commence fall migration in August, although at many sites some bats remain in their maternity colony area through September and even into October. Members of a maternity colony do not necessarily hibernate in the same hibernacula and may migrate to hibernacula that are over 300 km (190 mi) apart (Kurta and Murray 2002 and Winhold and Kurta 2006).

Indiana bats arrive at their hibernacula in preparation for mating and hibernation as early as late July, with adult males or nonreproductive females making up most of the early arrivals (Brack 1983). The number of Indiana bats active at hibernacula increases through August and peaks in September and early October (Cope and Humphrey 1977, Hawkins and Brack 2004, Hawkins et al. 2005). After fall migration, females typically do not remain active outside the hibernaculum as long as males. Males may continue swarming through October in what is believed to be an attempt to breed with late arriving females. Swarming is a critical part of the life cycle when Indiana bats converge at hibernacula, mate, and forage until sufficient fat reserves have been obtained to sustain them through the winter (Hall 1962). Swarming continues for several weeks, and mating may occur on cave ceilings or near the cave entrance during the latter part of the period. Limited mating activity occurs throughout the winter and in spring before the bats leave hibernation (Hall 1962).

The Indiana bat is a nocturnal insectivore. It emerges shortly after sunset and begins feeding on a variety of insects that are captured and consumed while flying. This species feeds almost exclusively on flying insects. Four orders of insects contribute most to the diet: Coleoptera, including beetles; Diptera, including flies; Lepidoptera, including moths; and Trichoptera, including caddisflies. The importance of each order varies across the range. Terrestrial-based prey such as moths and beetles have been reported more commonly in southern studies, whereas aquatic-based insects, including flies and caddisflies, dominated in the north.
Indiana bats forage over a variety of habitat types but prefer to forage in and around the tree canopy of both upland and bottomland forest, along roads, or along the corridors of small streams. Menzel et al. (2005) found that females foraged significantly closer to forests, roads, and riparian habitats than agricultural land and grasslands. Womack et al. (2012) documented selection by reproductive females of forests with higher canopy cover but more open mid-stories caused by management via prescribed fire. Bats forage between dusk and dawn at a height of approximately 6-90 feet above ground level and feed exclusively on flying insects, primarily moths, beetles, and aquatic insects (Humphrey et al. 1977).

Population Dynamics

The Indiana bat population has decreased significantly from an estimated 808,000 in the 1950s (USFWS 2007). Based on censuses taken at hibernacula in 2022, the current total known Indiana bat population is estimated to number 582,601, which represents an 8% increase since 2019 and a 12.3 % decline since 2007 when White Nose Syndrome (WNS) was first discovered in the U.S. (Figure 2).

Based on the most recent population data, an estimated 37.6% of the rangewide population of Indiana bats hibernated in caves within the bat's namesake state of Indiana and the Midwest RU contains 47% of the rangewide population. The species' rangewide, regional, state, and hibernacula-specific population trends are being closely monitored by the Service and available at https://www.fws.gov/species/indiana-bat-myotis-sodalis.

Given the 2022 rangewide Indiana bat population estimate of 582,601, we assume that there are approximately 3,641 to 4,855 maternity colonies throughout the species' entire range (assuming a 50:50 sex ratio [Humphrey et al. 1977] with an average maternity colony size of 60 to 80 adult

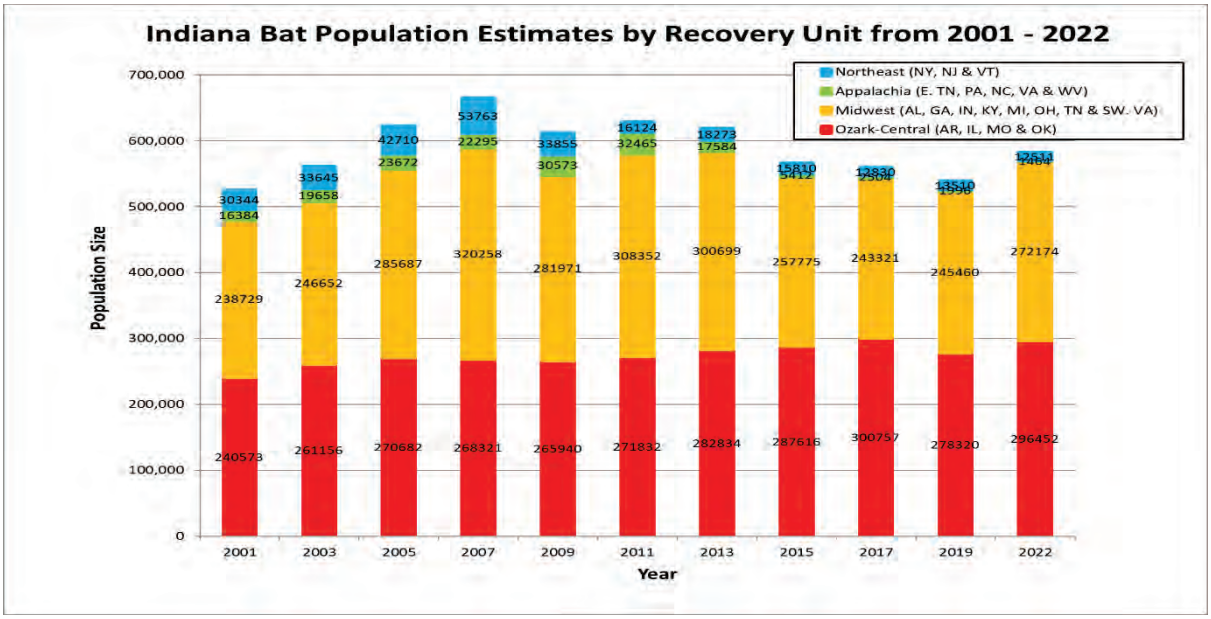


Figure 2. Indiana bat population estimates by Recovery Unit, 2001-2022.

females [Whitaker and Brack 2002]). As of the publication date of 2007 Recovery Plan, we had records of 269 maternity colonies in 16 states that were considered locally extant. Based on the assumptions above, those colonies represent only 5% to 7% of the assumed number of maternity colonies in existence.

Status and Distribution

Indiana bats are found over most of the eastern half of the U.S. In winter, the range of the species is restricted to areas with caves or underground mines, while the summer range is broader. Large wintering populations (more than 45,000 individuals) are found in Indiana, Illinois, Kentucky, and Missouri with smaller hibernacula occurring in 15 additional states. While their overall geographic range has changed relatively little since first listed, with recent declines due to WNS, there has been some shift in spatial distribution and abundance in occupied hibernacula (USFWS 2019). In some instances, there have been shifts toward manmade hibernacula (mines, tunnels, and a dam), concentration into fewer hibernacula, and noted redistribution from one hibernaculum to another nearby, suggesting immigration (USFWS 2019).

The recovery program for the Indiana bat delineates four Recovery Units (RUs): the Ozark-Central, Midwest, Appalachian Mountains, and Northeast RUs (USFWS 2007; Figure 3). The proposed project would be constructed within the Midwest RU, and we assume that bats impacted by the project will be from the Midwest RU.

Currently, the rangewide status of the species has slightly improved from previous few years, but since the onset of WNS, the population is still below the peak in 2007. Declines are associated with the onset of WNS which has spread from New York (NY) south and west across the range.

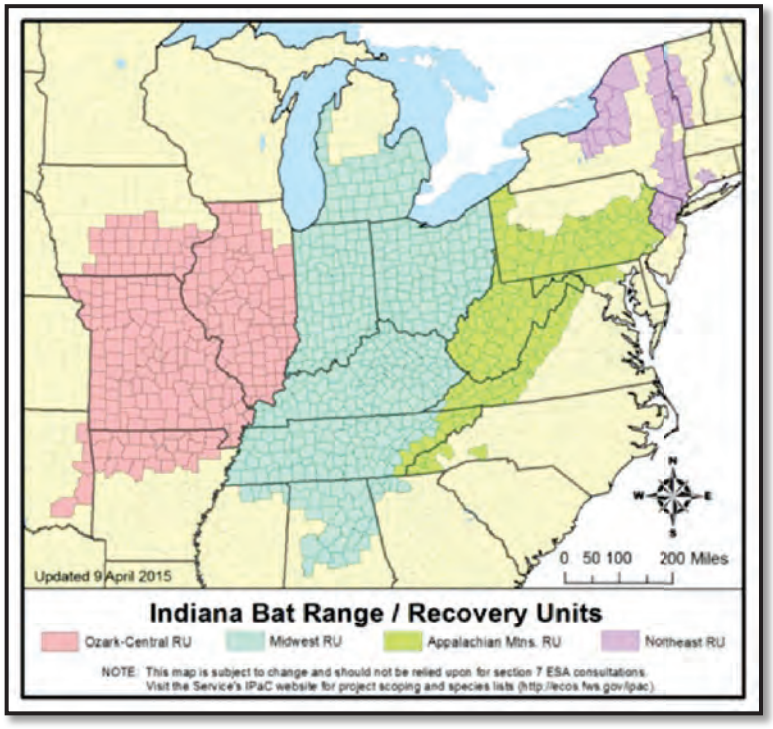


Figure 3. Indiana bat range and Recovery Unit map.

Impacts to Indiana bats to date are most severe in areas with the longest exposure to WNS (e.g., 75-99% declines in NY, WV, and PA) but declines have been observed in all RUs.

Hibernacula are divided into groups and defined in the Service's 2007 Plan: Priority 1 hibernacula typically have a current and/or historically observed winter population of greater than or equal to 10,000 Indiana bats; Priority 2 have a current or observed historic population of 1,000 or greater, but fewer than 10,000 bats; Priority 3 have current or observed historic populations of 50 to 1,000 bats; and Priority 4 have current or observed historic populations of fewer than 50 bats. Based on winter surveys, there are a total of 27 Priority 1 hibernacula in seven states: Illinois (one); Indiana (seven); Kentucky (six); Missouri (eight); New York (three); Tennessee (one); and West Virginia (one). There are also 58 Priority 2 hibernacula within the range.

In Indiana, two of the most populous Indiana bat hibernacula are [redacted] (n=92,951 bats in 2022) and [redacted] (critical habitat; n=86,991 bats in 2022), which are both located in southern Indiana approximately 7 and 12 miles, respectively, from the project corridor. [redacted] (P2) and [redacted] (P2) are also both within 10 miles of the project and housed a combined 5,930 hibernating bats in 2022. These cave populations account for nearly 85% of hibernating bats in the state, 68% in the Midwest RU, and 32% rangewide and thus greatly influence the status of the species within the Midwest RU and rangewide.

In 2019, the Service completed a 5-Year Review of the Indiana bat (USFWS 2019), which summarized the status of the species, progress towards recovery, and remaining threats to the

bat. The review found that the required recovery criteria for the Indiana bat had not been achieved and thus it should remain at its current 'endangered' status. The Recovery Priority Number for the Indiana bat remains at "5", reflecting a species that currently faces a high degree of threat and has a low recovery potential, primarily because of WNS. According to the review, since 2017 all Indiana bat hibernacula are WNS-affected. Although some species, particularly little brown bats and NLEBs, have fared worse, there is still concern regarding the long-term extinction risk for Indiana bats (USFWS 2019). Both the 2007 Recovery Plan and 5-Year Review are available on the Service's Indiana bat website at https://www.fws.gov/species/indiana-bat-myotis-sodalis.

