

APPENDIX K-1

Endangered, Threatened, and Rare Species Habitat Assessment and Wildlife Technical Report

Clarification Note for Central Alternative 1:

Central Alternatives 1A and 1B as described in the DEIS/FEIS are physically the same alternative. The only difference between them is that Central Alternative 1A would include tolls on both the new I-69 bridge and on the US 41 bridge. Central Alternative 1B would only include tolls on the new I-69 bridge. Any reference in this document to Central Alternative 1 applies to both Central Alternative 1A and Central Alternative 1B.

This document was completed before the development of Central Alternative 1B Modified (Selected); therefore, the alternative is not included in the document. Applicable information regarding Central Alternative 1B Modified (Selected) is provided in the FEIS.

October 15, 2018

ORX

69

ENDANGERED, THREATENED, AND RARE SPECIES HABITAT ASSESSMENT AND WILDLIFE TECHNICAL REPORT

I-69 OHIO RIVER CROSSING PROJECT
Evansville, IN and Henderson, KY





OHIO RIVER CROSSING

Endangered, Threatened, and Rare Species Habitat Assessment and Wildlife Technical Report

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CHAPTER 1 – INTRODUCTION

1.1 PURPOSE OF TECHNICAL REPORT

This technical report is being prepared to document the existing habitat conditions for the I-69 Ohio River Crossing (ORX) project with emphasis on state and federal listed endangered, threatened, and rare (ETR) wildlife species. The information will supplement previously collected data and will be used to help support National Environmental Policy Act (NEPA) compliance for the project. Information concerning federally listed ETR species will also be used to help satisfy the requirements of the Endangered Species Act (ESA).

1.2 PROJECT DESCRIPTION

The Federal Highway Administration (FHWA), Indiana Department of Transportation (INDOT), and Kentucky Transportation Cabinet (KYTC) issued a revised Notice of Intent (NOI) in the *Federal Register* on February 13, 2017 for the preparation of an Environmental Impact Statement (EIS) for the I-69 ORX project in the Evansville, IN and Henderson, KY area, which is part of the National I-69 Corridor that extends between Mexico and Canada. An NOI was previously issued for the project on May 10, 2001. Under that NOI, a Draft Environmental Impact Statement (DEIS) was completed in 2004, but the project was subsequently suspended in 2005.

In this report, the term “study area” is used to describe properties included in the three alternatives being examined for selection for the I-69 ORX project. For the new DEIS that is being prepared for the I-69 ORX project, the study area extends from I-69 (formerly I-164) in Indiana on the south side of Evansville (i.e., northern terminus) across the Ohio River to I-69 (formerly Edward T. Breathitt Pennyryle Parkway) at the KY 425 interchange southeast of Henderson, KY (i.e., southern terminus) (**Figure 1.2-1**). The section of Edward T. Breathitt Pennyryle Parkway between KY 351 and KY 425 that was not re-designated as I-69 was recently re-designated as US 41. The western limit of the study area is parallel to and extends a maximum of about 2,000 feet west of US 41. The eastern limit of the study area extends about 1,500 feet to 3.4 miles east of US 41. Currently, I-69 does not cross the Ohio River, and the only cross-river access between Evansville and Henderson is via US 41, which is classified as a principal arterial and does not meet current interstate design standards.

One of the first steps in the EIS process for the I-69 ORX project was the scoping phase, which included the development of the project’s purpose and need. As a result of this analysis, the following project needs have been identified:

- Lack of National I-69 Corridor system linkage
- High cost of maintaining cross river mobility on existing facilities
- Unacceptable levels of service for cross-river traffic
- High-crash locations in the I-69/US 41 corridor

Based on these needs, the project's purpose is:

- Provide cross-river system linkage and connectivity between I-69 in Indiana and I-69 in Kentucky that is compatible with the National I-69 Corridor
- Develop a solution to address long-term cross-river mobility
- Provide a cross-river connection that reduces traffic congestion and delay

Improve safety for cross-river traffic. Based on the project's purpose and need, an initial range of alternatives was developed and evaluated, and screened using secondary source and windshield survey data, and input from the public and federal, state, and local agencies. Because the range of alternatives was developed based on conceptual designs, they were referred to as corridors. Each corridor was evaluated on the degree to which it meets the purpose and need; its potential social, environmental, and economic impacts; and its conceptual cost. In addition to the No Build Alternative, the following five corridors were developed based on alternatives previously presented in the 2004 *Interstate 69 Henderson, Kentucky to Evansville, Indiana Draft Environmental Impact Statement* (INDOT, and KYTC 2004) and the 2014 *I-69 Feasibility Study, Henderson, Kentucky, SIU #4, Final* (KYTC 2014).

- West Corridor 1 (Based on Alternative 7 from the 2014 Feasibility Study)
- West Corridor 2 (Based on Corridors F and G from the 2004 DEIS and Alternatives 5 and 6 from the 2014 Feasibility Study)
- Central Corridor 1 (Based on Alternative 1a from the 2014 Feasibility Study)
- Central Corridor 2 (Based on the Preferred Alternative 2 from the 2004 DEIS)
- East Corridor (Based on Alternative 3 from the 2004 DEIS)

The results of the evaluation of these corridors were presented in a *Screening Report* (INDOT and KYTC 2017) completed on July 28, 2017 that recommended three corridors — West Corridor 1, West Corridor 2, and Central Corridor 1 — be carried forward for more detailed evaluation in the DEIS, in addition to the No Build Alternative. In the *Screening Report*, for West Corridors 1 and 2, it was assumed that both US 41 bridges would be taken out of service for vehicular use and the new I-69 bridge would have six lanes. For Central Corridor 1, it was assumed that both US 41 bridges would remain open and the new I-69 bridge would have four lanes. However, the report stated that the future use of the existing US 41 bridges and corresponding number of lanes on the new I-69 bridge for each corridor would be subject to further evaluation.

Following the *Screening Report*, preliminary designs were then developed within these corridors based on public and agency input, assessment of potential environmental and right-of-way impacts, and results of a traffic analysis. Follow-up studies were conducted regarding the location and configuration of interchanges, the disposition of and long-term maintenance costs for the existing US 41 bridges, and tolling scenarios with resulting traffic patterns. This included the development, evaluation, and screening of the following three different US 41 and I-69 bridge scenarios for each of the three corridors.

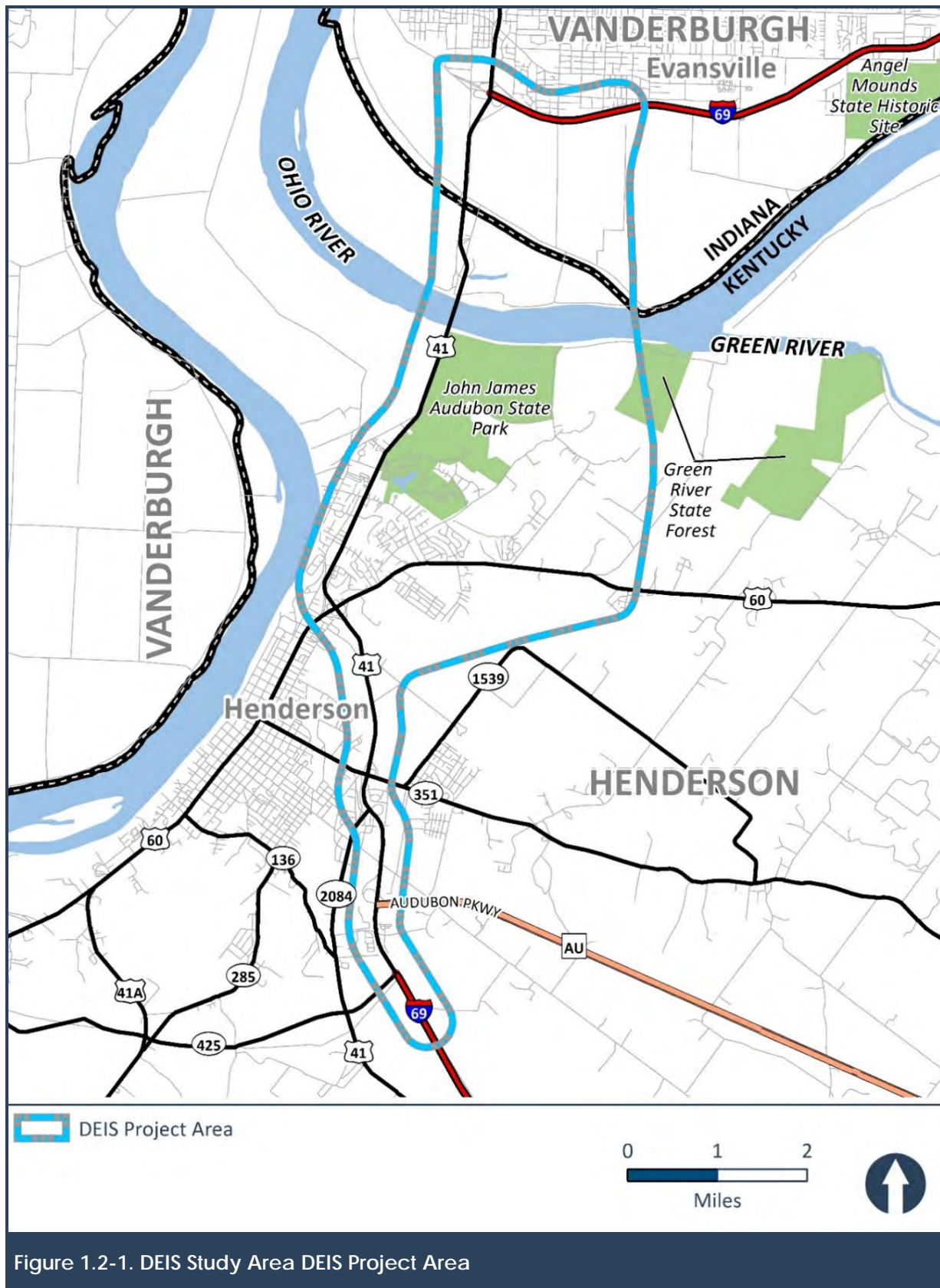


Figure 1.2-1. DEIS Study Area DEIS Project Area

- Build a six-lane I-69 bridge for all cross-river traffic and remove both US 41 bridges from vehicular use.
- Build a four-lane I-69 bridge and retain one US 41 bridge for local traffic.
- Build a four-lane I-69 bridge and retain both US 41 bridges for local traffic

The results from this next level of evaluation of the proposed project corridors were presented in a *Screening Report Supplement* (INDOT and KYTC 2018), dated January 2018. The *Screening Report Supplement* identified the best bridge scenario for each corridor and the following alternatives to be carried forward for detailed evaluation in the DEIS and this *Endangered, Threatened, and Rare Species Habitat Assessment and Wildlife Technical Report*.

- No Build Alternative: required by NEPA to serve as a baseline for comparison
- West Alternative 1: four lanes on the new I-69 bridge and retain one of the existing US 41 bridges
- West Alternative 2: six lanes on the new I-69 bridge and take both existing US 41 bridges out of service
- Central Alternative 1: four lanes on the new I-69 bridge and retain one of the existing US 41 bridges

The three recommended DEIS build alternatives are shown in **Figure 1.2-2** and described in greater detail in the following sections. Following the *Screening Report Supplement*, the term “taken out of service” when referring to the US 41 bridge(s) that would not be used for vehicular traffic was change to “removed”, indicating that the bridge would be demolished. In addition, it was determined that the northbound US 41 bridge would be retained and the southbound US 41 bridge would be removed for West Alternative 1 and Central Alternative 1.

Consistent with the Evansville Metropolitan Planning Organization’s fiscally-constrained Metropolitan Transportation Plan, tolling I-69 will be a key part of the financing for this project. The toll policy will define toll rates for different vehicle types and will be developed with the federally required financial plan prior to construction. The NEPA process will not determine the toll policy but will evaluate, and document in the DEIS, the environmental consequences associated with tolling being a part of the project.

1.2.1 WEST ALTERNATIVE 1

West Alternative 1 would include a new I-69 bridge approximately 5,400 feet long over the Ohio River and associated floodway that would be located approximately 70 feet west of the existing southbound US 41 bridge. The new bridge would include four lanes, with the capacity to expand to six lanes in the future, if needed, by restriping the lanes on the bridge; it would not require additional right-of-way or major construction. West Alternative 1 would also include four-lane sections for the remainder of I-69 beyond the bridge. The northbound US 41 bridge would be retained while the southbound US 41 bridge would be removed. The northbound US 41 two-lane bridge being retained, would be converted from a one-way bridge to a two-way bridge for local

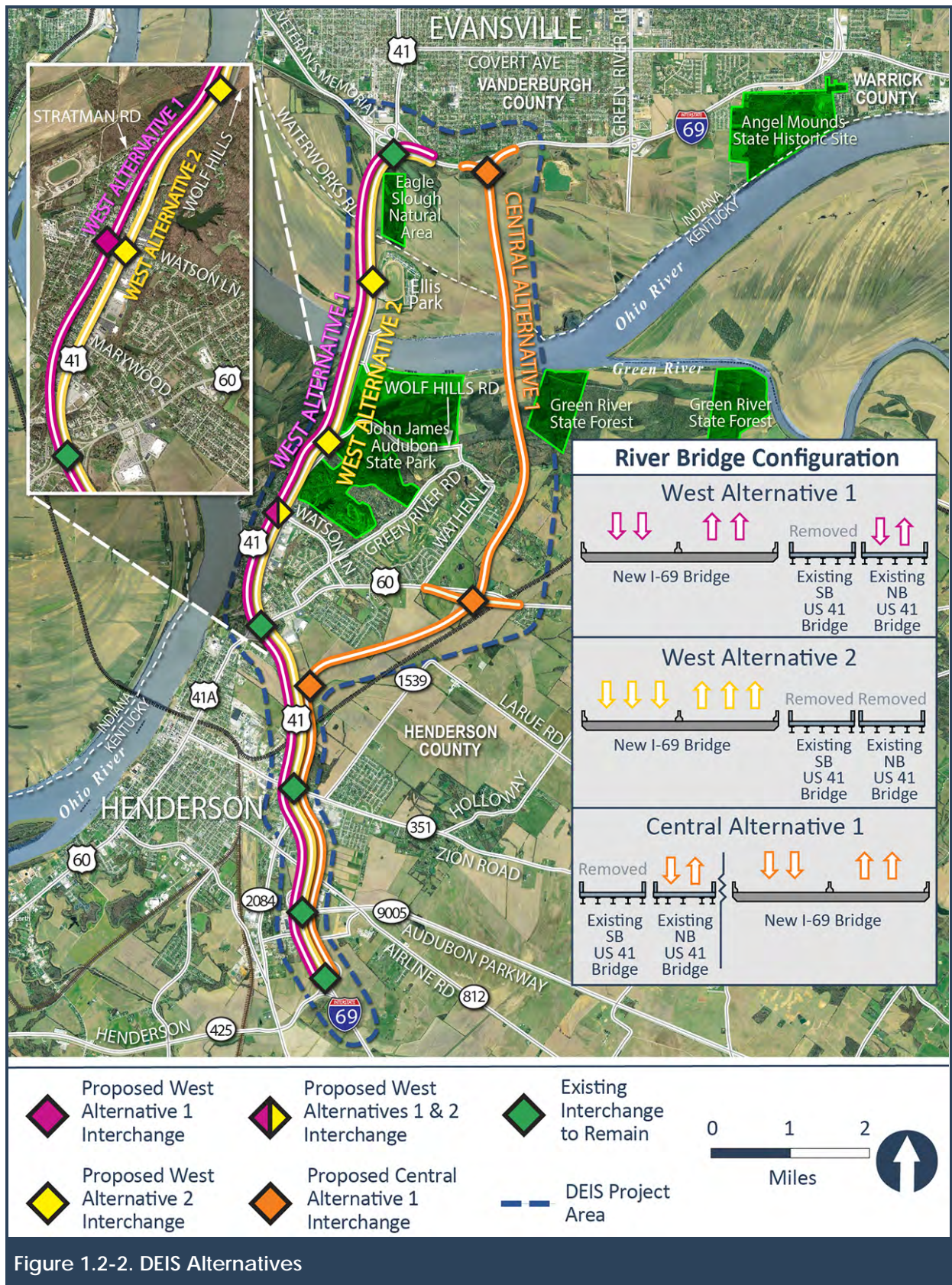


Figure 1.2-2. DEIS Alternatives

traffic. Most of West Alternative 1 would use rural design standards, including a grass median; however, through Henderson, it would use urban design standards and include a narrower median with a concrete barrier. West Alternative 1 would begin on the existing I-69 alignment in Indiana just east of the US 41 interchange and become the through movement for I-69. Connections to US 41 to the north and Veterans Memorial Parkway to the west would be provided. This alternative would bridge over Waterworks Road and Nugent Drive while maintaining local access to Waterworks Road and Ellis Park via US 41.

In Kentucky, the alternative would include a bridge to carry I-69 over Stratman Road, with local access to Stratman Road and Wolf Hills Road provided by US 41 and the local bridge. The alternative would continue south and run parallel to and approximately one block west of US 41 and the Henderson commercial strip. There would be no changes to US 41 through this area. An interchange would be constructed at Watson Lane to provide highway access to the commercial strip and adjacent residential areas. An overpass (no interchange) would be provided at Barker Road to maintain connection to residential areas west of the alternative. A local access road with a sidewalk would be provided on the west side of the alternative between Barker Road and Atkinson Park. The alternative would then continue south and tie into the existing four-lane, fully-controlled access section of US 41 south of the US 60 interchange. The US 60 interchange would be modified to provide connections to and from existing US 41, US 60, and I-69. US 41 (formerly named the Edward T. Breathitt Pennyryle Parkway) south of US 60 to KY 425, where I-69 in Kentucky currently ends, would be modernized to meet interstate standards through improvements to ramps and merge areas. The total length of West Alternative 1 is 11.1 miles, which includes 2.9 miles of existing US 41.

1.2.2 WEST ALTERNATIVE 2

As with West Alternative 1, West Alternative 2 would include a new I-69 bridge approximately 5,400 feet long over the Ohio River and associated floodway that would be located approximately 70 feet west of the existing southbound US 41 bridge. The new I-69 bridge for West Alternative 2 would include six lanes and both existing US 41 bridges would be removed. Except for the existing section of US 41 between US 60 and KY 425, which would remain four lanes, West Alternative 2 would also include widening the remainder of I-69 to six lanes. Most of West Alternative 2 would use rural design standards, including a grass median; however, through Henderson, it would use urban design standards and include a narrower median with a concrete barrier. Similar to West Alternative 1, West Alternative 2 would begin on existing I-69 in Indiana just east of the US 41 interchange and become the through movement for I-69. Connections to US 41 to the north and Veterans Memorial Parkway to the west would be provided. From the US 41/I-69 interchange to Ellis Park, the alternative would follow the existing US 41 alignment. An overpass bridge would carry traffic along Waterworks Road over I-69 and an interchange would be provided at Ellis Park.

In Kentucky, the proposed I-69 alignment for West Alternative 2 would follow existing US 41 through the Henderson commercial strip, with local access provided via a reconstructed US 41. The reconstructed US 41 would function as a frontage road, located adjacent to and east of the alternative. The reconstructed US 41 would include two lanes with a center two-way left turn

lane and a new sidewalk on the east side. There are currently no sidewalks along US 41 in this area. An interchange would be provided at Stratman Road/Wolf Hills Road and at Watson Lane. At the Watson Lane interchange, US 41 would be relocated approximately 300 feet to the east to provide adequate spacing between the interchange and the US 41/Watson Lane intersection. An overpass (no interchange) would be provided at Rettig Road to maintain connection to residential areas west of the alternative. In addition, a shared-use path would be provided on the west side of the new interstate. West Alternative 2 would continue south, within the US 41 corridor, to the existing US 60 interchange, which would be modified to provide connections to and from existing highways: US 41, US 60, and I-69. The existing four-lane section of US 41 (formerly named the Edward T. Breathitt Pennyryle Parkway) south of US 60 to KY 425, where I-69 in Kentucky currently ends, would be modernized to meet interstate standards. The total length of West Alternative 2 is 11.0 miles, which includes 2.9 miles of existing US 41.

1.2.3 CENTRAL ALTERNATIVE 1

Central Alternative 1 would include a new I-69 bridge, approximately 7,600 feet long over the Ohio River and associated floodway, located approximately 1.5 miles east of the existing US 41 bridges. The new I-69 bridge would include four lanes, with the capacity to expand to six lanes in the future (if needed) by restriping the lanes on the bridge. The remainder of the alternative would also include four lanes. The northbound US 41 bridge would be retained and the southbound US 41 bridge would be removed. The US 41 two-lane bridge being retained would be converted from a one-way bridge to a two-way bridge for local traffic. There would be no changes to US 41 through the commercial strip. Central Alternative 1 would use rural design standards and include a depressed grass median outside of the bridge limits.

Central Alternative 1 begins at existing I-69 in Indiana, approximately 1 mile east of the US 41 interchange. The alternative would continue south across the Ohio River just west of a gas transmission line. It would remain just west of the gas transmission line near the Green River State Forest, then turn southwest where a proposed overpass would carry the access road for the gas transmission line over the alternative. The alternative would continue south to US 60 where an interchange would be provided. As part of the US 60 interchange, US 60 would be relocated approximately 400 feet south, and would require a new bridge over the CSX Railroad east of the interchange. Central Alternative 1 would continue southwest and connect with US 41 via an interchange approximately 1 mile south of the US 60 interchange. From the alternative's interchange with US 41 to KY 425, the existing four-lane US 41 would be modernized to meet interstate standards through improvements to ramps and merge areas. The total length of Central Alternative 1 is 11.2 miles, which includes 2.8 miles of existing US 41.

1.3 ENVIRONMENTAL SETTING

The I-69 ORX study area begins on the south side of the City of Evansville, located in Vanderburgh County, IN and extends south across the Ohio River into the City of Henderson, located in Henderson County, KY. At its northern terminus, the study area falls within the Boonville Hills physiographic region. This region is composed of low elevation rolling hills to the north, flattening out into low-level floodplains near the Ohio River to the south. Across the river into Kentucky, the study area is located within the Western Coalfields physiographic region

(Atwood 1940). This region, like the Boonville Hills physiographic region, is comprised of low elevation rolling hills with large and wide expanses of floodplain along and adjacent to the banks of the Ohio River. Outside of the urban, commercial, and residential land coverage types that exist in Evansville and Henderson, land use in the region is dominated by a mixture of farmland, forests, and coal mining.

The majority of the study area falls within the lower elevations of the above described physiographic regions and is dominated by large expanses of bottomland forest, floodplains, and sloughs. Slightly higher elevations are observed in the extreme northern and southern edges of the study area, as the alignment extends into the plateau. The study area is located on the *Evansville South, Indiana* and *Henderson, Kentucky* USGS 7.5 minute Topographic Quadrangles (USGS 2016a, 2016b).

According to Braun (1950), the study area falls into the Hill Section (Shawnee physiographic area) of the Western Mesophytic Forest Region. The Kentucky portion of the study area is further classified by Braun as part of the Western Coal Fields, and the Indiana portion is simply described as “the Hill Section in Indiana.” Braun’s treatments of these forested areas generally describe the upland forests in this region as mixed mesophytic forest type on northern slopes and oak or oak-hickory forest on drier slopes and ridges. However, in keeping with the transitional nature of the Western Mesophytic Forest Region, lowland valley areas adjacent to the Ohio River differ substantially. Bottomland forests in the “wide flat silt-filled” valleys along the Ohio and Green Rivers consist of trees, such as cottonwood (*Populus deltoides*), pin oak (*Quercus palustris*), swamp white oak (*Q. bicolor*), sugarberry (*Celtis laevigata*), silver maple (*Acer saccharinum*), sweetgum (*Liquidambar styraciflua*), and bald cypress (*Taxodium distichum*). These alluvial valleys act as extensions of the Mississippi alluvial plain and make up a large part of the study area.

1.4 IDENTIFICATION OF LISTED SPECIES

Initial identification of state and federally listed species with potential of occurring within the I-69 ORX study area was obtained by reviewing the Henderson County, KY and Vanderburgh County, IN ETR species lists maintained by the Kentucky State Nature Preserves Commission (KSNPC) and the Indiana Department of Natural Resources - Division of Nature Preserves (IDNR-DNP), respectively (KSNPC 2015, IDNR 2017a). Data included in the *Report of Endangered, Threatened, and Special Concern Plants, Animals, and Natural Communities for Henderson County, Kentucky* was current as of December 2015, while data included in the online report entitled *Indiana County Endangered, Threatened and Rare Species List, County: Vanderburgh* was current as of February 11, 2016. Data from both sources was based on the Global Heritage Rank (GRANK) and State Heritage Rank (SRANK) systems.

The federal listing abbreviations are the same for both Indiana and Kentucky, including LE (Endangered), LT (Threatened), and SOMC (Species of Management Concern). Classification with state listed species differ slightly between IDNR-DNP and KSNPC. IDNR uses the following codes to explain status of ETR species: SE = state endangered; ST = state threatened; SR = state rare; SSC = state species of special concern; and SX = state extirpated. KSNPC classification system uses a similar set of codes to IDNR-DNP codes but has no SR (state rare) ranking and has an additional ranking of historic (H), which means the species has not been seen in the county for at

least 20 years. The KSNPC state listing codes are: N or blank = none, E = endangered, T = threatened, S = special concern, H = historic, and X = extirpated.

In addition to Indiana and Kentucky's respective natural heritage agencies, the Kentucky Department of Fish and Wildlife Resources (KDFWR) maintains records of occurrence data for species of concern. KDFWR was contacted regarding any potential for adverse impacts to habitats, wildlife, or rare, threatened, and/or endangered species. Their records provided an additional three bird species.

The U.S. Fish and Wildlife Service's (USFWS) *Information for Planning and Consultation* (IPaC) online system was reviewed to identify the federally listed species known or expected to occur within the I-69 ORX study area. This data source provided an additional eight species, including five freshwater mussels, one bird, and two bats. Discrepancy in the state lists and USFWS's IPaC was most likely due to expectations of a species occurring within the I-69 ORX study area versus the species known to occur within the two counties. **Table 1.4-1** contains the state and federally listed species known or expected to occur within Vanderburgh County, IN and Henderson County, KY.

Table 1.4-1. State and Federally Listed Species Potentially Occurring within the Study Area

SPECIES SCIENTIFIC NAME	SPECIES COMMON NAME	FEDERAL STATUS ¹	IN STATUS ²	KY STATUS ³	DATA SOURCE
CRUSTACEAN					
<i>Orconectes indianensis</i>	Indiana crayfish	-	SR	-	IDNR 2017a
MUSSELS					
<i>Margaritifera monodonta</i>	spectaclecase	LE	-	E	USFWS 2018
<i>Cyprogenia stegaria</i>	fanshell	LE	SE	E	KSNPC 2015, USFWS 2018
<i>Epioblasma obliquata</i>	catpaw	LE	-	E	KSNPC 2015, USFWS 2018
<i>Epioblasma rangiana</i>	northern riffleshell	LE	SE	E	USFWS 2018
<i>Epioblasma triquetra</i>	snuffbox	LE	SE	E	KSNPC 2015
<i>Fusconaia subrotunda</i>	longsolid	-	SE	S	KSNPC 2015
<i>Lampsilis abrupta</i>	pink mucket	LE	SE	E	KSNPC 2015, USFWS 2018
<i>Lampsilis ovata</i>	pocketbook	-	-	E	KSNPC 2015
<i>Obovaria retusa</i>	ring pink	LE	-	E	KSNPC 2015, USFWS 2018
<i>Plethobasus cooperianus</i>	orangefoot pimpleback	LE	SE	E	USFWS 2018
<i>Plethobasus cyphus</i>	sheepnose	LE	SE	E	IDNR 2017a, KSNPC 2015, USFWS 2018, KDFWR 2018
<i>Pleurobema clava</i>	clubshell	LE	SE	E	USFWS 2018
<i>Pleurobema cordatum</i>	Ohio pigtoe	-	SSC		IDNR 2017a

SPECIES SCIENTIFIC NAME	SPECIES COMMON NAME	FEDERAL STATUS ¹	IN STATUS ²	KY STATUS ³	DATA SOURCE
<i>Pleurobema plenum</i>	rough pigtoe	LE	SE	E	USFWS 2018
<i>Pleurobema rubrum</i>	pyramid pigtoe	SOMC	SE	E	KSNPC 2015
<i>Potamilus capax</i>	fat pocketbook	LE	SE	E	KSNPC 2015, USFWS 2018
<i>Theliderma cylindrica</i>	rabbitsfoot	LT	SE	T	IDNR 2017, KSNPC 2015, USFWS 2018, KDFWR, 2018
<i>Villosa lienosa</i>	little spectaclecase	-	SSC	S	KSNPC 2015
INSECTS					
<i>Catocala marmorata</i>	marbled underwing moth	-	SE	-	IDNR 2017a
<i>Nicrophorus americanus</i>	American burying beetle	LE	SX	X	IDNR 2017a, KSNPC 2015
<i>Traverella lewisi</i>	a Leptophlebiid mayfly	-	-	H	KSNPC 2015
FISHES					
<i>Erimyzon sucetta</i>	lake chubsucker	-	-	T	KSNPC 2015
<i>Ictiobus niger</i>	black buffalo	-	-	S	KSNPC 2015
AMPHIBIAN					
<i>Cryptobranchus a. alleganiensis</i>	eastern hellbender	-	SE	E	IDNR 2017a
<i>Hyla avivoca</i>	bird-voiced treefrog	-	-	S	KSNPC 2015
<i>Rana areolata circulosa</i>	northern crawfish frog	-	SE	S	KSNPC 2015
REPTILES					
<i>Apalone m. mutica</i>	midland smooth softshell	-	-	S	KSNPC 2015
<i>Farancia abacura reinwardtii</i>	western mud snake	-	SSC	S	KSNPC 2015
<i>Nerodia erythrogaster neglecta</i>	copperbelly water snake	-	SE	S	IDNR 2017a
<i>Opheodrys aestivus</i>	rough green snake	-	SSC	-	IDNR 2017a
<i>Thamnophis s. sauritus</i>	eastern ribbon snake	-	-	S	KSNPC 2015
BIRDS					
<i>Actitis macularius</i>	spotted sandpiper	-	-	E	KSNPC 2015
<i>Ardea alba</i>	great egret	-	SSC	T	IDNR 2017a, KSNPC 2015, KDFWR 2018
<i>Bartramia longicauda</i>	upland sandpiper	-	SE	H	IDNR 2017a
<i>Certhia americana</i>	brown creeper	-	-	E	KSNPC 2015, KDFWR 2018
<i>Cistothorus platensis</i>	sedge wren	-	SE	S	IDNR 2017a, KSNPC 2015
<i>Corvus ossifragus</i>	fish crow	-	-	S	KSNPC 2015
<i>Falco peregrinus</i>	peregrine falcon	-	SSC	E	IDNR 2017a

SPECIES SCIENTIFIC NAME	SPECIES COMMON NAME	FEDERAL STATUS ¹	IN STATUS ²	KY STATUS ³	DATA SOURCE
<i>Gallinula galeata</i>	common gallinule	-	SE	T	KSNPC 2015
<i>Haliaeetus leucocephalus</i>	bald eagle	Delisted	SSC	T	IDNR 2017a, KSNPC 2015, KDFWR 2018
<i>Ixobrychus exilis</i>	least bittern	-	SE	T	KSNPC 2015
<i>Lanius ludovicianus</i>	loggerhead shrike	-	SE	-	IDNR 2017a
<i>Lophodytes cucullatus</i>	hooded merganser	-	-	T	KSNPC 2015, KDFWR 2018
<i>Phalacrocorax auritus</i>	double-crested cormorant	-	-	T	KSNPC 2015
<i>Pheucticus ludovicianus</i>	rose-breasted grosbeak	-	-	S	KDFWR 2018
<i>Podilymbus podiceps</i>	pied-billed grebe	-	-	E	KDFWR 2018
<i>Rallus elegans</i>	king rail	-	SE	E	KSNPC 2015
<i>Riparia riparia</i>	bank swallow	-	-	S	KSNPC 2015
<i>Sternula antillarum</i>	least tern	LE	SE	T	USFWS 2018
<i>Tyto alba</i>	barn owl	-	-	S	KDFWR 2018
MAMMALS					
<i>Myotis grisescens</i>	gray bat	LE	SE	T	USFWS 2018
<i>Myotis septentrionalis</i>	northern long-eared bat	LT	SSC	E	USFWS 2018, KDFWR 2018
<i>Myotis sodalis</i>	Indiana bat	LE	SE	E	KSNPC 2015, USFWS 2018, KDFWR 2018
<i>Nycticeius humeralis</i>	evening bat	-	SE	S	IDNR 2017a, KSNPC 2015
<i>Sorex cinereus</i>	Cinereus (masked) shrew	-	-	S	KSNPC 2015, KDFWR 2018
<i>Sylvilagus aquaticus</i>	swamp rabbit	-	SE	-	IDNR 2017a
<i>Taxidea taxus</i>	American badger	-	SSC	-	IDNR 2017a
PLANTS					
<i>Acalypha deamii</i>	mercury	-	SR	-	IDNR 2017a
<i>Bolboschoenus fluviatilis</i>	river bulrush	-	-	E	KSNPC 2015
<i>Carex socialis</i>	social sedge	-	SR	-	IDNR 2017a
<i>Catalpa speciosa</i>	northern catalpa	-	SR	-	IDNR 2017a
<i>Chamaelirium luteum</i>	devil's-bit	-	SE	-	IDNR 2017a
<i>Chelone obliqua</i> var. <i>speciosa</i>	rose turtlehead	-	-	S	KSNPC 2015
<i>Crataegus viridis</i>	green hawthorn	-	ST	-	IDNR 2017a
<i>Didiplis diandra</i>	water-purslane	-	SE	E	IDNR 2017a
<i>Echinodorus berteroi</i>	burhead	-	SE	T	KSNPC 2015
<i>Hottonia inflata</i>	featherfoil	-	ST	-	IDNR 2017a

SPECIES SCIENTIFIC NAME	SPECIES COMMON NAME	FEDERAL STATUS ¹	IN STATUS ²	KY STATUS ³	DATA SOURCE
Hydrocotyle ranunculoides	floating pennywort	-	-	E	KSNPC 2015
Isoetes melanopoda	blackfoot quillwort	-	ST	E	IDNR 2017a
Nemophila aphylla	small-flower baby-blue-eyes	-	-	T	KSNPC 2015
Orobanche riparia	bottomland broomrape	-	SE	-	IDNR 2017a
Passiflora incarnata	purple passion-flower	-	SR	-	IDNR 2017a
Phacelia ranunculacea	blue scorpion-weed	-	SE	S	IDNR 2017a, KSNPC 2015
Polymnia laevigata	Tennessee leafcup	-	-	E	KSNPC 2015
Pontederia cordata	pickerel-weed	-	-	T	KSNPC 2015
Rhexia mariana var. mariana	Maryland meadow beauty	-	ST	-	IDNR 2017a
Silene ovata	ovate catchfly	-	SE	E	IDNR 2017a
Sparganium eurycarpum	large bur-reed	-	-	E	KSNPC 2015
Taxodium distichum	bald cypress	-	ST	-	IDNR 2017a
Vitis palmata	catbird grape	-	SR	-	IDNR 2017a

Source: IDNR 2017a; KSNPC 2015; USFWS 2018.

