Appendix M

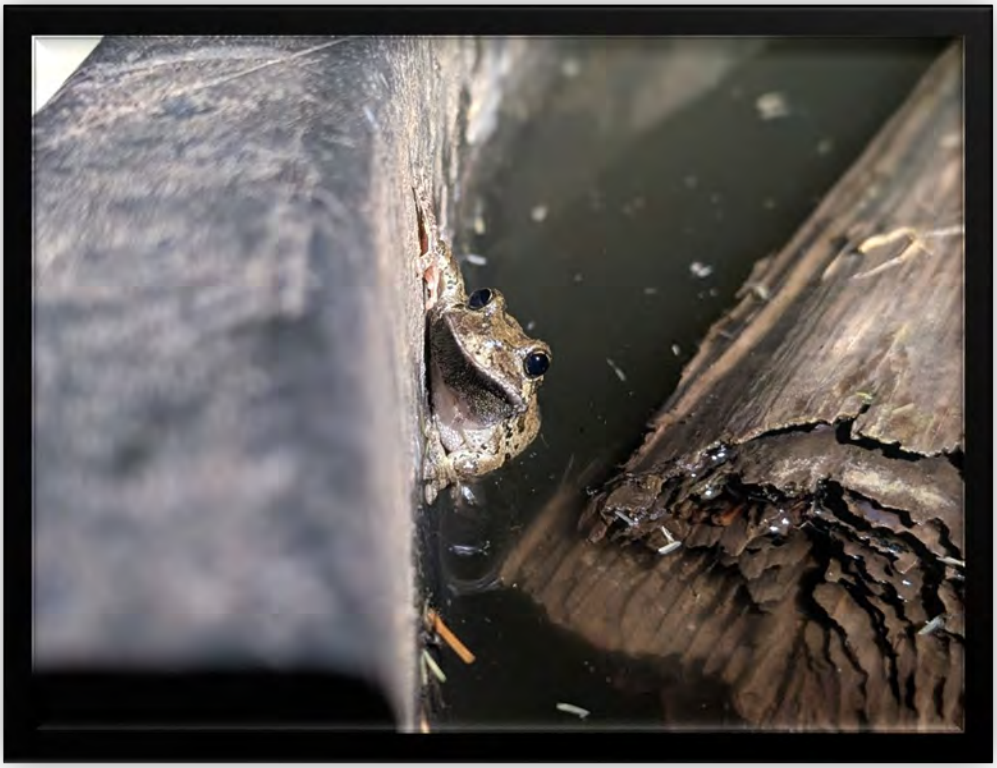
THREATENED AND ENDANGERED SPECIES HABITAT ASSESSMENT

Barrelhead Solar, LLC

Wayne County, Kentucky

COPPERHEAD
ENVIRONMENTAL CONSULTING

DRAFT
Wildlife and Habitat Assessment for the Barrelhead Solar Project Wayne County, Kentucky



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13 August 2025

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INTRODUCTION

Copperhead Environmental Consulting, Inc. (Copperhead) was contracted by Barrelhead Solar, LLC (the Applicant) to complete a wildlife and habitat assessment for the proposed Barrelhead Solar Project (Project) in Wayne County, Kentucky. The Project is situated on approximately 307 acres (the "Project Area") located approximately nine miles southwest of the town of Monticello (Figure 1).

ENVIRONMENTAL SETTING

The proposed Project Area is on the western border of Wayne County, Kentucky, which is in the Pennyroyal physiographic region.

Kentucky is also separated into 25 distinct ecoregions based on physical and biological similarities, such as geology, topography, soils, vegetation, and land use. The proposed project is located within the Eastern Highland Rim ecoregion of the Interior Plateau. The Eastern Highland Rim ecoregion is primarily composed of oak-hickory forest. A pure mixed mesophytic forest could also be found in ravines in the eastern part of this region. This region has a mixture of land uses, including wild forest and managed woodlands, pasturelands and croplands, and oil and gas development. The area is mostly underlain by Mississippian limestone, chert, shale, siltstone, and sandstone. Streams are nutrient-rich and moderate in gradient (Woods et al. 2002).