Threats to the Species

The Service categorizes threats based on the following five factors, consistent with current listing and recovery analyses under the ESA:

- The present or threatened destruction, modification, or curtailment of its habitat or range.
- Overutilization for commercial, recreational, scientific, or educational purposes.
- Disease or predation.
- The inadequacy of existing regulatory mechanisms.
- Other natural or man-made factors affecting its continued existence.

The 2007 Recovery Plan and 2009 and 2019 5-Year Reviews include detailed discussions of threats. The following summary is based primarily on those documents, with emphasis on the Midwest Recovery Unit.

The Present or Threatened Destruction, Modification, or Curtailment of its Habitat or Range

As discussed in the 2007 Recovery Plan, the Indiana bat requires forested areas for foraging and roosting. Loss of forest cover and degradation of forested habitats have been cited as contributing to the decline of Indiana bats (USFWS 1983, Gardner et al.1990, Garner and Gardner 1992, Drobney and Clawson 1995, and Whitaker and Brack 2002). At a landscape level, Indiana bat maternity colonies occupy habitats ranging from completely forested to areas of highly fragmented forest. Within the core range in the Midwest, forest cover is much more fragmented, at the landscape scale, than at the eastern edge of the range (Brack et al. 2002). According to Humphrey (1978), the conversion of floodplain and bottomland forests, recognized as high quality habitats for Indiana bats, has been a particular cause of concern. Conversion to agriculture has been the largest single cause of forest loss historically (although recent trends show an increase of forest cover in the Midwest RU); however, at present, urbanization and development, which results in more permanent conversion, has become an important factor as Indiana bats appear to avoid foraging in highly developed areas. In addition, one of the greatest emerging causes of conversion of forest and habitat loss within the range of the Indiana bat is energy production and transmission (e.g., oil, gas, coal, wind) (Oswalt et al. 2019, USFWS 2007).

Winter habitat is also at risk. There are well-documented examples of modifications to Indiana bat hibernation caves that affected the thermal regime of the cave, and thus the ability of the cave

to support hibernating Indiana bats, as summarized in the 2007 Recovery Plan. Destruction and modifications of hibernacula have been an ongoing concern although many of these caves have been protected in recent times. Of late, several Priority 1 hibernacula have been subject to potentially harmful developments and activities in their vicinity. Habitat threats related to urbanization and development, particularly in the energy sector, are increasing in these wintering areas as well (USFWS 2019).

Overutilization for Commercial, Recreational, Scientific, or Educational Purposes

Human disturbance of hibernating bats was originally identified as one of the primary threats to the species and remains a threat at several important hibernacula in the bat's range (USFWS 2007). The primary forms of human disturbance to hibernating bats result from recreational caving, cave commercialization (i.e., cave tours and other commercial uses of caves), vandalism, and research-related activities. Disturbance causes the bats to arouse and use fat reserves essential for successful hibernation. Progress has been made in reducing the number of caves and mines in which disturbance threatens hibernating Indiana bats, but the threat has not been eliminated.

There are far fewer documented examples of disturbance of Indiana bats in summer due to "overutilization for commercial, recreational, scientific, or educational purposes," compared with impacts to hibernating bats. However, research-related disturbance of summering Indiana bats has been observed (USFWS 2007).

As of April 2023, there were approximately 110 active (or in the process of renewal) section 10(a)(1)(A) permits (research permits) for Indiana bats in Region 3 of the Service (which includes most of the Midwest Recovery Unit), and roughly 236 rangewide. Generally, there is more mist netting being conducted for Indiana bat surveys in the Midwest Recovery Unit (as well as other parts of the range) than in the past. Much of this increase is associated with surveys to determine if Indiana bats are present at locations associated with proposed wind energy developments, as well as other development projects. Mortality associated with mist netting and associated handling of bats has been observed. However, insuring that only qualified, permitted researchers conduct this work and follow proper holding and marking techniques minimizes potential for research-related mortality.

Disease or Predation

In the past, disease and predation have generally not been considered major threats to bat populations, or Indiana bats specifically (USFWS 2007). The emergence of WNS has changed that. WNS is considered one of worst wildlife diseases in modern times (WNS 2019). Prior to the ongoing WNS epizootic, there had been little research into the occurrence and effects of diseases in bats in the U.S., except for rabies (Weller et al. 2009). WNS is now considered to be present within the entire range of the Indiana bat and millions of bats have died from this disease (USFWS 2012 and WNS 2019).

WNS has been characterized as a condition primarily affecting hibernating bats. Affected bats usually exhibit a white fungus on their muzzles and often on their wings and ears as well

(Blehert et al. 2009). Some affected bats may display abnormal behavior including flying during the day and in cold weather (before insects are available for foraging) and roosting towards a cave's entrance where temperatures are much colder and less stable. Many of the affected bats appear to have little-to-no remaining fat reserves which are necessary to survive until spring emergence. The fungus associated with WNS has been identified as *Pseudogymnoascus destructans*, or Pd, (formerly *Geomyces destructans*). The fungus thrives in the cold and humid conditions of bat hibernacula. All the possible modes of transmission are not currently known, although biologists suspect it is primarily spread by bat-to-bat contact. In addition, people may unknowingly contribute to the spread of WNS by visiting affected caves and subsequently transporting fungal spores to unaffected caves via their clothing and gear. Interestingly, Pd has been documented growing on hibernating bats in several European countries, but the fungus does not appear to be causing widespread mortality there (Puechmaille et al. 2010).

Within the U.S., WNS has been confirmed in the Indiana bat, little brown bat, eastern small-footed bat, NLEB, gray bat, tricolored bat, Yuma bat, cave bat, fringed bat, long-legged bat, western long-eared bat, and big brown bat. The Pd fungus has also been detected on six additional bat species: the cave myotis, eastern red bat, silver-haired bat, Rafinesque's big-eared bat, Virginia big-eared bat, and Townsend's big-eared bat. The causative fungus, *Pseudogymnoascus destructans* (Pd), has been found on an additional six species, including two endangered species, without confirmation of the disease.

WNS has been documented in all four RUs and was first detected in Indiana in 2010-2011. As of the winter of 2021-2022, WNS has been documented in bats in 38 states and 8 Canadian provinces, and there is evidence that the fungus that causes white-nose syndrome is present in five additional states and one Canadian province. Since WNS was first noted in 2007, the Northeast Indiana bat RU has declined by 76.7%, the Midwest RU by 15%, the Appalachia RU by 93.4% and the Ozark-Central RU by 15.6%, based on 2022 Indiana bat population data. WNS has caused an overall estimated 90% decline in all hibernating bat populations within the WNS-affected area and threatens regional or rangewide extinction in multiple species including the Indiana bat (Frick et al. 2010b, Thogmartin et al. 2013, Turner et al. 2011). In short, WNS has significantly and rapidly raised the degree of threat against the Indiana bat by causing reductions in its fitness, reproductive success, and survival, which has lowered the species' overall recovery potential. Additional information on WNS can be found at Whitenosesyndrome.org.

The Inadequacy of Existing Regulatory Mechanisms

Ownership of Indiana bat habitat is probably the primary factor that limits effectiveness of existing regulatory mechanisms. Of the 85 Priority 1 and 2 hibernacula, 16 (19%) are federally owned, 22 (26%) are state-owned, 45 (53%) are privately owned, 1 (1%) is city owned and 1 (1%) has an unknown ownership (USFWS 2019). ESA protection extends to hibernacula that are privately owned, but recovery options are often limited on private lands. However, it should be noted that most private hibernacula owners are cooperative in efforts to protect Indiana bats.

Other Natural or Man-made Factors Affecting its Continued Existence

Several natural factors are a threat to local bat populations, including flooding and freezing events at winter hibernacula (USFWS 2007). These natural events typically are not widespread, but rather associated with specific flood/freeze-prone sites.

Mounting data on the impact of climate change, including extreme events such as drought and flooding, on bats are a cause for concern as recent increases in global temperature represent one fifth, or less, of those expected over the next century (Frick et al. 2019, O'Shea et al. 2016, Rebelo et al. 2010, Sherwin et al. 2013, USGCRP 2018). In combination with WNS, habitat destruction, and other sources of environmental degradation, climate change poses a serious and increasing threat to Indiana bats.

Climate influences food availability, timing of hibernation, frequency and duration of torpor, rate of energy expenditure, reproduction, and development rates of juveniles (Sherwin et al. 2013). Warmer climates may benefit females by causing earlier parturition and weaning of young, allowing more time to mate and store fat reserves in preparation for hibernation. Similarly, earlier gestation and parturition may benefit juveniles by providing a longer growth period prior to the breeding season (Burles et al. 2009). Frick et al. (2010a) supported this finding by showing that little brown bat pups born early in the summer have higher survival and first-year breeding probabilities than those born later in the summer. In contrast, disruption of hibernation, extreme weather events, reduced water availability in arid environments, and the spread of disease may also cause significant mortalities (Adams and Hayes 2008, Adams 2010, and Hayes and Adams 2017).

With growing concerns about climate change, wind energy has become one of the fastest growing sources of renewable energy in the U.S. (American Wind Energy Association 2019). The current collocation of wind energy facilities within the range of the Indiana bat may lead to a meaningful impact on the population dynamics of the species, depending upon the magnitude of risk from collision faced by migrating and summer resident bats. Large-scale fatalities of bats (mostly other species) have occurred at multiple wind energy facilities across the range of the Indiana bat and recent studies have found that far more bats than birds are typically killed in the Midwest and Eastern U.S. (Arnett and Baerwald 2013, O'Shea et al. 2016). A total of 13 Indiana bat fatalities has been documented at wind energy facilities in six states (Illinois, Indiana, Iowa, Ohio, Pennsylvania, and West Virginia) since 2009 (Pruitt and Reed 2018). While this number may not seem high, monitoring fatalities is expensive and difficult, and many facilities do not participate in such efforts. The only well-documented method to reduce fatalities at wind turbines is limiting operation during high-risk periods, such as nocturnal periods of low wind speeds during fall migration (Arnett et al. 2011, Baerwald et al. 2009). Such operational curtailment can reduce bat fatalities by 44–93% (Arnett et al. 2011).

Other anthropogenic factors that may affect the continued existence of Indiana bats include numerous environmental contaminants (e.g., organophosphate and carbamate insecticides, oil spills, and PCBs), collisions with poorly constructed cave gates and vehicles, light pollution, and non-native invasive species.

2.2 Northern long-eared bat

The Service published its original decision to list the NLEB as a threatened species on April 2, 2015 (80 FR 17974-18033) with an effective date of May 4, 2015. The final rule determined that critical habitat designation for the NLEB was not determinable at the time. Subsequently, in March 2022, the Service proposed to reclassify the NLEB from its current status as federally threatened to federally endangered. The NLEB original listing and current reclassification proposal are due to sharp population declines associated with WNS. On November 30, 2022, the reclassification action was finalized, and the new listing was to go into effect January 20, 2023. That action was delayed, and the rule will go into effect March 31, 2023.