1. USFWS Status: LE = Endangered, LT = Threatened, SOMC = Species of Management Concern, and – = No Status

2. Indiana Status: SR = State Rare, SE = State Endangered, ST = State Threatened, SSC = State Species of Special Concern, and – = No Status, SX = State Extirpated

3. Kentucky Status: E = Endangered, S = Special Concern, T = Threatened, X = Extirpated, H = Historic, and – = No Status.

From the original list of species (**Table 5.1-1**), two insects, the American burying beetle (*Nicrophorus americanus*) and a Leptophlebiid mayfly (*Traverella lewisi*), were removed from further habitat analysis because they were considered extirpated and historic from within the I-69 ORX project counties, respectively. Once the project-specific data request was submitted and results were received from IDNR-DNP and KSNPC, the list of species requiring habitat assessments was reduced. Species retained for further evaluations included all federally listed species originally listed in Table 1.4-1 that were not considered extirpated, all state listed plant species with known sites occurring within one mile of the project alternatives, all state listed aquatic species with known sites occurring within five miles of the project alternatives, and all avian and mammalian species with known sites occurring within 10 miles of the project alternatives. Due to this method, some Indiana state listed species were evaluated that did not show up in the original list, because they occurred in Warrick County, but within a 10-mile radius of the project alternatives, including: short-eared owl (*Asio flammeus*), American bittern (*Botaurus lentiginosus*), yellow-crowned night-heron (*Nyctanassia violacea*), osprey (*Pandion haliaetus*), and Virginia rail (*Rallus limicola*).

In addition to the American burying beetle and a Leptophlebiid mayfly, eleven additional animal species that occurred in the original list (**Table 1.4-1**) were removed from further habitat analysis because they were outside the previously mentioned distances from the I-69 ORX project area

alternatives. These 11 species included the Indiana crayfish (*Orconectes indianensis*), marbled underwing moth (*Catocala marmorata*), black buffalo (*Ictiobus niger*), bird-voiced treefrog (*Hyla avivoca*), northern crawfish frog (*Rana areolate circulosa*), midland softshell (*Apalone m. mutica*), western mud snake (*Farancia abacura reinwardtii*), rough green snake (*Opheodrys aestivus*), eastern ribbon snake (*Thamnophis sauritus*), and common gallinule (*Gallinula galeata*). An additional 19 plant species that occurred in the original list (**Table 1.4.1**) were removed from further habitat analysis because they were outside the one-mile distance from the I-69 ORX project alternatives. These 19 species included the mercury (*Acalypha deamii*), river bulrush (*Bolboschoenus fluviatilis*), social sedge (*Carex socialis*), northern catalpa (*Catalpa speciosa*), devil's bit (*Chamaelirium luteum*), green hawthorn (*Crataegus viridis*), water-purslane (*Didiplis diandra*), burhead (*Echinodorus berteroi*), featherfoil (*Hottonia inflata*), floating pennywort (*Hydrocotyle ranunculoides*), blackfoot quillwort (*Isoetes melanopoda*), bottomland broomrape (*Orobanche riparia*), purple passion-flower (*Passiflora incarnata*), Tennessee leafcup (*Polymnia laevigata*), pickerel-weed (*Pontederia cordata*), Maryland meadow beauty (*Rhexia mariana var. mariana*), ovate catchfly (*Silene ovata*), large bur-reed (*Sparganium eurycarpum*), and catbird grape (*Vitis palmata*). **Appendix A** contains the results from the state agencies data request.

CHAPTER 2 – SPECIES ACCOUNTS

2.1 FEDERALLY LISTED SPECIES

2.1.1 MAMMALS

GRAY BAT – *MYOTIS GRISESCENS*

The gray bat was described as a separate species in 1909 from specimens collected at Nickajack Cave, Marion County, Tennessee (Decher and Choate 1995). The gray bat can be distinguished from other larger *Myotis* species by its long forearm, typically 1.57 to 1.81 inches, the attachment of wing membrane to the ankle rather than on the foot, and by its uniformly gray from base to tip pelage (Barbour and Davis 1969, Barbour and Davis 1974, USFWS 1982, Sealander and Heidt 1990).

USFWS listed the gray bat as an endangered species on April 28, 1976 under the ESA (Public Law 93-205). A gray bat recovery plan was developed by the recovery team biologists that outlined habitat requirements, critical habitat, potential causes for declines, and recovery objectives. The recovery plan was published by USFWS in 1982 (USFWS 1982) and has not been revised since.

The gray bat is restricted in distribution to the limestone-karst areas of the eastern and southern United States (Hall 1981, Hall and Wilson 1966, USFWS 1982). The only major gray bat hibernacula in Kentucky are found near Mammoth Cave National Park. These three caves contain approximately 350,000 bats and represent more than 99 percent of Kentucky's winter gray bat population (Mike Armstrong, USFWS, unpublished data).

Even though gray bats require cave-like habitats during the summer, the species summer distribution occurs throughout a slightly larger geographic area than winter distribution. Gray bats can establish maternity and bachelor colonies in dams, under bridges, and in storm sewers, which enables them to venture away from karst regions. According to USFWS (1982), 30 different caves are listed as Priority One maternity colony sites with eight in Missouri, six each in Alabama and Tennessee, four in Kentucky, three in Florida, two in Arkansas, and one in Illinois. Based on data received from KSNPC (2017) and IDNR (2017b), the gray bat has not been captured in Henderson County, KY, or Vanderburgh County, IN. However, the KSNPC data does indicate acoustical data recorded from near the Henderson County Airport that may represent this species. In addition, a gray bat from Vanderburgh County was submitted to the rabies laboratory (Whitaker and Mumford 2009). Currently, no maternity roost or hibernaculum are known to occur from this portion of Kentucky and Indiana.

The gray bat arrives at caves used as hibernacula during September and October each year. Bats typically form dense clusters of up to several thousand individuals on cave ceilings and walls where cave temperatures range from 42.1° – 52.0° F (Sealander and Heidt 1991, Hall 1962).

Copulation in gray bats occurs in late fall prior to hibernation (Sealander and Heidt 1990, Barbour and Davis 1969). Once mating has occurred, the females immediately go into hibernation. After mating, the males remain active for several weeks, during which time the fat reserves that were

depleted during the mating season are replenished. While adult males and juveniles of both sexes tend to enter hibernation several weeks later than adult females, most are in hibernation by early November.

Adult female gray bats are the first to emerge from hibernation in late March and early April, followed by juveniles of both sexes and adult males (Tuttle 1976). Most juveniles and adult males leave the hibernacula between mid-April and mid-May. Gray bats are known to disperse at distances of 11 to 326 miles to summer locations (Sealander and Heidt 1990, Tuttle 1976).

Summer maternity colonies of gray bats are generally found in large caves containing streams (Sealander and Heidt 1990). These colonies range from a few hundred to several thousand individuals in large caves in the central part of the eastern US. The relative humidity in these maternity caves ranges from 86 to 99 percent (Decher and Choate 1995). Males and non-reproductive females form bachelor colonies in less suitable caves within 19 miles of maternity sites (BCI 2001).

Gray bats emerge from caves or other roosts at dusk to forage for insects. Gray bats most often forage over bodies of water (reservoirs and streams), but also forage in riparian vegetation and over land (Sealander and Heidt 1990 LaVal et al. 1977). Sealander and Heidt (1990) and LaVal et al. (1977) found that gray bats usually forage below treetop height, sometimes as low as 6 feet. LaVal et al. (1977) also suggested that gray bats will forage over small, permanently flowing streams, however larger numbers of bats use larger streams. Tuttle (1979) estimated that a maternity colony of 250,000 bats may consume as much as a ton of insects each night.

Insects consumed by the gray bat vary depending on geographic location, season, and lunar cycles. Decher and Choate (1995) stated that the main prey of gray bats consisted of several genera and at least six species of mayflies (Ephemeroptera). Rabinowitz and Tuttle (1982) said that gray bats selected foraging areas with abundant mayflies. However, Ephemeroptera were less abundant in fecal pellet studies in Jessamine County, KY (Lacki et al. 1995) and in Indiana (Whitaker et al. 2001). Decher and Choate (1995) suggest that fecal pellet studies are biased against Ephemeroptera, because they are more digestible by the bat with less identifiable remains in the fecal pellets. This is especially true if the wings are culled by the bat prior to consumption (Rabinowitz and Tuttle 1982). Based on food studies using fecal pellets, it appears that the gray bat is primarily an opportunistic feeder, feeding on the most abundant aquatic insects available at the time (Lacki et al. 1995, Whitaker et al. 2001). Orders of insect consumed include; Diptera (primarily midges – Chironomidae), Trichoptera (caddisflies), Coleoptera (beetles), and Lepidoptera (moths). Whitaker et al. (2001) found some chironomid pupae, indicating that the gray bat apparently picked it up by skimming the surface of the water during foraging. LaVal and LaVal (1980) indicated a dietary preference of Plecoptera (stoneflies), Ephemeroptera (mayflies), and Trichoptera (caddisflies), comprising up to 98 percent of insects consumed.

NORTHERN LONG-EARED BAT – *MYOTIS SEPTENTRIONALIS*

The northern long-eared bat is distinguished by its long ears, especially when compared to other *Myotis* species. They are a medium-sized bat of about 3 to 3.7 inches, with a wingspan of 9 to 10 inches. The fur color ranges from medium to dark brown on the back, and tawny to pale-brown

on the underside. On April 2, 2015, USFWS published a final rule in the Federal Register (80 FR 17974) designating the northern long-eared bat as a threatened species under the ESA throughout its geographic range.

The northern long-eared bat uses a wide variety of forested habitats for roosting, foraging, and traveling and may also utilize some adjacent and interspersed non-forested habitat, such as emergent wetlands and edges of fields. This species has also been found roosting in structures like barns and sheds (particularly when suitable tree roosts are unavailable). Roosting habitat includes forested areas with live trees and/or snags with a diameter at breast height (DBH) of equal to or greater than three inches that exhibit exfoliating bark, cracks, crevices, and/or other cavities (USFWS 2017a). Although less research has been conducted on the preferred species of roosting tree for the northern long-eared bat compared to the Indiana bat, the following species have been documented as maternity roosts: American beech (*Fagus grandifolia*), silver maple, red maple (*Acer rubrum*), black cherry (*Prunus serotina*), green ash (*Fraxinus pennsylvanica*), black locust (*Robinia pseudoacacia*), and elm species (*Ulmus spp.*), as well as several types of artificial roosting structures (Foster and Kurta 1999, Grindal and Brigham 1999, Owen et al. 2002, Thompson 2006, Lacki et al. 2009). Suitable summer habitat includes roosting sites, as well as foraging and travel habitat such as adjacent edges of agricultural fields, old fields, pastures, fencerows, riparian forests, and other wooded corridors. According to USFWS (2017b), any forest where trees equal to or greater than three inches DBH are present is considered to have potential roosting habitat for the northern long-eared bat. In addition, any suitable roost tree (trees meeting the above criteria) within 1,000 feet of a larger forested area could be considered potential roosting habitat for the northern long-eared bat (USFWS 2017a). Winter habitat includes underground caves and cave-like structures, such as abandoned or active mines and railroad tunnels.

The northern long-eared bat is found throughout the eastern and midwestern U.S. and southern Canada. In the US, it ranges from Maine south to central North Carolina along the Atlantic coast, extending west into eastern Oklahoma and north into North Dakota and eastern Wyoming and Montana. In the south, the northern long-eared bat extends into parts of Georgia, Alabama, Mississippi, and Louisiana (USFWS 2014). Historically, the eastern portion of the northern long-eared bats range has held its greatest abundance (Caceres and Barclay 2000), and numbers in the southern and western portion of the bat's range are considered naturally low (Thompson 2006). In Kentucky, the northern long-eared bat is either known from or thought to likely occur in every county in the state (USFWS 2016). Until the appearance of white nose syndrome (WNS), the species was the most frequently captured bat in forested mountainous habitats in eastern Kentucky (James Kiser, unpublished data). According to Whitaker and Mumford (2009), the northern long-eared bat probably occurs throughout Indiana, but seems rare in the northern portion of the state. Based on data received from KSNPC (2017b) and Whitaker and Mumford (2009), the northern long-eared bat has been captured in both Henderson County, KY and Vanderburgh County, IN.

This species breeds in late summer and early fall when large numbers of bats congregate in and near the entrances of caves and mines. Females will store sperm during hibernation, and the

gestation period ranges between 50 and 60 days. Females give birth to one pup the following spring.

The northern long-eared bat is a generalist predator of aerial invertebrates. The species forages at night in forested areas, riparian zones, along forest edges, and in clearings. They feed on moths, flies, leafhoppers, caddisflies, and beetles, which they catch while in flight using echolocation. This bat also feeds by gleaning motionless insects from vegetation and water surfaces.

The northern long-eared bat is generally considered an opportunistic feeder as well, but is much less dependent on aquatic insects for food than the Indiana bat or the gray bat. In a study examining the guano of 107 northern long-eared bats, Whitaker and Mumford (2009) found that the primary food source was Diptera (37.5 percent of total contents). The second most abundant food item found was Coleoptera, making up 24.5 percent total contents. In contrast, Feldhamer et al. (2009) examined the diet of 116 northern long-eared bats in southern Illinois and found that the primary food source consumed was Lepidoptera (31.8 percent), while the second and third most abundant food items found were Trichoptera (21.8 percent) and Coleoptera (19.3 percent), respectively.

INDIANA BAT – *MYOTIS SODALIS*

The Indiana bat was listed as endangered by USFWS on March 11, 1967 (32 FR 4001). The Indiana bat is a small, brownish bat with blackish wings (Kurta 1995) similar in appearance to the little brown bat and the northern long-eared bat. The Indiana bat can be distinguished from these species based on the following characteristics: (1) the Indiana bat has smaller feet and shorter hairs on its toes (the hairs do not extend beyond the toenails); (2) the Indiana bat has a distinct keel on the calcar, a spur on the membrane between the foot and the tail; and (3) the Indiana bat has a pinkish colored pug-nose (Mumford and Whitaker 1982, Whitaker and Hamilton 1998).

During the winter, the Indiana bat generally hibernates in caves, although abandoned mines, abandoned railroad tunnels, and even a hydroelectric dam have also been used (USFWS 2007a). The range of the Indiana bat includes much of the eastern US. It occurs from Iowa, Oklahoma and Wisconsin, northeast to Vermont, and south to northwestern Florida and northern Arkansas (Barbour and Davis 1969). The majority of the wintering population occurs within the limestone cave region of Indiana, Kentucky, and Missouri. As of the 2017 surveying period, 530,705 Indiana bats were estimated range-wide, and hibernacula that contained these occurred in 17 states, including Alabama, Arkansas, Georgia, Illinois, Indiana, Kentucky, Michigan, Missouri, New Jersey, New York, North Carolina, Ohio, Pennsylvania, Tennessee, Vermont, Virginia, and West Virginia (USFWS 2017b). Currently, critical winter habitat is established and includes 11 caves and two non-coal mines, including six in Missouri, two each in Indiana and Kentucky; and one each in Illinois, Tennessee, and West Virginia (USFWS 2007a). Summer distribution of the Indiana bat occurs throughout a wider geographic area than winter distribution. The core summer range includes southern Iowa, northern Missouri, northern Illinois, northern Indiana, southern Michigan, and western Ohio.

The presence of Indiana bats in a particular area during the summer appears to be determined largely by the availability of suitable natural roost structures. The suitability of a particular tree

as a roost site is determined by its condition (live or dead), the amount of exfoliating bark, the tree's exposure to solar radiation, its relative location to other trees, as well as availability of a permanent water source and foraging areas (USFWS 2007a). Dead trees with a combination of loose, exfoliating bark, cracks, and crevices are preferred as maternity roosts; however, live trees are often used as secondary roosts depending on microclimate conditions (USFWS 2007a). Over 30 species of trees have been documented as maternity roosts, but 87 percent of these are various ashes (*Fraxinus* spp.), elms (*Ulmus* spp.), hickories (*Carya* spp.), maples (*Acer* spp.), poplars (*Populus* spp.), and oaks (*Quercus* spp.) (Kurta 2004). Roost trees are typically located within 1,600 feet of a perennial or intermittent stream (Gardner et al. 1996). According to USFWS (2017), any forest where trees equal to or greater than five inches DBH are present is considered to have potential roosting habitat for the Indiana bat. In addition, any suitable roost tree (trees meeting the above criteria) within 1,000 feet of a larger forested area could be considered potential roosting habitat for the Indiana bat (USFWS 2017a).

The Indiana bat annually repeats a cycle of six life history events: (1) spring "staging" period upon its emergence from hibernation; (2) spring migration; (3) summer birthing; (4) fall migration; (5) fall "swarming" prior to hibernation; and (6) hibernation.

Indiana bats begin to arrive at their hibernacula in late July. Upon arrival, the bats engage in a behavior known as fall swarming. Swarming is characterized by large numbers of Indiana bats coming together in a mating frenzy at the entrances of hibernacula before hibernating. Sperm is transferred to the females during swarming, but ovulation and fertilization of eggs are delayed until after the end of hibernation in spring. By late September, many females begin hibernation, and swarming bats are predominantly male.

The Indiana bat emerges from hibernation from March through May and engages in spring staging before migrating to its summer habitat. Female bats start to leave hibernacula in late March through early April, and peak emergence occurs in mid-April with few or no females remaining in early May; while most males leave the hibernacula by mid-May (Cope and Humphrey 1977, LaVal and LaVal 1980). During the spring staging period, the bats begin their feeding forays, and some copulation may also occur (Whitaker and Hamilton 1998).

The Indiana bat may travel several miles from day roosts to foraging areas. Gardner et al. (1991) found that individuals from an Illinois maternity colony traveled 2.5 miles to foraging areas. In fragmented habitat, bats will use hedge rows and other features on the landscape as travel ways between foraging areas and day roosts (Murray and Kurta 2004). Rather than crossing open habitats (e.g., pasture land, open water, agricultural fields), the Indiana bat will increase travel distance by 55 percent in Michigan to take advantage of the protective cover of tree-lines (Murray and Kurta 2004). Known to forage in both upland and floodplain forest (Brack 1983, Humphrey et al. 1977, LaVal and LaVal 1980, Gardner et al. 1991, Kiser and Elliott 1996), Indiana bats are opportunistic foragers, feeding on a variety of small insects. Diets vary between habitats, geographic locations, season, sex, and age of the bat (Kurta and Whitaker 1998, Brack and LaVal 1985, Belwood 1979). Sparks and Whitaker (2004) summarized food habit studies conducted over 30 years and determined that the Indiana bat's diet consisted primarily of insects belonging to the orders Diptera (flies), Lepidoptera (moths) and Coleoptera (beetles), but when locally

abundant, Trichoptera (caddisflies) and Hymenoptera (wasps and ants) may be the predominant food. Several pest species, including mosquitoes (Diptera: Culicidae), Asiatic oak weevil (*Cyrtopistomus castaneus*), spotted cucumber beetle (*Diabrotica undecimpunctata*), and Hessian fly (*Mayetola destructor*) (Sparks and Whitaker 2004, Kurta and Whitaker 1998, Kiser and Elliott 1996), are also consumed by Indiana bats when locally abundant.

Foraging activity is usually interrupted by periods of rest, referred to as night roosting. Most Indiana bats use trees as night roosts (Butchkoski and Hassinger 2002, Murray and Kurta 2004), although they do occasionally utilize bat boxes (Burchkoski and Hassinger 2002) and concrete bridges (Kiser et al. 2002). Night roosting is any time a bat stops flying during the night. The purpose of night roosts is to provide bats a resting place between foraging bouts, promote digestion and energy conservation, provide retreats from predators and inclement weather, provide places to ingest food transported from nearby feeding areas, function as feeding perches for sit-and-wait predators, and serve as a place to promote social interactions and information transfer (Ormsbee et al. 2007).

2.1.2 FRESHWATER MUSSELS

SPECTACLECASE – MARGARITIFERA MONODONTA

The spectaclecase (formerly known as *Cumberlandia monodonta*) is a freshwater mussel that can be distinguished by its large size, elongated shape and arcuate ventral margin, poorly developed teeth, white nacre, dark coloration and roughened surface (Baird 2000). The spectaclecase mussel is large (up to 9 inches in length) with an elongated and often curved shell that is somewhat inflated, providing them with their common name. The spectaclecase was listed in March 2013 by USFWS as a federally listed endangered species (USFWS 2012a).

Historically, the spectaclecase mussel was found throughout the Mississippi River system except in the upper Missouri River, the uppermost sections of the Ohio River, the Cumberland and Tennessee Rivers, and in the lowland tributaries in the Mississippi Delta regions of Mississippi and Louisiana. USFWS (2011) reported that the spectaclecase was historically known from at least 44 streams in 15 states, and that today these mussels have been extirpated from 4 of these states and are found in only 19 streams. In the Ohio River basin, the species is known from the confluence with the Mississippi River upstream to West Virginia (Haag and Cicerello 2016). Based on data provided by KSNPC (2017) and IDNR (2017b), there are no known sites of this species within the I-69 ORX study area.

The spectaclecase is more of a habitat-specialist than most mussel species. They are typically found in large rivers, sheltered from the main force of the current. They have been found in substrates ranging from mud and sand, to gravel, cobble, and boulders, but large aggregations have been found under slab boulders or bedrock shelves (Baird 2000, Parmalee and Bogan 1998).

As with most freshwater mussels, reproduction involves the release of sperm by males into the water current; female mussels siphoning water for food and respiration also siphon sperm that then fertilizes their eggs. These fertilized eggs develop into microscopic larvae called glochidia. Spectaclecase mussels have the smallest glochidia known for any North American mussel (0.0024

inches) (Baird 2000). The glochidia are released in the form of conglomerates (gelatinous containers with numerous glochidia inside). These released larvae must attach to the gills or fins of a specific host, usually a fish, to complete development into a juvenile mussel. The specific host of the spectaclecase remains unidentified at this time.

FANSHELL – *CYPROGENIA STEGARIA*

The fanshell was described as a distinct species by Rafinesque in 1820 from specimens collected in Ohio (Parmalee and Bogan 1998). The fanshell grows to 3-4 inches and is characterized by its numerous fine green dots, dashes, sometimes bundled into broken rays on the shell and shingle-like growth rings, and knobs on the anterior half of the shell (Cicerello and Schuster 2003). On June 21, 1990, the fanshell was listed as endangered under the ESA (Federal Register 55: 25591).

Habitat for the fanshell includes a gravel and coarse sand substrate in relatively deep water with moderate currents of medium to large rivers (Bates and Dennis 1985, Gordon and Layzer 1989). In Kentucky on the Green River, Cicerello and Hannan (1990) found the fanshell in swift flowing riffles and the area immediately above (upstream) where water reaches depths of 3.3 feet, and flows over sand, gravel, and occasionally cobble substrate. Based on historical records, the fanshell is strictly an Ohioan or interior basin species. The fanshell's historic distribution includes the Ohio River mainstream, lower Tennessee and Clark's Rivers, lower Cumberland River, lower and upper Green River, Barren River, Salt River, upper Cumberland River below Cumberland Falls, Kentucky River, Licking River, Tygarts Creek, and Big Sandy River (Cicerello et al. 1991). As of 1991, extant populations in the Commonwealth only occurred in short sections of the Green and Licking Rivers, Rolling Fork, and in the lower Tennessee River below Kentucky Lake Dam where it was reintroduced (Haag and Cicerello 2016). Based on information obtained from KSNPC (2017) and maps in Haag and Cicerello (2016), no sites occur within the study area, but the fanshell was recovered from the Angel State Historic Site along the north bank of the Ohio River, 2.5 miles west of Newburgh, in Vanderburgh County, IN, approximately 5.5 miles east of the study area.

Habitat alteration, especially impoundments, navigation facilities, channel dredging, sand and gravel mining, sedimentation, and water pollution, has eliminated the species from most of its range, either directly affecting the species, or reducing its fish host. According to Jones and Neves (2002), less than 10 percent of the fanshell's historic range is still occupied, and where it is still present, only small sections of the rivers contain reproducing populations (USFWS 1991a).

Food habits of the fanshell are unknown, but it probably consumes microscopic detritus, diatoms, phytoplankton, and zooplankton from the water (USFWS 1991a). The reproductive cycle of mussels is very unorthodox because males release sperm into the water column and females downstream use their gills to filter it from the water. In addition, female freshwater mussels use their gills as marsupia and eggs remain there until they mature into glochidia. The fanshell is bradyctictic, meaning females are gravid in August, contain glochidia in September, and releases them from May to July the following year (Parmalee and Bogan 1998). To complete the reproductive cycle, glochidia must attach to the gills or fins of a host fish until metamorphosis is finished and they drop to the streambed (USFWS 1991a). Watters et al. (2009) described some of

the reported fish hosts for the fanshell glochidia: mottled sculpin (*Cottus bairdi*), banded sculpin (*Cottus carolinae*), tangerine darter (*Etheostoma aurantiaca*), greenside darter (*Etheostoma blennioides*), snubnose darter (*Etheostoma simoterum*), banded darter (*Etheostoma zonale*), blotchside logperch (*Percina burtoni*), logperch (*Percina caprodes*), and Roanoke darter (*Percina roanoka*).

CATSPAW – *EPIOBLASMA OBLIQUATA*

The catspaw, or purple catspaw is a medium sized, ovate freshwater mussel with a thick to heavy shell. The shell's periostracum is tan or dark brown with radiating, darker, green rays that are more prominent on the posterior side of the shell. The nacre is a deep purple color that often fades to white at the margins of the shell. Specimens, particularly from the Ohio River, have been found with a mauve or entirely white nacre (Watters et al. 2009). The catspaw was listed as endangered by USFWS on July 10, 1990 (50 CRF 17).

The catspaw is bradyctictic, with gravid females found from September to April of the next year (Hoggarth et al. 1995, Watters et al. 1998). Watters et al. (1998) reports potential host fish for the catspaw based on metamorphosis of glochidia in a laboratory setting as: rock bass (*Ambloplites rupestris*), mottled sculpin, stonecat (*Noturus flavus*), blackside darter (*Percina maculata*), and logperch.

Habitat for the catspaw is restricted to gravel and sand substrates in main-channel shoals, primarily in large streams (Haag and Cicerello 2016). It lives completely buried in the substrate, with females moving to the surface to release glochidia. Females, at this time, have been found on stream margins in shallow water. Historically, the catspaw was common in the Ohio River and Cumberland River systems. Only a single remaining population of catspaw is known, in Killbuck Creek, a relatively small stream in Ohio, where individuals are found in riffle and run habitats with a mixture of sand, gravel, and cobble substrate in relatively swift to nearly still water (Watters et al. 2009). It is intolerant of impoundments, and dams have drastically altered the nature of stream and river systems in all of its original range (Haag and Cicerello 2016). Successful propagation of this mussel has allowed small numbers of individuals to be reintroduced into several rivers, but none of these occurrences are near the I-69 ORX study area. Based on information obtained from KSNPC (2017) and maps in Haag and Cicerello (2016), no sites occur within the study area, but the catspaw was recovered from the Angel Archeological Site along the north bank of the Ohio River, 2.5 miles west of Newburgh, in Vanderburgh County, IN.

NORTHERN RIFFLESHELL – *EPIOBLASMA RANGIANA*

Northern riffleshell (formerly known as *Epioblasma torulosa rangiana*) was first described as a distinct species by Lea in 1838 from a specimen from near Poland, Ohio, which most likely was from the Mahoning River (Watters et al. 2009). The northern riffleshell is a medium sized mussel (up to 2.75 inches or 70 mm in length) with a greenish, yellow to tan colored shell. The shell's periostracum has numerous radiating dark green rays. The shell nacre is white, iridescent, and very thin posteriorly and extending along the margins (Watters et al. 2009). The northern riffleshell was listed as endangered without critical habitat on February 22, 1993 by USFWS (Federal Register 58(13): 5638-5642).

The northern riffleshell is bradytictic and Watters et al. (2009) report that gravid females have been observed from September to June of the following year. Females remain buried in the substrate until brooding, which occurs during the winter and spring when they move to the surface of the substrate. Females of this species parasitize fish by trapping them between their valves, “inflating” a mantle gasket around the head of the fish, and pumping glochidia onto the fish (Watters et al. 2009). This behavior reportedly may last for 5 to 10 minutes. Odee and Watters (2000) determined that glochidia encysted on banded darter, bluebreast darter (*Etheostoma caeruleum*), and brown trout (*Salmo trutta*) successfully metamorphosed in a laboratory setting. Brown trout is an exotic species whose geographic range overlaps minimally with northern riffleshell due to restrictive thermal habitat requirements. Therefore, its potential to serve as a viable host may be limited.

Habitat for the northern riffleshell is variable. The northern riffleshell occurs in riffle areas with swift currents in a substrate of coarse sand and gravel to a substrate of firmly packed fine gravel, typically in shallow (few inches to six feet deep) water (Parmalee and Bogan 1998). Based on historical records, the northern riffleshell was once widespread, although only locally common, in Ohio, Pennsylvania, Michigan, Indiana, Illinois, Kentucky, possibly Tennessee, and Ontario, Canada (Williams et al. 1993). The present day distribution as illustrated by the USFWS Recovery Plan (USFWS 1994) is greatly restricted and includes only Fish Creek along the Indiana/Ohio border, Big Darby Creek, the Detroit River near the Michigan/Ontario border, the upper Green River in Kentucky, the Elk River in West Virginia, and the Alleghany River, French Creek, and LeBoeuf Creek in Pennsylvania (USFWS 1994). Surveys in some of the aforementioned locations yielded only fresh dead valves or live individuals occurring in low densities. In Kentucky, the northern riffleshell’s historic distribution includes the Ohio River mainstem, upper Green River, Salt River, Kentucky River, and Licking River (Cicerello et al. 1991). According to Haag and Cicerello (2016), all natural populations of the northern riffleshell in Kentucky appear to be extirpated. If naturally occurring populations do occur in Kentucky, they would be in free-flowing sections of the Green River. Northern riffleshell was reintroduced at four locations in the Licking River during 2013 and 2014 (Haag and Cicerello 2016). Based on data provided by KSNPC (2017) and IDNR (2017b), no sites for this species are known from within the I-69 ORX study area.