Topography

Wayne County contains both the Pennyroyal Plateaus and the Eastern Kentucky Coal Field physiographic regions. The Cumberland Escarpment, which runs from southwest to northeast through Wayne County, separates these two areas. The western section of Wayne County is a karst (sinkhole) plain with upland masses that rise between 950 to 1,050 feet, scattered throughout the region. The Eastern Kentucky Coal Field Region is a higher plateau area and contains the highest elevations in the county. Elevations are highest just south of Powersburg and 3/4 miles north of the Kentucky-Tennessee border (approximately 1,788 feet), and lowest near the northern portion of the county at Lake Cumberland (approximately 723 feet) (McGrain and Currens 1978). A digital elevation model (DEM) of the Project Area is provided in Figure 2.

Results of the desktop review identified much of the Project Area as intensely karst (Figure 3). Karst topography is a type of landscape that is associated with soluble rocks, such as limestone, which can dissolve when interacting with water, thus potentially creating sinkholes, sinking streams, caves, and other potential underground features.

Watershed and Hydrological Features

The Project Area is within the Lower Otter Creek Watershed (Hydrologic Unit Code [HUC] 051301030502). A review of the United States Geological Survey (USGS) National Hydrography Dataset (NHD) and the United States Fish and Wildlife Service (USFWS) National Wetlands

Inventory (NWI) identified approximately 4,434.7 linear feet of waterways that intersect the Project Area, including Potts Creek (3,392.9 feet), and two types of wetlands, totaling approximately 4.5 acres (Table 1).

Table 1. Wetland Types identified by the National Wetlands Inventory in the Project Area, Wayne County, Kentucky.

Wetland Type	Acres	Percent of Project Area
Freshwater Pond	1.3	0.42%
Riverine	0.62	0.20%
Total	**1.93**	**0.63%**

*Acreages are based on spatial data from USFWS NWI (2021); actual acreages may differ slightly from officially surveyed acres.
Source: USFWS 2021a.

Copperhead also reviewed the Federal Emergency Management Agency (FEMA) National Flood Hazard Layer (NFHL) to identify regulatory floodplains that may be present in the Project Area. A floodplain is the relatively level land area along a stream or river that is subjected to periodic flooding (FEMA 2009). The area subject to a 1-percent chance of flooding in any given year is normally called a 100-year floodplain and is considered the regulatory floodplain by FEMA. The area subject to a 0.2 percent chance of flooding in any given year is normally called a 500-year floodplain. The southern boundary of the Project Area is within the 100-year floodplain of Potts Creek, as displayed in Figure 4.

As part of the proposed project, a wetland and stream delineation was completed on August 17-21, 2024, and September 29, 2024, by Copperhead. The delineation resulted in the identification of 12 wetlands (four palustrine emergent and seven palustrine forested wetlands), one pond, and 22 linear waterbodies (two perennial, nine intermittent, and 11 ephemeral). Of these features, seven wetlands, nine intermittent streams, and two perennial streams are likely to be considered jurisdictional (Copperhead Environmental Consulting 2025b).

Determinations and boundaries, when presented, are preliminary and are subject to final verification by the United States Army Corps of Engineers (USACE) Nashville District. The USACE and the Kentucky Division of Water have regulatory authority over all waters in Kentucky protected under the Clean Water Act.

Figure 5.1-5.7 displays the results of the wetland and stream delineation.

Land Use and Soil Types

Land cover classes within the Project Area were determined from the USGS National Land Cover Database (Dewitz and USGS 2021). The Project Area is largely comprised of pasture/hay (212.61 acres), followed by deciduous forest (60.33 acres), and cultivated crops (11.2 acres) (Table 2 and Figure 6).

Table 2. Land Cover Types for the Barrelhead Solar Project, Wayne County, Kentucky.

Name	Project Area	
	Acres	Percent
Cultivated Crops	11.2	3.6%
Deciduous Forest	60.33	19.7%
Developed, Low Intensity	2.69	0.9%
Developed, Open Space	3.80	1.2%
Hay/Pasture	212.61	69.3%
Herbaceous	0.83	0.3%
Mixed Forest	9.25	3.0%
Shrub/Scrub	6.24	2.0%
Total	337	

*NLCD calculations are based on the 2023 USGS NLCD; actual acreages may differ slightly from officially surveyed acres.
Note: Sums of percentages might not equal 100 percent due to rounding errors.

Soil types within the Project Area were identified using the United States Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS) Web Soil Survey. Approximately 126.22 acres are considered farmland of statewide importance, and 12.24 acres are considered prime farmland. Another 5.36 acres could be considered prime farmland if drained (Table 3 and Figure 7).