Species and Critical Habitat Description

The NLEB is a medium-sized bat with an average adult weight of 5 to 8 grams, average body length from 77 to 95 millimeters, and forearm length between 34 and 38 millimeters (Caceres and Pybus 1997). Its fur ranges from medium to dark brown on the dorsal side, and tawny to pale brown on the ventral side, with dark brown ears and wing membranes. As indicated by its common name, the NLEB is distinguished from other Myotis species by its relatively long ears (average 0.7 inches (17 mm)) (Whitaker and Mumford 2009) that, when laid forward, extend beyond the nose up to 0.2 inches (5 mm) (Caceres and Barclay 2000). Within its range, the NLEB is sometimes confused with the little brown bat or the western long-eared myotis (Myotis myotis). The NLEB is distinguished from the little brown bat by its longer ears, tapered and symmetrical tragus, slightly longer tail, and less glossy pelage (Caceres and Barclay 2000), and from the western long-eared myotis by its darker pelage and paler membranes (Caceres and Barclay 2000).

Life History and Biology

NLEBs migrate between winter hibernacula and summer roosting habitat. When female NLEBs emerge from hibernation, they migrate to maternity colony areas. The distance and routes traveled from winter hibernacula to summer roosting areas is not definitively known, but the species is considered to migrate shorter distances than the Indiana bat (USFWS 2014). The annual chronology of the NLEB is like the generalized Indiana bat chronology, spring migration from winter hibernacula usually occurs between mid-March and mid-May, whereas most fall migration from summer roosting areas back to winter hibernacula occurs from mid-August through mid-October.

While the NLEB is not considered a long-distance migratory species, short migratory movements (56 km (35 mi) to 89 km (55 mi)) occur between summer roost and winter hibernacula (Nagorsen and Brigham 1993 and Griffin 1945). However, movements from hibernacula to summer colonies may range from 8 to 270 km (5 to 168 mi) (Griffin). Several studies show a strong homing ability of NLEB in terms of return rates to a specific hibernaculum, although bats may not return to the same hibernaculum in successive winters (Caceres and Barclay 2000). Banding studies in Ohio, Missouri, and Connecticut show return rates to hibernacula of 5.0 percent (Mills 1971), 4.6 percent (Caire et al. 1979), and 36 percent (Griffin 1940), respectively.

During the summer, NLEBs typically roost singly or in colonies underneath bark or in cavities or crevices of both live trees and snags. Male and non-reproductive female summer roost sites also may include cooler locations (e.g., caves and mines) (Barbour and Davis 1969 and Amelon and Burhans 2006). The NLEB has also been observed roosting in colonies in human-made structures (e.g., buildings, barns, a park pavilion, sheds, cabins, under eaves of buildings, behind window shutters, and bat houses). They are not likely dependent on a certain species of tree for roosts throughout their range; rather, certain tree species will form suitable cavities or retain bark suitable for their use (Foster and Kurta 1999). A significant preference for dead or dying trees was reported for NLEBs in Kentucky (Silvis et al. 2012), Illinois, and Indiana. The use of live trees versus snags may reflect the availability of such structures in study areas (Perry and Thill 2007) and the flexibility in roost selection when there is a sympatric bat species present (e.g., Indiana bat) (Timpone et al. 2010).

Roosts trees used by NLEBs are often in fairly close proximity to each other within the species' summer home range. For example, in Missouri, Timpone et al. (2010) radio-tracked 13 NLEBs to 39 roosts and found the mean distance between the location where captured and roost tree was 1.7 km (1.1 mi) (range 0.07–4.8 km [0.04–3.0 mi]), and the mean distance traveled between roost trees was 0.67 km (0.42 mi) (range 0.05–3.9 km [0.03–2.4 mi]).

Some studies have found tree roost selection to differ slightly between males and females. NLEB males have been found to use smaller diameter trees more readily for roosting than females, suggesting males are more flexible in roost selection than females (Lacki and Schwierjohann 2001 and Perry and Thill 2007).

The NLEB predominantly overwinters in hibernacula that include caves and abandoned mines. Hibernacula used by NLEB are typically large, with large passages and entrances (Raesly and Gates 1987), relatively constant, cooler temperatures (0 to 9 degrees C [32 to 48 degrees F]) (Raesly and Gates 1987, Caceres and Pybus 1997, and Brack 2007), with high humidity and no air currents (Fitch and Shump 1979, Van Zyll de Jong 1985, Raesly and Gates 1987, and Caceres and Pybus 1997). The NLEB is typically found roosting in small crevices or cracks in cave or mine walls or ceilings, often with only the nose and ears visible.

The swarming season fills the time between the summer and winter seasons (Lowe 2012) and the purpose of swarming behavior may include introduction of juveniles to potential hibernacula, copulation, and stopping-over sites on migratory pathways between summer and winter regions (Kurta et al. 1997; Lowe 2012; Parsons et al. 2003; and Randall and Broders 2014). For the NLEB, the swarming period may occur between July and early October, depending on latitude within the species' range (Caire et al. 1979; Hall and Brenner 1968; Fenton 1969; Kurta et al. 1997; and Lowe 2012).

Spring staging for the NLEB is the period between winter hibernation and spring migration to summer habitat. During this time, bats begin to gradually emerge from hibernation, exit the hibernacula to feed, but re-enter the same or alternative hibernacula to resume daily bouts of torpor (state of mental or physical inactivity) (Whitaker and Hamilton 1998). The staging period for the NLEB is likely short in duration (Caire et al. 1979 and Whitaker and Hamilton 1998). Variation in timing (onset and duration) of staging for Indiana bats was based on latitude and

weather (USFWS 2007); similarly, timing of staging for NLEBs is likely based on these same factors.

NLEBs typically form their maternity colonies in June and July (Harvey et al. 2011). Maternity colonies, consisting of females and young, are generally small, numbering from fewer than 30 (Whitaker and Mumford 2009) to 60 individuals (Caceres and Barclay 2000); however, one group of 100 adult females was observed in Vermilion County, Indiana (Whitaker and Mumford 2009). In West Virginia, maternity colonies in two studies had a range of 7 to 88 individuals (Owen et al. 2002) and 11 to 65 individuals, with a mean size of 31 (Menzel et al. 2002). In Minnesota, the average maternity colony size reported in 2017 was 8.2 females per colony, based on emergence surveys conducted at 39 active maternity colony roosts (Swingen et al. 2017). Lacki and Schwierjohann (2001) found that the number of bats within a given roost declined as the summer progressed. Pregnant females formed the largest aggregations (mean = 26), and post-lactating females formed the smallest aggregation (mean = 4). The largest reported colony size was 65 bats. Other studies have also found that the number of individuals roosting together in each roost typically decreases from pregnancy to post-lactation (Foster and Kurta 1999; Garroway and Broders 2008; Johnson et al. 2012; Lacki and Schwierjohann 2001; Perry and Thill 2007).

Females are pregnant when they arrive at maternity roosts and produce a single young per year, as is typical for the genus Myotis (Asdell 1964; Hayssen et al. 1993; Krochmal and Sparks 2007; and Sparks et al. 1999). Parturition typically occurs between late May and early June (Caire et al. 1979; Krochmal and Sparks 2007; and Whitaker and Mumford 2009). Juveniles become volant between late June and early August (Caire et al. 1979; Sasse and Pekins 1996; and Krochmal and Sparks 2007). As is the case with other species of bats in North America, mortality for NLEB is high during the first year (Caceres and Pybus 1997). NLEBs have been observed roosting in areas of increased solar heating, which increases their developmental rate and reduces the need to lower their body temperature and metabolic rate (i.e., enter a state of torpor) (Lacki and Schwierjohann 2001).

The NLEB has a diverse diet including moths, flies, leafhoppers, caddisflies, beetles (Brack and Whitaker 2001; Griffith and Gates 1985; and Nagorsen and Brigham 1993) and arachnids (spiders) also being a common prey item (Feldhamer et al. 2009); diet composition appears to differ geographically and seasonally (Brack and Whitaker 2001).

Foraging techniques include hawking and gleaning, in conjunction with passive acoustic cues (Nagorsen and Brigham 1993 and Ratcliffe and Dawson 2003). Hawking is aerial foraging, catching insects in flight using echolocation. Observations of NLEB foraging on arachnids (Feldhamer et al. 2009), presence of green plant material in their feces (Griffith and Gates 1985), and non-flying prey in their stomach contents (Brack and Whitaker 2001) suggest considerable gleaning behavior. The NLEB has the highest frequency call of any bat species in the Great Lakes area (Kurta 1995). Gleaning allows this species to gain a foraging advantage for preying upon moths because moths are less able to detect these high frequency echolocation calls (Faure et al. 1993).

Population Dynamics

Prior to the onset of WNS the species was abundant throughout much of the eastern U.S. and thus, was not a focus of detailed demographic studies. Since WNS, populations have been in a period of catastrophic decline across most of the range. Francl et al. (2012) documented a 77% decline in summer capture rates of NLEBs in West Virginia and adjacent areas of Pennsylvania in the two years following the arrival of WNS. Available evidence, including both winter and summer data, indicates NLEB abundance has and will continue to decline substantially over the next 10 years under current demographic conditions (USFWS 2022).

Unfortunately, there are no firm population size estimates for the NLEB rangewide. In 2015, as part of the Midwest Wind Energy Multi-Species Habitat Conservation Plan, an estimate for the six-state area that included the States of Illinois, Indiana, Iowa, Ohio, Michigan, and Missouri, showed there may have been more than four million bats in the area. The estimate was calculated by adjusting the 2013 Indiana bat winter population size in those states based on the ratio of NLEBs compared to Indiana bats in summer mist-net surveys. This information is limited since most of the mist-net data was gathered prior to the onset of WNS in the Midwest. In the 2016 Programmatic Biological Opinion (PBO) on the final 4(d) rule for the NLEB the Service estimated the U.S. population to be 6,500,000 individuals (adults), including 127,842 in Indiana (USFWS 2016). In 2023, using similar methods as the PBO, the Service estimated NLEBs have declined to 201,266 adults rangewide and 2,552 in Indiana (USFWS 2023).

Status and Distribution

NLEB's range includes much of the eastern and north-central U.S., and all Canadian provinces west to the southern Yukon Territory and eastern British Columbia (Caceres and Pybus 1997; Environment Yukon 2011; and Nagorsen and Brigham 1993) (Figure 4). In the U.S., the species' range reaches from Maine west to Montana, south to eastern Kansas, eastern Oklahoma, Arkansas, and east to South Carolina (Amelon and Burhans 2006; Caceres and Barclay 2000; Simmons 2005; and Whitaker and Hamilton 1998). The species' range includes all or portions of 37 states, the District of Columbia, and seven Canadian provinces, and has been divided into five geographic representation units: Southeast, Eastern Hardwoods, Subarctic, Midwest, and East Coast (Figure 4).

Historically, the species has been most frequently observed in the northeastern U.S. and in Canadian Provinces of Quebec and Ontario, with sightings increasing during swarming and hibernation (Caceres and Barclay 2000). However, throughout most of the species range it is patchily distributed, and historically was less common in the southern and western portions of the range than in the northern portion of the range (Amelon and Burhans 2006).