SNUFFBOX – *EPIOBLASMA TRIQUETRA*

The snuffbox was also first described as a distinct species by Rafinesque in 1820 from specimens collected in Ohio (Parmalee and Bogan 1998). It grows to 2 to 3 inches in length and is characterized by a triangular, inflated shell, a sharp posterior ridge, and dark green rays and v-shaped markings (Cicerello and Schuster 2003). The snuffbox is the most widely distributed species in the genus *Epioblasma* and is known to occur in sixteen states and one Canadian province (Williams et al. 1993). The snuffbox was formally listed as endangered under the ESA on February 14, 2012 (77 Federal Register 8632).

The snuffbox, like all members of the *Epioblasma* genus, uses the “periodic” life history strategy characterized by low to moderate fecundity, long-term brooding of young, small adult size, early age at maturity, and a moderate length life span (Haag 2012). Eggs appear in female snuffboxes in September and glochidia shortly thereafter (Watters et al. 2009). Brooding of glochidia lasts

through the winter until April or May. The snuffbox is known to infest potential hosts by trapping the head of the fish between the valves (Barnhardt et al. 1998 cited from Watters et al. 2009). Apparently no lure or conglutinate is used to attract potential hosts. Watters et al. (2009) identified black sculpin (*Cottus baileyi*), mottled sculpin, banded sculpin, Ozark sculpin (*Cottus hypselurus*), blackspotted topminnow (*Fundulus olivaceus*), logperch, blackside darter, and Roanoke darter as potential hosts for the snuffbox on the basis of laboratory tests.

The snuffbox is found in small to medium sized streams, large rivers, as well as lakes. It occurs in swift currents of riffles and shoals and the wave-washed shores of lakes in gravel and sand, with occasional rocks and boulders. Individuals often burrow deep into the substrate, unless spawning or attracting a host fish (USFWS 2012c). Due to habitat destruction and fragmented populations, the current status of the snuffbox has been reduced to 79 streams and lakes in fourteen states and Ontario, representing a 62 percent range-wide decline (USFWS 2012c). Historically, the snuffbox was widespread in the Ohio River and all major drainages, with the exception of the lowland habitats in western Kentucky including most of the lower Green River drainage (Haag and Cicerello 2016). Based on information obtained from KSNPC (2017) and maps in Haag and Cicerello (2016), no sites occur within the study area, but the snuffbox was recovered from the Angel Mounds State Historic Site along the north bank of the Ohio River, 2.5 miles west of Newburgh, in Vanderburgh County, IN, approximately 5.5 miles east of the study area.

PINK MUCKET – *LAMPSILIS ABRUPTA*

The pink mucket is a medium sized mussel with a smooth yellow or yellowish-green shell with faint green rays (USFWS 1985). The shells of the pink mucket are somewhat inflated and valves become thick and heavy in mature individuals, which can reach lengths of 4.72 inches (Parmalee and Bogan 1998). The pink mucket was listed as endangered by USFWS on June 14, 1976 (USFWS 1985).

Females become gravid in August and glochidia appear in September. This species is bradytictic: brooding of the glochidia lasts through the winter; glochidia are discharged in June (Parmalee and Bogan, 1998, Watters et al. 2009). Pink mucket females have a spotted mantle flap, which is thought to mimic a fish eyespot and attract host fish (USFWS 1985). Laboratory studies have confirmed several hosts for the pink mucket: largemouth bass (*Micropterus salmoides*), smallmouth bass (*M. dolomieu*), spotted bass (*M. punctulatus*), white crappie (*Pomoxis annularis*), walleye (*Sander vitreus*), and sauger (*S. canadensis*) (Barnhart et al. 1997, Williams et al. 2008). The freshwater drum (*Aplodinotus grunniens*) may also be a host for the pink mucket based on its use by *Lampsilis higginsii* (Williams et al. 2008, Parmalee and Bogan 1998, USFWS 1985).

The pink mucket typically inhabits medium to large rivers. Preferred substrates include sand, gravel, and mud in slower moving waters and rocky ledges in higher velocity flows (Watters et al. 2009). Williams et al. (2008) indicates the pink mucket occurs in free-flowing reaches of larger rivers, and is occasionally found in large creeks in gravel with sand where currents keep silt washed away from the mussels. Historically, the pink mucket had a widespread distribution occurring in at least 25 rivers and tributaries, including the Ohio River, Kanawha River, Green River, and Mississippi River. Based on information obtained from KSNPC (2017) and maps in

Haag and Cicerello (2016), there are no known occurrences within the study area, but the pink mucket was recovered from the Angel Mounds State Historic Site along the north bank of the Ohio River, 2.5 miles west of Newburgh, in Vanderburgh County, IN, approximately 5.5 miles east of the study area.

RING PINK – *OBOVARIA RETUSA*

The ring pink was described as a distinct species by Lamarck in 1819, but he erroneously gave the type locality as Nova Scotia. Type locality information was corrected in 1969 by Johnson to be the Ohio River at Cincinnati (Parmalee and Bogan, 1998). The shell of the ring pink is medium-sized (up to 3.15 inches in length) with pale yellowish-green to tan periostracum, heavy to massive, and rounded or square with prominent umbo (Watters et al. 2009). The umbo is very wide and prominent, distinctly twisted anteriorly and becomes more so with age, eventually looking like “golf stick driver head.” The nacre is unique in this mussel with pale to dark purple in the middle, including the hinge and teeth, and abruptly changing to white at the pallial line. USFWS proposed the ring pink, formerly known as golf stick pearly mussel, as an endangered species on March 7, 1989 (Federal Register 54(43): 9529-9533). A final listing occurred on September 29, 1989 (Federal Register 54(188): 40109-40112).

Gravid ring pink mussels have been observed in late August (Ortmann 1909 and 1912 as cited in USFWS 1991b). The presence of eggs in females during August and gravid females with glochidia in September makes the species a bradytictic breeder (Parmalee and Bogan 1998). Ring pink glochidia are reported to be rather large and hookless, which indicate they attach to fish gills. The host fish for the ring pink is unknown (Parmalee and Bogan 1998, Watters 1994), however, a closely related species, hickorynut (*O. obovaria*) uses the shovelnose sturgeon (*Scaphirhynchus platyrhynchus*) as a host (Watters 1994).

The ring pink is characterized as a large river species (Bates and Dennis 1985, Bogan and Parmalee 1983), but it has been found occupying sand and gravel substrates in as little as two feet of water (Neel and Allen 1964). According to Parmalee et al. (1982), the ring pink inhabits deep stretches of rivers with swift current and coarse sand and gravel substrates. With the exception of a fresh dead specimen found near Lock and Dam 6 on the Green River, Kentucky, all recent individuals taken from this river have been found in shallow water with good current (Cicerello and Hannan 1990).

Based on historical records, the ring pink is strictly an Ohioan or Interior Basin species. Historically, it was widely distributed throughout the Cumberland, Ohio, and Tennessee River drainages (USFWS 1991b). According to Williams et al. (1992), the species occurred in Alabama, Illinois, Indiana, Kentucky, Ohio, Pennsylvania, Tennessee, and West Virginia. According to USFWS (1990a), the distribution and reproduction capabilities of this species has been seriously impacted by the construction of impoundments on the larger rivers it once inhabited.

In Kentucky, the ring pink’s historic distribution includes the mainstem Ohio River, lower Tennessee and Clark’s Rivers, lower Cumberland River, lower and upper Green River, Barren River, upper Cumberland River below Cumberland Falls, and Kentucky River (Cicerello et al. 1991, Haag and Cicerello 2016). As with other listed mussels, habitat alteration has eliminated the

species from most of its range in Kentucky. As of 2016, it is thought the only extant population of the ring pink occurs in a short section of the Green River in Warren, Edmonson, and Hart counties (Haag and Cicerello 2016). Based on information obtained from KSNPC (2017) and maps in Haag and Cicerello (2016), there are no known occurrences within the study area, but the ring pink was recovered from the Angel Mounds State Historic Site along the north bank of the Ohio River, 2.5 miles west of Newburgh, in Vanderburgh County, IN, approximately 5.5 miles east of the study area.

ORANGE-FOOT PIMPLEBACK – *PLETHOBASUS COOPERIANUS*

The orange-foot pimpleback was described as a distinct species by Lea in 1834 from specimens collected in the Ohio River (Parmalee and Bogan 1998, USFWS 1984a). The orange-foot pimpleback is a medium sized (up to 3.54 inches) mussel with a moderately thick, oval to somewhat triangular and moderately inflated shell (Watters et al. 2009). The shell surface contains irregular pustules often concentrically elongated on the posterior 50 to 60 percent of the shell. Additionally, the posterior slope contains a few curving pustules. The shell surface, or periostracum has numerous fine green rays on yellow to tan background coloration in juveniles, but these rays are often lost as the shell becomes reddish-brown in adults (Watters et al. 2009). The orange-foot pimpleback was listed by USFWS as an endangered species in September 1975 (Federal Register 40(188):44329-44333). A final listing occurred on June 14, 1976 (Federal Register 41(115):24062-24067).

Based on two gravid females found during early June in the Cumberland River, the orange-foot pimpleback is considered tachytictic (spawns in spring but glochidia are released in summer) (Parmalee and Bogan 1998). Yokley (1972) also observed an individual with charged gills in August, which further supports the species as a tachytictic breeder. The host for orange-foot pimpleback is unknown (Watters et al. 2009).

The orange-foot pimpleback is a big river species, occupying sand and coarse gravel substrates in water depths ranging from 12 to 18 feet (Parmalee and Bogan 1998). Yokley (1972) also reported the species from clean gravel, free of silt, in the Tennessee River. According to USFWS (1984a), the species has been found in the lower Ohio River in sand and gravel at water depths of 15 to 29 feet. However, Bogan and Parmalee (1983) think the species lived in shallower riffle and shoal sections of the Tennessee, Cumberland, and Ohio Rivers. If true, the occurrence of the species in deeper water may be an artifact of habitat alteration.

Based on historical records, the orange-foot pimpleback is strictly an Ohioan or Interior Basin species. Historically, it occurred throughout the Tennessee, Cumberland, and Ohio River drainages (USFWS 1984a). According to Williams et al. (1992), the species occurred in Alabama, Illinois, Indiana, Kentucky, Ohio, Pennsylvania, and Tennessee. Apparently, the orange-foot pimpleback was once common in the Ohio River between St. Mary's and Marietta, in the Wabash River, and in the Cumberland River (USFWS 1984a). As of 1984, the orange-foot pimpleback was known from only three rivers, including the Cumberland, Tennessee, and lower Ohio Rivers. According to USFWS (1984a), the largest concentration of this species occurs in the Tennessee River an undetermined distance below Pickwick Dam.

In Kentucky, the orange-foot pimpleback's historic distribution includes the Ohio River mainstem, lower Tennessee and Clark's Rivers, lower Cumberland River, lower and upper Green River, Barren River, Salt River, and upper Cumberland River below Cumberland Falls (Cicerello et al. 1991). Habitat alteration, especially impoundments, navigation facilities, channel dredging, sand and gravel mining, sedimentation, and water pollution, has eliminated the species from most of its range in Kentucky. Extant populations occur only in the short free-flowing section of the lower Ohio River in McCracken and Ballard Counties and lower Tennessee River below Kentucky Lake in free-flowing sections in Livingston and Marshall Counties (Haag and Cicerello 2016). Based on data provided by KSNPC (2017) and IDNR (2017b), there are no known occurrences within the I-69 ORX study area.

SHEEPNOSE – *PLETHOBASUS CYPHYUS*

The sheepnose was first described as a distinct species by Rafinesque in 1820 from specimens collected at Falls of the Ohio (Haag and Cicerello 2016). The sheepnose has a thick, oval or oblong, somewhat elongate, and slightly inflated shell that can be up to 5 inches in length with a rounded anterior end and bluntly pointed posterior end. The shell surface is mostly smooth with a row of knobs/tubercles on the center of valve, which may become worn down in older specimens. The shell surface, or periostracum of the sheepnose has no rays and is often yellowish color, but may also become dark brown with age. The sheepnose was listed in March 2013 by USFWS as a federally listed endangered species (USFWS 2012a).

The sheepnose is a short-term (tachytictic) brooder, spawning and releasing young within a few weeks during the summer (Watters et al. 2009). Sheepnose glochidia are expelled in jellylike masses of mucus called conglutinates. When a fish eats a conglutinate, glochidia are exposed and attach to the gills. The only confirmed wild host for sheepnose glochidia is the sauger. Laboratory studies by Wolf et al. (2012) and Hove et al. (2015) looking at potential host species for sheepnose glochidia found transformation of juveniles on 12 different minnow species, including a topminnow, and 29 cyprinid and six non-cyprinid species, respectively.

The sheepnose is primarily a large stream species. It inhabits medium to large rivers in shallow areas with moderate to swift current that flows over gravel or mixed sand and gravel substrate (Cummings and Mayer 1992). It has also been found in habitats composed of mud, cobble, and boulders, and in large rivers it may be found in deep runs (USFWS 2012b). Distribution of the sheepnose along with other native mussels occurs, as described by Strayer (1999), within flow refuges, areas which have relatively low particulate movement during flood conditions. They will likely occur where sheer stress during moderate flooding is too low to displace mussels from substrate.

Even though the sheepnose is found across the Midwest and Southeast, according to Parmalee and Bogan (1998), it has been extirpated throughout much of its former range or reduced to isolated populations. The sheepnose was historically found in 77 different streams, but now is reduced to only 26. It is known to occur within the Ohio River from the confluence with the Mississippi River upstream to Pennsylvania, including extant populations in western Kentucky and southern Indiana (Haag and Cicerello 2016). The populations in the lower Ohio River may

be contiguous with those in the lower Tennessee and Green Rivers (Haag and Cicerello 2016). Based on data provided by KSNPC (2017) and IDNR (2017b), there are no known occurrences for the sheepsnose from within the I-69 ORX study area, but one pre-1990 site is located at the mouth of the Green River. Additionally, the species was represented by shells recovered from the Angel Mounds State Historic Site along the north bank of the Ohio River, 2.5 miles west of Newburgh, in Vanderburgh County, IN, approximately 5.5 miles east of the study area. Recently, a sheepsnose was found near the I-69 ORX study area, in the Ohio River (RM 783.4) upstream from the confluence of the Green River (Koch, pers. comm. 2017).

CLUBSHELL – *PLEUROBEMA CLAVA*

The clubshell is a moderately inflated, elongate, and triangular shaped freshwater mussel. The shell's periostracum is tan, yellowish, or greenish and becomes darker with age (Watters et al. 2009). The smooth periostracum of juvenile clubshell often have bold green stripes that are interrupted into a checkerboard pattern, but these green colorations are often lost in adults. Nacre of the shell is porcelain white with some iridescent posteriorly. The clubshell was listed as endangered by USFWS on February 22, 1993 (50 CRF 17).

The clubshell is a short-term brooder, and eggs appear in May with glochidia developing in June and July (Watters et al. 2009). Females infect fish hosts by release of a white conglomerate that is perceived as a prey item. O'dee and Watters (2000) found that glochidia placed on central stoneroller (*Campostoma anomalum*), striped shiner (*Luxilus chrysocephalus*), blackside darter, and logperch successfully metamorphosed in a laboratory setting, thus possibly representing natural hosts.

Habitat for the clubshell includes a variety of riverine environments ranging from large rivers to smaller channel streams, but not penetrating far into headwaters (Haag and Cicerello 2016). The clubshell occurs in clean coarse sand, gravel, and cobble, where it may bury several inches into the substrate (Watters et al. 2009). It appears to be more common in the downstream ends of riffles and islands, but typically away from depositional areas and lentic environments. Historically, the clubshell was widely distributed in the Ohio River basin and occurred in most of the major drainages (USFWS 1994). Its distribution is now restricted to roughly 13 populations in the Ohio River and Lake Erie Basins. According to Haag and Cicerello (2016), the clubshell is intolerant of impoundments and populations in larger rivers and likely was eliminated by dams. With the exception of one unsubstantiated recent record from the Ohio River in Meade County by Clarke (1995) cited in Haag and Cicerello (2016), the species has not been seen in the Ohio River in over 100 years. Based on data provided by KSNPC (2017) and IDNR (2017b), there are no known occurrences within the I-69 ORX study area.

ROUGH PIGTOE – *PLEUROBEMA PLENUM*

The rough pigtoe is a medium sized (up to 3.54 inches) mussel with a rather thick, moderately inflated, triangular shaped shell. The shell's periostracum is coarse, with a satin finish, and tan, yellowish, or reddish brown in color and becomes darker with age (Watters et al. 2009). The periostracum of juvenile rough pigtoe often have green stripes that are often lost in adults. Nacre of the shell is porcelain white, rarely with rose flush, and with some iridescent posteriorly. The

rough pigtoe was listed as endangered without critical habitat on June 14, 1976 by USFWS (Federal Register 41(115):24062-24067).

The rough pigtoe appears to be tachytictic with gravid females having been found in May. Host fish species are unknown for the rough pigtoe (USFWS 1984b).

Although rough pigtoes can become established in small rivers or head water stretches of medium-sized rivers, they are typically found in large rivers, in firmly packed gravel and sand substrates (Parmalee and Bogan 1998). They may also occur in stable muddy, sand, and cobble of large rivers and their impoundments (Watters et al. 2009).

According to Haag and Cicerello (2016), the rough pigtoe is endemic to the Ohio River basin where it occurred historically throughout the Ohio River and its larger tributaries from the confluence of the Tennessee River upstream to Pennsylvania. In Kentucky, the rough pigtoe's historic distribution included the Ohio River mainstream, lower and upper Green River, Barren River, upper Cumberland River below Cumberland Falls, Kentucky River, and Licking River (Cicerello et al. 1991). Current distribution of this species is restricted to the Tennessee River mainstem and the upper Clinch River in Tennessee, and the Green River and the Barren River in Kentucky, and possibly in the Cumberland River (USFWS 1984b, Haag and Cicerello 2016). Based on data provided by KSNPC (2017) and IDNR (2017b), there are no known occurrences within the I-69 ORX study area.

FAT POCKETBOOK – *POTAMILUS CAPAX*

The fat pocketbook has a large (five inches), rounded to somewhat oblong, and greatly inflated, thin to moderately thick shell. The shell's periostracum is smooth and very shiny, yellow, yellowish-tan, or olive in color without rays and becomes dark brown in older individuals (Cummings and Mayer 1992). The nacre of the shell is white, sometimes tinged with pink or salmon. USFWS proposed the fat pocketbook as an endangered species on September 26, 1975 (Federal Register 40(188):44329-44333). A final listing occurred on June 14, 1976 (Federal Register 41(115):24062-24067).

Gravid fat pocketbooks have been observed from June to October, which indicates the species is bradytictic (Ortmann 1914 as cited in USFWS 1989). Fat pocketbook glochidia are reported to be rather small (0.105 x 0.185 mm), spined, and ax-head or hatchet-shaped (Utterback, 1915 cited in Oesch 1984). The host fish for the fat pocketbook is freshwater drum (Cummings and Mayer 1993).

Early habitat information was based upon scattered collection sites and general field observations. Parmalee (1967) reported the fat pocketbook from sand and mud bottoms, in flowing water a few inches to more than eight feet in depth. Bates and Dennis (1983) found the species in sand, mud, and fine gravel substrates in the St. Francis River, Arkansas. Conversely, Clarke (1985) reported this species primarily from sand substrates in the St. Francis River. Historically, the fat pocketbook was probably more common in large river sloughs and oxbows having a silt substrate (Miller and Payne 2005). Such habitat was more common near the mouth of rivers prior to man-induced modifications such as locks, dams, levees, channel maintenance,

and bank protection measures. Ahlstedt and Jenkinson (1991) reported that the fat pocketbook was most likely to be found in a mixture of sand, clay, and silt, which they referred to as "sticky mud." Based on the presence of dense populations of fat pocketbook in the St. Francis watershed, Arkansas, the species appears to be tolerant and even show a preference for depositional areas. This recent information tends to show the species is not lotic as previously thought by USFWS (1989). Miller and Payne (2005) determined that man-made ditches, existing bayous, sloughs, and streams within the St. Francis Watershed provide suitable habitat for the fat pocketbook. In western Kentucky, Haag and Cicerello (2016) describe the fat pocketbook's habitat as medium-sized to large rivers in depositional backwater areas along shore, behind wing dams, or in side channels and sloughs.

Based on historical records, the fat pocketbook was found in larger rivers within the Mississippi River drainage from Arkansas and Mississippi north to Minnesota and Wisconsin, and west to eastern Missouri and Iowa, and within the Ohio River upstream to near the mouth of the Green River in Kentucky and Indiana (Haag and Cicerello 2016). However, most records for the species appear to occur within three population centers, including the upper Mississippi River above St. Louis, Missouri, the Wabash River in Indiana, and the St. Francis River in Arkansas (Bates and Dennis 1983, USFWS 1989). According to USFWS (1989) and Miller and Payne (2005), the largest extant population of the fat pocketbook is in the St. Francis River and its associated canals and sloughs.

In Kentucky, the fat pocketbook has been reported from the Mississippi River, the Ohio River mainstem up to near the mouth of Green River, and the lower Cumberland, Green, Clark's, and Tradewater Rivers (Haag and Cicerello 2016). Populations in the lower Ohio River appear to be large and healthy, and together with the large population in the Wabash River may form one single metapopulation. Individual fat pocketbooks have been found in the Ohio River just upstream of the study area, approximately 2 miles upstream from the mouth of the Green River and have also been found approximately 4.5 miles downstream of study area (KSNPC 2017). The site upstream of Green River is located in Henderson County, KY at RM 782.3 (approximately 3 miles east of the study area) and was documented on October 3, 2008.

RABBITSFOOT – *THELIDERMA CYLINDRICA*

The rabbitsfoot (formerly known as *Quadrula cylindrica cylindrica*) is a medium to large (up to 5.12 inches) sized freshwater mussel which is thick and elongate, with a squared posterior and rounded anterior shell. It is compressed to a near cylinder, as its name suggests. The shell's periostracum is green to yellowish with many green upside-down triangular markings of varying sizes. In adults, these markings may be represented as rays or streaks of green. Pustules on the shell may be a lighter color. The nacre is a porcelain white, occasionally with a light pink hue, and often iridescent posteriorly (Watters et al. 2009). The rabbitsfoot was listed as federally threatened by USFWS on September 17, 2013 (50 C.F.R. § 17).

The rabbitsfoot is tachytictic. Eggs develop in June through August and glochidia are released in August as tan to orange lanceolate conglomerates (Ortmann 1919 cited in Watters et al. 2009) that are consumed by fish hosts, thereby infecting them with glochidia. Watters et al. (2009) identified

the rainbow darter (*Ethiostoma caeruleum*) and striped shiner as potential hosts based on metamorphosis of glochidia in a laboratory setting, however Haag and Cicerello identify rabbitsfoot as a host specialist on minnows (2016). Fobian (2007) identified fish hosts for rabbitsfoot populations west of the Mississippi River as the blacktail shiner (*Cyprinella venusta*), bluntface shiner (*C. camura*), red shiner (*C. lutrensis*), spotfin shiner (*C. spiloptera*), and cardinal shiner (*Luxilus cardinalis*). In addition, rosyface shiner (*Notropis rubellus*), striped shiner, and emerald shiner (*N. atherinoides*) served as hosts for the rabbitsfoot, in some stream populations. Host suitability information is lacking for the eastern range of this species.

The rabbitsfoot occurs in sand and gravel substrate in creeks and small rivers with high water quality. Though it may be found in main-channel mussel beds with other species, it typically occurs in more specialized habitat in slack water adjacent to current, where it is often found unburied along the water's edge. Alternatively, in big rivers, like the lower Tennessee, the rabbitsfoot is found in 9 to 12 feet of water (Parmalee and Bogan 1998). Historically, the species was probably uncommon range-wide, but may have been locally common in some streams. The rabbitsfoot ranges in the Mississippi River watershed from Missouri to northern Louisiana and west to Oklahoma and Kansas. In the Ohio River basin, this species ranges from the junction with the Mississippi River upstream to Pennsylvania. Within the Great Lakes basin, the range includes the Maumee River system (Haag and Cicerello 2016). This species is only marginally tolerant of impoundment and has been extirpated in most large rivers, with localized populations surviving in the lower Ohio River. Two records of the rabbitsfoot in the Ohio River upstream of the study area near Owensboro exist after 1990. However, only four populations are currently known in the state of Kentucky, and these do not include any populations in the Ohio River (Haag and Cicerello 2016). Based on data provided by KSNPC (2017) and IDNR (2017b), there are no known occurrences within the I-69 ORX study area, but one historic site is located in the Ohio River between river miles (RMs) 784.6 and 786.7. Additionally, the species was represented by shells recovered from the Angel Mounds State Historic Site along the north bank of the Ohio River, 2.5 miles west of Newburgh, in Vanderburgh County, IN, approximately 5.5 miles east of the study area.

2.1.3 BIRDS

LEAST TERN – *STERNA ANTILLARUM*

The interior population of the least tern was listed as endangered under the ESA on June 27, 1985 (50 FR 21784). The availability of the interior least tern's preferred nesting habitat, infrequently flooded but un-vegetated sandbars, had sharp declines after the impoundment of most large rivers in the central US for navigation and flood control. Although coastal populations are relatively stable, interior populations along major rivers within Arkansas, Colorado, Illinois, Indiana, Iowa, Kansas, Kentucky, Louisiana, Mississippi, Missouri, Montana, Nebraska, New Mexico, North Dakota, Oklahoma, South Dakota, Tennessee, and Texas were specifically listed due to this reduction of suitable nesting habitat and subsequent decline in breeding populations (USFWS 1990).

Interior least terns are small piscivorous birds in the Laridae family of the order Charadriiformes. Like most members of these taxa, interior least terns are a colonial nesting species. Their preferred

nesting habitat consists of bare sand areas, particularly sandbars associated with larger, un-channelized rivers. However, other natural and man-made habitats are utilized including river levees, salt flats, dredge spoil locations, and even rooftops. The suitability of bare sand areas for nesting habitat has been characterized by four primary variables (Lott et al. 2013): height above water level; distance from woody vegetation over 6.6-feet high; relative lack of herbaceous vegetation; and the availability of prey within 6.21 miles (Sherfy et al. 2012).

Interior least terns arrive on nesting grounds in late April with most nesting completed by late May through mid-June. Each nest consists of a shallow, unlined scrape containing a clutch of two to three buff-colored eggs with brown spots (Barbour et al. 1973). Colony sizes vary greatly depending on the size and quality of available nesting habitat, but may consist of up to 13,000 birds (Lott et al. 2013) with larger colonies being more susceptible to predation than smaller colonies (Burger 1984). Within a colony, individual nest spacing may vary between several to hundreds of meters (USFWS 1990). Foraging for small fishes, their primary prey item, generally occurs within a maximum of 6.21 miles of the nest site (Sherfy et al. 2012).

In the past, interior least terns were documented in southwestern Kentucky using Reelfoot Lake (unclear nesting status) and frequently using Ballard County Wildlife Management Area (WMA) during the breeding season, “apparently nesting on sandbars in the rivers.” Additionally, they were noted as being seen occasionally at Kentucky Lake and Lake Barkley during migration, particularly below Kentucky Dam (Barbour et al. 1973). In addition to confirmed breeding along the Mississippi River in Carlisle, Hickman, and Fulton Counties, confirmed breeding in McCracken County and probable breeding in Livingston County along the lower Ohio River, small numbers have been documented as far upstream as Louisville on the Ohio River. Until 1953, prior to impoundment of the Ohio River, a nesting colony of up to 30 pairs was located in Union County on an island in the Ohio River, and in 1967 there was a failed nesting attempt at the Falls of the Ohio in Jefferson County (Palmer-Ball 1996). In 1986, a single nest was discovered on a dike in a cooling pond impoundment at the Gibson Station power plant near the Wabash River in Gibson County, IN. Since that time, the population has expanded within the Gibson Station site and to other nearby areas including the Cane Ridge Wildlife Area (part of Patoka River National Wildlife Refuge), Tern Bar Slough Wildlife Conservation Area, the Wabash River, and agricultural fields nearby (Hayes and Pike 1999). Based on data provided by KSNPC (2017) and IDNR (2017b), there are no known occurrences within the I-69 ORX study area. Additionally, the nearest known nesting site is further than the 6.21-mile foraging range for this species, making the area unlikely to provide foraging habitat for nesting terns.

2.2 STATE LISTED SPECIES

2.2.1 MAMMALS

EVENING BAT – *NYCTICEIUS HUMERALIS*

The evening bat is listed as state endangered in Indiana and as a species of special concern in Kentucky (KSNPC 2015, IDNR 2017a). It is found throughout much of the midwestern and eastern US, ranging from Nebraska and Iowa, east to Pennsylvania, and south to Florida and the Gulf coast, including eastern Texas (Barbour and Davis 1974, Simmons 2005 in Wilson and Reeder

2005). In Kentucky, the species occurs most commonly in the western third of the state (Barbour and Davis 1974), but can also be found in appropriate habitats throughout the central and southern portions of the state.

According to Whitaker and Munford (2009), the evening bat is an uncommon summer resident and found primarily in the southern part of Indiana. The evening bat can be found in both upland and bottomland forests, though it prefers bottomland forests. Like the Indiana and northern long-eared bats, the evening bat prefers dead trees with a combination of loose, exfoliating bark, cracks, and crevices as summer maternity roosts, and populations have been documented in hollow dead and live trees, several man-made structures, such as old, typically uninhabited buildings and barns (Whitaker and Hamilton 1998). In Kentucky and Indiana, any forested area with trees exhibiting the above characteristics and that are within the range of the evening bat should be considered potential summer foraging and roosting habitat. Foraging generally occurs in more open to semi-open habitats including open areas in forests, such as road corridors and open understories, field edges, and various bodies of water. Based on data received from KSNPC (2017) and IDNR (2017b), the evening bat is known at four locations from within 10 miles of the I-69 ORX study area. Two auditory recordings were collected for the evening bat at Henderson County Airport in Kentucky, approximately 7.5 miles west of the southern terminus of the study area. There is also a capture record in Kentucky over Lick Creek, approximately eight miles east of the southern terminus of the study area. In Indiana, there is a capture record on a tributary to Bayou Creek approximately 6 miles west of the northwestern terminus of the study area.

MASKED SHREW – *SOREX CINEREUS*

While the masked shrew is considered common throughout Indiana with the exception of the southern portion of the state (Whitaker and Mumford 2009), it is listed as a species of special concern in Kentucky (KSNPC 2015). The masked shrew is typically considered more of a habitat generalist than other members of the genus *Sorex*. It can be found in habitats ranging from thick hardwood forests, bogs, and swamps, to open grassy fields and marshes (Whitaker and Hamilton 1998). Although occurring in a large variety of habitat types, the only requirements seem to be that the area remain moist and that adequate cover is present for hiding and foraging (dead, rotten logs; thick leaf litter; large, thick mats of moss or dead grass). Like their habitat preferences, the masked shrew has a large and varied diet, including anything from mollusks, insects, small annelids, and carrion (Whitaker and Hamilton 1998). Several sites for the masked shrew are known from Henderson County, KY, and they are located in bottomland hardwood forests along the Ohio River. A site for this species is present within the West Alternative of the I-69 ORX project, and two sites are known along the Green River near the confluence with Ohio River (KSNPC 2017).

SWAMP RABBIT – *SYLVILAGUS AQUATICUS*

The swamp rabbit is found in the southern and southeastern US from Texas and Louisiana, east into northwestern South Carolina, and north into Oklahoma, southeastern Kansas, and extreme southern Illinois and Indiana where it reaches its northern limit (Reid 2006, Whitaker and Hamilton 1998). It is listed as state endangered in Indiana (IDNR 2017a) but has no listing status in Kentucky. In Kentucky, this species is restricted to the western third of the state (Barbour and

Davis 1974). While southern populations are considered stable, northern populations including those in Kentucky and Indiana are declining, reaching the point of near extirpation (Whitaker and Hamilton 1998, Barbour and Davis 1974). The swamp rabbit requires lowland swamps, bottomlands, and wet riverine habitats with access to higher ground (ridges, levees, knolls, etc.) nearby (Whitaker and Hamilton 1998, Barbour and Davis 1974, Reid 2006). These areas of higher ground are required for this species to ride out flood periods, conditions often associated with such habitats. There is a known record of the swamp rabbit in Indiana from the Ohio River floodplain forest approximately 5.5 miles west of the southern portion of the study area (IDNR 2017b).