Although they are typically found in low numbers in inconspicuous roosts, most records of NLEBs are from winter hibernacula surveys (Caceres and Pybus 1997). More than 780 hibernacula have been identified throughout the species range in the U.S., although many hibernacula contain only a few (1 to 3) individuals (Whitaker and Hamilton 1998). NLEBs are documented in hibernacula in 29 of the 37 States in the species' range. Other States within the

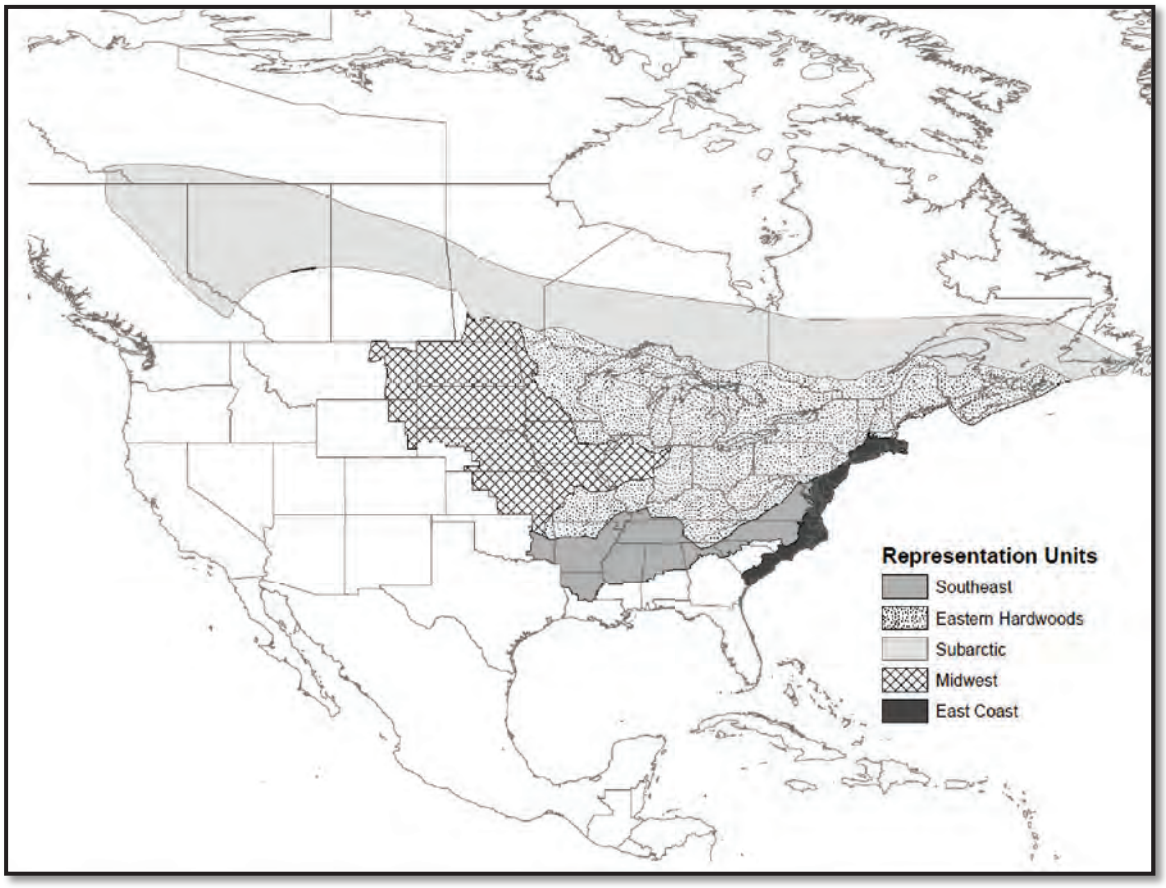


Figure 4. NLEB range and Representation Units map.

species' range have no known hibernacula (due to no suitable hibernacula present, lack of survey effort, or existence of unknown retreats).

The current range and distribution of NLEBs must be described and understood within the context of the impacts of WNS. Prior to the onset of WNS, the best available information on NLEB came primarily from summer surveys (primarily focused on Indiana bat or other bat species) and some targeted research projects. In these efforts, was very frequently encountered and was considered the most common Myotid bat in many areas.

Overall, the species was once widespread and abundant throughout its historic range (Caceres and Barclay 2000). WNS has been particularly devastating for NLEBs in the Northeast, where the species was believed to be the most abundant (Herzog and Reynolds 2012, Turner et al. 2011, Langwig et al. 2012). Similarly, there are data supporting substantial declines in NLEB populations in portions of the Midwest due to WNS. In addition, WNS has been documented at more than 100 NLEB hibernacula in the Southeast, with apparent population declines at most sites. We expect further declines as the disease continues to spread across the species' range.

Threats to the Species

As with the Indiana bat, the Service uses the five statutory factors for determining listing decisions, and disease (WNS) is thought to be the dominant factor for the NLEB. The Species Status Assessment (USFWS 2022) describes the primary threats to the NLEB as WNS, wind related mortality, effects from climate change, and habitat loss. The following factors include a discussion of each of these threats.

The Present or Threatened Destruction, Modification, or Curtailment of its Habitat or Range

NLEB require suitable habitat for roosting and foraging, and commuting between those habitats during spring, summer, and fall. Forest is a primary component of roosting, foraging, and commuting habitat. Wetlands and water features are important foraging and drinking water sources. Loss of these habitats influences survival and reproduction of NLEB colonies. Throughout the range of the NLEB, forest conversion is expected to increase due to commercial and urban development, energy production and transmission, and natural changes. Forest conversion causes loss of potential habitat, fragmentation of remaining habitat, and if occupied at the time of the conversion, direct injury or mortality to individuals. Adverse impacts are more likely in areas with little forest or highly fragmented forests (e.g., western U.S. and central Midwestern states), as there is a higher probability of removing roosts or causing loss of connectivity between roosting and foraging habitat. As part of the 2022 Species Status Assessment, the Service looked at land cover data over a 10-year period from 2006 to 2016 and found that while overall forest land cover had remained stable (and even increased in some areas), deciduous forest cover had decreased across all RPUs by 1.4 million acres. Emergent wetland habitat decreased by a similar amount as well.

In addition to active season habitat threats, modification of hibernacula, particularly altering or closing hibernacula entrances, is considered a significant threat to the NLEB. Some modifications, for example closure of a cave entrance with structures/materials besides a bat-friendly gate, can cause a partial or complete loss of the utility of a site to serve as hibernaculum. Humans can also disturb hibernating bats, either directly or indirectly, resulting in an increase in energy-consuming arousal bouts during hibernation (Johnson et al. 1998; Thomas 1995).

Finally, environmental contaminants, in particular insecticides, other pesticides, and inorganic contaminants, such as mercury and lead, may also have detrimental effects on NLEBs. Contaminants may bio-accumulate (become concentrated) in the tissues of bats, potentially leading to a myriad of sub-lethal and lethal effects.

Various conservation measures such as reducing construction limits, seasonal tree-clearing, developing habitat conservation plans, species-specific programmatic consultations, bat-friendly forest management prescriptions, mitigation, bat-friendly gates at hibernacula, and conservation easements can help protect bats and minimize impacts.

Disease or Predation

The effect of WNS on NLEB has been extreme, such that most summer and winter colonies experienced severe declines following the arrival of WNS. Just four years after the discovery of WNS, for example, Turner et al. (2011) estimated that NLEBs experienced a 98% decline in winter counts across 42 sites in Vermont, New York, and Pennsylvania. Similarly, Frick et al. (2015) estimated the arrival of WNS led to a 10–fold decrease in NLEB colony size. Most recently, Cheng et al. (2021) used data from 27 states and 2 provinces to conclude WNS caused estimated population declines of 97–100% across 79% of NLEB's range.

Long-term summer survey data (including pre- and post-WNS) for the NLEB, where available, corroborate the population decline evident in hibernacula survey data. For example, summer surveys from 2005–2011 near Surry Mountain Lake in New Hampshire showed a 98% decline in capture success of NLEB post-WNS, which is similar to the hibernacula data for the State (a 95% decline) (Moosman et al. 2013). Current hibernacula survey data indicate that populations of NLEBs in the Midwestern states have declined between 50 and 75 percent (USFWS unpublished data).

There are multiple national and international efforts underway in attempt to reduce the impacts of WNS. To date, there are no proven measures to reduce the severity of impacts.

Other Natural or Man-made Factors Affecting its Continued Existence

Wind related mortality is proving to be a consequential stressor at local and RPU levels. Wind power is a rapidly growing portion of North America's energy. As of 2019, wind power was the largest source of renewable energy in the country, providing 7.2% of U.S. energy (American Wind Energy Association 2020). Modern utility-scale wind power installations (wind facilities) often have tens or hundreds of turbines installed in a given area, generating hundreds of megawatts (MW) of energy each year. Installed wind capacity in the U.S. as of October 2020 was 104,628 MW (Hoen et al. 2018; USFWS unpublished data).

Most bat mortality at wind energy projects is caused by direct collisions with moving turbine blades (USFWS 2022). Bat mortality at wind facilities was identified around 2003, when post-construction studies at the Buffalo Mountain, Tennessee, and Mountaineer, West Virginia, wind projects documented the highest bat mortalities reported at the time (31.4 bats/MW and 31.7 bats/MW, respectively; Kerns and Kerlinger 2004; Nicholson et al. 2005). Bat mortalities continue to be documented at wind power installations across North America and Europe.

Although bat fatality varies across species, facilities, and season, NLEBs have been documented being killed at wind facilities. Analyses using data from Wiens et al. (2022) and Whitby et al. (2022) suggest that the impact of wind related mortality is discernible in the ongoing decline of NLEB. Based on data from Wiens et al. (2022) comparing a no wind baseline scenario to current and future wind scenarios, the projected NLEB abundance decreases 24–33% by 2030 under the current wind scenario and up to 83% by 2060 under the future high impact wind scenario.

There are many ongoing efforts to improve our understanding of bat interactions with wind turbines and explore additional strategies for reducing bat mortality at wind facilities. To date, operational strategies (e.g., feathering turbine blades when bats are most likely to be active) are the only broadly proven and accepted measures to reduce the severity of impacts.

In addition to wind project concerns, there is growing apprehension about impacts to bat populations in response to climate change (Jones et al. 2009; Jones and Rebelo 2013; and O'Shea et al. 2016). Jones et al. (2009) identified several climate change factors that may impact bats, including changes in hibernation, mortality from extreme drought, cold, or excessive rainfall, cyclones, loss of roosts from sea level rise, and impacts from human responses to climate change (e.g., wind turbines). Sherwin et al. (2013) reviewed and discussed potential impacts of climate change, including effects to bat foraging, roosting, reproduction, and biogeography. Climate change is also likely to influence disease dynamics as temperature, humidity, phenology, and other factors affect the interactions between Pd and hibernating bats (Hayman et al. 2016; McClure et al. 2020; and Hoyt et al. 2021). However, the impact of climate change is unknown for most species (Hammerson et al. 2017).

The NLEB's risk of exposure to climate changes is rangewide, although depending on locations and inherent differences in populations, understanding climate change impacts to a large-ranging species is difficult. While there are several changing climatic variables, the Service's analysis in the status assessment focused solely on changes in temperature and precipitation. These variables influence NLEB resource needs, such as suitable roosting habitat (all seasons), foraging habitat, and prey availability. Overall, average temperature and precipitation has increased since the early 1900's, with some parts of the U.S. experiencing greater changes than others. Although there may be some benefit to NLEB from a changing climate, overall negative impacts are anticipated. While we lack species-specific observations for NLEB, observed impacts to date for other insectivorous bats, such as the little brown bat, include reduced reproduction due to drought conditions leading to decreased availability of drinking water (Adams 2010) and reduced adult survival during dry years (drought) in the Northeast (Frick et al. 2010). Furthermore, too much moisture and precipitation could affect bats' echolocation, foraging, thermal regulation, reproduction, and prey abundance (USFWS 2022). Responses will vary throughout the NLEB range based on the extent of annual temperature rise in the future

3.0 Environmental Baseline

Environmental baseline refers to the condition of the listed species or its designated critical habitat in the Action Area, without the consequences to the listed species or designated critical habitat caused by the proposed action. The environmental baseline includes the past and present impacts of all Federal, State, or private actions and other human activities in the Action Area, the anticipated impacts of all proposed Federal projects in the Action Area that have already undergone formal or early section 7 consultation, and the impact of State or private actions which are contemporaneous with the consultation in process. The consequences to listed species or designated critical habitat from ongoing agency activities or existing agency facilities that are not within the agency's discretion to modify are part of the environmental baseline.