AMERICAN BADGER – *TAXIDEA TAXUS*

Occurring in every state west of the Mississippi River except Louisiana (Whitaker and Hamilton 1998, Reid 2006), the American badger is generally considered a locally common species in the west. In the east, its range is much more limited with documented occurrences in only six states, including Wisconsin, Ohio, Michigan, Illinois, Indiana (Whitaker and Hamilton 1998), and Kentucky (KDFWR 2014). It is listed in Indiana as a species of special concern (IDNR 2017a), but has no listing status in Kentucky. Throughout most of its range, the badger is a habitat generalist, occupying everything from tundra, mountains, forests, swamps/marshes, and open areas. East of the Mississippi River, however, it prefers open areas with softer, often sandy, soils where it can burrow and dig for food, and seems to avoid wooded areas and swamps/marshes at all cost. Such habitats include prairies, grasslands, and farmlands (Whitaker and Hamilton 1998).

There is a known record of the American badger in Indiana along Interstate 64 approximately 6.8 miles west of Evansville (10.5 miles northwest of northern portion of study area), and another record 1.5 miles northwest of northern portion of study area near a wastewater treatment plant at the mouth of Eagle Creek (IDNR 2017b). Additionally, a dead American badger was found by Mike Morton on April 18, 2001 along US 41 near the southern end of the study area in Henderson County (KDFWR 2014). Without knowing this information and while conducting habitat assessments, project biologists found what appeared to be denning activity and foraging sign of badgers near the US 41 bridge over Van Wyk Road. Additional information obtained later placed the “road killed” badger from 2001 within 656 feet of the suspected denning and foraging activity site (Zach Couch, pers. comm. 2017). Trail cameras placed at one of the suspected sites during December 2017 failed to document any badgers, however the cold weather may have limited the species activity.

2.2.2 FRESHWATER MUSSELS

LONGSOLID – *FUSCONAIA SUBROTUNDA*

The longsolid mussel is listed as state endangered in Indiana and as a species of special concern in Kentucky (IDNR 2017a, KSNPC 2015). It is relatively endemic to the Ohio River basin, occurring throughout the Ohio River and in large tributaries from the Tennessee River up to Pennsylvania, and was potentially historically found in the Maumee River basin of western Lake Erie (Watters et al. 2009). In Kentucky, the longsolid was formerly broadly distributed throughout the Ohio River and its larger tributaries. However, due to habitat loss resulting from

impoundment, it is now extremely rare in the Ohio River. A single record post-1990 exists near the study area. The longsolid is restricted to main-channel habitats in medium to large rivers. The longsolid is found in gravel and sand and is typically a small component of existing mussel beds (Haag and Cicerello 2016). Females are gravid from June through August, and glochidia are released in red to pink cylinders within a composite conglutinate (Watters et al. 2009). Its host fish is unknown, however it is likely a minnow host specialist, like other *Fusconaia* species (Haag and Cicerello 2016).

Based on data obtained from KSNPC (2017b) and IDNR (2017b), there are no known occurrences within the I-69 ORX study area, but one occurrence is known from the confluence of the Ohio and Green Rivers in Henderson County, KY. Additionally, a single weathered valve (shell) from a longsolid was located in a cobble substrate sample collected downstream of Central Alternative 1 during the ground-truthing of side scan sonar results (INDOT and KYTC2018).

POCKETBOOK – *LAMPSILIS OVATA*

The pocketbook is listed as state endangered in Kentucky but is not listed in Indiana (KSNPC 2015, IDNR 2017a). This mussel is endemic to the Ohio River basin and occurs throughout the Ohio River and large tributaries. The pocketbook and plain pocketbook (*L. cardium*) are very closely related and can be difficult to tell apart. However, the two species forms occur together in large rivers within the range of the pocketbook, which suggests that the distinct species status for each is correct. Currently, the pocketbook is rare in the Ohio River due to its low tolerance of impoundment. Three records of the pocketbook exist upstream of the study area post-1990. Individuals were found upstream of Owensboro, KY near Rockport and Tell City, IN. The pocketbook is found in gravel and sand substrates in medium to large rivers and is not found in depositional areas, and it is typically a small proportion of existing mussel beds (Haag and Cicerello 2016). Similar to the plain pocketbook, females are gravid almost perpetually, from August to the following May (Ortmann 1919 cited in Watters et al. 2009). Glochidia are “broadly subspatulate” and metamorphose on similar species as the plain pocketbook (*Micropterus spp.*), but most successfully on sauger (Haag and Cicerello 2016). Based on data obtained from KSNPC (2017) and IDNR (2017b), there are no known occurrences within the I-69 ORX study area, but there are two records of the pocketbook in the Ohio River west of Henderson with one site at Henderson Island. Additionally, the species was represented by shells recovered from the Angel Mounds State Historic Site along the north bank of the Ohio River, 2.5 miles west of Newburgh, in Vanderburgh County, IN.

OHIO PIGTOE – *PLEUROBEMA CORDATUM*

The Ohio pigtoe is state listed in Indiana as a species of special concern but is not listed in Kentucky (IDNR 2017a, KSNPC 2015). This mussel is endemic to the Ohio River basin and occurs throughout the Ohio River and large tributaries. The Ohio pigtoe has declined in the last 100 years coinciding with the destruction of large river ecosystems. However, it still remains locally common in healthier river reaches downstream of navigation dams. Three records post-1990 exist for the Ohio pigtoe in the Ohio River near the I-69 ORX study area. This mussel prefers medium to large rivers and is found in gravel and sand substrates. It also can be a dominant species in mussel bed communities where it is found (Haag and Cicerello 2016). Females are gravid in May

through September and release glochidia in the form of non-elastic conglutinates, containing no un-fertilized eggs (Watters 2008). The Ohio pigtoe is specifically a minnow (Cyprinidae) host specialist (Haag and Cicerello 2016). Based on data provided by IDNR (2017b), there are no known occurrences within the I-69 ORX study area, but one occurrence is known between the West and Central Alternatives, and two are recorded in the Ohio River west of Henderson KY.

PYRAMID PIGTOE – *PLEUROBEMA RUBRUM*

The pyramid pigtoe is a state listed endangered mussel species in Indiana and Kentucky (IDNR 2017a, KSNPC 2015). It is distributed throughout the Ohio River basin and in the majority of its large tributaries up to Pennsylvania. The historical range of this species is difficult to determine, however, due to probable misidentification of several other closely related species. Despite misidentifications, the pyramid pigtoe was clearly a common and distinguishing member of large-stream mussel communities throughout the Ohio River basin in Kentucky. Being relatively intolerant of river dams, most of its habitat has been drastically altered, and there are no confirmed records of live or recent dead individuals in the Ohio River itself in over 50 years. A single dead shell was recovered near the study area post-1990 near the mouth of the lower Green River. Restricted to the main channel of medium to large rivers, the pyramid pigtoe is found in gravel and sand substrates and usually is a small component of mussel assemblages (Haag and Cicerello 2016). Although glochidia size and shape have not been documented, female pyramid pigtoes were found to be gravid in May and July by Ortmann (1919 cited in Watters et al. 2009) and like the Ohio pigtoe, the pyramid pigtoe is also a minnow (Cyprinidae) host specialist (Haag and Cicerello 2016).

Based on data obtained from KSNPC (2017b), a historic site occurs between RMs 800.9 and 801.2 in the Ohio River west of Henderson and a shell was recovered from the Angel Mounds State Historic Site along the north bank of the Ohio River, 2.5 miles west of Newburgh, in Vanderburgh County, IN, approximately 5.5 miles east of the study area.

LITTLE SPECTACLECASE – *VILLOSA LIENOSA*

The little spectaclecase is a state listed species of special concern in Indiana and in Kentucky (IDNR 2017a, KSNPC 2015). Females release large, club-shaped conglutinates (Utterback 1916) and are host specialists primarily using sunfishes (*Lepomis* spp.) to successfully transform glochidia. It is distributed in the Ohio River basin up to roughly the Kanawha River, West Virginia, but not in most of the Tennessee River drainage. It also occurs in the lower Mississippi River basin from Louisiana to southeastern Missouri and west to eastern Oklahoma. The little spectaclecase occurs in two distinct habitats in Kentucky: sluggish lowland streams in depositional areas in the Mississippi Embayment and also in upland streams in sand and gravel substrates (Haag and Cicerello 2016). Although its distribution has remained widespread, populations have declined drastically in the last 50 years, especially in upland populations in Kentucky. Current populations in the state are small and broadly scattered. Reasons for its decline are unknown, because several systems which it has vanished from continue to support large and diverse mussel communities.

Only two records exist from the Ohio River, one in Jefferson and the other in Oldham County, KY. One pre-1990 record of a little spectaclecase shell exists near the study area in Canoe Creek, a tributary to the Ohio River, at the US 41 bridge at Cedar Grove in Henderson County (Haag and Cicerello 2016, KSNPC 2017). A population of little spectaclecase was found within the project corridor while completing habitat assessments for ETR species. The site is located in North Fork Canoe Creek where US 41 crosses in Henderson County.

2.2.3 FISH

LAKE CHUBSUCKER – *ERIMYZON SUCETTA*

Although the lake chubsucker has no state listing in Indiana, in Kentucky it is listed as threatened (KSNPC 2015). The lake chubsucker is found throughout much of the midwestern and eastern US, ranging from Wisconsin and Michigan (Great Lakes and Mississippi River basin lowlands), east to Pennsylvania, and south into the gulf states (Page and Burr 1991). On the Atlantic coast, this species ranges from Florida, north to eastern Virginia and South Carolina. In Kentucky, this species is restricted to the western third of the state where it is known from 12 counties, including Henderson (KSNPC 2015). According to the distribution map in Simon and Tomelleri (2011), the lake chubsucker occurs through the northern quarter of Indiana and along the Patoka River while absent from along the Ohio River. The lake chubsucker is found in pools and sluggish waters of spring pools, sloughs, swamps, lakes, and ponds containing substrates of silt, sand, and/or debris (Page and Burr 1991, Etnier and Starnes 1993). Because it prefers sluggish, slack water habitat with finer substrates, it rarely occurs in streams (Page and Burr 1991), and never in those with a high gradient. Although no occurrences are reported within the I-69 ORX study area, one has been documented just east of the project corridor in Cypress Slough, which is at the confluence of the Green River and Ohio River and approximately 1.5 river miles from Central Alternative 1 (KSNPC 2017).

2.2.4 AMPHIBIANS

EASTERN HELLBENDER – *CRYPTOBRANCHUS A. ALLEGANIENSIS*

The eastern hellbender (*Cryptobranchus a. alleganiensis*) has a state status of critically imperiled in Kentucky and Indiana (KSNPC 2015, IDNR 2017a), and this large salamander has an extensive range. The eastern hellbender is found in and around the Appalachian Mountains of the eastern US, with the exception of one small disjunct population in central Missouri. It ranges from southern New York, south along the Appalachian Mountains to extreme northwestern South Carolina, west through northern Georgia and Alabama in the south and Indiana and Illinois in the north (Conant and Collins 1998, Barbour 1971). In Kentucky, this species is widespread, but never common, occurring in 57 counties throughout the state (KSNPC 2015). The eastern hellbender occurs in large streams and rivers with moderate current and ample amounts of cover, typically in the form of large logs, rocks, and other debris (Conant and Collins 1998, Barbour 1971). Its preferred cover is large, boulder sized, flat rocks that are almost fully embedded in the substrate. This habitat, fully embedded with only a small entrance available, is thought to provide greater protection from predators and strong currents during times of high water flow. Based on data provided by IDNR (2017b) and KSNPC (2017), there are no known occurrences within the I-

69 ORX study area. However, there is one record of eastern hellbender approximately 5 miles northwest of the West Alternatives in Pigeon Creek (IDNR 2017b).

2.2.5 REPTILES

COPPERBELLY WATER SNAKE – *NERODIA ERYTHROGASTER NEGLECTA*

The copperbelly water snake, a subspecies of the more common plain-belly water snake (*N. erythrogaster*), is limited in range to two separate geographic areas. The northern population, located in southern Michigan, northeastern Indiana, and northwestern Ohio, contains the largest known populations of this species (USFWS 2008) and is federally listed as threatened under the ESA. The southern population is located in southern Indiana, Illinois, and northwestern Kentucky (USFWS 2016, Conant and Collins 1998) and is not federally listed. However, it is state listed in both Kentucky [species of special concern (KSNPC 2015) and Indiana – endangered (IDNR 2017a)]. While recent genetic work by Makowsky and others (2012) has revealed that the subspecies *N. e. neglecta* is not unique, resulting in all subspecies being listed as the plain-belly water snake, Kentucky and Indiana still recognize it as distinct. This species requires areas of semi-permanent to permanent shallow water sources including floodplain wetlands, seasonal wetlands, springs, ditches, marshes, and shallow, slow moving streams (USFWS 2008, USFWS 2016). While shallow water sources are important to the copperbelly water snake for foraging, it requires access to drier uplands for hibernation, especially during mid-winter floods and freezing temperatures. It will also use bottomland hibernation sites, such as felled tree root networks, crayfish burrows, brush and rock piles, and mammal lodges.

No records were found within a 10-mile radius of the study area in Kentucky through a data request from KSNPC (2017). Within Indiana, there is a record from Frenchman’s Slough in the peninsula formed by the large bend in the Ohio River approximately four miles west of downtown Henderson and the West Alternatives (IDNR 2017b). A population of copperbelly water snake is known to occur within the wetland complex between US 41 and the Green River Road (John MacGregor, KDFWR, pers. comm. 2017). A juvenile snake was found in Henderson County, KY on Green River Road at the mouth of Green River by James Kiser on October 10, 2017. The following day, an adult copperbelly water snake was found swimming across Eagle Creek within the Indiana portion of the study area.

2.2.6 BIRDS

PIED-BILLED GREBE – *PODILYMBUS PODICEPS*

The pied-billed grebe is a small waterbird, similar in appearance to ducks but only distantly related. It has a wide breeding range that includes almost all of North America with the exception of northern and western Canada. However, in Kentucky, this species is listed as special concern (KSNPC 2015). In Indiana this species has no state listing. The pied-billed grebe nests within dense emergent vegetation near open water where it constructs a floating nest (Muller and Storer 1999). The pied-billed grebe has been documented in Kentucky within one mile of the study area (KDFWR 2018).

SPOTTED SANDPIPER – *ACTITIS MACULARIUS*

Although the spotted sandpiper has no state listing in Indiana, in Kentucky it is listed as endangered (KSNPC 2015). It occurs within a variety of riparian, wetland, and lacustrine habitats with open water edges (Kleen et al. 2004). Nests are generally constructed in shallow depressions in the ground along streams or ponds near open patches of sand or gravel, with most potential habitat occurring downstream of dams in the Ohio River. The only confirmed nesting locations in Kentucky are in Jefferson and Franklin Counties (Palmer-Ball 1996). Although no sites are known to occur within the I-69 ORX study area, it has been documented just northeast of the study area on a sandbar just downstream of Newburgh Dam, which is approximately 7.5 RMs from Central Alternative 1 (KSNPC 2017).

UPLAND SANDPIPER – *BARTRAMIA LONGICAUDA*

The upland sandpiper is an upland shorebird of native prairies and similar habitats such as pasture, hay fields, and even airports (Kleen et al. 2004). Although it is state-listed as endangered in Indiana (IDNR 2017a), it is not listed in Kentucky. The conversion of prairie and pasture land to monoculture row crop agriculture has drastically reduced habitat for this species (Kleen et al. 2004). Nesting upland sandpipers are not known from Kentucky. Although no sites are known to occur within I-69 ORX study area, it has been documented approximately 6.8 miles north of the study near the Evansville-Dress Regional Airport (IDNR 2017b).

GREAT EGRET – *ARDEA ALBA*

While the great egret has a state status of S2, imperiled in Kentucky (KSNPC 2015), it is listed as a species of special concern in Indiana (IDNR 2017a). The great egret is a large wading bird that is a colonial nester with other wading birds, such as great blue herons (*Ardea herodias*) and black-crowned night-herons (*Nycticorax nycticorax*). Nests are generally located high in canopy trees along stream corridors or bottomlands (Palmer-Ball 1996), and most foraging occurs in open wetlands and marshes (Peterjohn 2001). Nesting great egrets are generally found in the western portion of Kentucky along the floodplain wetlands of the larger rivers. After their recovery from DDT impacts, great egrets have been documented nesting only in Ballard and Trigg Counties, KY (Palmer-Ball 1996). Based on data provided by IDNR (2017b) and KSNPC (2017), no sites are known from within the I-69 ORX study area, but one site is located between the West and Central Alternatives, and two additional sites are known to occur in sloughs along the Ohio River downriver from the study area. The nearest of these sites to the I-69 ORX is approximately 1.5 miles west near the confluence of Eagle Creek and the Ohio River.

AMERICAN BITTERN – *BOTAURUS LENTIGINOSUS*

The breeding range of the American bittern includes the northern half of the US, from coastal Virginia west to coastal California, and north to the Canadian border (Lowther et al. 2009). In Kentucky, this species is listed as historic, indicating that no breeding individuals have been observed within the past 20 years (KSNPC 2015). In Indiana, this species is state listed as endangered (IDNR 2017a). Preferred nesting areas for this species include a variety of habitat types, typically with emergent vegetation, including: freshwater wetlands, marshes, and the marshy borders of lakes and ponds (Palmer-Ball 1996, Lowther et al. 2009). In addition, the

American bittern has been noted to nest in habitats such as tidal marshes, grassy fields and meadows, and other upland sites, though these incidents are exceedingly rare (Palmer-Ball 1996, Lowther et al. 2009). In Kentucky, historic breeding occurrences of the American bittern are known from six counties, including: McClean, Muhlenberg, Oldham, Trigg, Hopkins, and Jefferson (Palmer-Ball 1996, KSNPC 2015). Although no sites are known to occur within the I-69 ORX study area, it has been documented from a reclaimed mine site in Warrick County, IN approximately 10 miles northeast of the study area (IDNR 2017b).

LEAST BITTERN – *IXOBRYCHUS EXILIS*

The breeding range of the least bittern includes much of the midwestern and eastern US, ranging from Minnesota east to the Atlantic coast and south to the gulf coast (Sibley 2000, Poole et al. 2009). While a common species in the right habitats throughout its range, the least bittern is state listed as threatened in Kentucky (KSNPC 2015) and endangered in Indiana (IDNR 2017a). A marsh bird, the least bittern requires permanent water sources with tall, emergent vegetation for nesting (Poole et al. 2009, Palmer-Ball 1996). Such habitats include fresh and brackish water marshes and swamps (Poole et al. 2009), and in Kentucky it has been documented nesting in shallow ponds on reclaimed strip-mines (Palmer-Ball 1996). Based on data received from IDNR (2017b), a documented least bittern site in Warrick County, IN is within 10 miles of the I-69 ORX study area. Two additional nest sites are known from within 10 miles of the study area in Henderson County, KY with one of these occurring in a moist field at Hardy Slough in the Sauerheber Unit of Sloughs (WMA) (KSNPC 2017).

SEDGE WREN – *CISTOTHORUS PLATENSIS*

The sedge wren is a bird of moist, early successional habitats across their range, but in the southern portions of their range they often use pastures and hay fields. More typical habitats, such as grass and sedge meadows, are less common in their southern range. Historically, the sedge wren may not have nested in Kentucky and may have actually benefitted from past anthropomorphic disturbances (Palmer-Ball 1996). The sedge wren is state-listed as a species of special concern in Kentucky (KSNPC 2015) and is listed as endangered in Indiana (IDNR 2017a). Although no sites are known to occur within the I-69 ORX study area, it has been documented just east of the study area at Angel Mounds State Historic Site near Evansville, IN at the site of a former Mississippian settlement (IDNR 2017b). Additionally, a site is known for the Sloughs State (WMA) just northeast of Hardy Slough Pond (Sauerheber Unit), which is approximately nine miles west of the West Alternatives (KSNPC 2017).

FISH CROW – *CORVUS OSSIFRAGUS*

The fish crow ranges throughout the southern and eastern US from the Gulf coast of Texas to Massachusetts along the Atlantic coast and inland along major river systems (Wells and McGowan 1991). It is listed as a species of special concern in Kentucky, where it is restricted to the western third of the state with documented occurrences in 11 counties including: Ballard, Carlisle, Fulton, Henderson, Hickman, Livingston, Lyon, Marshall, McCracken, McLean, and Union (KSNPC 2015). It is not listed in Indiana, thus distributional records for this portion of the study area are not available. The fish crow inhabits areas around large, permanent bodies of water, such as large streams, rivers, lakes, and oceans (Collins 1960, Wells and McGowan 1991).

A site suitable as habitat for the fish crow is present within the I-69 ORX study area near the open water slough just north of the Ohio River at the edge of the West Alternatives (KSNPC 2017).

SHORT-EARED OWL – *ASIO FLAMMEUS*

While the heart of the breeding range of the short-eared owl includes northern North America, they are considered year-round residents in the US along several areas near the Canadian border, as well as the Pacific northwest, south to northern California, and east to northern Indiana (Sibley 2000, Wiggins et al. 2006). Although not common, breeding records are known from Kentucky in Ohio and Muhlenberg Counties (KSNPC 2015, Palmer-Ball 1996). This species is state listed in both Kentucky and Indiana as endangered (KSNPC 2015, IDNR 2017a). Short-eared owls nest on the ground in open areas in almost any habitat type excluding forests, although open areas in forests may be used as winter habitat (Wiggins et al. 2006). Preferred habitat types include those with no woody vegetation and large expanses of grassy areas for cover, such as grasslands and marshes (Wiggins et al. 2006). In Kentucky, breeding individuals have been recorded using reclaimed surface mines where succession is still in the early stages (Palmer-Ball 1996). Although no sites are known to occur within the I-69 ORX study area, it has been documented from a reclaimed mine site in Warrick County, IN approximately 10 miles northeast of the study area (IDNR 2017b).

BARN OWL – *TYTO ALBA*

The barn owl is a widespread (circumglobal, in fact) species of owl so-named because of its propensity to roost and nest in barns and other similar structures such as caves and cavities in trees. Within North America, they are considered year-round residents from all but Canada, the upper Midwest, and parts of New England. However, this species considered to be in decline due to reduced availability of grasslands near suitable nesting structures (Marti et al. 2005). This species is state listed in Kentucky as special concern (KSNPC 2015), but has no listing in Indiana. In the east, grasslands and agricultural fields are traditionally considered the primary habitat of barn owls, but the availability of small mammal prey near suitable nesting structures appears to be the essential factor for determining nesting habitat (Marti et al. 2005). The barn owl has been documented in Kentucky within one mile of the study area (KDFWR 2018).

PEREGRINE FALCON – *FALCO PEREGRINUS*

Although the year-round and breeding range is more limited, the peregrine falcon has been documented in every state within the continental US (White et al. 2002). Listed as endangered in Kentucky, the species is known from 12 counties throughout the state, including: Boone, Campbell, Carroll, Garrard, Greenup, Harlan, Jefferson, Kenton, Mason, Meade, Mercer, and Trimble (KSNPC 2015), but it can be seen during migration in almost every county. This species is listed as a species of special concern in Indiana, where it occurs in the southern counties along the Ohio River. Although the peregrine falcon can be found in almost any habitat type from forests to wetlands, the historical preference was for high, open cliff faces (White et al. 2002). However, with the expansion of urban development over the past two decades, many man-made structures including bridges, sky scrapers, and utility towers are being used as nesting sites. Based on data obtained from KSNPC (2017b) and IDNR (2017b), no sites are known from within

the I-69 ORX study area. However, an observation was made within Evansville, IN approximately 2.5 miles northwest of Central Alternative 1.

BALD EAGLE – *HALIAEETUS LEUCOCEPHALUS*

Once listed as federally endangered under the ESA, the bald eagle is now widespread throughout the North America and can be seen in every state within the continental US (Sibley 2000). Although population increases of this species led to its delisting in 2007, it is still considered rare in both Kentucky and Indiana and is state listed as threatened in Kentucky and as a species of special concern in Indiana (KSNPC 2015, IDNR 2017a). In addition, the bald eagle is federally protected under the Bald and Golden Eagle Protection Act. In Kentucky, breeding pairs are known from 31 counties scattered throughout the state. The bald eagle prefers large bodies of water, such as rivers and lakes (Kleen et al. 2004) but can also be found around large wetland complexes and other permanent bodies of water. According to data obtained from IDNR (2017b), five bald eagle nest sites are known from within 10 miles of the I-69 ORX study area. Two additional nest sites are known from within 10 miles of the study area in Henderson County, KY (KSNPC 2017) with one of these occurring approximately 2,000 feet east of the West Alternatives. This site is within the large wetland complex just north of Wolf Hills Road and John James Audubon State Park. Additionally, several bald eagles were observed flying along the Ohio River near the West Alternatives and near the Green River/Ohio River confluence near Central Alternative 1 during field investigations.

OSPREY – *PANDION HALIAETUS*

Widespread in breeding distribution, the heart of the breeding range for the osprey includes the southeastern and eastern US from Texas to Maine, and areas of the western US and Pacific northwest (Bierregaard et al. 2016). However, small disjunct breeding populations are known from all over the country. In Kentucky, this species is state listed as a species of special concern, while it is listed as endangered in Indiana (KSNPC 2015, IDNR 2017a). Once declining throughout their entire range, the osprey seems to be rebounding and expanding its range. A habitat generalist, the osprey will use any habitat type as long as the following conditions are met: large, permanent water present, such as rivers, lakes, or ocean where an abundant population of fish are present; and large, stable nesting structures are present that are capable of supporting the nest (Bent 1961, Bierregaard 2016). Throughout their range, they can be found nesting in habitats from forests to open grasslands and marshes, in old-growth trees and man-made structures, buildings, and equipment (Bent 1961, Bierregaard 2016). Based on data obtained from KSNPC (2017) and IDNR (2017b), no sites are known from within the I-69 ORX study area, but a nest site is known to occur on the Blue Grass Fish (WMA) in Warrick County, IN, which is approximately 9.5 miles northeast of the study area.

LOGGERHEAD SHRIKE – *LANUS LUDOVICIANUS*

A year-round resident of the southern half of North America, the breeding range of the loggerhead shrike extends north into much of the western US, west of the Mississippi River, and into Ohio, Indiana, and Illinois in the east (Reuven 1996). Although not state listed in Kentucky (KSNPC 2015), this species is state listed as endangered in Indiana (IDNR 2017a) and is one of the many passerine species that seem to be declining throughout its range (Reuven 1996). A bird of

open areas, the loggerhead shrike prefers grasslands and prairies where vegetation is not high or thick (Reuven 1996). In Kentucky, it is known to occupy other open areas as well, including farmland, pastures, mowed hayfields, yards, roadsides, and developed areas, such as airports and rural road edges (Palmer-Ball 1996). Although not tracked by KSNPC, probable breeding records from near Henderson are shown in The Kentucky Breeding Bird Atlas (Palmer-Ball 1996). Based on data obtained from IDNR (2017b), no sites are known from within the I-69 ORX study area, but a site is known to occur in Vanderburgh County, KY along US 41, approximately 10 miles north of the study area.

HOODED MERGANSER – *LOPHODYTES CUCULLATUS*

The hooded merganser breeds throughout the midwestern and eastern US from North Dakota east to the Atlantic coast, and south to northern Florida and Texas, as well as in the Pacific northwest (Dugger et al. 2009, Sibley 2000). Although it has a large breeding range, this species is often very locally distributed (Palmer-Ball 1996). It can be found year-round in both Kentucky and Indiana. While affording no official state listing in Indiana, it is still considered rare. It is known to breed in 15 counties throughout Kentucky, where it is considered extremely rare and state listed as threatened (KSNPC 2015). A bird of slow moving, shallow waters, the hooded merganser prefers backwater sloughs and lowland ponds along major river systems for breeding (Palmer-Ball 1996, Dugger et al. 2009). While they have been documented using man-made structures in more open areas, this species is typically found in shallow systems near large stands of mature forests (Palmer-Ball 1996, Dugger et al. 2009). Two sites for the hooded merganser occur within the sloughs at Eagle Slough Natural Area (ESNA), which is at the edge of the West Alternatives (IDNR 2017b). Two additional sites are known from within 10 miles of the study area in Henderson County, KY, with one of these occurring in Muddy Slough - Hardy Slough in the Sauerheber Unit of Sloughs (WMA) (KSNPC 2017).

YELLOW-CROWNED NIGHT-HERON – *NYCTANASSIA VIOLACEA*

The breeding range of the yellow-crowned night-heron occupies a large portion of the southern Midwest, and the southern and southeastern US. It ranges from southern Indiana, west to southeastern Nebraska, south to the Gulf coast, and east along the Atlantic coast to Massachusetts, with small disjunct breeding populations occurring as far north as Minnesota (Watts 2011). In Kentucky, this species is known from 14 counties throughout the state and is state listed as threatened (KSNPC 2015). In Indiana, it is state listed as endangered (IDNR 2017a). A bird with wide habitat usage, the yellow-crowned night-heron nests in a variety of habitats depending on geographic location, including: barrier, spoil, and bay islands on the coast; and in swamps, forested wetlands, forested uplands near lakes, rivers, and creeks inland (Watts 2011). Based on data obtained from IDNR (2017b), no sites are known from within the I-69 ORX study area, but a site is known to occur in Warrick County, IN approximately 10 miles northeast of Central Alternative 1.

DOUBLE-CRESTED CORMORANT – *PHALACROCORAX AURITUS*

While many sources list the breeding range of the double-crested cormorant as being limited to coastal areas and the upper Midwest (Dorr et al. 2014, Sibley 2000), confirmed records from other areas of the Midwest and South are well documented, including records from Kentucky (KSNPC

2015, Palmer-Ball 1996), Ohio (Peterjohn 2001), and Illinois (Kleen et al. 2004). While not listed in Indiana, this species is considered rare and is listed as threatened in Kentucky, where it is known to breed in five counties, including Henderson (KSNPC 2015). The double-crested cormorant prefers permanent, typically larger bodies of water for foraging, with close access to land for nesting (Dorr et al. 2014, Palmer-Ball 1996). Although they prefer larger bodies of water, they have been documented nesting in smaller water sources as well, including larger swamp/pond systems in Kentucky (Palmer-Ball 1996). Based on data obtained from KSNPC (2017), no sites are known from within the I-69 ORX study area, but a nest site is known from a slough near Diamond Island in Henderson County, KY, which is approximately 7.5 miles west of the study area.

KING RAIL – *RALLUS ELEGANS*

Although it has a breeding range covering much of the southeastern US and the Atlantic Coast, the king rail is not considered a common species because populations have been declining for the past 50 years (Pickens and Meanley 2015). Considered extremely rare in Kentucky, where it is state listed as endangered, breeding records exist for the king rail in four counties, three of which are bordered by the Ohio or Mississippi Rivers (Palmer-Ball 1996, KSNPC 2015). King rail is listed endangered in Indiana (IDNR 2017a), as well, however, no known occurrences have been documented in Vanderburgh County. A marsh bird, the king rail is always associated with areas of shallow water in habitats, such as marshes, rice fields, temporary ponds, creeks, ditches, lakes, and mudflats (Pickens and Meanley 2015, Palmer-Ball 1996), where it spends its time hunting for crustaceans and aquatic insects. Based on data obtained from KSNPC (2017), no sites are known from within the I-69 ORX study area, but a nest site is known to occur from Hardy Slough in the Sauerheber Unit of Sloughs (WMA), which is approximately 10 miles east of the study area.

VIRGINIA RAIL – *RALLUS LIMICOLA*

The Virginia rail breeds in much of the northern US, where its range extends from the Canadian border south to Illinois, Indiana, Ohio, and Virginia in the east, and as far south as New Mexico and Arizona in the west (Sibley 2000, Conway 1995). This species is not state listed in Kentucky, where it is considered a migrant, with only one breeding record from the early 1800s (Palmer-Ball 1996). In Indiana, it is state listed as endangered (IDNR 2017a). A marsh bird, the Virginia rail nests in a variety of wet habitats, but prefers those with tall, standing, emergent vegetation and habitats in the early stages of ecological succession. Such habitats include: freshwater and brackish wetlands and marshes; along seasonal or semi-permanent ponds; and the edges of lakes (Conway 1995). Based on data obtained from IDNR (2017b), no sites are known from within the I-69 ORX study area, but a site is known to occur in Warrick County, IN approximately eight miles northeast of Central Alternative 1.