The purpose of the environmental baseline is to describe past and ongoing human and natural factors that have contributed to the current status of the species and its habitat in the project Action Area. Rangewide factors affecting the species include those listed previously in the Threats to the Species subsection.

3.1 Status of Species within the Action Area

3.1.1 Habitat in the Action Area

Land use throughout the Action Area is a mosaic of woodland, cropland, pasture, residential property, and miscellaneous green space. Forest cover is a predominant land use (45%) within the Buck Creek watershed and is primarily associated with Buck Creek valley and portions of the karst plain both east and west of Buck Creek. Buck Creek, one of four major tributaries to the Ohio River in Harrison County, has a watershed that drains about 114 square miles of southern Harrison and Floyd Counties and has been designated an Indiana Outstanding River by the Natural Resources Commission as a State Heritage Program Site with outstanding ecological importance. The Buck Creek stream channel has undergone very little alteration and is the primary habitat for aquatic macroinvertebrates that serve as a source of prey for bats in the region. Secondary aquatic resources in the area are limited to a few sinking streams, ephemeral channels, and sinkhole ponds.

Woodland habitat within the Action Area varies from clusters of scattered individual trees associated with residential sites to large expansive woodland tracts greater than 40 acres in size. These habitat areas were delineated along a 400-foot-wide corridor and a habitat assessment was conducted for each woodland unit in accordance with the Phase 1 habitat assessment protocol in the Range-Wide Indiana Bat and Northern Long-eared Bat Survey Guidelines (USFWS 2022). Each unit was characterized in terms of dominant canopy species, relative cover by age class, and canopy/mid-story/understory cover. Additionally, individual live and dead snag potential bat roost trees were identified and documented for each habitat area. Appendices G, H, and I of the BA provide additional detailed information.

The project area also contains many karst features. Karst geologists surveyed an area of approximately 900 acres that included the three preliminary alternative corridors to inventory and characterize karst features within the landscape of the Action Area (See BA Appendix A, Map 12). This effort yielded 111 features that were classified as sinkhole, sink point, soil piping, sinking stream, or spring. None of the sinkholes, sink points, or soil pipings appeared to provide access to underground voids suitable for bat use. Most of the springs identified in the karst survey area discharge along or near Buck Creek. A small number of sinking streams were also identified, including one that is a contributing source to Watson Spring.

Two caves were identified within the Action Area (but outside of the project construction area). [redacted], as close as 0.14 miles from the construction area, is located within the extreme headwater reach of [redacted], approximately 0.2 mile from the confluence with Buck Creek. The cave opening is approximately two feet wide and one foot high and is located roughly one-third of the way up the valley slope. Based on potential high-water levels, limited space and size, and lack of airflow, this cave is unlikely to provide suitable bat habitat.

[redacted] is located approximately 0.4 miles from the construction area on the face of a very steep valley slope a short distance west of Buck Creek. According to the BA, the entrance is approximately 20 foot wide and four foot in height, but the cave is reduced to a tight, wet breakdown crawl space approximately 30 feet from the entrance. From the Indiana Cave Survey description, after about 50 feet, the crawl way opens to a walking stream passage section, beyond which there are alternating crawl spaces and open rooms, including a deep "bathtub" section. The cave has a six-inch PVC pipe throughout its length and a pump installed through the ceiling of the cave by the landowner to operate a geothermal heating/cooling system for his residence. The landowner periodically enters the cave for maintenance of the geothermal system and indicated that two bats were once observed in the cave during the summer, although the species of bat was not known, and date and year not provided. This cave may be used occasionally by roosting bats but because of continued disturbance is likely not suitable for over-wintering or gray bat maternity use. Furthermore, based on the distance from expected activities, impacts are not anticipated for this cave. More detailed karst information can be reviewed in the *Karst Report, SR 11 Roadway Project, Harrison County, Indiana* (2022).

Finally, Union Chapel Bridge, along with 24 other culverts within the three alternative corridors were investigated for signs of bat use; however, no evidence was found. Many of the culverts are small (<24 inches) and the Union Chapel bridge design limits suitability for bat roosting (no seams, gaps, or vertical stringers).

3.1.2 Indiana Bat in the Action Area

There is suitable fall, summer, and spring habitat for this species throughout the area surrounding the project site, as well as multiple hibernacula approximately 7-15 miles northwest and southeast. While there are no records of Indiana bats within the Action Area, there are multiple fall and winter records associated with the nearby hibernacula, along with several summer mist-net records in the Harrison-Crawford State Forest, approximately 10-12 miles northwest. Two mist-net sites about 2 miles south along Buck Creek were surveyed in the 1990's, although no Indiana bats were encountered. To our knowledge, summer surveys are very limited in the project area.

Hibernacula within 10 miles of the Action Area include: [redacted] (Priority 1), [redacted] (Priority 2), [redacted] (Priority 2), [redacted] (Priority 3) and an unnamed cave (Priority 3). This past winter, most of the Priority 1 and Priority 2 hibernacula were surveyed in Indiana. [redacted] is now the largest hibernacula in Indiana and the Midwest RU with over 90,000 hibernating Indiana bats, and the second largest hibernacula rangewide. [redacted] is approximately 7 miles from the Action Area and forested areas at and adjacent to the project site are considered fall swarming and spring staging habitat. In addition, [redacted], approximately 7 miles in the opposite direction, housed nearly 6,000 Indian bats this past winter. Finally, [redacted] (Critical Habitat; Priority 1) and several other small hibernacula (Priority 3/Priority 4) are located within 15 miles from the Action Area. Based on 2022 data, this part of the state houses approximately 85% of the wintering Indiana bat population in Indiana, 69% of the Midwest RU population, and 31% of the rangewide population.

3.1.3 Northern Long-eared Bat

As with the Indiana bat, there is suitable habitat for the NLEB in the Action Area and surrounding landscape. Older mist-net surveys from the 1990s detected NLEBs along Buck Creek, approximately 2 miles south of the project site, and summer mist-net surveys within nearby Harrison-Crawford State Forest captured NLEBs. No recent surveys have been performed in the project area.

The NLEB has also been documented wintering at [redacted], [redacted], [redacted], and [redacted], all within 10 miles of the project site. [redacted] and [redacted], approximately 12 miles away, are also known hibernacula for the NLEB. Unlike the Indiana bat, hibernacula-specific population information for the NLEB is not available for these caves. No roost tree data is available for the NLEB in southern Indiana due to few surveys and no telemetry work. The somewhat recent listing of the species may account for some of the limited data.

3.2 Factors Affecting Species Environment within the Action Area

Factors affecting Indiana bats and NLEBs in the Action Area are generally a subset of the threats previously discussed that affect the species' rangewide, particularly WNS and habitat conversion. Activities such as timber harvesting, cutting of snags, agriculture, degradation of water quality, and roadkill along existing roadways likely affect Indiana bats and NLEBs to varying degrees within the Action Area, and may continue into the reasonably foreseeable future.

For a detailed description of the threats affecting the covered species rangewide, please refer to the Threats to the Species subsection.

4.0 Effects of the Action

This section addresses the direct and indirect effects of the action on the NLEB and Indiana bat. In accordance with 50 CFR 402.02, effects of the action are all consequences to listed species or critical habitat that are caused by the proposed action, including the consequences of other activities that are caused by the proposed action. A consequence is caused by the proposed action if it would not occur but for the proposed action and it is reasonably certain to occur. Effects of the action may occur later in time and may include consequences occurring outside the immediate area involved in the action. (See 50 CFR § 402.17).

Effects of proposed mitigation, which has been incorporated into the project, will also be assessed. The Action Area and all proposed mitigation sites are within the Midwest RU for the Indiana bat and the Eastern Hardwoods Representation Unit for the NLEB. Note that there is no designated critical habitat for the Indiana bat in the Action Area and no effects to critical habitat are expected. Our analysis considers the following factors:

Proximity of the action: The proposed action will affect presumed occupied maternity habitat, fall swarming habitat, and spring staging habitat of Indiana bats and NLEBs.

Distribution: The Action Area includes summer maternity, fall swarming, and spring staging habitat for both species. [redacted] is approximately 7 miles from the site and contains the largest Indiana bat hibernating population in the Midwest RU and is known to contain NLEBs as well.

Nature of Effects: See Section 4.1 and 4.2.

Timing: Project activities will affect Indiana bats and NLEBs in the spring staging, summer maternity, fall swarming, and migratory stages of their life cycle. During the inactive, winter season, all covered species hibernate in caves and mines underground. Activities conducted outside of hibernacula are unlikely to cause take during the winter.

Duration: Construction effects will primarily be short-term as far as noise, lighting, and water quality concerns. Habitat removal will be permanent as will impacts from roadway operation such as road run-off, traffic, and vehicular collisions (although collision impacts may be offset by a shift of vehicles from use of local roads to the new roadway section).

Disturbance frequency: Habitat removal and construction impacts will result in a one-time disturbance to habitat and impact to individuals within the Action Area. Roadway operation will result in ongoing potential for vehicular collision, traffic noise/lights, and road run-off.

Disturbance intensity and severity: In general, intensity increases as projects impact more acres of suitable habitat or greater number of individuals. Severity is a function of the effect of a disturbance related to the recovery rate of the species; severity is highest for impacts to maternity colonies, moderate for non- maternity, swarming, and staging populations, and is lowest for migratory individuals.

Total project impacts (including tree removal for utility relocations) consist of 19.19 acres of tree loss, 17.39 acres of which is suitable Indiana bat and NLEB habitat. In addition, 49 potential roost trees will likely be removed within the planned construction area. No wetland impacts are expected and approximately 300 feet of stream impacts may occur. Traffic volume and noise will likely increase overall in the project area, including temporary noise and vibration from blasting activities. No new permanent lighting is expected although lights associated with vehicles will be novel in some areas. To compensate for adverse impacts, FHWA/INDOT will contribute funds to the Rangewide Indiana Bat and Northern Long-eared Bat In-lieu Fee Program.

Below, we deconstructed the project into its various components and outlined the anticipated direct and indirect impacts and their effects on Indiana bats and NLEBs by phase of the project: construction, operation, or maintenance. The applicable time of year impacts are realized is also indicated. After each adverse effect is a brief description of specific avoidance, minimization, and mitigation efforts that FHWA and INDOT have already taken or agreed to implement (or attempt to implement) to further reduce adverse effects and incidental take of Indiana bats and NLEBs within the Action Area (these are shown in italics). For our analysis and accompanying Incidental Take Statement, we presumed **17.39 acres of tree impacts**.