BANK SWALLOW – *RIPARIA RIPARIA*

Often considered a common breeding resident of much of the northern half of the US, the bank swallow is known to breed as far south as western Tennessee in the east, and New Mexico in the west, with a small disjunct breeding population known in southern Texas (Garrison 1999). It is considered a common summer breeding resident in Indiana, but its Kentucky distribution is generally limited to the northern and western counties bordering the Ohio and Mississippi Rivers (Palmer-Ball 1996). It is listed in Kentucky as a species of concern (KSNPC 2015). A highly social

bird, the bank swallow requires highly erodible soils where it burrows and nests (Garrison 1999). This explains the bird's name, as habitats typically utilized include steep, often vertical, sandy banks associated with rivers and streams (Garrison 1999). While the bank swallow seems to prefer this natural habitat type, nest colonies have been recorded in man-made habitats as well, including the vertical banks of sand and gravel quarries; and in one instance, a nesting pair was observed in a storage pile of agricultural lime in Fayette County, KY (Palmer-Ball 1996). While sites such as these can be created in a variety of habitat types, all current records of nesting in man-made habitats are near to (within one mile) of a larger river system. Based on data obtained from KSNPC (2017), no sites are known from within the I-69 ORX study area, but a historic site occurs along the shore of the Ohio River, approximately seven miles west of Henderson, KY.

ROSE-BREASTED GROSBEAK – *PHEUCTICUS LUDOVICIANUS*

The rose-breasted grosbeak is a brightly-colored songbird that breeds within the forests of Appalachia, the northeast, and midwestern United States and into central-western Canada. It is a fairly common summer breeding resident in the northern half of Indiana, but it is generally migratory species through Kentucky. It is listed in Kentucky as a species of concern (KSNPC 2015), but has no listing in Indiana. Although it may breed in a variety of deciduous and mixed forests, the bird appears to prefer more lowland, secondary forests such as stream corridors and bottomland forests over mature forests and drier upland forests (Wyatt and Francis 2002). The rose-breasted grosbeak has been documented in Kentucky within one mile of the study area (KDFWR 2018).

BROWN CREEPER – *CERTHIA AMERICANA*

The brown creeper is a small, inconspicuous songbird that inhabits forests throughout the United States. Although its genus is widespread around the world, in North America it is the only member of its family. It is listed in Kentucky as endangered (KSNPC 2015), but has no listing in Indiana. It is primarily a winter resident throughout most of the Midwest and Southeast but is a sporadic breeder where suitable habitat exists. Its nesting habitat is typically mature forest with large, living, mature trees for foraging and standing dead trees where it may nest underneath the flaking bark. Primary threats include forest fragmentation and the removal of large living or dead trees due to logging or development (Poulin et al. 2013). The brown creeper has been documented in Kentucky within one mile of the study area (KDFWR 2018).

2.2.7 STATE-LISTED PLANTS

ROSE TURTLEHEAD – *CHELONE OBLIQUA* VAR. *SPECIOSA*

The rose turtlehead is a rare flowering plant in the figwort family (Scrophulariaceae). In Kentucky, it has a listing of special concern; however, it is not listed in Indiana. Its habitat is restricted to wet woods and meadows in the western part of the state. This species flowers from August to October and differs from other Kentucky *Chelone* species by its red-purple flowers and leaves with longer petioles. The rose turtlehead is differentiated from the even less common variety, *C. o. obliqua* by its more obtuse upper floral bracts and more strongly ciliolate sepals (Jones 2005).

There is a known record for this species near the intersection of Tillman-Bethel Road and Green River Road, approximately one mile east of Central Alternative 1. The population is located in floodplain forest just west of a small creek draining Cypress Slough (KSNPC 2017). Although not listed in Indiana, it was also documented from ESNA in the northern portion of the study area by Dr. Robert Mohlenbrock (SLT 2015).

SMALLFLOWER BABY-BLUE-EYES – *NEMOPHILA APHYLLA*

The smallflower baby-blue-eyes is designated as threatened in Kentucky, but is not listed in Indiana. It is a small, unassuming member of the waterleaf family (*Hydrophyllaceae*) of flowering plants that inhabits rich woods of the Mississippi Embayment and the Interior Plateau of Kentucky. The small, pale-blue to white flowers are open from April to May. This genus is monotypic in Kentucky and is differentiated from other genera in this family in Kentucky by its short stamens, small solitary flowers, and 3- to 5-pinnate lobed leaves (Jones 2005).

There is a known record in John James Audubon Park in Henderson, KY. The population is located on a forested eastern slope near the beginning of the Merit Badge (Eagle Glen) Trail. This location is approximately 450-feet east of West Alternative 2 and approximately 2,000 feet south of the intersection of US 41 and Wolf Hills Road (KSNPC 2017).

BLUE SCORPION-WEED – *PHACELIA RANUNCULACEA*

The blue scorpion-weed is a flowering plant species listed endangered in Indiana and of special concern in Kentucky. It is a member of the waterleaf family (*Hydrophyllaceae*) and is often associated with loess soils in alluvial and rich slope forests (KSNPC 2017) of the Mississippi Embayment of Kentucky. It has pale lavender to pink flowers from April through June and can be differentiated from other members of the genus by its decumbent stems and by its shorter stamens on glabrous filaments (Jones 2005).

There is a known population located approximately 4,000 feet west of Central Alternative 1 and 7,000 feet east of the West Alternatives near intersection of Wolf Hills Road and Green River Road. The location is near the top of a northeastern slope in a small remnant patch of forest (KSNPC 2017).

BALD CYPRESS – *TAXODIUM DISTICHUM*

Although relatively common in Kentucky, bald cypress is listed as threatened in Indiana. In Indiana, bald cypress is very near the northernmost extension of its range where it can be found along the Ohio and Wabash River drainages (Kartesz 2015).

There are known bald cypress trees within the ESNA and adjacent forested wetlands just south of Evansville, IN. The ESNA is located in the northern portion of the study area between Central Alternative 1 and the West Alternatives (IDNR 2017b).

CHAPTER 3 – METHODS

Prior to conducting field work and state and federal agency coordination, initial identification of species of concern was based on an unofficial species list from USFWS IPaC website (USFWS 2018), the KSNPC Henderson County ETR species list (KSNPC 2015), and the IDNR Vanderburgh County ETR species list (IDNR 2017a). Data analysis is based on the combined footprint of West Alternative 1, West Alternative 2, and Central Alternative 1 (study area) using current design files as of November 29, 2017. The southern portion of the study area, also known as the Pennyrile Extension, was included as part of the footprint of each of the three alternatives for analysis.

Design files were imported into ArcMap version 10.4.1, and the construction limits polylines were converted to a single shapefile of the entire study area including the three build alternatives.

3.1 FEDERAL SPECIES COORDINATION

The shapefile of the combined study area was submitted to USFWS IPaC website and two “official species lists” were obtained, one from the Indiana Field Office and one from the Kentucky Field Office. The primary difference between the two lists is the number of federally-listed freshwater mussels. Within the study area, the Ohio River, where most of the listed freshwater mussels are most likely to occur, is entirely within the boundaries of the state of Kentucky (USFWS 2018).

“Official species lists” from USFWS reflect the potential for a species to occur based on that species’ current or historic range. This differs from state species lists which are based solely on known or historic species records.

3.2 STATE SPECIES COORDINATION

A data request was submitted for a Standard Occurrence Report from Kentucky State Nature Preserves Commission (KSNPC). The combined study area shapefile was submitted along with a project description to determine any Kentucky species of concern for the project. A response including Kentucky species of concern, known species locations, and nearby conservation lands was received from KSNPC on November 14, 2017.

A data request was submitted to IDNR Indiana Natural Heritage Data Center (NHDC) using the combined study area shapefile as well. A response from the NHDC was received on November 20, 2017 which included Indiana species of concern, known species locations, and nearby high quality natural communities.

The data requested from both agencies included:

- Any and all species records within one mile of the study area,
- Any aquatic species records within five miles of the study area,
- Any federal status species within five miles of the study area, and
- Any avian or mammal records within ten miles of the study area.

A coordination letter and study area boundaries were submitted to the KDFWR Environmental Section on March 19, 2018 to request information on any potential adverse impacts to habitats, wildlife, or rare, threatened, and/or endangered species. A response was provided by KDFWR on June 1, 2018 including information on a number of occurrences of state and federal listed species within 10-mile buffer of the study area. These included four additional bird species within one mile of the study area that were not otherwise identified through natural heritage data within the study area buffer.

3.3 FIELD HABITAT ASSESSMENT

On-site assessments of terrestrial habitat were conducted during the weeks of October 9, October 23, and November 6, 2017. During these field visits, the entirety of the three alternatives were traversed on foot by two teams of two biologists to document and describe the various habitat types as they relate to species of concern. Habitat descriptions generally focused on vegetation structure and dominant species in each vegetative stratum. These on-site assessments were used to classify the various habitats within the alternatives.

A Trimble 7x GPS unit was used in the field to collect location data on boundaries between habitats, presence of significant pollinator habitat, and other notable features. These location data were later used in conjunction with topographic maps and recent aerial imagery to delineate each classified habitat throughout the three alternatives.

To obtain substrate data within the Ohio River, a side scan sonar survey was conducted by Mainstream Commercial Divers, Inc. (MCDI) in November 2017. The primary objective of this survey was to assess the potential for, suitability of, and potential impacts to mussel habitat within the Ohio River portion of the West and Central Alternatives. This survey was also used to inform study plans for a formal mussel survey. Reflectance signatures collected during the side scan sonar survey were used to develop preliminary classifications of river bed substrate type, which were then incorporated into shapefiles in ArcGIS software. These shape files were then used for map figures, acreage calculations, and other analysis. Side scan sonar results were then ground-truthed in December 2017 by collecting sediment samples within each preliminary river bed substrate type (INDOT and KYTC 2018).

3.4 HABITAT DATA ANALYSIS

Each of the three alternatives was exported as a separate shapefile for comparison of the individual alternatives (West Alternative 1, West Alternative 2, and Central Alternative 1). These data were imported into ArcMap version 10.4.1 along with the location data collected during the on-site habitat assessments and recent aerial imagery so that each of the various habitats identified could be delineated. Topology was created within ArcMap for the habitat shapefiles to ensure that no gaps or overlap of habitats occurred that could cause errors in area calculations. After each habitat was delineated throughout the study area, acreage of each habitat type within each alternative was calculated using ArcMap.

CHAPTER 4 – RESULTS

4.1 HABITAT DESCRIPTIONS AND WILDLIFE OBSERVED

Habitat results from field investigations were classified into ten different habitat types within the I-69 ORX study area in Vanderburgh County, IN, and Henderson County, KY. Remaining areas not delineated as habitat consisted of paved and commercial areas with little to no vegetation. Delineated habitat types include: bottomland hardwood forest, mixed deciduous forest, upland scrub-shrub(forest edge), wetland scrub-shrub, old field, open water, riverine, residential, mowed and maintained areas, and agricultural row crops. These delineated habitats can be grouped into larger habitat associations, namely: forested habitats, early successional habitats, and human-influenced habitats.

Forested habitats (bottomland hardwood and mixed upland deciduous forest) provide key structure and functions for certain taxa. These functions include roosting and maternity habitat for bat species, nesting platforms for raptors, and particular light regimes for certain plant species.

Early successional habitats (upland and wetland scrub-shrub, old field, riverine, and open water) are important for other species. Due to increased light availability and incomplete dominance by climax species, early successional habitats can often (if not heavily impacted) have much higher biodiversity (Horn 1974). These areas provide important habitat for many bird species, herbaceous plant species, and generally have the greatest concentration of pollinator habitat.

Human-influenced habitats within the study area include residential, mowed and maintained areas, and agricultural row crops. Most ETR species have become so due to destruction or conversion of their habitats to human usage. It then follows that human-influenced habitats are less likely, although not entirely unlikely, to provide important habitat for species of concern.

It should be noted that in the context of this document habitat types such as wetland scrub-shrub were identified and described in terms of structure and function as habitat for wildlife and plants. This document was not intended to imply any jurisdictional or non-jurisdictional status regarding waters of the state or United States. Soil sampling or investigation of wetland indicators in accordance with U.S. Army Corps of Engineers (USACE) wetland delineation and determination methods was not conducted as part of the scope of this document. For an analysis of jurisdictional waters, see the *Waters of the U.S. Technical Report* (INDOT and KYTC 2018).

The various habitats throughout the three alternatives are displayed in four maps in **Appendix B**. **Table 4.1-1** provides the acres of each described habitat across the three alternatives.

Table 4.1-1. Potential Habitat Impacts.

HABITAT TYPE	WEST ALTERNATIVE 1	WEST ALTERNATIVE 2	CENTRAL ALTERNATIVE 1
Bottomland Hardwood Forest	87.9	63.9	20.9
Mixed Deciduous Forest	8.9	7.3	24.9
Upland Scrub-Shrub	10.1	7.8	4.8
Wetland Scrub- Shrub	4.0	1.5	3.7
Old Field	50.9	50.6	31.5
Open Water	13.0	4.7	13.3
Riverine	5.7	5.7	4.3
Residential	48.5	27.0	6.1
Mowed and Maintained Areas	53.8	52.5	7.8
Agricultural Row Crops	17.2	15.3	235.4
Commercial and Paved	115.7	154.9	25.5
Total	415.8	391.5	378.3

4.1.1 BOTTOMLAND HARDWOOD FOREST

Within the proposed alternatives for the project, bottomland hardwood forests are primarily associated with the Ohio River floodplains and broad, flat former terraces. Due to their landscape position, these forests are often subject to temporary flood flows, particularly during the winter and spring months. This flood regime drives wetland hydrology in flat and concave landscape positions and influences both species composition and forest structure throughout.

More mature, higher quality bottomland hardwood forest within the proposed alternatives have trees with larger DBH, greater stratification of canopy and midstory layers, greater composition and diversity of oak species, and greater species richness overall. These more mature bottomland forests have dominant canopy trees with DBH ranges exceeding 20 inches and consisting of various combinations of red maple, green ash, sycamore (*Platanus occidentalis*), American elm (*Ulmus americana*), sweetgum, silver maple, black willow (*Salix nigra*), river birch (*Betula nigra*), cottonwood, pin oak, cherrybark oak (*Quercus pagoda*), and bur oak (*Q. macrocarpa*). More mature midstory strata consisted of 3 to 10-inch DBH trees including swamp white oak, shellbark hickory (*Carya laciniosa*), sugarberry, cottonwood, American elm, green ash, hackberry (*Celtis occidentalis*), overcup oak (*Q. lyrata*), silver maple, and red mulberry (*Morus rubra*). These areas had the most diverse shrub layer as well, consisting of spicebush (*Lindera benzoin*), pawpaw (*Asimina triloba*), and young saplings of red maple, sugarberry, green ash, and swamp white oak.

Younger and cut-over bottomland forests had smaller DBH canopy trees with no representation of oak species. The forest canopy in these areas largely consisted of four- to 10-inch DBH red maple, silver maple, cottonwood, black walnut (*Juglans nigra*), sycamore, sweetgum, black willow, American elm, and green ash. Midstory trees consisted of two six-inch red maple, silver maple, green ash, sweetgum, American elm, and boxelder (*Acer negundo*) with an occasional river birch or black willow. The shrub layer consisted of buttonbush (*Cephalanthus occidentalis*),

spicebush, pawpaw, and halberdleaf rosemallow (*Hibiscus laevis*) along with saplings of midstory and overstory trees. These younger forests generally had less size and age stratification between canopy and midstory layers and more developed shrub layers.

The most common herbaceous species found throughout the bottomland hardwood forests were smallspike false nettle (*Boehmeria cylindrica*), lizard's tail (*Saururus cernuus*), rice-button aster (*Symphyotrichum dumosum*), and gray's sedge (*Carex grayi*). Woody vines included poison ivy (*Toxicodendron radicans*), trumpet creeper (*Campsis radicans*), Virginia creeper (*Parthenocissus quinquefolia*), and greenbrier (*Smilax rotundifolia*). Japanese chaff-flower (*Achyranthes japonica*), a very serious invasive species, is a dominant herbaceous species in many of the floodplain forests.

Large amounts of woody debris were found throughout the bottomlands, both from wrack material from seasonal floods and from the decay of standing dead trees. This woody debris provides cover for many species of small mammals, reptiles, and amphibians, particularly salamanders. Frequent standing dead snags provide roosting habitat for bats and woodpeckers.

Bird species observed included the barred owl (*Strix varia*), hairy woodpecker (*Leuconotopicus villosus*), and wood duck (*Aix sponsa*). Reptiles and amphibians included the copperbelly water snake, southern leopard frog (*Lithobates sphenoccephalus*), smallmouth salamander (*Ambystoma texanum*), western chorus frog (*Pseudacris triseriata*), northern cricket frog (*Acris crepitans*), and green frog (*Lithobates clamitans*). Mammals observed included the gray squirrel (*Sciurus carolinensis*) and white-tailed deer (*Odocoileus virginianus*), both of which benefit from the hard mast produced by bottomland oak trees. Crayfish burrows were found in many of the wetter tracts of forest and wetland mussels or "floaters" such as giant floater (*Pyganodon grandis*) were found in several locations.

4.1.2 MIXED DECIDUOUS FOREST

Mixed deciduous upland forest is primarily found within the southern portions of the alternatives, particularly within the higher elevation, more dissected portions of Central Alternative 1 north of US-60. These areas generally consist of mesic sugar maple communities with some higher elevations grading into oak-hickory forest communities. The most mature examples of the mixed deciduous forests within the alternatives fall into these two categories. Although most of this habitat within the study area consist of upland communities, due to landscape position, the mixed deciduous forest fragments ranging from the Pennyryle Parkway east through US-60 may have potential to contain wetlands. Small forested areas nearer to US 41 and the City of Henderson are also much more disturbed and lacking more characteristic climax communities. These various mixed deciduous forests are generally younger and more disturbed than the bottomland forests in the study area, most likely due to their history of logging.

Although all the forests of this type have been logged at some time, the most mature forests have canopy trees ranging from 8- to 16-inch DBH with dominant species generally being a combination of either sugar maple (*A. saccharum*) and bitternut hickory (*C. cordiformis*) or black oak (*Q. velutina*), chinquapin oak (*Q. muhlenbergii*), sweetgum, and shagbark hickory (*C. ovata*). In flatwoods areas bordering agricultural fields and streams, pecan (*Carya illinoensis*) often replaces sugar maple and various oak species as a dominant canopy species. Midstory trees

generally consisted of three- to eight-inch DBH sugar maple, hackberry or sugarberry, white mulberry (*M. alba*), sweetgum, and sassafras (*Sassafras albidum*). The shrub layer consisted of various combinations of pawpaw, spicebush, bladdernut (*Staphylea trifoliata*), and coralberry (*Symphoricarpos orbiculatus*) along with seedlings of midstory and canopy trees. These more mature forests also had much more woody debris on the forest floor and more standing dead and dying snags. Although atypical, some areas were found to have very little leaf litter. Leaf litter and woody debris on the forest floor are strong indicators of habitat for woodland salamanders, ground beetles, land snails, and small mammals.

The most mature mixed deciduous forest found onsite was in a small cemetery just southeast of the intersection of US 41 and US-60, which was dominated by 16-43-inch DBH black oak, chinquapin oak, tulip poplar (*Liriodendron tulipifera*), sugarberry, and bitternut hickory. This forest had a scant midstory of sugarberry and sassafras and a low shrub layer of coralberry and white mulberry.

In contrast, the younger and more disturbed forests had poorly-stratified canopy and midstory layers and a variable composition of seral-stage tree species. In general, these younger forests had canopy trees with a DBH range of 6-12 inches and midstory trees with a DBH range of three to four inches. There was little variation between canopy and midstory species which included silver maple, sycamore, hackberry, black cherry, black locust, Osage orange (*Maclura pomifera*), and white mulberry. These forests also consistently had greater composition of non-native and invasive species in the shrub layer, such as Chinese privet (*Ligustrum sinense*), bush honeysuckle (*Lonicera maackii*), Callery pear (*Pyrus calleryana*), and burningbush (*Euonymus alatus*).

The most common herbaceous species encountered during field assessments included white snakeroot (*Ageratina altissima*), Christmas fern (*Polystichum acrostichoides*), and very large amounts of Japanese chaff-flower. More open and recently logged areas also had larger amounts of pokeweed (*Phytolacca americana*), alternate wingstem (*Verbesina alternifolia*), and yellow crownbeard (*V. occidentalis*). The most common herbaceous species found within the youngest and most disturbed forests were Japanese honeysuckle (*Lonicera japonica*), Johnsongrass (*Sorghum halepense*), Canada goldenrod (*Solidago canadensis*), cocklebur (*Xanthium strumarium*), tall ironweed (*Vernonia gigantea*), and common reed (*Phragmites australis*).

Most wildlife encountered during field assessments were bird species including wild turkey (*Meleagris gallopavo*), red-bellied woodpecker (*Melanerpes carolinus*), pileated woodpecker (*Hylatomus pileatus*), blue jay (*Cyanocitta cristata*), white-breasted nuthatch (*Sitta carolinensis*), Carolina wren (*Thryothorus ludovicianus*), Cooper's hawk (*Accipiter cooperii*), song sparrow (*Melospiza melodia*), white-throated sparrow (*Zonotrichia albicollis*), northern cardinal (*Cardinalis cardinalis*), and mourning dove (*Zenida macroura*). Other wildlife encountered included woodchucks (*Marmota monax*), western chorus frogs, and smallmouth salamander. Additionally, live hickories and white oaks along with dead American elm and black locust trees provide potential roosting habitat for various myotis bat species.

4.1.3 UPLAND SCRUB-SHRUB

Upland scrub-shrub habitats primarily exist as an ecotone and are generally located along the edges of other habitat types. Within the various alternatives, upland scrub-shrub is primarily found along edges of agricultural fields and highway rights-of-way or within powerline or gas line corridors. Upland scrub-shrub is most often a seral stage of development and generally occurs in areas of anthropomorphic disturbance. For this reason, many of these habitats are often degraded and largely composed of non-native species. However, due to their habitat structure, they may still provide significant habitat for early-successional fauna and flora.

Throughout the alternatives, upland scrub-shrub was composed of a varying mixture of shrub species and saplings of various tree species. The most common species encountered within these habitats were sugarberry, white mulberry, and Callery pear, but other species encountered included eastern red cedar (*Juniperus virginiana*), silver maple, green ash, false indigobush (*Amorpha fruticosa*), northern catalpa, hackberry, boxelder, roughleaf dogwood (*Cornus drummondii*), bush honeysuckle, black cherry, Osage orange, sweetgum, smooth sumac (*Rhus glabra*), autumn olive (*Elaeagnus umbellata*), blackberry (*Rubus argutus*), and black walnut. More degraded scrub-shrub habitats were generally located nearer to roadways and population centers and further from more mature, forested habitats.

Herbaceous species encountered within the upland scrub-shrub areas included Johnsongrass, Illinois bundleflower (*Desmanthus illinoensis*), Canada goldenrod, pokeweed, Virginia wild rye (*Elymus virginicus*), rice button aster, false nettle, sericea lespedeza (*Lespedeza cuneata*), cocklebur, poison hemlock (*Conium maculatum*), and alternate wingstem. The most commonly encountered woody vines throughout the upland scrub-shrub habitat type included Japanese honeysuckle, poison ivy, trumpet creeper, and summer grape (*Vitis aestivalis*).

More degraded scrub-shrub areas were more likely to have higher density of non-native and invasive species, such as Callery pear, white mulberry, bush honeysuckle, autumn olive, tall fescue (*Schedonorus arundinaceus*), Johnsongrass, sericea lespedeza, Japanese honeysuckle, and poison hemlock.

Bird species were the most commonly encountered wildlife within these areas and included red-shouldered hawk (*Buteo lineatus*), American crow (*Corvus brachyrhynchos*), northern cardinal, song sparrow, and Carolina wren.

4.1.4 WETLAND SCRUB-SHRUB

Unlike upland scrub-shrub, which is a seral stage habitat that is maintained by periodic disturbance, many but not all wetland scrub-shrub habitats have reached equilibrium and can be thought of as a type of climax ecosystem. However, wetland scrub-shrub is still an ecotone and often exists at the interface between open water and forest.

The very wettest areas within this habitat type are perennially flooded, and this flooding acts to limit succession. These communities most often are comprised of buttonbush and swamp rose mallow (*Hibiscus moscheutos*). These areas may exist at the margin of open water areas or may exist as lowland pockets within more mature forest. Very often, these habitats are devoid of

herbaceous vegetation, but may sometimes include swamp dock (*Rumex verticillatus*), duckweed (*Lemna* spp.), various knotweeds (*Persicaria* spp.) and water purslane (*Ludwigia* spp.) species.

A second type of wetland scrub-shrub exists along the banks of the Ohio River where inundation, erosion, and sediment deposition act to limit forest succession. These areas are generally dominated by saplings of black willow, false indigobush, and sometimes saplings of silver maple. Although herbaceous vegetation is often scant, the most characteristic herbaceous species are green switchgrass (*Panicum virgatum*) and witchgrass (*P. capillare*). Other herbaceous vegetation may include spiny amaranth (*Amaranthus spinosus*), various morning glory species (*Ipomoea* spp.), various bindweed species (*Convolvulus* spp.), and common wormwood (*Artemisia vulgaris*).

The remaining areas of wetland scrub-shrub are simply disturbed areas that have not been permitted to develop into forest. These include wet areas at the margin of forest, right-of-way easements, agricultural fields, or along maintained drainage channels. These areas are dominated by various shrubs and tree saplings and may include black willow, silver maple, false indigobush, green ash, boxelder, northern catalpa, sugarberry, American elm, sandbar willow (*Salix interior*), and halberdleaf rosemallow. Observed herbaceous species included reed canary grass (*Phalaris arundinaceus*), common wormwood, Illinois bundleflower, rice button aster, wild rye species, and sumpweed (*Iva annua*).

Wildlife encountered within the wetland scrub-shrub habitats included American coots (*Fulica americana*), mourning doves, Asiatic clam (*Corbicula fluminea*), giant floater, southern leopard frog, northern cricket frog, and several beaver dams and lodges.

4.1.5 OLD FIELD

Old field communities are generally accepted to be the transition or seral stage of succession wherein disturbed grasslands first begin to be repopulated with young woody growth. As the term implies, these areas are often the next step in succession beyond pasture, hayfields, lawns, or agricultural fields. This habitat type is found in periodically maintained areas within the various alternatives, both in wet and dry locations.

Wetter examples of old field habitat can be found in periodically maintained utility and bridge right-of-way within the alternatives. These areas tend to have a higher composition of grasses, such as hairy joint grass (*Arthraxon hispidus*), barnyard grass (*Echinochloa crus-galli*), fall panic grass (*Panicum dichotomiflorum*), rice cutgrass (*Leersia oryzoides*), green switchgrass, reed canarygrass, and prairie cordgrass (*Spartina pectinata*). Other common forbs and sedges included various beggar's tick species (*Bidens* spp.), nutsedges (*Cyperus* spp.), curly dock (*Rumex crispus*), caric sedges (*Carex grayi*, *C. lupulina*, et al.), cocklebur, and various knotweed species (*Persicaria* spp.). Common woody species included buttonbush, green ash, halberd-leaf hibiscus, false indigobush, and sandbar willow.

More typical, drier old field habitats were generally found along less-often maintained highway right-of-way, at agricultural field edges, and in fallow fields throughout the various alternatives. These areas were much more forb-dominated than the wetter examples of old field habitat. The most commonly encountered herbaceous species included Johnsongrass, Canada goldenrod,

curly dock, wingstem species (*Verbesina* spp.), rice button aster, grease grass (*Tridens flavus*), white verbena (*Verbena urticifolia*), Jerusalem artichoke (*Helianthus tuberosus*), common milkweed (*Asclepias syriaca*), and dogbane (*Apocynum cannabinum*). Common woody species found within these areas included white mulberry, Callery pear, silver maple, black locust, smooth and winged sumac (*Rhus copallinum*), sycamore, and roughleaf dogwood.

These areas provide habitat for many of the species that require open areas such as mice, voles, rabbits, and raptors. Observed wildlife consisted primarily of bird species including red-tailed hawks (*Buteo jamaicensis*), turkey vultures (*Cathartes aura*), American crows, song sparrows, white-throated sparrows, and house wrens (*Troglodytes aedon*). More diverse portions of these old field areas also provide important habitat for pollinator species such as butterflies, moths, and a multitude of other insect species.

4.1.6 OPEN WATER

Open water habitats throughout the alternatives are generally permanently flooded to a depth sufficient to exclude even the most tolerant wetland plants such as buttonbush. The types of open water habitats include excavated ponds, areas inundated from dam or levee construction, beaver ponds, and natural sloughs and oxbows.

Although very little vegetation can be found growing within these open water habitats other than duckweed (*Lemna* spp.), a variety of inundation-tolerant or floating stem plants can be found around the edges including nodding beggar's ticks (*Bidens cernua*), floating water primrose (*Ludwigia peploides*), buttonbush, valley redstem (*Ammannia coccinea*), water smartweed (*Persicaria amphibia*), red-root flatsedge (*Cyperus erythrorhizos*), small beggar's ticks (*Bidens discordea*), camphorweed (*Pluchea camphorata*), and occasionally bald cypress. Over time, during droughts, bald cypress may invade these habitats and survive to maturity where they are often used as nesting platforms for wading birds, bald eagles, and other raptors.

These open water areas provide both winter and summer habitat for a variety of waterfowl including both diving and dabbling ducks. Additionally, these areas provide both foraging and basking habitat for a variety of turtles and snakes including copperbelly water snakes. Wildlife observed utilizing these habitats during field assessments included great blue heron, red-winged blackbird (*Agelaius phoeniceus*), wood duck, American crow, turkey vulture, red-tailed hawk, bald eagle, brown thrasher (*Toxostoma rufum*), northern cardinal, American coot, red-eared sliders (*Trachemys elegans*), copperbelly water snakes, and beavers (*Castor canadensis*).

4.1.7 RIVERINE

Riverine habitats are those aquatic habitats consisting of flowing water (lotic habitats) as opposed to the sluggish or still waters (lentic habitats) generally associated with the open water habitat type. Riverine habitat within the study area is primarily associated with the Ohio River.

Riverine habitats share many of the same animal species with open water habitats, but with essentially no rooted plant life due to the scouring action of perpetually flowing waters.

Riverine habitats provide winter and summer habitat for a variety of waterfowl including both diving and dabbling ducks. Additionally, these areas provide both foraging and basking habitat

for a variety of turtles and snakes. Wildlife likely to utilize these habitats include the great blue heron, red-winged blackbird (*Agelaius poeniceus*), bald eagle, American coot, red-eared sliders (*Trachemys elegans*), and beavers (*Castor canadensis*). However, the most important taxa of concern in this project context are the freshwater mussels. The Ohio River contains one of the most diverse freshwater mussel assemblages in eastern North America.

4.1.8 RESIDENTIAL

The majority of residential areas within the study area limits is located within West Alternative 1 and West Alternative 2. Smaller amounts are located in the vicinity of US-60 and along the Ohio River within Central Alternative 1. While these areas often have significant tree canopy cover ranging from savannah-like to woodland-like conditions, these areas have almost exclusively mowed groundcover. Shrubs often exist in landscaping and around property boundaries, but many landscape shrubs are well-documented invasive species.

Within the West Alternatives, almost all of the residential areas are located in a relatively dense neighborhood along the west side of US 41 within the City of Henderson proper. These areas are dominated by well-spaced 10-18-inch DBH pin oak, sugar maple, and sweetgum trees, often with interlocking canopies. Smaller trees acting as a midstory layer include scattered silver maple, red maple, and flowering dogwood (*Cornus florida*). Neighborhoods appear to decrease in age moving south with more non-native and invasive landscaping plants becoming more common. These non-native landscape plants include Callery pear, burningbush, and heavenly bamboo (*Nandina domestica*). The residential areas along US-60 within Central Alternative 1 have similar conditions, but trees and shrubs are much more widely spaced with much larger mowed portions between. Typical wildlife species observed included blue jays, mourning doves, European starlings (*Sturnus vulgaris*), and house sparrows.