4.1 Direct Effects

Construction

- Tree/Forest Clearing (Spring, Summer, Fall)

    - Mortality/Injury/Harassment of roosting bats – Removal of an occupied roost tree would likely result in death, injury, or harm of individuals or a colony. Construction and tree removal activities near occupied roost trees could result in bats fleeing trees during the day and increase risk of predation and stress.

      FHWA/INDOT have agreed to abide by seasonal tree-cutting restrictions by not clearing any trees greater than 3 inches in diameter when bats are likely to be present: between April 1 and November 15. Therefore, direct take of bats is not anticipated from tree clearing during construction.

    - Permanent Loss of Roosting and Foraging Habitat – Estimates of direct loss of suitable forest habitat for bats are 17.39 acres. This amount represents a loss of 0.05% of forest within the Buck Creek watershed and 0.5% of the Action Area forest. Furthermore, if we center a maternity colony area for each species at Buck Creek, loss of 17.39 acres accounts for 0.27% of forest in the Indiana bat maternity colony area and 0.70% of forest in the NLEB maternity colony area.

      FHWA/INDOT minimized impacts to forest and wetland areas when developing the proposed alignment. They also proposed to provide compensatory mitigation for unavoidable loss of forest.

    - Fragmentation of foraging habitat – Tree-clearing and construction may degrade the remaining habitat's quality by reducing the size of and distance between remaining forest tracts. It may also create a barrier to bat movement along commuting and foraging corridors.

      While developing the alignment, FHWA/INDOT attempted to avoid and minimize impacts to forested areas especially near the Buck Creek crossing.

- Stream Modifications (Spring, Summer, Fall)

    - Water Quality/Aquatic Habitat Impacts - According to the BA, the alignment will cross Buck Creek, a perennial stream, and two sinking stream basins. Spills of hazardous materials and soil erosion could occur during construction and degrade the quality of both surface and ground water, as well as physical stream properties. Stream and water quality impacts can affect bats in terms of aquatic insect prey and drinking water. The potential for adverse impacts may be higher in karst areas that are traversed by the alignment.

FHWA/INDOT will follow best management practices and will mitigate for stream impacts as appropriate. Buck Creek and most of its floodplain will be bridged and no piers are planned within the waterway. Road run-off from the bridge will be directed to the floodplain and not discharged directly to the stream. An erosion control plan sensitive to the unique challenges of protecting karst groundwater will be developed in accordance with INDOT standards and Indiana Department of Environmental Management (IDEM) requirements. The erosion plan will include, but not necessarily be limited to, silt fences, and temporary seed mix to control migration of sediment into Buck Creek, contributing surface water features, and sinkholes. Karst features will be addressed in accordance with INDOT's Protection of Karst Features During Project Development and Construction *document.*

- Bridge Construction (Spring, Summer, Fall)

    - Aquatic Habitat Impacts and Barrier Effects - Construction activities could impact water quality, stream flow, and bank vegetation. This could lead to reduced aquatic insect production and degrade the quality of riparian foraging areas. Furthermore, the new structure may create a barrier to or disrupt existing foraging areas and flyways.

      Impacts will be minimized by spanning as much of the floodplain as possible to preserve wildlife corridors and to minimize fill. FHWA/INDOT will span the floodplain at the proposed crossing of the Buck Creek and the height of the structure will allow for continued movement beneath the bridge. Nighttime work on bridge construction will be limited or avoided to reduce deterrents to nighttime bat movement/foraging along the corridor.

- Blasting Activities (Spring, Summer, Fall)

    - Roosting/Hibernation Disturbance - Although some blasting work may be needed at the Bluff Creek crossing, no known bat hibernacula, or connections to known hibernacula, occur in the Action Area. Blasting could impact bats roosting in the vicinity.

      INDOT will consider blasting outside of the pup season (May through July) to avoid vibrations and additional noise during the bats' non-volancy period.

Project operation

- Increased Traffic and Traffic Speed (Spring, Summer, Fall)

    - Death or Injury Due to Collision - Individuals may be directly killed by vehicles traveling on the newly extended SR 11 roadway once it is operational. There have been various studies that have shown bats are killed

- by vehicular traffic (Russell et al. 2009; Gaisler, 2009; Lesinski 2007, 2008; Berthinussen and Altringham 2012).

  The Service anticipates that all bats that are struck by vehicles will be killed. However, based on the best available scientific data, the actual number of bats that may be struck and killed from vehicles cannot be precisely quantified. There will likely be some offset from reduced use of other local roads and the new bridge height should allow for bats foraging along Buck Creek to pass under the roadway.

- Increased Light / Noise / Vibration (Spring, Summer, Fall)

  - Disturbance - Increased light, traffic noise, and vibrations could cause disturbance to bats while commuting, roosting, and foraging, and thereby lower the suitability of adjacent habitats and or create a barrier effect to bat movement. Several studies have indicated that noise and light impacts may result in decreased use of areas near roads (Bennett and Zurcher 2013; Kitzes and Merlender 2014; Stone et al, 2015; Siemers and Schaub 2011). Although some bats have persisted near roadways, such as the I-70/Indianapolis Airport area, their proximity to the interstate could be due to lack of more suitable roosting areas nearby (USFWS 2002).

    FHWA/INDOT did not propose specific measures to avoid, minimize, or mitigate novel traffic noise and vibration; however, they are not proposing any roadway lighting at this time. If they deem lighting necessary in the future, downward facing lights with full cut-off lenses are suggested.

Project Maintenance

- Bridge Repair / Replacement (Spring, Summer, Fall)

  - Roosting Disturbance - Bridges may be used as temporary day or night roosts, and repairs or future replacement could affect bats using the structures. Some habitat destruction could occur because of access needs during maintenance or other bridge work.

    INDOT routinely assesses bridges for bat use and will coordinate with the Service if needed to reduce unnecessary disturbances.

  - Aquatic Habitat Impacts - Highway project maintenance could result in spills of hazardous materials into streams, wetlands, or karst areas. Spills could degrade the quality of both surface and ground waters. Road salt and herbicides used to maintain the roadway may degrade surface and ground water through runoff. Construction debris could fall into or be left in waterways. Water quality impacts could affect availability of suitable prey and drinking water.

Impacts will be reduced or avoided via standard best management practices such as low salt and no spray areas. The bridge drainage system will be designed to prevent runoff from being deposited directly into Buck Creek.

4.2 Indirect effects

Indirect effects are caused by or result from the proposed action, are later in time, and are reasonably certain to occur. Many of the indirect effects are beyond the authority of the FHWA or INDOT to control. Anticipated indirect effects include the following.

Construction, operation, and maintenance

- Water Quality Degradation
    - Long-term roadway runoff from vehicular travel can affect water quality by introducing pollutants such as oil, grease, metals, sand, rubber, salts, etc.

      The bridge drainage system will be designed to prevent runoff from being deposited directly into Buck Creek from deck drains. All bridge runoff will be captured and discharged onto the floodplain to allow for filtering of roadway contaminant.

- Utility Right-of-Way (ROW) Impacts
    - Utility relocation is likely to result in permanent removal of some amount of foraging and commuting habitat. Utility ROWs may also be maintained with herbicides.

      The scope of potential utility work has been estimated in the BA. Seasonal tree clearing will be implemented along with standard BMPs for sediment/erosion control and construction within karst areas. Utility tree impacts are included in final tree-clearing acreages and mitigated for as part of the project mitigation.

- Impacts to Soil and Water from Vehicle Accidents
    - Spills could degrade quality of both surface and ground waters and surrounding soils and karst features. Water quality affects bats in terms of their aquatic insect prey and drinking water.

      Roadway design will incorporate detainment features to intercept and contain road runoff contaminants and hazardous spill materials to protect karst groundwater resources. The bridge drainage system will be designed to prevent runoff from being deposited directly into Buck Creek from deck drains. All bridge runoff will be captured and discharged onto the floodplain to allow for filtering of roadway contaminants.

4.3 Analysis of Effects of Stressors

As a result of project activities, maternity roosting habitat, foraging habitat, and fall swarming and spring staging habitat will be modified during biologically significant times of year and while bats are hibernating. These activities include the permanent removal of 17.39 acres of suitable bat habitat, introduction of novel noise, light, and traffic, and construction of facilities (roadway and bridge) on new terrain. Because the footprint of this transportation project is primarily linear in shape, losses to any one patch or areas of important habitat (e.g., maternity colony area or hibernacula swarming areas) are minimized. Due to the similar life history and habitat use, the following discussion pertains to both the Indiana bat and the NLEB, except where noted.

4.3.1 Direct Effects Analysis

Effects of Loss of Roosting, Swarming, and Staging Habitat,

Cutting an Indiana bat or NLEB roost tree when bats are present (April 1 – November 15) is likely to result in bats being injured or killed. Therefore, FHWA/INDOT will restrict the removal of trees in the project area to the period between November 16 and March 31 when Indiana bats and NLEBs are absent.

Some adverse effects could still stress bats to the point where take is reasonably certain to occur. The effect of cutting (or having a potential roost tree fall naturally) an unoccupied roost ranges from “irrelevant (in the case of a rarely used alternative roost) to dramatic (when a roost is actively used by a colony)” (Kurta 2004). For example, the loss of a primary roost tree or multiple alternate roost trees during the non-occupancy season would cause displaced individuals to expend increased levels of energy while seeking out replacement roost trees when they return the following spring. If increased energy expenditure occurs during a sensitive period of a bat’s reproductive cycle (e.g., pregnancy) it is assumed that spontaneous abortion or other stress-related reproductive delays or losses would be a likely response in some individuals, particularly those that may have already been under other environmental stresses (e.g., WNS). It has been hypothesized that these stresses and delays in reproduction could also result in lower fat reserves being deposited prior to hibernation and ultimately lead to lower winter survival rates (USFWS 2002). For example, females that do give live birth may have pups with lower birth weights or their pups may have delayed development (i.e., late into the summer). This could in turn affect the overwinter survival of the young-of-the-year bats if their delayed development caused them to enter fall migration and winter hibernation periods with inadequate fat reserves.

Removal of a bat primary roost tree (that is still suitable for roosting) in the winter is also expected to result in temporary or permanent colony fragmentation and smaller colonies may provide less thermoregulatory benefits for adults and for nonvolant pups in cool spring temperatures. Removal of multiple alternate roost trees in the winter is also expected to result in similar adverse effects. Kurta (2005) suggested that loss of a single alternate roost at any time of year probably has little impact on Indiana bats because the colony has a minimum of 8–25 other trees from which to select, but loss of a primary roost could be detrimental. Similarly, in a long-term study of an Indiana bat maternity colony in Indiana, Sparks et al. (2003) found that the

natural loss of a single primary maternity roost led to the fragmentation of the colony (bats used more roosts and congregated less) the year following the roost loss.

According to the 2007 Recovery Plan, the habitat surrounding hibernacula may be one of the most important habitats in the annual cycle of the Indiana bat [and NLEB]. This habitat must support the foraging and roosting needs of large numbers of bats during the fall swarming period. After arriving at a given hibernaculum, many bats build up fat reserves (Hall 1962), making local foraging conditions a primary concern. Migratory bats may pass through areas surrounding hibernacula, apparently to facilitate breeding and other social functions (i.e., bats that utilize the area for swarming may not hibernate at the site) (Barbour and Davis 1969; Cope and Humphrey 1977). Areas surrounding hibernacula also provide important summer habitat for those male bats that do not migrate. Loss or degradation of habitat within this area has the potential to impact a large proportion of the total population. This is particularly true for hibernacula supporting large numbers of bats, or areas that support multiple hibernacula that together support large numbers of bats, such as the area this project occurs in.