Within Central Alternative 1, there are also part-time residential areas or river-camps along both the north and south banks of the Ohio River. These areas represent a narrow strip between agricultural fields and the black willow-false indigobush scrub-shrub areas along the banks of the Ohio. Although the herbaceous understory is primarily mowed grass, maintenance is much more sporadic than in full-time residences. Trees within these areas are well-spaced cottonwood, silver maple, and green ash of 16- to 36-inch DBH with occasional dead snags of black locust. Wildlife observed within these areas included fox squirrel (*Sciurus niger*), European starling, mourning dove, killdeer (*Charadrius vociferus*), American robin (*Turdus migratorius*), and eastern bluebird (*Sialia sialis*). A bald eagle was also observed from this area, flying over the Ohio River.

4.1.9 MOWED AND MAINTAINED AREAS

Mowed and maintained areas within the various alternatives primarily consist of street and highway right-of-way that are mowed on a regular basis. In certain portions of the alternatives, these areas may intergrade toward old field conditions when maintenance mowing is reduced to one to two times per year, where slopes are too steep for mower usage, or where areas are seasonally too wet for mower usage. In some areas, the brush is cut on a semi-annual basis while others are mowed regularly with lawn mowers.

More regularly mowed areas generally consist of tall fescue, green foxtail (*Setaria viridis*), bermudagrass (*Cynodon dactylis*), crabgrass (*Digitaria* spp.), red clover (*Trifolium pratense*), and white clover (*T. repens*). Areas that are allowed to grow up to some extent may additionally include species such as crown vetch (*Coronilla varia*), poison hemlock, grease grass, Johnsongrass, and teasel (*Dipsacus fullonum*). Very few plant species within these areas are native and most are considered invasive.

However, these areas do provide habitat for animals such as eastern cottontail rabbit (*Sylvilagus floridanus*), white-tailed deer, small mammals, European starlings, and birds of prey such as red-tailed hawks and American kestrels (*Falco sparverius*).

4.1.10 AGRICULTURAL ROW CROPS

Within the various alternatives, the only agricultural row crops observed were corn and soybeans. These fields are plowed at least once per year and no-till practices were not observed within the study area. It is likely that most of these fields have crop rotation between corn and soybeans, but it appears that cover-cropping is not utilized in these areas. Based on past aerial imagery, it appears that agricultural row crop fields are unvegetated from the time of corn and soybean harvest in October or November until planting in late May or June.

During summer, these areas provide habitat for more common species such as house mice (*Mus musculus*), white-footed mice (*Peromyscus leucopus*), deer mice (*Peromyscus maniculatus*), raccoons (*Procyon lotor*), wild turkey, and deer. During and after harvest and throughout the winter, these barren fields provide habitat primarily for migratory birds such as the American crow, Canada goose (*Branta canadensis*), snow goose (*Chen caerulescens*), greater white-fronted goose (*Anser albifrons*), killdeer, horned lark (*Eremophila alpestris*), snow bunting (*Plectrophenax nivalis*), lapland longspur (*Calcarius lapponicus*), and species that only migrate through such as vesper sparrow (*Poocetes gramineus*) and palm warbler (*Setophaga palmarum*).

4.1.11 ADDITIONAL WILDLIFE SPECIES EXPECTED

A combination of onsite observations, general knowledge of wildlife within the area, past surveys conducted in and around the study area, and various peer reviewed references were used to develop a list of common wildlife species expected to occur within the study area. This list includes: coyote (*Canis latrans*), eastern red bat (*Lasiurus borealis*), little brown bat (*Myotis lucifugus*), tri-colored bat (*Perimyotis subflavus*), silver-haired bat (*Lasionycteris noctivagans*), hoary bat (*Lasiurus cinereus*), river otter (*Lontra canadensis*), bobcat (*Lynx rufus*), pine vole (*Microtus pinetorum*), mink (*Mustela vison*), deer mouse, meadow jumping mouse (*Zapus hudsonius*), muskrat (*Ondatra zibethicus*), masked shrew, swamp rabbit, gray fox (*Urocyon cinereoargenteus*), long-tailed weasel (*Mustela frenata*), spotted salamander (*Ambystoma maculatum*), marbled salamander (*A. opacum*), eastern tiger salamander (*A. tigrinum*), eastern red-spotted newt (*Notophthalmus viridescens*), zigzag salamander (*Plethodon dorsalis*), slimy salamander (*P. glutinosus*), American toad (*Bufo americanus*), Fowler's toad (*B. fowerli*), Cope's gray treefrog (*Hyla chrysoscelis*), green treefrog (*H. cinerea*), spring peeper (*Pseudacris crucifer*), bullfrog (*Rana catesbiana*), eastern spiny softshell turtle (*Apolone spinifera*), smooth softshell turtle (*A. mutica*), snapping turtle (*Chelydra serpentina*), painted turtle (*Chrysemys picta*), common map turtle

(*Graptemys geographica*), Ouachita map turtle (*G. ouachitensis*), river cooter (*Pseudemys concinna*), musk turtle (*Sternotherus odoratus*), northern copperhead (*Agkistrodon contortrix*), black racer (*Coluber constrictor*), diamondback water snake (*Nerodia rhombifera*), northern water snake (*N. sipedon*), prairie kingsnake (*Lampropeltis calligaster*), black kingsnake (*L. niger*), rough green snake, brown snake (*Storeria dekayi*), five-lined skink (*Eumeces fasciatus*), broadhead skink (*E. laticeps*), fence lizard (*Sceloporus undulatus*), ground skink (*Scincella lateralis*), and various species of freshwater fishes and mussels.

4.1.12 SPECIALIZED SPECIES AND HABITAT ASSOCIATIONS

POLLINATOR SPECIES

The term “pollinator species” refers to any species (insect, mammal, bird, etc.) that carries out the process of plant pollination. While this term is often used to refer to two major orders of insects: Lepidoptera (moths and butterflies) and Hymenoptera (ants, bees, and wasps), there are many other insect orders, as well as mammals and birds, that play a very active and important role in the pollination process. However, because most pollinators occurring within the US, including both Indiana and Kentucky, are insects of various orders, the following information will focus on these animals.

Like all living organisms, pollinators require two basic needs: food (larval host plants, nectar, and pollen sources) and shelter (places to lay their eggs and hide from predators), though both of these requirements vary considerably depending on the species in question. In general, habitat that provides high quality food sources is open allowing for a greater level of solar exposure, oftentimes resulting in a wider diversity of flowering plant communities rich in nectar and pollen sources (Evans and Smith 2013). Such habitats can include anything from early successional forests and open wetlands to man-made forest openings, such as utility right-of-way and roadside edges (Evans and Smith 2013). For Lepidoptera, larval food sources must also be considered, as the distribution of particular species, especially those specializing on a limited number of plants, is closely linked to the availability of its larval host (Covell 1984; Scott 1986; Write and Pavulaan 1999; Beadle and Leckie 2012). While food requirements may be different, it can be generalized that an open area with a large diversity of native flowering plants will provide most pollinators with adequate food sources. With regard to shelter, however, requirements vary widely between species. While certain groups of Hymenoptera require large, hollow trees or man-made structures for nesting, other members of the same order require loose loamy soil for the same purpose. Some Lepidoptera require large stands of thick pine forest for roosting, while others will roost in front yard flower beds.

Because of the nature of the project, it is impossible to determine every species of native or non-native flowering plant, potential larval food plant, and nesting habitat that occurs throughout the entire study area and throughout the entire growing season. However, by noting flowering species that were present and flowering in the preferred habitat types (typically old-fields, utility right-of-way, and roadsides within the study area), as well as referencing lists of known occurrences of pollinator species in Henderson County, it can be reasonably assumed that the following pollinator species can be expected within the study area. Pollinators with documented occurrences in Henderson County, KY would be expected to also be observed across the Ohio

River in Vanderburgh County, IN. Although the Lepidoptera (butterflies and moths) and Hymenoptera (wasps and bees) have a major role in pollination, there are also many species of both the Coleoptera (Beetles) and Diptera (Flies) that serve an important role in pollination.

LEPIDOPTERA

While there are 61 species of butterflies known to occur from Henderson County (Covell 1999, Covell et al. 2009), this is likely an under representation of the true number that occur there, as there are still several regions of the state where even the most common species are not documented (Evans and Smith 2013). The following is a list of the common species that are documented from Henderson County that can reasonably be expected to occur within the study area: silver spotted skipper (*Epargyreus clarus*), Juvenal's duskywing (*Erynnis juvenalis*), Horace's duskywing (*E. horatius*), least skipper (*Ancyloxypha numitor*), fiery skipper (*Hylephila phyleus*), Peck's skipper (*Polites peckius*), sachem (*Atalopedes campestris*), zabulon skipper (*Poanes zabulon*), pipevine swallowtail (*Battus philenor*), black swallowtail (*Papilio polyxenes*), eastern tiger swallowtail (*Pterourus glaucus*), spicebush swallowtail (*P. troilus*), zebra swallowtail (*Eurytides marcellus*), cabbage white (*Pieris rapae*), clouded sulphur (*Colias philodice*), orange sulphur (*C. eurytheme*), cloudless sulphur (*Phoebis sennae*), coral hairstreak (*Satyrium titus mopsus*), red-banded hairstreak (*Calycopis cecrops*), gray hairstreak (*Strymon melinus*), eastern tailed-blue (*Everes comyntas*), summer azure (*Celastrina neglecta*), spring azure (*C. ladon*), question mark (*Polygonia interrogationis*), eastern comma (*P. comma*), American lady (*Vanessa virginiensis*), painted lady (*V. cardui*), red admiral (*V. atalanta*), common buckeye (*Junonia coenia*), great spangled fritillary (*Speyeria cybele*), pearl crescent (*Phyciodes tharos*), red-spotted purple (*Limenitis arthemis*), viceroy (*L. archippus*), little wood-satyr (*Megisto cymela*), and monarch (*Danaus plexippus*).

HYMENOPTERA

Although true inventories of the Hymenoptera are much more rare than those of Lepidoptera, thus leaving a void in information available, it can be reasonably assumed that the following, typically common, species of pollinating Hymenoptera can be found within the study area: eastern bumble bee (*Bombus impatiens*), two-spotted bumble bee (*B. bimaculatus*), half-black bumble bee (*B. vagans*), brown-belted bumble bee (*B. griseocollis*), American bumble bee (*B. pensylvanicus*), carpenter bee (*Xylocopa spp.*), paper wasps (*Polistes spp.*), bald-faced hornet (*Dolichovespula maculata*), giant European hornet (*Vespa crabo*), yellowjacket (*Vespula spp.*), and the European honeybee (*Apis mellifera*).

MIGRATORY BIRDS

Although other laws such as the Lacey Act were passed in the beginning of the 20th century to curtail the exploitation of wild birds, the Migratory Bird Treaty Act (MBTA) of 1918 is generally recognized as the first real protection afforded to migratory birds. This law was the result of a convention between the US and Great Britain on behalf of Canada to protect migratory birds that utilize portions of both countries.

The MBTA established a ban on actions to:

pursue, hunt, take, capture, kill, attempt to take, capture or kill, possess, offer for sale, sell, offer to purchase, purchase, deliver for shipment, ship, cause to be shipped, deliver for transportation, transport, cause to be transported, carry, or cause to be carried by any means whatever, receive for shipment, transportation or carriage, or export, at any time, or in any manner, any migratory bird included in the terms of this Convention...for the protection of migratory birds...or any part, nest, or egg of any such bird. (16 U.S.C. § 703-712)

This set of prohibited actions is generally referred to as “take.” These protections were later extended to migratory birds of the US that utilize portions of Mexico, Japan, and the former Soviet Union (USFWS 2017c).

Raptors were not originally included in the MBTA, but protection was extended to birds of prey, such as hawks and owls by a 1972 amendment to the MBTA. The Bald Eagle Protection Act was approved in 1940 and further amended in 1962 to protect Golden Eagles as well (USFWS 2015). This act, now known as the Bald and Golden Eagle Protection Act, extended similar protections to eagles as afforded by the MBTA, but with a further prohibition on “take”, which included any act to “molest or disturb.” “Disturb” is defined in the Act as “to agitate or bother a bald or golden eagle to a degree that causes, or is likely to cause, based on the best scientific information available, 1) injury to an eagle, 2) a decrease in its productivity, by substantially interfering with normal breeding, feeding, or sheltering behavior, or 3) nest abandonment, by substantially interfering with normal breeding, feeding, or sheltering behavior” (16 U.S.C. § 668-668c).

Although not all birds migrate (some are year-round residents of particular areas), all species are protected under the MBTA, with the exception of those considered non-native, exotic, or invasive, such as: European starling, house sparrow, and rock dove (*Columba livia*). Due to the large diversity of habitat types found within the study area, it can be reasonably assumed that several species of migratory birds can be found within the study area. Although no such survey has officially been conducted for the study area, ESNA, a small nature preserve located directly adjacent to the western edge of the proposed study area in Evansville, IN, has a running list of every bird species encountered within its boundaries (SLT 2015). A list of birds potentially occurring within the study area was developed using the ESNA list, along with breeding records from both the Kentucky Breeding Bird Atlas (KBBA) (Palmer-Ball 1996) and the Indiana Breeding Bird Atlas (IBBA) (USGS 2011) (see **Table 4.1-2**). It is important to note, however, that those birds listed by ESNA that are not listed by either KBBA or IBBA may only represent migrants and/or wintering species and should not be considered *breeding* birds without additional documentation.

Table 4.1-2. List of birds occurring within Vanderburgh County, IN, and Henderson County, KY, and near the I-69 ORX study area.

SPECIES COMMON NAME	ESNA	KBBA	IBBA
greater white-fronted goose	X		
snow goose	X		
Ross's goose	X		
Canada goose	X	X	X
wood duck	X	X	X
gadwall	X		
American wigeon	X		
American black duck	X		
mallard	X	X	X
blue-winged teal	X		
green-winged teal	X		
northern shoveler	X		
northern pintail	X		
canvasback	X		
redhead	X		
ring-necked duck	X		
lesser scaup	X		
bufflehead	X		
hooded merganser	X	X	
common merganser	X		
ruddy duck	X		
wild turkey	X	X	X
northern bobwhite		X	X
common loon	X		
pied-billed grebe	X	X	
horned grebe	X		
American white pelican	X		
double-crested cormorant	X		
great blue heron	X		X
great egret	X		
green heron	X		X
black-crowned night-heron	X		
yellow-crowned night-heron	X	X	
black vulture	X		
turkey vulture	X	X	X

SPECIES COMMON NAME	ESNA	KBBA	IBBA
osprey	X		X
bald eagle	X	X	
northern harrier	X		
sharp-shinned hawk	X		
Cooper's hawk	X		X
red-shouldered hawk	X	X	X
red-tailed hawk	X	X	X
American kestrel	X	X	X
peregrine falcon	X		
American coot	X		
sandhill crane	X		
killdeer	X	X	X
Mississippi kite			X
spotted sandpiper	X		
solitary sandpiper	X		
greater yellowlegs	X		
lesser yellowlegs	X		
semipalmated sandpiper	X		
least sandpiper	X		
pectoral sandpiper	X		
Bonaparte's gull	X		
ring-billed gull	X		
herring gull	X		
rock dove	X	X	X
Eurasian collared-dove			X
mourning dove	X	X	X
yellow-billed cuckoo	X	X	X
black-billed cuckoo	X		
eastern screech owl	X	X	X
great horned owl	X	X	X
barred owl	X	X	X
common nighthawk	X	X	X
eastern whip-poor-will		X	
chimney swift	X	X	X
ruby-throated hummingbird	X	X	X
belted kingfisher	X	X	X
red-headed woodpecker	X	X	X

SPECIES COMMON NAME	ESNA	KBBA	IBBA
red-bellied woodpecker	X	X	X
yellow-bellied sapsucker	X		
downy woodpecker	X	X	X
hairy woodpecker	X	X	X
northern flicker (yellow-shafted)	X	X	X
pileated woodpecker	X	X	X
olive-sided flycatcher	X		
easternwood pewee	X	X	X
yellow-bellied flycatcher	X		
Acadian flycatcher	X	X	X
willow flycatcher	X	X	X
least flycatcher	X		
eastern phoebe	X	X	X
great-crested flycatcher	X	X	X
eastern kingbird		X	X
white-eyed vireo	X	X	X
yellow-throated vireo	X	X	
blue-headed vireo	X		
Bell's vireo			X
warbling vireo	X	X	X
Philadelphia vireo	X		
red-eyed vireo	X	X	X
blue jay	X	X	X
American crow	X	X	X
fish crow	X	X	
horned lark	X	X	X
purple martin		X	X
tree swallow	X	X	X
northern rough-winged swallow	X	X	X
bank swallow	X	X	
barn swallow	X	X	X
cliff swallow		X	
Carolina chickadee	X	X	X
tufted titmouse	X	X	X
red-breasted nuthatch	X		
white-breasted nuthatch	X	X	X
brown creeper	X	X	

SPECIES COMMON NAME	ESNA	KBBA	IBBA
Carolina wren	X	X	X
house wren	X	X	X
winter wren	X		
golden-crowned kinglet	X		
ruby-crowned kinglet	X		
blue-gray gnatcatcher	X	X	X
eastern bluebird	X	X	X
veery	X		
gray-cheeked thrush	X		
Swainson's thrush	X		
hermit thrush	X		
wood thrush	X	X	X
American robin	X	X	X
gray catbird	X	X	X
northern mockingbird	X	X	X
brown thrasher	X	X	X
European starling	X	X	X
cedar waxwing	X	X	X
loggerhead shrike		X	
blue-winged warbler	X		
golden-winged warbler	X		
Tennessee warbler	X		
orange-crowned warbler	X		
Nashville warbler	X		
northern parula	X	X	X
yellow warbler	X	X	
chestnut-sided warbler	X		
magnolia warbler	X		
Cape May warbler	X		
black-throated blue warbler	X		
myrtle (yellow-rumped) warbler	X		
black-throated green warbler	X		
Blackburnian warbler	X		
yellow-throated warbler	X	X	X
pine warbler	X		
prairie warbler	X	X	
palm warbler	X		

SPECIES COMMON NAME	ESNA	KBBA	IBBA
bay-breasted warbler	X		
blackpoll warbler	X		
cerulean warbler	X	X	
black and white warbler	X	X	X
American redstart	X	X	
prothonotary warbler	X	X	
worm-eating warbler	X		
Swainson's warbler	X		
ovenbird	X		
northern waterthrush	X		
Louisiana waterthrush	X		X
Kentucky warbler	X	X	X
Connecticut warbler	X		
mourning warbler	X		
common yellowthroat	X	X	X
hooded warbler	X	X	X
Wilson's warbler	X		
Canada warbler	X		
yellow-breasted chat	X	X	X
summer tanager		X	X
scarlet tanager		X	
eastern towhee	X	X	X
American tree sparrow	X		
chipping sparrow	X	X	X
field sparrow	X	X	X
grasshopper sparrow		X	
savannah sparrow	X		
song sparrow		X	X
fox sparrow	X		
northern cardinal		X	X
blue grosbeak		X	X
indigo bunting		X	X
dickcissel		X	X
red-winged blackbird		X	X
eastern meadowlark		X	X
common grackle		X	X
brown-headed cowbird		X	X

SPECIES COMMON NAME	ESNA	KBBA	IBBA
orchard oriole		X	X
Baltimore oriole		X	X
purple finch	X		
house finch	X	X	X
American goldfinch	X	X	X
house sparrow	X	X	X

Source: SLT 2015, Palmer-Ball 1996, and USGS 2011.

ESNA = Eagle Sloughs Natural Area; KBBA = Kentucky Breeding Bird Atlas; IBBA = Indiana Breeding Bird Atlas

FRESHWATER MUSSELS

The Ohio River and its larger tributary streams historically contained one of the most diverse freshwater mussel assemblages in North America. According to Haag and Cicerello (2016), the Ohio River and its minor tributaries historically contained 76 species of freshwater mussel. Many of these species, especially those considered endangered, may not still be present within the river due to modifications of habitat. Historically, the river was relatively shallow and contained numerous flow regimes, subsurface micro-habitats, sand and gravel bars, and shoals. Today the entire length of the river is impounded with a series of navigational dams, which has reduced and limited preferred mussel habitat. Despite impoundment and history of water pollution, portions of the river still contain a diverse mussel fauna. Based on data included on species distribution maps in Haag and Cicerello (2016), this section of Ohio River in Henderson County is known to have contained 37 species based on specimens collected at locations other than Angel Mounds State Historic Site (**Table 4.1-3**). An additional four species including the fatmucket (*Lampsilis siliquoidea*), lilliput (*Toxolasma parvum*), paper pondshell (*Utterbackia imbecillis*), and little spectaclecase have been documented from smaller perennial streams, sloughs, and ponds within Henderson County (Haag and Cicerello 2016).

Table 4.1-3. List of freshwater mussels documented from Ohio River in Henderson County, KY

SPECIES COMMON NAME	SCIENTIFIC NAME
three ridge	<i>Amblema plicata</i>
flat floater	<i>Utterbackiana suborbiculata</i>
rock pocketbook	<i>Arcidens confragosus</i>
purple wartyback	<i>Cyclonaias tuberculata</i>
butterfly	<i>Ellipsaria lineolata</i>
elephant-ear	<i>Elliptio crassidens</i>
spike	<i>Eurynia dilatata</i>
Wabash pigtoe	<i>Fusconaia flava</i>
longsolid	<i>Fusconaia subrotunda</i>

SPECIES COMMON NAME	SCIENTIFIC NAME
plain pocketbook	<i>Lampsilis cardium</i>
pocketbook	<i>Lampsilis ovata</i>
yellow sandshell	<i>Lampsilis teres</i>
white heelsplitter	<i>Lasmigona complanata</i>
flutedshell	<i>Lasmigona costata</i>
fragile papershell	<i>Leptodea fragilis</i>
black sandshell	<i>Ligumia recta</i>
washboard	<i>Megaloniaias nervosa</i>
threehorn wartyback	<i>Obliquaria reflexa</i>
hickorynut	<i>Obovaria olivaria</i>
bankclimber	<i>Plectomerus dombeyanus</i>
sheepnose	<i>Plethobasus cyphus</i>
Ohio pigtoe	<i>Pleurobema cordatum</i>
pyramid pigtoe	<i>Pleurobema rubrum</i>
round pigtoe	<i>Pleurobema sintoxia</i>
pink heel splitter	<i>Potamilus alatus</i>
fat pocketbook	<i>Potamilus capax</i>
pink papershell	<i>Potamilus ohioensis</i>
giant floater	<i>Pyganodon grandis</i>
rabbits foot	<i>Theliderma cylindrica</i>
monkeyface	<i>Theliderma metanevra</i>
wartyback	<i>Cyclonaias nodulata</i>
pimpleback	<i>Cyclonaias pustulosa</i>
mapleleaf	<i>Quadrula quadrula</i>
pistolgrip	<i>Quadrula verrucosa</i>
ebonyshell	<i>Reginaia ebena</i>
deertoe	<i>Truncilla truncata</i>
pondhorn	<i>Unio merus tetralasmus</i>

Source: Haag and Cicerello 2016

Many of the ETR species listed by USFWS for this portion of the Ohio River are based on shell material found at nearby archeological sites. Based on information obtained from USFWS (2018), KSNPC (2015), KSNPC (2017), IDNR (2017a), and IDNR (2017b), the I-69 ORX study area is within the historic or current range of 18 species of freshwater mussel with either federal or state protective status. Habitat preferences, specifically substrate types used, for these 18 species are presented in **Table 4.1-4**.

Table 4.1-4. Federally and state listed freshwater mussel species potentially occurring within the I-69 ORX study area and their associated habitat use.

SPECIES COMMON NAME	HABITAT TYPE AND USES	OCCURENCES WITHIN PROJECT AREA
spectaclecase	Open Water (Ohio River) – mud, stable sand, gravel, cobble, boulders, and slab-rock substrates	None Documented
Fanshell	Open Water (Ohio River) – gravel, stable coarse sand, and cobble substrates	None Documented
Catspaw	Open Water (Ohio River) – gravel, stable sand, and cobble substrates	None documented, but shells known from Angel Mounds State Historic Site
northern riffleshell	Open Water (Ohio River) – stable coarse sand, and gravel substrates	None documented
Snuffbox	Open Water (Ohio River) - gravel, stable sand, and boulders substrates	None documented, but shells known from Angel Mounds State Historic Site
pink mucket	Open Water (Ohio River) – gravel, stable sand, and mud with sand substrates	None documented, but shells known from Angel Mounds State Historic Site
ring pink	Open Water (Ohio River) –gravel, and stable coarse sand substrates	None documented, but shells known from Angel Mounds State Historic Site
orangefoot pimpleback	Open Water (Ohio River) – gravel and stable sand substrates	None documented
sheepnose	Open Water (Ohio River) – stable mixed sand, gravel, mud-cobble, and boulder substrates	None documented, but shells known from Angel Mounds State Historic Site and live animals from Ohio River at river mile 783.4 upstream of confluence with Green River
clubshell	Open Water (Ohio River) – stable sand, gravel, and cobble substrates	None documented
rough pigtoe	Open Water (Ohio River) - stable sand, gravel, and mud-cobble substrates	None documented
fat pocketbook	Open Water (Ohio River) – stable sand, clay, silt, mud, and fine gravel substrates	None documented, but known from Ohio River 4.5 miles downstream of study area, and up stream of study area at river mile 782.3
rabbitsfoot	Open Water (Ohio River) – stable sand, and gravel substrates	None documented, but shells known from Angel Mounds State Historic Site and one historic record in Ohio River between river miles 784.6 and 786.7
longsolid	Open Water (Ohio River) – gravel and stable sand substrate	None documented, but known from confluence of Ohio and Green River; a weathered valve (shell) was found downstream from Central Alternative 1 (INDOT and KYTC 2018)
pocketbook	Open Water (Ohio River) – gravel and stable sand substrate	None documented, but known from Henderson Island and Angel Mounds State Historic Site

SPECIES COMMON NAME	HABITAT TYPE AND USES	OCCURENCES WITHIN PROJECT AREA
Ohio pigtoe	Open Water (Ohio River) – gravel and stable sand substrate	None documented, but known from between the West and Central Alternatives
pyramid pigtoe	Open Water (Ohio River) – gravel and stable sand substrate	None documented, but known from a historic site from Ohio River between river miles 800.9 and 801.2 just west of Henderson
little spectaclecase	Open Water (edges of Ohio River & smaller perennial streams) – stable sand, gravel, and depositional areas	Yes, Found during habitat assessments in North Fork Canoe Creek where US 41 crosses in Henderson County

Riverine mussels, which include all of the listed species above with the exception of the fat pocketbook and little spectaclecase, all prefer coarse and stable sand, gravel, or cobble substrate. The fat pocketbook and little spectaclecase can be found in mixed mussel beds on these substrates but prefer stable sand, silt, and clay mixtures with detrital depositions.

To better understand the potential for freshwater mussels within the Ohio River in the study area, mussel substrate preferences were compared to substrate classification data collected using side scan sonar with field verification. Results from the side scan sonar survey and sediment sampling identified eight acoustic classes which were extrapolated as eight substrate classes (INDOT and KYTC 2018). These substrate classes are used to assess the potential for, suitability of, and potential impacts to freshwater mussel habitat within the Ohio River portions of the West and Central Alternatives. **Table 4.1-5** presents the identified acoustic classes and extrapolated substrate classes of the Ohio River bed within the project alternatives.

Based on the known habitat preferences of listed species of freshwater mussels (**Table 4.1-5**), Class 7 (coarse gravel, cobble, and hardpan/bedrock) substrates provide the highest quality freshwater mussel habitat while Class 1 (unstable sand) and Class 8 (hardpan/bedrock) provide the lowest quality habitat. The remaining substrate classes (Class 2 through Class 6) are intermediate in habitat quality. Class 7 has the distinction of being the only substrate wherein native freshwater mussels were physically detected during sediment sampling. These include the ebony shell (*Reginaia ebena*) and the state-listed longsolid mussel (*Fusconaia subrotunda*) (INDOT and KYTC 2018).

Based on substrate preference by rare freshwater mussels and the acreage of sand/silt substrate along shoreline (12.0 acres) and acreage of coarse gravel/cobble/hardpan/bedrock substrate (23.8 acres), Central Alternative 1 with approximately 35.8 acres provides more potential mussel habitat and will require more sampling effort than the two West Alternatives, which have approximately 20.7 acres of potential mussel habitat.

Table 4.1-5. Side scan sonar and sediment sampling results within the Ohio River for the project alternatives.

ACOUSTIC CLASS	SIDE SCAN SONAR SUBSTRATE CLASS	SEDIMENT SAMPLING SUBSTRATE CLASS	ACRES WITHIN WEST ALT. 1	ACRES WITHIN WEST ALT. 2	ACRES WITHIN CENTRAL ALT. 1
1	Sand	Sand	52.2	52.2	31.2
2	Sand/Silt Shoreline	Silt/Clay	12.8	12.8	12.0
3	Woody Debris	Silt/Clay, Fine Sand, Gravel	1.10	1.10	-
4	Sparse Wood	Fine Sand, Coarse Gravel	4.70	4.70	-
5	Manmade Debris	Heterogenous Mixture	1.10	1.10	-
6	Unknown	Cobble, Silt/Clay	1.00	1.00	-
7	Cobble over Bedrock	Coarse Gravel, Cobble, Hardpan/Bedrock	-	-	23.8
8	Bedrock	Hardpan/Bedrock	-	-	17.2

Source: INDOT and KYTC 2018.

4.1.13 BATS AND BRIDGES

The use of transportation bridges by bats has been poorly studied with very few published papers appearing in the scientific literature. Anecdotal observations of bats roosting under transportation bridges appear quite early in the scientific literature (Davis and Cochrum 1963, Mumford and Cope 1958), but only within the last 20 years have biologists discovered that some bridges are important to local bat communities. The prime example of this importance is the Congress Avenue Bridge in Austin, Texas, which provides roosting habitat for approximately 1.5 million Mexican free-tailed bats (*Tadarida brasiliensis*) and has become the “poster child” for bat use of transportation bridges. The observation of Mexican free-tailed bats emerging at this bridge has generated millions of dollars of tourism for the local economy. However, not all transportation bridges provide habitat for millions of bats. In fact, most transportation bridges are not occupied by bats, and even those that are occupied only contain a few individuals. However, some of the transportation bridges containing smaller numbers of bats may be very important to the local bat community because of their use by endangered, threatened, or special concern species. Several federally listed bats, including the Indiana bat, northern long-eared bat, and gray bat are known to use transportation bridges in the southeastern and midwestern states (Keeley and Tuttle 1999, Kiser et al. 2002, Johnson et al. 2002, Ormsbee et al. 2007).

Bat use of transportation bridges may be classified as either day roosting or night roosting; and for some bridges, especially those used by larger colonies or multiple species, they may actually be used as both roost types. During the long period between sunrise and sunset, bats use day roosts, which provide shelter from predators, from adverse weather for migratory individuals, and for solitary males and females, bachelor colonies, and reproductive females along with their

dependent young (Kunz 1982). Night roosts are used for short periods during the night between foraging bouts and are typically dry locations that provide protection from predators and a place for bats to gather and socialize. These night roosts often also have temperatures much higher than ambient, which aids in digestion of prey. Night roosts also provide safe havens for recently volant (capable of flying) young where they may locate their mothers, rest, and nurse. Of the two types, day roosts, especially where large maternity colonies are found, are normally the more sensitive type of roost.

As with any roost used by bats, the location, type of structure, and the micro-habitat provided by the roost will dictate the type of bat use and the amount of use. During most studies of bat bridges, researchers have identified the following characters as important to the use of the bridge by bats: location over a water body; adjacent habitat connectivity; decking type (e.g., concrete, metal); style of bridge (e.g., girder, slab, steel truss); amount of solar exposure; and presence of vertical crevices (0.5–1.25 inches wide and 12 inches or greater in depth). When bridges have the appropriate characteristics, physical evidence of bat use may include: observation of individual bats; squeaking sounds of bats; guano deposits either on the ground or plastered on the bridge supports and girders; and urine or body oil stains from cracks and crevices where bats enter and exit the structure.

Numerous bridges were identified during field investigations for the I-69 ORX project that provide suitable habitat for roosting bats. Most of the existing bridges identified are located within the West Alternatives or are shared by all alternatives. Since habitat assessments were completed during a period of time when most bats are not present under bridges, a systematic bridge and bat survey was not completed. However, physical evidence of bat use (e.g., guano) was found at several bridges, and the big brown bat (*Eptesicus fuscus*) was found roosting underneath two bridges along US 41 near the southern end of study area. The US 41 bridge over North Fork Canoe Creek contained two big brown bats during October and large amounts of *Myotis*- or *Perimyotis*-sized guano was found adhered to the concrete I-beams/girders of these two bridges (north and south bound lanes). Visual habitat assessments and bat surveys completed during summer are the only means of determining if any of these bridges provide substantial habitat for bats or if any of listed species are using the structures.

4.2 ENDANGERED, THREATENED, AND RARE SPECIES AND HABITAT ASSOCIATIONS

Although ETR species often use specialized habitats, each species may utilize portions of multiple habitats seasonally or even daily throughout their life cycles. In an attempt to quantify and classify potential habitat for ETR species throughout the alternatives, it becomes necessary to broadly assign potential habitats to each species. The results of this assignment of habitats to each ETR species can be found in **Table C-1** in **Appendix C**. **Table 4.2-1** presents a preliminary estimate of potential habitat for ETR species within the three alternatives by summing the acres of each assigned habitat type from **Table 4.1-1** throughout each individual alternative.

Table 4.2-1. Acres of potential habitat for ETR species within the project alternatives.

SPECIES COMMON NAME	FEDERAL SPECIES	ACRES WITHIN WEST ALTERNATIVE 1	ACRES WITHIN WEST ALTERNATIVE 2	ACRES WITHIN CENTRAL ALTERNATIVE 1
BIRDS				
American bittern		17.0	6.2	17.0
bald eagle	X	110.7	75.9	42.3
bank swallow		73.7	62.6	52.8
barn owl		50.9	50.6	31.5
brown creeper		96.9	71.2	45.8
double-crested cormorant		22.8	12.0	21.4
fish crow		110.7	75.9	42.3
great egret		110.7	75.9	42.3
hooded merganser		110.7	75.9	42.3
king rail		17.0	6.3	17.0
least bittern		17.0	6.2	17.0
least tern	X	0.0	0.0	0.0
loggerhead shrike		60.9	58.5	36.3
osprey		110.7	75.9	42.3
peregrine falcon		115.7	155.0	25.5
pie-billed grebe		22.8	12.0	21.4
rose-breasted grosbeak		96.9	71.2	45.8
sedge wren		72.1	67.5	270.6
short-eared owl		50.9	50.6	31.5
spotted sandpiper		22.8	12.0	21.4
upland sandpiper		50.9	50.6	31.5
Virginia rail		17.0	6.3	17.0
yellow-crowned night-heron		110.7	75.9	42.3
FISH				
lake chubsucker ¹		17.0	6.3	17.0
FRESHWATER MUSSELS				
clubshell ¹	X	7.90	7.90	23.80
fanshell ¹	X	7.90	7.90	23.80
fat pocketbook ²	X	20.70	20.70	35.80
little spectaclecase ²		7.90	7.90	23.80
longsolid ¹		7.90	7.90	23.80
northern riffleshell ¹	X	7.90	7.90	23.80
Ohio pigtoe ¹		7.90	7.90	23.80
orange-foot pimpleback ¹	X	7.90	7.90	23.80
pink mucket ¹	X	7.90	7.90	23.80

SPECIES COMMON NAME	FEDERAL SPECIES	ACRES WITHIN WEST ALTERNATIVE 1	ACRES WITHIN WEST ALTERNATIVE 2	ACRES WITHIN CENTRAL ALTERNATIVE 1
pocketbook ¹		7.90	7.90	23.80
purple cat's paw ¹	X	7.90	7.90	23.80
pyramid pigtoe ¹		7.90	7.90	23.80
rabbitsfoot ¹	X	7.90	7.90	23.80
ring pink ¹	X	7.90	7.90	23.80
rough pigtoe ¹	X	7.90	7.90	23.80
sheepnose ¹	X	7.90	7.90	23.80
snuffbox ¹	X	7.90	7.90	23.80
spectaclecase ¹	X	7.90	7.90	23.80
MAMMALS				
evening bat ³		136.5	90.9	27.0
gray bat ⁴	X	22.8	12.0	21.4
Indiana bat ³	X	96.9	71.2	45.8
northern long-eared bat ³	X	106.9	79.1	50.6
masked shrew		151.8	123.4	81.0
swamp rabbit		155.8	120.8	69.4
American badger		132.0	126.3	279.5
REPTILE				
copperbelly water snake		105.0	70.2	37.9
AMPHIBIAN				
eastern hellbender ⁵		7.90	7.90	41.00
VASCULAR PLANTS				
bald cypress		105.0	70.2	37.9
blue scorpion-weed		8.9	7.3	24.9
rose turtlehead		92.0	65.5	24.6
small-flower baby-blue-eyes		8.9	7.3	24.9
Federally-listed Species Total		452.8	353.7	481.5
State-listed Species Total		2778.0	2165.5	2144.1

1. Suitable habitat includes all Ohio River bed substrates other than sand, silt/clay, and hardpan/bedrock.
2. Suitable habitat includes all Ohio River bed substrates other than sand and hardpan/bedrock.
3. Acres of habitat for the evening bat, Indiana bat, and northern long-eared bat are based on roosting and maternity habitat
4. Acres of habitat for the gray bat are based on foraging habitat
5. Suitable habitat includes all Ohio River bed substrates other than sand and silt/clay.

CHAPTER 5 – DISCUSSION

5.1 LISTED SPECIES DOCUMENTED NEAR THE ALTERNATIVES

Natural heritage data generally provide records within 10-mile, 5-mile, and 1-mile buffers around a given proposed project area to reflect these varying probabilities of occurrence based on mobility of each species group. This includes a 10-mile buffer for mammals and birds, a 5-mile buffer for all federally listed species, aquatic species (fishes, mussels, amphibians), and reptiles, and a one-mile buffer for state and federally listed species. See **Table 5.1-1** below for all state and federally listed species in both Kentucky and Indiana with known occurrences within their respective 1-, 5-, and 10-mile buffers, as provided by KSNPC (2017), IDNR (2017b), and KDFWR (2018). **Section 5.2** provides a written description of each known state or federally listed species occurrence within the project alternatives.

Table 5.1-1. State and federally listed species within occurring in Kentucky and Indiana within the 1-, 5-, and 10-mile buffers of the project alternatives.

COMMON NAME	SCIENTIFIC NAME	FEDERAL STATUS	KENTUCKY STATUS	INDIANA STATUS	STATE OF OCCURRENCE	DISTANCE FROM PROJECT ALTERNATIVE (1, 5, OR 10 MILE)
BIRDS						
fish crow	<i>Corvus ossifragus</i>	-	S	-	KY	1, 10
king rail	<i>Rallus elegans</i>	-	E	-	KY	10
Virginia rail	<i>Rallus limicola</i>	-	-	SE	IN	10
double-crested cormorant	<i>Phalacrocorax auratus</i>	-	T	-	KY	10
bank swallow	<i>Riparia riparia</i>	-	S	-	KY	10
American bittern	<i>Botaurus lentiginosus</i>	-	-	SE	IN	10
least bittern	<i>Ixobrychus exilis</i>	-	T	SE	KY/IN	10
great egret	<i>Ardea alba</i>	-	T	SSC	KY/IN	1, 10
yellow-crowned night-heron	<i>Nyctanassa violacea</i>	-	-	SE	IN	10
spotted sandpiper	<i>Actitis macularius</i>	-	E	-	KY	10
upland sandpiper	<i>Bartramia longicauda</i>	-	-	SE	IN	10
hooded merganser	<i>Lophodytes cucullatus</i>	-	T	-	KY	1, 10
bald eagle	<i>Haliaeetus leucocephalus</i>	D	T	SSC	KY/IN	1, 5, 10
osprey	<i>Pandion haliaetus</i>	-	-	SE	IN	10

COMMON NAME	SCIENTIFIC NAME	FEDERAL STATUS	KENTUCKY STATUS	INDIANA STATUS	STATE OF OCCURRENCE	DISTANCE FROM PROJECT ALTERNATIVE (1, 5, OR 10 MILE)
peregrine falcon	<i>Falco peregrinus</i>	-	-	SSC	IN	10
sedge wren	<i>Cistothorus platensis</i>	-	S	SE	KY/IN	10
loggerhead shrike	<i>Lanius ludovicianus</i>	-	-	SE	IN	10
short-eared owl	<i>Asio flammeus</i>	-	-	SE	IN	10
rose-breasted grosbeak	<i>Pheucticus ludovicianus</i>	-	S	-	KY	1
barn owl	<i>Tyto alba</i>	-	S	-	KY	1
pied-billed grebe	<i>Podilymbus podiceps</i>	-	E	-	KY	1
brown creeper	<i>Certhia americana</i>	-	E	-	KY	1
MAMMALS						
masked shrew	<i>Sorex cinereus</i>	-	S	-	KY	1,10
Indiana bat	<i>Myotis sodalis</i>	LE	E	SE	KY/IN	5, 10
evening bat	<i>Nycticeus humeralis</i>	-	S	SE	KY/IN	10
gray bat	<i>Myotis grisescens</i>	LE	T	-	KY	10
northern long-eared bat	<i>Myotis septentrionalis</i>	LT	E	-	KY	10
swamp rabbit	<i>Sylvilagus aquaticus</i>	-	-	SE	IN	10
American badger	<i>Taxidea taxus</i>	-	-	SSC	IN	10
MUSSELS						
sheepnose	<i>Plethobasus cyphus</i>	LE	E	SE	KY/IN	1, 5, 10
snuffbox	<i>Epioblasma triquetra</i>	LE	E	-	KY	5
ring pink	<i>Obovaria retusa</i>	LE	E	-	KY	5
pink mucket	<i>Lampsilis abrupta</i>	LE	E	-	KY	5
fat pocketbook	<i>Potamilus capax</i>	LE	E	-	KY	5
catpaw	<i>Epioblasma obliquata</i>	LE	E	-	KY	5
fanshell	<i>Cyprogenia stegaria</i>	LE	E	-	KY	5

COMMON NAME	SCIENTIFIC NAME	FEDERAL STATUS	KENTUCKY STATUS	INDIANA STATUS	STATE OF OCCURRENCE	DISTANCE FROM PROJECT ALTERNATIVE (1, 5, OR 10 MILE)
rabbitsfoot	<i>Theliderma cylindrica</i>	LT	T	ST	KY/IN	1, 5, 10
little spectaclecase	<i>Villosa lienosa</i>	-	S	-	KY	5
pocketbook	<i>Lampsilis ovata</i>	-	E	-	KY	5
longsolid	<i>Fusconaia subrotunda</i>	-	S	-	KY	1, 5
pyramid pigtoe	<i>Pleurobema rubrum</i>	SOMC	E	-	KY	1, 5
Ohio pigtoe	<i>Pleurobema cordatum</i>	-		SSC	IN	1, 5
FISH						
lake chubsucker	<i>Erimyzon sucetta</i>	-	T	-	KY	5
AMPHIBIANS						
eastern hellbender	<i>Cryptobranchus alleganiensis</i>	-	E	-	KY	5
PLANTS						
blue scorpion-weed	<i>Phacelia ranunculacea</i>	-	S	SE	KY/IN	1
small-flower baby-blue-eyes	<i>Nemophila aphylla</i>	-	T	-	KY	1
bald cypress	<i>Taxodium distichum</i>	-	-	ST	IN	1

Source: KSNPC 2017 and IDNR 2017b

5.2 LISTED SPECIES DOCUMENTED WITHIN THE ALTERNATIVES

Several state or federally listed species have been documented within the boundaries of the alternatives. Some of these species records came from state natural heritage data (KSNPC 2017, IDNR 2017b, KDFWR 2018) while other species were documented during on-site habitat assessments and field investigations during the autumn of 2017.

5.2.1 KENTUCKY NATURAL HERITAGE RECORDS

There is a single record for the masked shrew within the Kentucky portion of the study area. This record is located near the US 41 bridge approach on the south side of the Ohio River, which falls within both West Alternatives.

5.2.2 INDIANA NATURAL HERITAGE RECORDS

There is a record for the hooded merganser at ESNA in the Indiana portion of the study area. Indiana natural heritage data and species records are presented as polygons rather than point

locations. Although the centroid of the polygon is outside of the alternatives, there is overlap with the species polygon for both West Alternatives.

There is also a record for bald cypress at ESNA. Like the record for the hooded merganser, the centroid of the record is outside of the alternatives, but there is overlap with the species polygon for both West Alternatives.

5.2.3 KENTUCKY DEPARTMENT OF FISH AND WILDLIFE RESOURCES RECORDS

According to a letter provided by KDFWR, there are records of the Indiana bat and the northern long-eared bat within 10 miles of the study area. There are also records of the sheepsnose and rabbitsfoot mussel within 10 miles of the study area.

KDFWR further indicated that the masked shrew, bald eagle, great egret, and hooded merganser were known within one mile of the study area.

Although the distance from the study area of these occurrence records has been provided by KDFWR, no specific location information for occurrences has been provided to date. It is therefore unclear if these records coincide with other identified occurrence records.

Records were provided of four additional bird species within one mile of the study area that were not otherwise identified through natural heritage data within the study area buffer. These include the rose-breasted grosbeak, barn owl, pied-billed grebe, and brown creeper.

5.2.4 2017 FIELD OBSERVATIONS

Five state listed species were encountered during onsite habitat assessments and mussel substrate ground-truthing. These were found in both Indiana and Kentucky and include freshwater mussels, a bird, a plant, and a reptile. Four were found within the boundaries of the alternatives.

A population of little spectaclecase was found in North Fork Canoe Creek at the US 41 crossing in Henderson County, KY. This location falls within the southern portion of all three alternatives.

A single weathered shell of the longsolid was found in the Ohio River in a cobble substrate sample collected downstream of Central Alternative 1 during ground-truthing of side scan sonar data (INDOT and KYTC 2018).

Several bald eagles were observed flying along the Ohio River near the West Alternatives, as well as near the confluence of the Green River near Central Alternative 1. Bald eagles were also observed on several occasions near the intersection of Wolf Hills Road and US 41 within both West Alternatives. This area is not far from the documented nest location.

Several small seedlings and saplings of bald cypress were observed adjacent to US 41 near the Eagle Creek crossing in Indiana. These locations fall within both of the West Alternatives.

Copperbelly water snakes were observed on two occasions during the time period of the habitat assessments. One juvenile was found at the mouth of Green River east of Central Alternative 1, and one adult was found swimming in Eagle Creek within the Central Alternative 1.

5.3 LIKELIHOOD OF OCCURRENCE OR IMPACT

It is unlikely that the interior least tern uses the project alternatives based on the lack of unvegetated and seldom-flooded sandbars. Some sand and gravel bar habitats exist along the Ohio River, but are often flooded. Also, the nearest known nesting records are more than 6.2 miles from the study area, which is the maximum documented foraging distance for nesting least terns.

The Ohio River has long been known for its freshwater mussel beds, and it is likely that listed mussel species exist within the project alternatives. Based on substrate preference by rare freshwater mussels and the acreages of sand/silt and coarse gravel/cobble/hardpan/bedrock substrates documented during the substrate sampling, Central Alternative 1 likely provides more potential mussel habitat and will require more sampling effort than the two West Alternatives.

Bat presence is assumed under the KYTC *Programmatic Conservation Memorandum of Agreement for the Indiana bat* (USFWS 2012d), excluding the gray bat. However, the implementation of strict Best Management Practices (BMPs) and other water quality protection measures will reduce impacts to these species.

Visual habitat assessments and bat surveys completed during summer are the only means of determining if any of the existing transportation bridges provide substantial habitat for bats or if any of the listed species are using the structures.

Project disturbance limits have not been finalized for the various alternatives. Therefore, for a preliminary assessment of the alternatives analysis reference *Section 4.2 Endangered Threatened, and Rare Species and Habitat Associations*. Habitats were broadly assigned for each species in an attempt to quantify and classify potential habitat for ETR species throughout the alternatives. Further data collection and on-site surveys would be necessary to determine the presence of state and federally listed species or to fully quantify potential impacts.

Future data collection will inform the Biological Assessment (BA), which will be completed and submitted to USFWS. Ultimately, USFWS will make determinations concerning the project's impacts to federally-listed species.

CHAPTER 6 – LITERATURE CITED

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APPENDIX A

Natural Heritage Data

Table A-1. Kentucky Natural Heritage Data

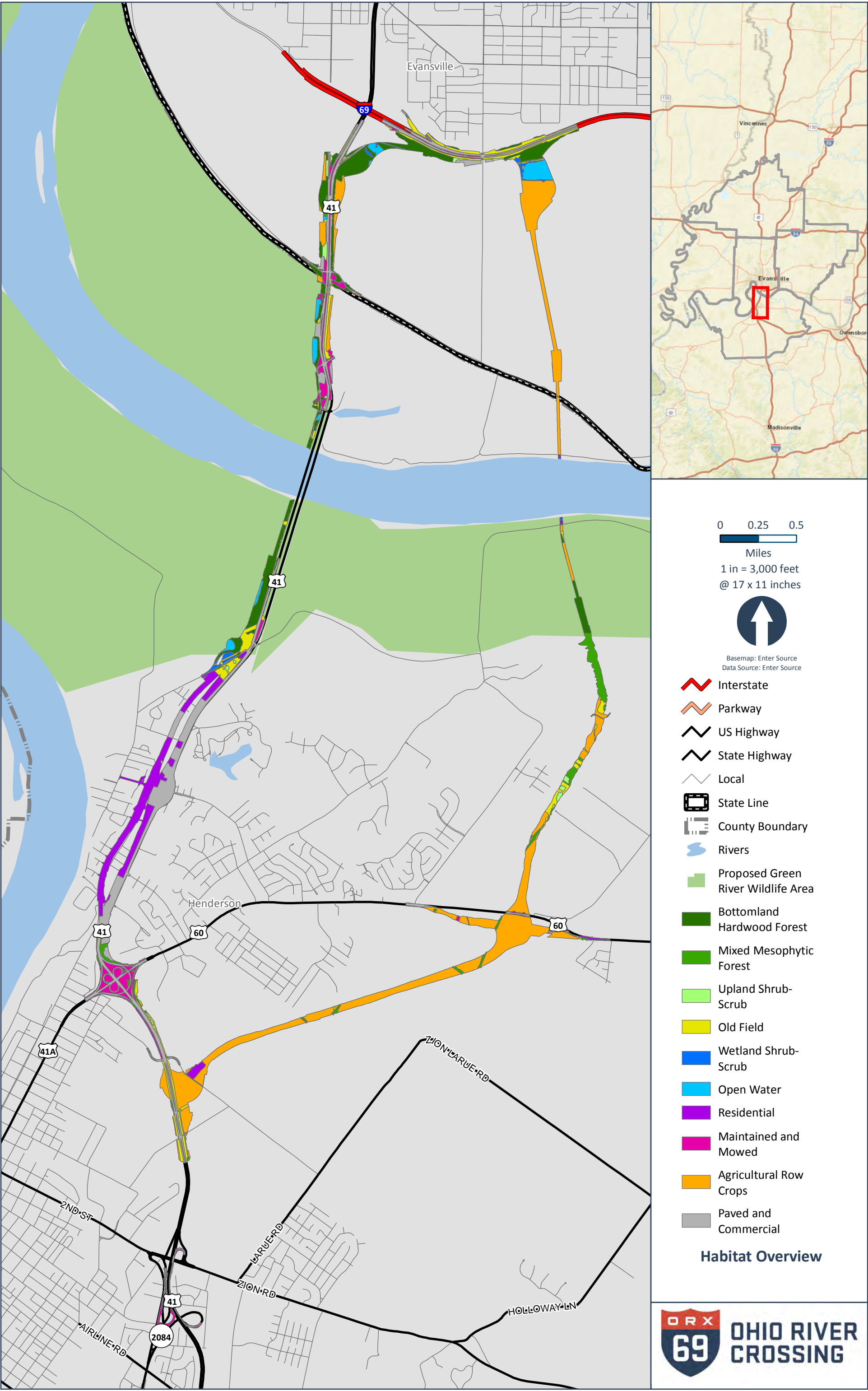
Taxa	Common Name	Scientific Name	County	State Listing	Federal Listing	Last Observed	Location Comments
Breeding Birds	Spotted Sandpiper	<i>Actitis macularius</i>	Henderson	E		7/9/2000	Sandbar parallel to and just off Ky shore just below Newburgh Dam.
Breeding Birds	Great Egret	<i>Ardea alba</i>	Henderson	T		6/5/1951	12 mi W of Henderson, 2 mi E of head of Diamond Island on the Ohio River [also described as w/in 1.0 mi below Big Pond on Deep Slough (Wiley 1964)].
Breeding Birds	Great Egret	<i>Ardea alba</i>	Henderson	T		5/9/2000	N side of KY 414 opposite J.J. Audubon State Park State Nature Preserve.
Breeding Birds	Sedge Wren	<i>Cistothorus platensis</i>	Henderson	S		8/23/2006	Sauerheber Unit Sloughs WMA, Hardy Slough (007A and 007B), Muddy Slough (007C), W of Pond Creek Marsh (007D) and nearby on W side of KY 268 just NW of headquarters (007E).
Breeding Birds	Fish Crow	<i>Corvus ossifragus</i>	Henderson	S		6/16/1988	North of Henderson, on N side of Ohio River just E of US 41 bridge.
Breeding Birds	Bald Eagle	<i>Haliaeetus leucocephalus</i>	Henderson	T	Delisted	4/16/2004	Swamp just N KY 414 and E of US 41, just N of J.J. Audubon State Park.
Breeding Birds	Bald Eagle	<i>Haliaeetus leucocephalus</i>	Henderson	T	Delisted	2007	Sauerheber Unit Sloughs WMA, woods SW of Hardy Slough.
Breeding Birds	Least Bittern	<i>Ixobrychus exilis</i>	Henderson	T		1985	Pond Bayou, approx 1 mi NW of Geneva.
Breeding Birds	Hooded Merganser	<i>Lophodytes cucullatus</i>	Henderson	T		5/20/1998	Sauerheber Unit Sloughs WMA, Muddy Slough (006A), Hardy Slough (006B) and large waterfowl impoundment N of Pond Creek Marsh (006C).
Breeding Birds	Hooded Merganser	<i>Lophodytes cucullatus</i>	Henderson	T		5/30/2007	Slough between Horse Pond Slough and Cypress Bend, NE of West Franklin Road.
Breeding Birds	Double-crested Cormorant	<i>Phalacrocorax auritus</i>	Henderson	T		6/5/1951	12 mi W of Henderson, 2 mi E of head of Diamond Island on the Ohio River. Loc also described as w/in 1.0 mi below Big Pond on Deep Slough (Wiley Dupl EO, 1964).
Breeding Birds	King Rail	<i>Rallus elegans</i>	Henderson	E		7/11/1996	Hardy Slough, Sauerheber Unit Sloughs WMA.
Breeding Birds	Bank Swallow	<i>Riparia riparia</i>	Henderson	S		7/7/1940	Shore of Ohio River, 7 mi W of Henderson.
Fishes	Lake Chubsucker	<i>Erimyzon sucetta</i>	Henderson	T		9/9/1980	Cypress Slough, 0.3 km S of Green River and 4.0 km NW of the mouth of Race Creek.
Freshwater Mussels	Fanshell	<i>Cyprogenia stegaria</i>	Henderson	E	LE	1959	Angel Archaeological Site, N Bank Ohio River, 2.5 MI W of Newburgh, Vanderburgh CO., IN
Freshwater Mussels	Catspaw	<i>Epioblasma obliquata obliquata</i>	Henderson	E	LE	pre-1060	Angel Archaeological Site, N Bank Ohio River, 2.5 MI W of Newburgh, Vanderburgh CO., IN
Freshwater Mussels	Snuffbox	<i>Epioblasma triquetra</i>	Henderson	E	LE	pre-1060	Angel Archaeological Site, N Bank Ohio River, 2.5 MI W of Newburgh, Vanderburgh CO., IN
Freshwater Mussels	Longsolid	<i>Fusconaia subrotunda</i>	Henderson	S		1/1/1996	Ohio River at mouth of Green River
Freshwater Mussels	Pink Mucket	<i>Lampsilis abrupta</i>	Henderson	E	LE	No Date	Angel Archaeological Site, N Bank Ohio River, 2.5 MI W of Newburgh, Vanderburgh CO., IN
Freshwater Mussels	Pocketbook	<i>Lampsilis ovata</i>	Henderson	E		9/5/1927	Ohio River 2 MI SW of Henderson.
Freshwater Mussels	Pocketbook	<i>Lampsilis ovata</i>	Henderson	E		No Date	Angel Archaeological Site, N Bank Ohio River, 2.5 MI W of Newburgh, Vanderburgh CO., IN
Freshwater Mussels	Ring Pink	<i>Obovaria retusa</i>	Henderson	E	LE	1939-1959	Angel Archaeological Site, N Bank Ohio River, 2.5 MI W of Newburgh, Vanderburgh CO., IN
Freshwater Mussels	Sheepnose	<i>Plethobasus cyphus</i>	Henderson	E	LE	1939-1959	Angel Archaeological Site, N Bank Ohio River, 2.5 MI W of Newburgh, Vanderburgh CO., IN
Freshwater Mussels	Sheepnose	<i>Plethobasus cyphus</i>	Henderson	E	LE	pre-3/13/1989	Ohio River, Mouth of Green River.
Freshwater Mussels	Pyramid Pigtoe	<i>Pleurobema rubrum</i>	Henderson	E	SOMC	pre-1060	Angel Archaeological Site, N Bank Ohio River, 2.5 MI W of Newburgh, Vanderburgh CO., IN
Freshwater Mussels	Pyramid Pigtoe	<i>Pleurobema rubrum</i>	Henderson	E	SOMC	No Date	Ohio river mile 800.9 to 801.2 along left descending bank.
Freshwater Mussels	Fat Pocketbook	<i>Potamilus capax</i>	Henderson	E	LE	pre-1957	Ohio River, Evansville, Indiana.
Freshwater Mussels	Fat Pocketbook	<i>Potamilus capax</i>	Henderson	E	LE	10/3/2008	Ohio River, Henderson Co: River Mile 782.3
Freshwater Mussels	Rabbitsfoot	<i>Quadrula cylindrica cylindrica</i>	Henderson	T	LT	8/7/1982	Ohio River mile 784.6-786.7, 40-170 yds from south shore.
Freshwater Mussels	Rabbitsfoot	<i>Quadrula cylindrica cylindrica</i>	Henderson	T	LT	1959	Angel Archaeological Site, N Bank Ohio River, 2.5 MI W of Newburgh, Vanderburgh CO., IN
Freshwater Mussels	Little Spectaclecase	<i>Villosa lienosa</i>	Henderson	S		No Date	Canoe Creek at US-41A bridge, at Cedar Grove, 3.3 mi SSW of Henderson.
Insects	American Burying Beetle	<i>Nicrophorus americanus</i>	Henderson	X	LE	5/15/1921	Henderson.
Insects	A Leptophlebiid Mayfly	<i>Traverella lewisi</i>	Henderson	H		9/5/1967	Ohio River At Evansville.
Mammals	Gray Myotis	<i>Myotis grisescens</i>	Henderson	T	LE	6/7/2016	Anabat Bat Detector placed in Forest/plowed field edge at Henderson County Airport, approx 98 m S of KY-135
Mammals	Gray Myotis	<i>Myotis grisescens</i>	Henderson	T	LE	6/7/2016	Anabat Bat Detector B placed in Forest/plowed field edge at Henderson County Airport, approx 180 m N of Pond Creek
Mammals	Little Brown Bat	<i>Myotis lucifugus</i>	Henderson	N		6/7/2016	Anabat Bat Detector B placed in Forest/plowed field edge at Henderson County Airport, approx 180 m N of Pond Creek
Mammals	Northern Long-Eared Bat	<i>Myotis septentrionalis</i>	Henderson	E	LT	6/7/2016	Anabat Bat Detector B placed in Forest/plowed field edge at Henderson County Airport, approx 180 m N of Pond Creek
Mammals	Indiana Bat	<i>Myotis sodalis</i>	Henderson	E	LE	7/11/2002	Floodplain drain on E side of Tillman Bethel Road, ca. 0.4 air mi S of the mouth of the Green River.
Mammals	Indiana Bat	<i>Myotis sodalis</i>	Henderson	E	LE	6/7/2012	Anabat Bat Detector placed in Forest/plowed field edge at Henderson County Airport, approx 98 m S of KY-135
Mammals	Evening Bat	<i>Nycticeius humeralis</i>	Henderson	S		7/20/2011	ca 0.6 aerial mi w of Spottville Rd bridge over Lick Creek.
Mammals	Evening Bat	<i>Nycticeius humeralis</i>	Henderson	S		6/7/2016	Anabat Bat Detector placed in Forest/plowed field edge at Henderson County Airport, approx 98 m S of KY-135
Mammals	Evening Bat	<i>Nycticeius humeralis</i>	Henderson	S		6/7/2016	Anabat Bat Detector B placed in Forest/plowed field edge at Henderson County Airport, approx 180 m N of Pond Creek
Mammals	Eastern Pipistrelle	<i>Perimyotis subflavus</i>	Henderson	N		7/20/2011	SE of intersection of Bluff City Spottsville Rd and Chaney Rd
Mammals	Eastern Pipistrelle	<i>Perimyotis subflavus</i>	Henderson	N		6/7/2016	Anabat Bat Detector B placed in Forest/plowed field edge at Henderson County Airport, approx 180 m N of Pond Creek
Mammals	Cinereus Shrew	<i>Sorex cinereus</i>	Henderson	S		11/28/1976	Off US 41, 0.7 MI S Ohio River
Mammals	Cinereus Shrew	<i>Sorex cinereus</i>	Henderson	S		7/25/1978	Along S side of E end of Cypress Slough
Mammals	Cinereus Shrew	<i>Sorex cinereus</i>	Henderson	S		7/27/1978	Just S of W end Cypress Slough
Vascular Plants	Rose Turtlehead	<i>Chelone obliqua var. speciosa</i>	Henderson	S		10/9/1980	On S and W side of JCT of Tillman-Bethel RD and Green River Rd, W of Cypress Slough
Vascular Plants	Small-flower Baby-blue-eyes	<i>Nemophila aphylla</i>	Henderson	T		4/3/1998	Audubon State Park, in woods by start of Merit Badge (Eagle Glen) Trail (Margnum 8), and John James Audubon State Park SNP, Limestone Slope Forest S of KY 414, CA 0.5 Air MI E from its JCT w/ US 41 (Margnum 10)
Vascular Plants	Blue Scorpion-weed	<i>Phacelia ranunculacea</i>	Henderson	S		4/14/1999	CA 2.3 Air MI E of US-41; Just NE of Audubon State Park: Along 414 CA 0.1 MI w of JCT w/ Green River Rd.