The loss of bat habitat associated with construction of the roadway project will be permanent. A few bats displaced by clearing for the project may perish, but most displaced bats will likely establish a new summer home range in nearby habitat. The relative abundance and availability of suitable habitat in areas surrounding the project site should enhance the potential for displaced bats to successfully relocate to a new area.

Effects of Lost Commuting and Foraging Habitat

Tree-clearing may alter foraging habitat and travel corridors, forcing bats to fly farther while foraging at night or avoid former foraging areas. The quality of foraging habitat may also be temporarily degraded due to erosion, and subsequent sedimentation of stream corridors, associated with construction of the project. Buck Creek is one of only a few primary streams in the region. The new crossing will bifurcate the riparian and bluff forest habitat of Buck Creek as it spans the valley.

Forest removal and roadway construction will not only reduce available habitat but will fragment the commuting and foraging habitat and likely create some barrier to bat movement. With the new roadway, we expect increases in traffic volume (and accompanying noise and light), roadway width, and traffic speed. Numerous studies have concluded that roadways can impact the movement of bats between areas separated by roads. Kerth and Merber (2009) discovered bats making significant detours to avoid roads and find more suitable crossing points. Other studies have found that fewer bats crossed roads as the gap created between habitat on each side increased (Abbott et al. 2012; Bennett and Zurcher 2013; Russell et al. 2009). Two different studies found that bats were significantly more likely to reverse course as they approached roadways with vehicles present (Zurcher et al. 2010), and that this turning frequency was further increased as the vehicular noise level increased (Bennett and Zurcher 2013). This barrier to movement can reduce the available foraging habitat and alter commuting routes, which in turn can increase energy expenditure and mortality. In addition, since Indiana bats and NLEBs are known to return to their same foraging areas year after year, those bats displaced by the project may alter their foraging areas and create increased competition in other nearby territories.

Some bats have been known to cross roadways and use underpasses (D. Sparks, Environmental Services Inc., personal communication; Kerth and Merber 2009; Bach et al. 2004). The height of the Buck Creek bridge is anticipated to be 115 feet tall at the highest point (per the BA) and should help to facilitate some movement under the roadway in that location; however, we anticipate that some bats will be deterred from the Buck Creek drainage and seek alternate foraging areas once clearing, construction, and operation of the new roadway commences. Furthermore, the gaps in cover created by the construction could increase the bats susceptibility to predation for those that continue to use the area.

Effects from Lighting and Noise

Bat behavior may be affected by lights and noise while foraging and traveling between roosting and foraging habitat. Foraging in lighted areas may increase risk of predation or it may deter bats from using those areas. Woodland species, including many Myotids, have been shown to avoid lighted spaces. Stone et al. (2012) revealed that even at low light levels, Myotis species' [and others] activity was significantly reduced in lit areas verses dark, controlled areas. In other studies, certain species appear to only be found away from lights, despite the lighting being within their home range (Stone et al. 2015). In a 2017 paper by Spoelstra et.al., they concluded that the reduction of slow-flying species in the study area (such as Myotids) in the presence of white and green light, suggests habitat loss for these animals.

Artificial lights may reduce foraging opportunities if bats pass through these areas hurriedly. Polak et al. (2011) showed that *Eptesicus bottae* passed through lit areas more quickly without foraging and only foraged in the dark areas. Furthermore, insects may be drawn out of the darker woodland areas, decreasing prey availability for woodland bats. A recent study suggested that artificial lighting may also negatively affect bat drinking activity (Russo et al. 2017). In this study, most of the 12 recorded species showed reduced drinking activity under illumination and the forest species never drank from the troughs when illuminated. Other than novel light from traffic, and possibly temporary lighting during construction, no new permanent lighting is currently planned.

Lighting impacts are expected to be short-range since light intensity decreases with distance. Currently, plans for night-time construction activities are unknown, but according to the BA, night-time work will be limited as much as possible, particularly at the Buck Creek crossing, and any lighting used will be directed away from bat habitat. This will eliminate or limit exposure to lights during the construction phase. Permanent street lighting is not anticipated. While these measures may reduce the reach of light impacts within the surrounding habitat, we anticipate that temporary lighting (if used), along with lights from vehicle headlights, will affect some bats as they commute and forage in the area and likely contribute to a barrier effect of the roadway.

In addition to light, noise impacts from construction, operation and maintenance of the SR 11 Extension Project may also impact bat activity in the area. Most noise generated from project-related construction activities will likely occur during daylight hours when Indiana bats are roosting in trees. Unfamiliar noises from the operation of chainsaws, bulldozers, skidders, trucks, etc. are likely to occur in relatively proximity to occupied primary and alternate roost trees during the summer reproductive season. The novelty of these noises and their relative volume

levels will likely dictate the range of responses from individuals or colonies of bats. At low noise levels (or farther distances), bats initially may be startled and have increased respiration/heart rates, but they would likely habituate to the low background noise levels. At closer range and louder noise levels (particularly if accompanied by physical vibrations from heavy machinery and the crashing of falling trees) many bats would probably be startled to the point of fleeing from their day-time roosts and in a few cases may experience increased predation risk. Because the noise levels in construction areas will likely continue for more than a single day the bats roosting within or close to these areas are likely to shift their focal roosting areas further away or may temporarily abandon these roosting areas completely. Bats that flush their roost and/or avoid travel and foraging areas in response to this stressor may be harmed due to an increase in energy expenditure. Increased energy demands could have a significant effect on bats due to their low body mass. Because females require increased energy reserves during lactation (Kurta et al. 1989), an increased demand for energy in response to noise and vibrations could be especially detrimental to lactating females and, subsequently, their pups.

Callahan (1993) noted that the likely cause of the bats in his study area abandoning a primary roost tree was disturbance from a bulldozer clearing brush adjacent to the tree. Female bats in Illinois used roosts at least 1640 ft (500 m) from paved roadways (Garner and Gardener 1992). Very low bat usage close to interstates has also been noted by other bat biologists (Whitaker, Jr. per. comm.). Conversely, some bats did use roosts near the Interstate-70/Indianapolis Airport area, including a primary maternity roost 1,970 ft (0.6 km) south of Interstate-70. This primary maternity roost was not abandoned despite constant noise from the interstate and airport runways, however; their proximity to the interstate could also have been due to lack of more suitable habitat nearby.

Finally, many bats rely on hearing their echolocation calls to maneuver, detect prey, and communicate (Altringham and Kerth 2016). Siemers and Schaub (2011) found that noise affected foraging efficiency of *M. myotis* (a gleaning feeder). Schaub et al. (2008) also determined that captive *M. myotis* preferred silent chambers versus chambers with traffic noise being played. Noise from traffic and construction may disrupt bats' communication and passive listening for prey, predators, or other environmental information (West 2016).

Like lighting, noise impacts are anticipated to be limited in their spatial reach because of sound reduction over distance; however, due to the rural nature of the project area, background noise levels are low and new noises in this area may be more significant, at least initially. Minimal construction is planned to occur at nighttime, reducing impacts to foraging bats. There is evidence that bats may acclimate to noises over time, such as the Indiana bat maternity colony at the Indianapolis Airport (USFWS 2002); however, other studies indicate bats are sensitive to these stressors. As a result, we anticipate some small amount of take will occur due to introduced noise and lighting.

Effects of Water Quality Impacts

Impacts to water resources may also adversely affect Indiana bats and NLEBs in the Action Area. Potential adverse impacts include contamination of drinking water and reduction or contamination of the aquatic insect forage base. Foraging habitat and aquatic insect production

associated with disturbed stream segments will likely be relatively poor until the riparian zone and aquatic community become re-established. Removal of vegetation during or after grading activities could also potentially cause short-term adverse effects on the hydrologic characteristics and water quality in the watershed. A reduction in vegetative cover could potentially increase water yield and stream discharge; changes in vegetation cover could alter normal nutrient cycles in both terrestrial and aquatic systems, and use of temporary access/construction roads and trails during the construction phase could cause soil erosion leading to sedimentation.

Other impacts may result in the short term from construction runoff, and over the long-term from road salts and other pollutants resulting from vehicular traffic and accidental spills. Some small potential exists for accidental fuel/oil spills or spills of other hazardous materials from chainsaws and heavy equipment during the forest-clearing phase and subsequent roadwork, which could degrade the quality of both surface and ground water. Water quality could also be adversely affected during a major spill or accident once the new roadway is operational, although the probability of this is not known. We expect effects from removal of vegetation and soil disturbance to be temporary in nature. Other potential effects will be minimized by the implementation of best management practices during the construction, operation, and maintenance of the project.

Effects of Vehicular Collision

While some bats may avoid roads, for those that do attempt to cross the roadway, death as a result of collision with a vehicle is a possibility. Use of linear landscape features such as riparian corridors, forest edge, tree lines, etc., make bats susceptible to vehicle collision where these features intersect roadways. Russel et al. (2009) found 27 road-killed *M. lucifugus* and *one M. sodalis* along a stretch of highway in Pennsylvania that separated roosting and foraging areas. Bat mortality has been documented in many other instances where roadways have divided habitat (Gaisler et al. 2009; Medinas et al. 2013; Russel et al. 2009). Lesinski (2008) found over 50 *Myotis nattereri* dead along a section of highway in Poland where tree lanes ran perpendicular to the roadway. Like many species, tree canopy is especially important to Indiana bats and NLEBs in the vicinity of roosts, hibernacula, and along flight corridors and foraging areas.

Although bats are very agile, many Myotis species will fly at slower speeds when foraging (Stone et al. 2012) and often lower to the ground (Harvey 1992; LaVal et al. 1977; and Brack 1985 as cited in Mitchell 1998). In the Pennsylvania study, the highway separated a known maternity roost from foraging habitat. The researchers observed that the lower the canopy cover near the road, the lower the bats flew. Bats that were observed flying across an open field during the study did so at heights less than two meters (Russel et al. 2009). Another study also found bats crossing at lower heights where vegetation was limited (Berthinussen and Altringham 2012). These lower flight paths can put bats at higher risk for vehicular collision.

Some direct mortality from vehicular collisions may be compensatory rather than additive as the number of collisions currently occurring on other local roads may decrease as traffic shifts to the new roadway segment. And, while it has been shown that Indiana bats will cross over busy highways when they separate foraging from roosting areas, it should also be noted that through a radio telemetry study done by Indiana State University, Sparks (pers. comm.) observed that

individuals of the Indianapolis Airport Colony avoided flying over Interstate-70 where a bridge provided a 35-ft high corridor beneath the road. The results of this study indicate that bats may avoid flying over highways when an alternative corridor is present. Research published by Zurcher et al. (2010) indicates that bats may avoid traffic. In this study, bats were more than twice as likely to reverse their flight course while crossing a road when vehicles were present.

No detailed analysis of vehicle collision on population-level biology is available at this time but given the long lives and low fecundity of bats it is likely that even occasional road-related fatalities can have population-level impacts (D. Sparks, written communication, February 4, 2010). The new SR 11 extension has a design speed of up to 55 mph, with an anticipated 45 mph posted speed which could reduce a bat's chance of avoiding collision. Although the bridge is high across Buck Creek, some portions of the bridge will cross the floodplain area at a lower height and potentially intersect with the canopy to some extent at the cut in the forested bluff east of the creek. As a result, we anticipate that some bats may be killed crossing the roadway at these locations during foraging or commuting.