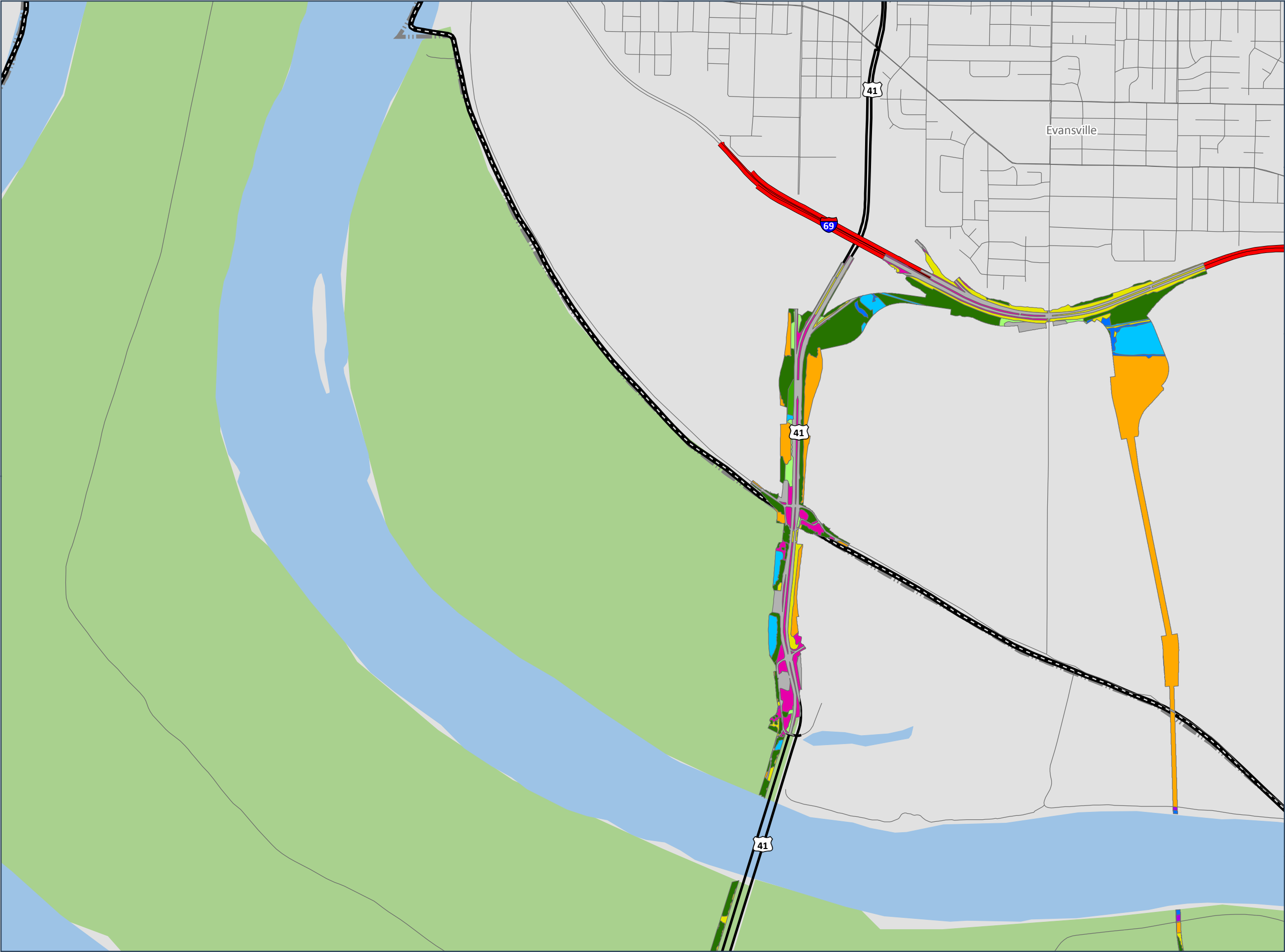
Table A-2. Indiana Natural Heritage Data

Taxa	Common Name	Scientific Name	County	State Listing	Federal Listing	Last Observed	Location Comments
Amphibian	Eastern Hellbender	<i>Cryptobranchus alleganiensis alleganiensis</i>	Vanderburgh	SE	C	No Date	Eagle Slough Natural Area
Bird	Great Egret	<i>Ardea alba</i>	Vanderburgh	SSC		4/21/1986	
Bird	Great Egret	<i>Ardea alba</i>	Vanderburgh	SSC		4/21/1986	
Bird	Short-eared Owl	<i>Asio flammeus</i>	Warrick	SE		7/4/1997	Ayrshire Mine
Bird	Upland Sandpiper	<i>Bartramia longicauda</i>	Vanderburgh	SE		1954	
Bird	American Bittern	<i>Botaurus lentiginosus</i>	Warrick	SE		6/10/2000	Ayrshire Mine
Bird	Sedge Wren	<i>Cisiothorus platensis</i>	Vanderburgh	SE		7/28/1998	Angel Mounds State Memorial
Bird	Peregrine Falcon	<i>Falco peregrinus</i>	Vanderburgh	SSC		1995	Evansville Observation
Bird	Bald Eagle	<i>Haliaeetus leucocephalus</i>	Vanderburgh	SSC		2017-2001	Bald Eagle Nest Name- Schlenker Ditch
Bird	Bald Eagle	<i>Haliaeetus leucocephalus</i>	Vanderburgh	SSC		12/24/2016	Bald Eagle Nest Name- Eagle Slough
Bird	Bald Eagle	<i>Haliaeetus leucocephalus</i>	Warrick	SSC		5/16/2016	Cypress Slough Site- Newburgh
Bird	Bald Eagle	<i>Haliaeetus leucocephalus</i>	Vanderburgh	SSC		2/17/2017	Cypress Slough Site- Old Henderson Rd
Bird	Bald Eagle	<i>Haliaeetus leucocephalus</i>	Vanderburgh	SSC		12/24/2016	Cypress Slough Site- Bald eagle nest name Eagle Slough
Bird	Least Bittern	<i>Ixobrychus exilis</i>	Warrick	SE		6/5/1985	
Bird	Loggerhead Shrike	<i>Lanius ludovicianus</i>	Vanderburgh	SE		6/26/1982	
Bird	Hooded Merganser	<i>Lophodytes cucullatus</i>	Vanderburgh			6/2/2000	Eagle Slough Natural Area
Bird	Hooded Merganser	<i>Lophodytes cucullatus</i>	Vanderburgh			6/2/2000	Eagle Slough Natural Area
Bird	Yellow-crowned Night-heron	<i>Nyctanassa violacea</i>	Warrick	SE		6/5/1985	
Bird	Osprey	<i>Pandion haliaetus</i>	Warrick	SE		No Date	Bluegrass Fish and Wildlife Area- Nest Platform
Bird	Virginia Rail	<i>Rallus limicola</i>	Warrick	SE		6/4/1993	Ayrshire Mine
Fish	Spottail Darter	<i>Etheostoma squamiceps</i>	Vanderburgh			3/19/1998	Carpentier Creek
Insect Coleoptera	American Burying Beetle	<i>Nicrophorus americanus</i>	Vanderburgh	SX	LE	5/30/1927	
Mammal	Indiana Bat or Social Myotis	<i>Myotis sodalis</i>	Warrick	SE	LE	5/21/1998	Alcoa Warrick Operations
Mammal	Evening Bat	<i>Nycticeius humeralis</i>	Vanderburgh	SE		No Date	
Mammal	Swamp Rabbit	<i>Sylvilagus aquaticus</i>	Vanderburgh	SE		1969	Dam # 48
Mammal	American Badger	<i>Taxidea taxus</i>	Vanderburgh	SSC		1988-2006	
Mammal	American Badger	<i>Taxidea taxus</i>	Vanderburgh	SSC		1988-2006	
Mollusk	Pocketbook	<i>Lampsilis ovata</i>	Vanderburgh			11/12/1994	Ohio River
Mollusk	Black Sandshell	<i>Ligumia recta</i>	Vanderburgh			11/12/1994	Cypress Creek Slough Site- Ohio River
Mollusk	Sheepnose	<i>Plethobasus cyphus</i>	Vanderburgh	SE	LE	11/12/1994	Ohio River
Mollusk	Sheepnose	<i>Plethobasus cyphus</i>	Vanderburgh	SE	LE	11/12/1994	Ohio River
Mollusk	Round Pigtoe	<i>Pleurobema coccineum</i>	Vanderburgh			11/12/1994	Ohio River
Mollusk	Ohio Pigtoe	<i>Pleurobema cordatum</i>	Vanderburgh	SSC		11/12/1994	Ohio River- River Mile 795.2-799.8
Mollusk	Ohio Pigtoe	<i>Pleurobema cordatum</i>	Vanderburgh	SSC		7/8/1982	Ohio River- River Mile 784.6-786.7
Mollusk	Ohio Pigtoe	<i>Pleurobema cordatum</i>	Vanderburgh	SSC		9/8/1997	Ohio River- River Mile 812.8-814.9
Mollusk	Ohio Pigtoe	<i>Pleurobema cordatum</i>	Vanderburgh	SSC		11/12/1994	Ohio River- River Mile 795.2-799.8
Mollusk	Ohio Pigtoe	<i>Pleurobema cordatum</i>	Vanderburgh	SSC		7/8/1982	Ohio River- River Mile 784.6-786.7
Mollusk	Rabbitsfoot	<i>Quadrula cylindrica cylindrica</i>	Vanderburgh	SE	LT	7/8/1982	Ohio River- River Mile 784.6-786.7
Mollusk	Rabbitsfoot	<i>Quadrula cylindrica cylindrica</i>	Vanderburgh	SE	LT	7/8/1982	Ohio River- River Mile 784.6-786.7
Mollusk	Rabbitsfoot	<i>Quadrula cylindrica cylindrica</i>	Vanderburgh	SE	LT	7/8/1982	Ohio River- River Mile 784.6-786.7
Reptile	Copperbelly Water Snake	<i>Nerodia erythrogaster neglecta</i>	Vanderburgh	SE	PS:LT	No Date	
Vascular Plant	Bald Cypress	<i>Taxodium distichum</i>	Vanderburgh	ST		1/19/1979	Eagle Slough Natural Area

APPENDIX B

Habitat Maps





0 0.25 0.5
Miles
1 in = 2,000 feet
@ 11 x 17 inches

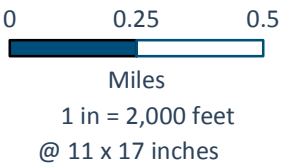
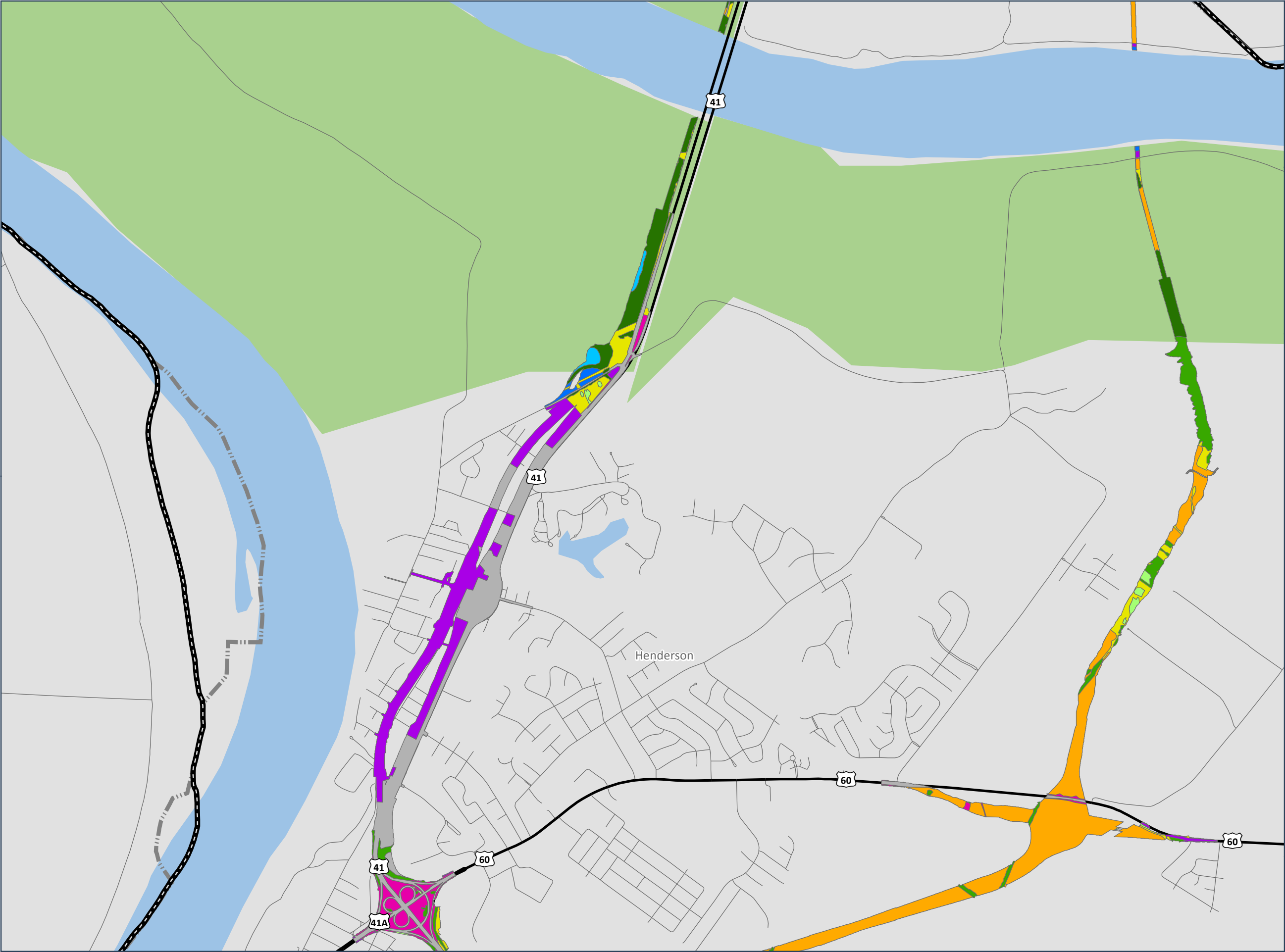


Basemap: Enter Source
Data Source: Enter Source

- Interstate
- Parkway
- US Highway
- State Highway
- Local
- Project Area
- Rivers
- Proposed Green River Wildlife Area
- State Line
- Bottomland Hardwood Forest
- Mixed Mesophytic Forest
- Upland Shrub-Scrub
- Old Field
- Wetland Shrub-Scrub
- Open Water
- Residential
- Maintained and Mowed
- Agricultural Row Crops
- Paved and Commercial

Habitat: North Section



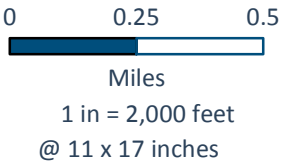
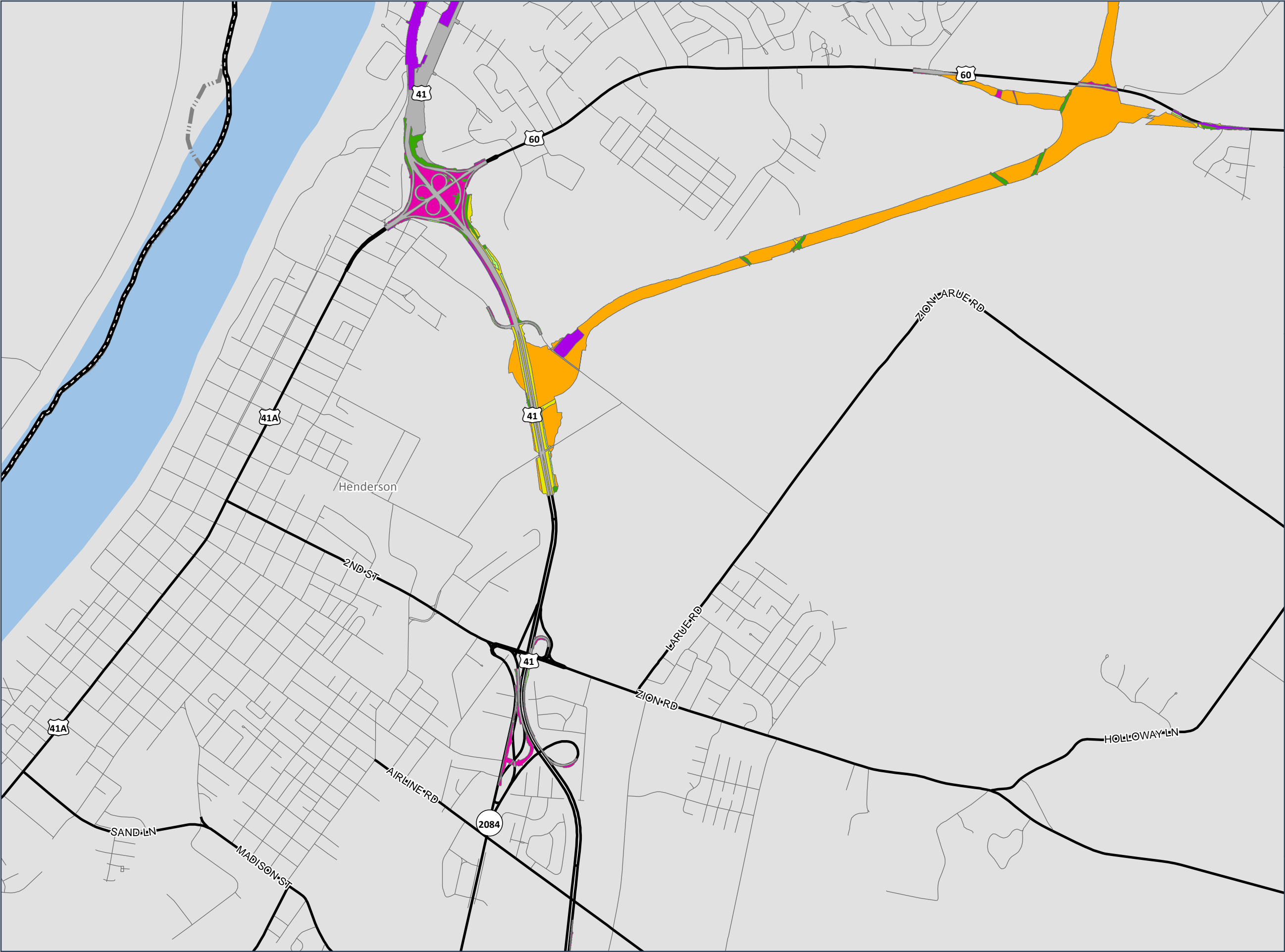


Basemap: Enter Source
Data Source: Enter Source

- Interstate
- Parkway
- US Highway
- State Highway
- Local
- Project Area
- Rivers
- Proposed Green River Wildlife Area
- State Line
- Bottomland Hardwood Forest
- Mixed Mesophytic Forest
- Upland Shrub-Scrub
- Old Field
- Wetland Shrub-Scrub
- Open Water
- Residential
- Maintained and Mowed
- Agricultural Row Crops
- Paved and Commercial

Habitat: North Section





Basemap: Enter Source
Data Source: Enter Source

- Interstate
- Parkway
- US Highway
- State Highway
- Local
- Project Area
- Rivers
- Proposed Green River Wildlife Area
- State Line
- Bottomland Hardwood Forest
- Mixed Mesophytic Forest
- Upland Shrub-Scrub
- Old Field
- Wetland Shrub-Scrub
- Open Water
- Residential
- Maintained and Mowed
- Agricultural Row Crops
- Paved and Commercial

Habitat: South Section



APPENDIX C

Table C-1 ETR Species Assigned Habitats

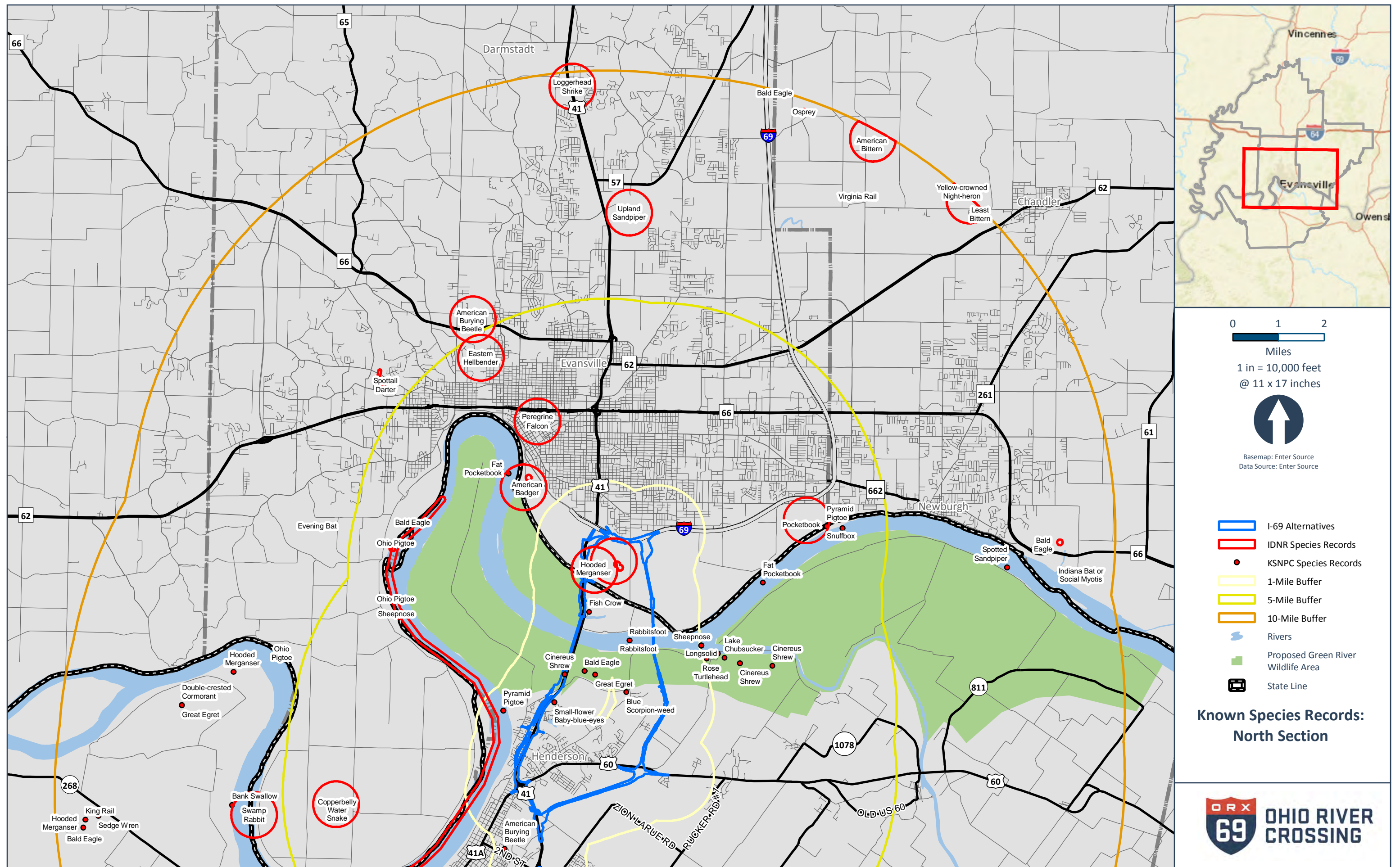
Table C-1. ETR Species Assigned Habitats

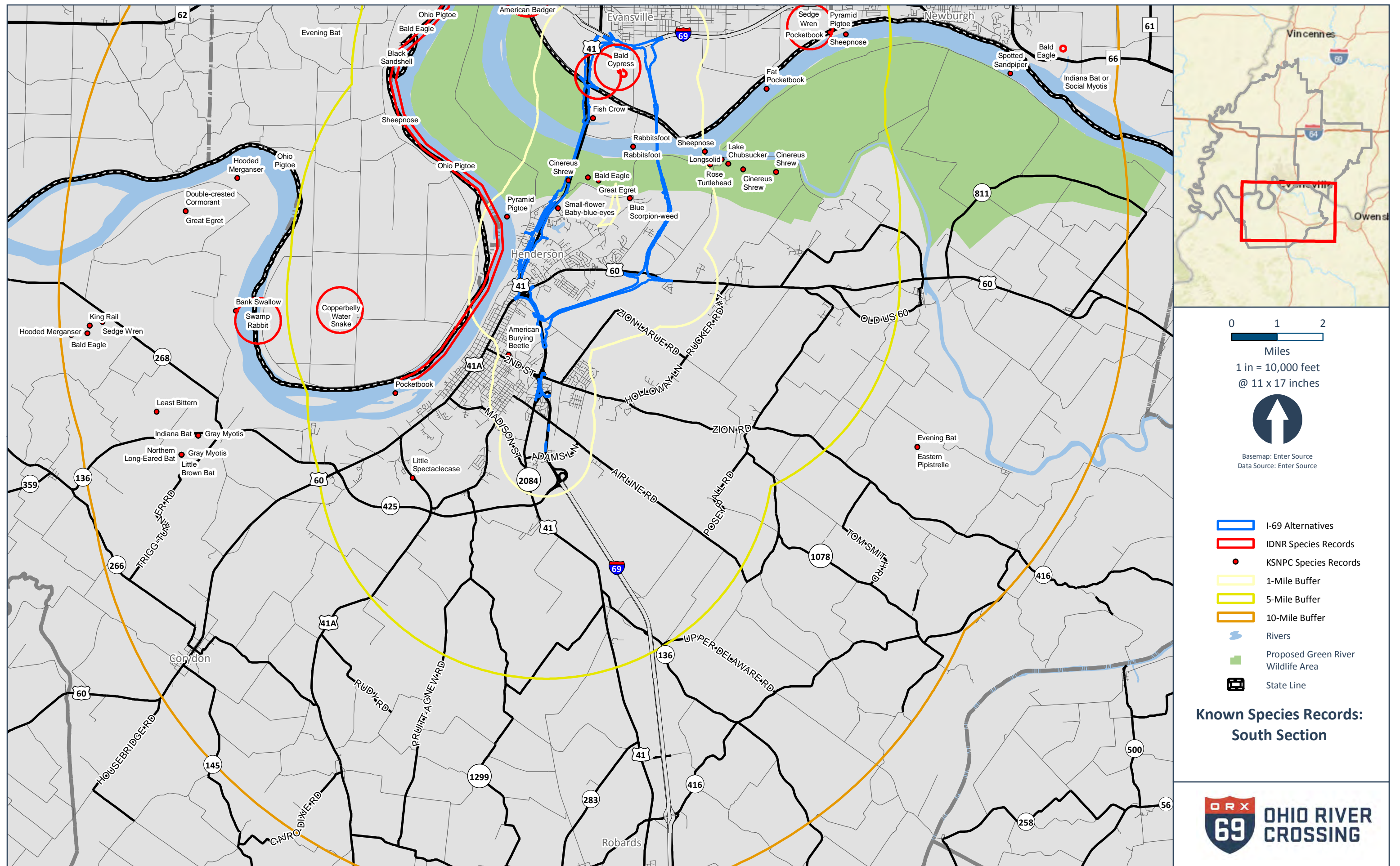
TAXA	COMMON NAME	BOTTOMLAND HARDWOOD FOREST	MIXED MESOPHYTIC FOREST	WETLAND SHRUB-SCRUB	UPLAND SHRUB- SCRUB	OLD FIELD	OPEN WATER	MAINTAINED AND MOWED AREAS	RESIDENTIAL	AGRICULTURAL ROW CROPS	PAVED AND COMMERCIAL
Birds	American Bittern			X			X				
	Bald Eagle	X		X			X				
	Bank Swallow			X		X	X				
	Double-crested Cormorant			X			X				
	Fish Crow	X		X			X				
	Great Egret	X		X			X				
	Hooded Merganser	X		X			X				
	King Rail			X			X				
	Least Bittern	X		X			X				
	Least Tern			X			X				
	Loggerhead Shrike				X	X					
	Osprey	X		X			X				
	Peregrine Falcon										X
	Sedge Wren			X		X				X	
	Short-eared Owl					X					
	Spotted Sandpiper			X			X				
	Upland Sandpiper					X					
	Virginia Rail			X			X				
	Yellow-crowned Night-Heron	X		X			X				
Fishes	Lake Chubsucker						X				
Freshwater Mussels*	Clubshell						X				
	Fanshell						X				
	Fat Pocketbook						X				
	Little Spectaclecase						X				
	Longsolid						X				
	Northern Riffleshell						X				
	Ohio Pigtoe						X				
	Orangefoot Pimpleback						X				
	Pink Mucket						X				
	Pocketbook						X				
	Purple Cat's Paw						X				
	Pyramid Pigtoe						X				
	Rabbitsfoot						X				
	Ring Pink						X				
	Rough Pigtoe						X				
	Sheepnose						X				
	Snuffbox						X				
	Spectaclecase						X				
Mammals	Evening Bat	X		X			X		X		
	Gray Bat	X		X			X				
	Indiana Bat	X	X	X			X				
	Northern Long-Eared Bat	X	X	X	X		X		X		
	Masked Shrew	X	X	X		X					
	Swamp Rabbit	X		X		X	X				
	American Badger				X	X		X		X	
Reptiles	Copperbelly Water Snake	X		X			X				
Amphibians*	Eastern Hellbender						X				
Vascular Plants	Bald Cypress	X		X			X				
	Blue Scorpion-weed		X								
	Rose Turtlehead	X		X							
	Small-flower Baby-blue-eyes		X								

*Freshwater mussel species and the eastern hellbender only use the riverine (lotic) subset of open water habitats

APPENDIX D

Known Species Records Maps



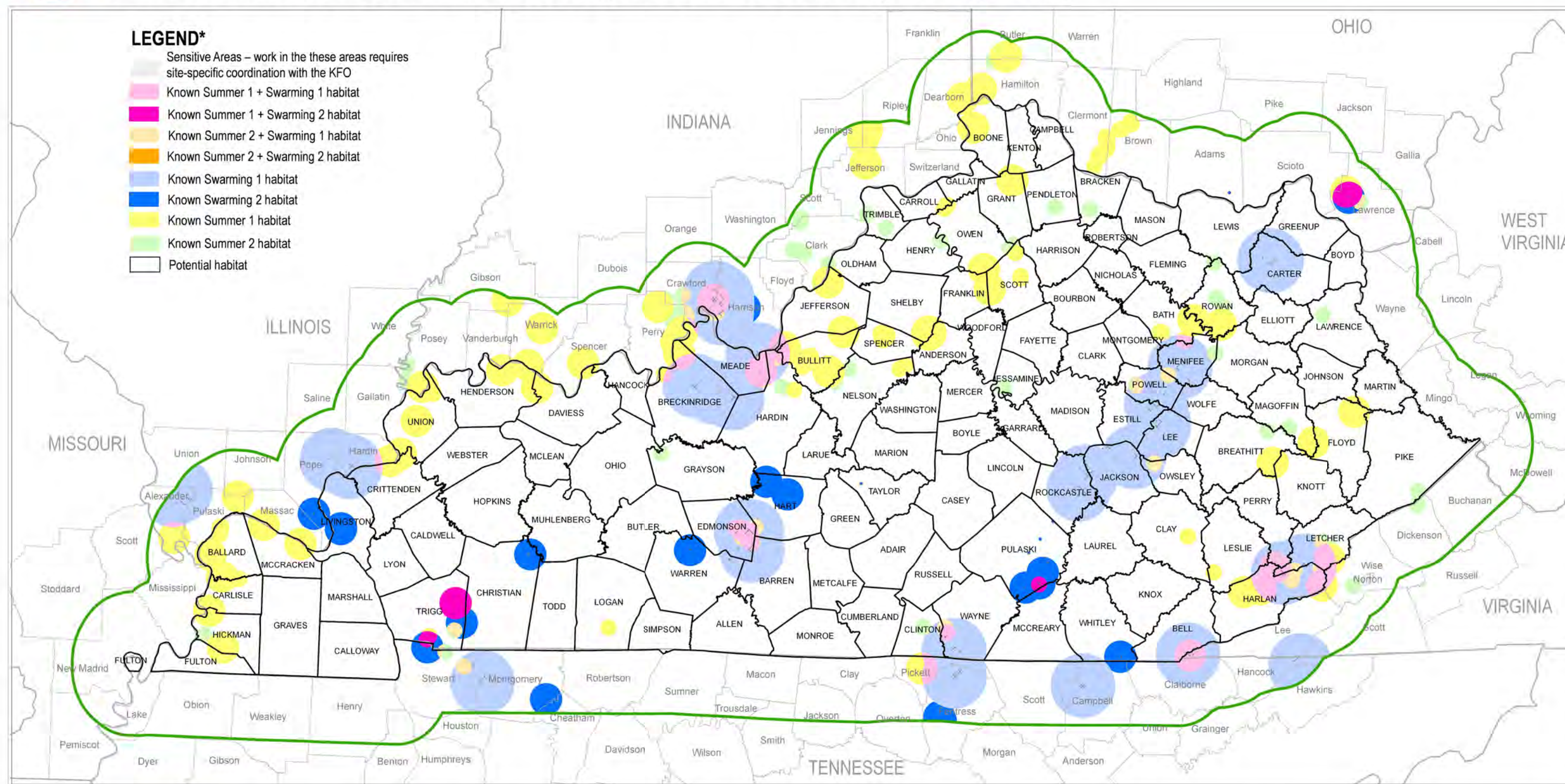


APPENDIX E

Indiana Bat Map



Known Indiana bat habitat in Kentucky and within 20 miles (January 2018)



NOTE: This map is based on species occurrence information and is subject to change as new data become available. Please contact our office at 502/695-0468 to ensure you are working with the most current version.

*For an explanation of terms, please see the Conservation Strategy for Forest-Dwelling Bats in the Commonwealth of Kentucky.

0 10 20 40 60 80 100 Miles

The USFWS makes no warranty for use of this map and cannot be held liable for actions or decisions based on map content. This map was produced as an appendix to the Conservation Strategy for Forest-Dwelling Bats in the Commonwealth of Kentucky and should only be used in the context of this Strategy.