4.3.2 Indirect Effects Analysis

Habitat loss and degradation from utility relocations and maintenance, long-term water quality impacts, or hazardous spills resulting from roadway accidents, could indirectly impact Indiana bats and NLEBs. Water quality impacts would be like those described under the Direct Effects section and reduced, in part, with a bridge drainage system that avoids direct runoff to the stream. Utility tree-clearing has been estimated and included in the total tree-clearing amount. Tree removal for utilities will occur in the non-active period and be included in compensatory mitigation amounts.

4.4 Effects of Mitigation

The FHWA and INDOT have incorporated measures into the proposed project design to avoid, minimize and mitigate the impacts of the project to the maximum extent practical. Proposed avoidance, minimization and mitigation procedures are discussed in the BA and included in the beginning of this opinion as part of the proposed action.

Compensatory mitigation will be provided at a 3:1 mitigation ratio for impacts to all suitable habitat greater than 300 feet from existing paved roads and a 1.5:1 ratio for impacts to habitat less than 300 feet from existing paved roads. Mitigation will be in the form of payment into the Range-Wide Indiana Bat and Northern Long-Eared Bat In-Lieu Fee Program (USFWS 2017; amended and restated in 2022). Compensatory mitigation will provide suitable habitat for breeding, foraging, sheltering, or dispersal commensurate with habitat lost because of the project. Implementation of mitigation will be in consultation with the Service's INFO.

Finally, floodplain impacts are expected to be mitigated according to the Indiana Department of Natural Resource's Construction in a Floodplain permit guidelines. This activity would benefit bats in the project area.

4.5 Species Response to the Proposed Action

We estimate that adult female and juvenile Indiana bats and NLEBs from one maternity colony each may be directly or indirectly taken by the proposed activity, as well as some bats that use the area for fall swarming and spring staging activities. Under no likely scenarios, is the estimated amount of take of reproductive individuals likely to cause an appreciable long-term change in viability of an individual maternity colony or to the species' regional or rangewide status. In none of the maternity areas is the amount of proposed tree clearing or vehicular death believed to be extensive enough to cause a maternity colony to be permanently displaced from its traditional summer range; the availability of suitable habitat in the area and adequate flyway space under the Buck Creek bridge will limit overall effects and these impacts are not likely to alter a colony's long-term reproduction and survival. Thus, all currently extant Indiana bat and NLEB maternity colonies (and swarming-staging populations) are likely to persist within the Action Area following implementation of the proposed action.

5.0 Cumulative Effects

In the context of the ESA, cumulative effects are defined as the effects of future State, tribal, local, or private actions that are "reasonably certain" to occur in the Action Area considered in this biological opinion. Future Federal actions that are unrelated to the proposed action are not considered because they require separate consultation pursuant to section 7 of the ESA. Southern Harrison County is largely forested and agricultural with scattered and small clusters of residential properties and very limited to no commercial or industrial operations. There are no known developments planned or expected in the Action Area in the foreseeable future. As mentioned previously, there is no critical habitat within the Action Area and therefore no impacts to this resource is expected.

6.0 Conclusion

Section 7(a)(2) of the Endangered Species Act requires that Federal agencies ensure that any action they authorize, fund, or carry out is not likely to jeopardize the continued existence of listed species. "Jeopardize the continued existence of" means "to engage in an action that reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species" (50 CFR 402.02).

After reviewing the current status of the Indiana bat and NLEB, the environmental baseline of each species for the Action Area, the effects of the proposed roadway construction, operation and maintenance, and the cumulative effects, it is the Service's biological opinion that the SR 11 Extension Project, as proposed, is not likely to jeopardize the continued existence of the Indiana bat or NLEB because the proposed action is not expected to significantly reduce the reproduction, numbers, or distribution of either species within its range. Therefore, we do not anticipate a reduction in the likelihood of survival or recovery of either species as a whole.

Briefly, the basis for this conclusion (as detailed in the biological opinion) is as follows:

- Tree clearing will take place between November 16 and March 31 when bats are not using the area.
- INDOT will provide funds to TCF In Lieu Fee Program to provide mitigation for bat habitat impacts.
- Mitigation will equal 1.5 times the amount of tree clearing within 100 feet of existing roads and 3 times the amount of clearing for impacts beyond 300 feet.
- No hibernacula will be impacted by the proposed action.
- The Buck Creek bridge will be at a height (up to 115 ft high) to provide for a continued flyway for bats and other wildlife movement.

INCIDENTAL TAKE STATEMENT

Section 9 of the Act and Federal regulations pursuant to section 4(d) of the Act prohibit the take of endangered and threatened species without special exemption. Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. Harm is further defined by the Service to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering. Harass is defined by the Service as intentional or negligent actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavioral patterns which include, but are not limited to, breeding, feeding, or sheltering [50 CFR §17.3]. Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(a)(2), taking that is incidental to and not intended as part of the agency action is not considered prohibited taking under the Act, provided that such taking is in compliance with the terms and conditions of an Incidental Take Statement (ITS).

The measures described below are non-discretionary and must be undertaken by the FHWA or their designee (e.g., INDOT) for the exemption in section 7(o)(2) to apply. The FHWA has a continuing duty to regulate the activity covered by this incidental take statement. If the FHWA fails to assume and implement the terms and conditions of the incidental take statement, the protective coverage of section 7(o)(2) may lapse. To monitor the impact of incidental take, the FHWA must report the progress of the action and its impact on the species to the Service as specified in the incidental take statement [50 CFR §402.14(i)(3)].

AMOUNT OR EXTENT OF TAKE

The Service believes it is likely that incidental take of Indiana bats and NLEBs in the Action Area will occur as a direct or indirect result of the proposed action in the following forms:

- Harm through habitat modification and permanent direct loss of maternity roosting habitat, foraging habitat, and commuting corridors, resulting in lost reproduction
- Harm through disruption or abandonment of traditional roosting, foraging, and commuting corridors that are bisected by the roadway and bridge and no longer suitable based on canopy gaps; these gaps could lead to additional exposure to predators and adjusting foraging areas could result in short-term disruption in fitness and reproduction.
- Death or injury from direct collision with vehicles traveling on the new roadway.
- Disturbance of bats due to lighting and noise from construction and operation of the new roadway creating deterrents to typical foraging and commuting corridors

We express the anticipated incidental take with surrogate measures. 50 CFR 402.14(i)(1)(i) states that surrogates may be used to express the amount or extent of anticipated take provided that the biological opinion or ITS: (1) describes the causal link between the surrogate and take of the listed species; (2) describes why it is not practical to express the amount of anticipated take or to monitor take-related impacts in terms of individuals of the listed species; and (3) sets a clear standard for determining when the amount or extent of the taking has been exceeded.

It is unlikely that direct mortality of small-sized bats from roadkill will be detected, that is, we do not expect that most dead or moribund bats are likely to be found. The same is true for take associated with habitat modification/loss and disturbance; detecting or finding dead individuals is unlikely. However, we can track the level of anticipated take by monitoring the amount of habitat modification as a surrogate since tree removal will be the cause of most direct and indirect take. The proposed action will result in the loss of up to 17.39 acres of suitable Indiana bat and NLEB habitat. The Service anticipates that reproductive and viability consequences at the colony level are not likely to occur with the proposed amount of habitat modification. If the amount of habitat modification exceeds the specified levels, the trigger for reinitiation has been met.

EFFECT OF THE TAKE

Overall, the harm, harassment, injury, or death of individuals caused by removal of 17.39 acres of suitable forested Indiana bat and NLEB habitat and 291 linear feet of stream impact is not likely to affect the Midwest RU or rangewide status of either the Indiana bat or the NLEB. In the accompanying biological opinion, the Service determined that the aggregate level of anticipated take is not likely to result in jeopardy to either species.

REASONABLE AND PRUDENT MEASURES

The Service believes the following reasonable and prudent measures are necessary and appropriate to minimize take of the Indiana bat and NLEB:

1. Design the project footprint to have the minimum feasible width within the forested corridors and maintain habitat connectivity wherever possible.

2. Implement all conservation, avoidance, and minimization measures. These measures will benefit a variety of wildlife species, including bats.

3. Any injured or dead bats incidentally observed should be reported to the Service.

4. Construction personnel and INDOT maintenance staff should be made aware of potential construction, maintenance or operation issues concerning Indiana bats and NLEBs.

TERMS AND CONDITIONS

To be exempt from the prohibitions of section 9 of the Act, the Federal Highway Administration must comply with the following terms and conditions, which implement the reasonable and prudent measures described above and outline required reporting/monitoring requirements. These terms and conditions are non-discretionary.

1. The FHWA must implement the proposed action as described in the initiation package, including all conservation, avoidance, and minimization measures, including seasonal tree clearing.

2. Any dead bats located within the construction limits, roadway, or right-of-way should be immediately reported to INFO [(812) 334-4261], and subsequently transported (frozen or on ice) to INFO. No attempt should be made to handle any live bat, regardless of its condition; report bats that appear to be sick or injured to INFO. INFO will make a species determination on any dead or moribund bats. If an Indiana bat is identified, INFO will contact the appropriate Service Law Enforcement office as required.

3. Provide the Service with final construction impact figures and compensatory mitigation fee details for review and notify the INFO of payment to the TCF In Lieu Fee Program.

In conclusion, the Service believes that the permanent loss of suitable summer roosting and foraging habitat for Indiana bats and NLEBs will be limited to 17.39 acres of suitable forest habitat within the Action Area. This acreage represents an approximate 0.27% loss of the presumed Indiana bat maternity colony forested acreage and a 0.70% loss of the presumed NLEB maternity colony forested acreage. The reasonable and prudent measures, with their implementing terms and conditions, are designed to minimize the impact of incidental take that might otherwise result from the proposed action. If, during the course of the action, this level of incidental take is exceeded (or tree clearing occurs during the period April 1-November 15 within any given year) such incidental take represents new information requiring reinitiation of consultation and review of the reasonable and prudent measures provided. The FHWA must immediately provide an explanation of the causes of the taking and review with the Service the need for possible modification of the reasonable and prudent measures.

CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the ESA directs federal agencies to utilize their authorities to further the purposes of the ESA by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information. The Service recommends the following actions:

1. Control non-native and invasive species.

2. Expand on scientific research and educational outreach efforts on Indiana bats and NLEBs in coordination with the Service's INFO.

3. Provide funding to conduct research on understanding, controlling, and mitigating the effects of White-Nose Syndrome.

REINITIATION NOTICE

This concludes formal consultation with FHWA on the construction, operation, and maintenance of the SR 11 Extension Project in Harrison County, Indiana. As provided in 50 CFR §402.16, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained (or is authorized by law) and if: (1) the amount or

extent of incidental take is exceeded; (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion; (3) the agency action (e.g., highway construction, operation, and maintenance) are subsequently modified in a manner that causes an effect to the listed species or critical habitat not considered in this opinion; or (4) a new species is listed or critical habitat designated that may be affected by the action. In instances where the amount or extent of incidental take is exceeded, any operations causing such take must cease pending reinitiation.

Literature Cited

Citations available upon request from the Indiana Ecological Services Field Office.