Table 3. Soil Types found within the Project Area, Wayne County, Kentucky.

Map Unit	Soil Type	Prime Farmland	Acres
CgD	Caneyville-Garmon association, steep	Not prime farmland	8.19
FrC2	Frederick silt loam, 6 to 12 percent slopes, eroded	Farmland of statewide importance	126.22
FrD2	Frederick silt loam, 12 to 20 percent slopes, eroded	Not prime farmland	124.39
GcF	Garmon-Caneyville association, very steep	Not prime farmland	29.93
MoB	Mountview silt loam, 2 to 6 percent slopes	All areas are prime farmland	12.24
Ne	Newark silt loam, occasionally flooded	Prime farmland if drained	5.36
W*	Water	Not prime farmland	0.58

Source: Soil Survey Staff 2022.
*Not a soil type.

SPECIES EVALUATED

Special Status Plant and Wildlife Species

A review of the USFWS Information for Planning and Consultation (IPaC) tool[1] identified seven federally listed and candidate species under the Endangered Species Act (ESA) with potential to occur within the Project Area (Table 4; USFWS 2025a). Additionally, 14 federally listed species and 19 state-listed species were identified through the Office of Kentucky Nature Preserves Biological Assessment Tool (OKNP BAT) and the Kentucky Department of Fish and Wildlife Resources (KDFWR) Species Search by Quad (Cumberland City Quad) (Table 4).

[1] Department of Interior July 15, 2025, memo entitled, "Departmental Review Procedures for Decisions, Actions, Consultations, and other Undertakings Related to Wind and Solar Energy Facilities," this proposed solar project is not eligible to use the IPaC tool for consultation with USFWS. However, the IPaC species list for this project was generated on May 20, 2025, and should be used until further guidance is received from USFWS.

Table 4. Federal and State-listed Species with potential to occur within the Project Area, Wayne County, Kentucky.

Taxa	Scientific Name	Common Name	ESA Status[1]	State Status[2]	Critical Habitat[3]	Source
Birds	*Centronyx henslowii*	Henslow's sparrow	N	S	-	KDFWR
Birds	*Grus americana*	Whooping crane	XN	-	N/A	IPaC
Birds	*Junco hyemalis*	Dark-eyed junco	N	S	-	OKNP
Birds	*Spatula clypeata*	Northern shoveler	N	E	-	OKNP
Fish	*Acipenser fulvescens*	Lake sturgeon	N	E	-	OKNP
Fish	*Hybopsis amnis*	Pallid shiner	N	E	-	KDFWR
Insects	*Danaus plexippus*	Monarch butterfly	PT*	-	No	IPaC
Mammals	*Corynorhinus rafinesquii*	Rafinesque's big-eared bat	N	S	-	OKNP
Mammals	*Corynorhinus townsendii virginianus*	Virginia big-eared bat	E	E	No	IPaC
Mammals	*Myotis grisescens*	Gray bat	E	T	N/A	IPaC
Mammals	*Myotis leibii*	Eastern small-footed bat	N	T	-	KDFWR
Mammals	*Myotis septentrionalis*	Northern long-eared bat	E	E	N/A	IPaC
Mammals	*Myotis sodalis*	Indiana bat	E	-	No	IPaC
Mammals	*Perimyotis subflavus*	Tricolored bat	PE*	T	N/A	IPaC
Mussels	*Actinonaias pectorosa*	Pheasantshell	N	S	-	OKNP
Mussels	*Alasmidonta marginata*	Elktoe	N	T	-	OKNP
Mussels	*Cumberlandia monodonta*	Spectaclecase	E	E	N/A	OKNP
Mussels	*Cyprogenia stegaria*	Fanshell	E	E	N/A	OKNP
Mussels	*Dromus dromas*	Dromedary pearlymussel	E	E	N/A	OKNP
Mussels	*Elliptio crassidens*	Elephantear	N	S	-	OKNP
Mussels	*Epioblasma brevidens*	Cumberlandian combshell	E	E	No	OKNP
Mussels	*Epioblasma capsaeformis*	Oyster mussel	E	E	No	OKNP
Mussels	*Epioblasma triquetra*	Snuffbox	E	E	N/A	OKNP
Mussels	*Epioblasma walkeri*	Tan riffleshell	E	E	N/A	OKNP
Mussels	*Fusconaia subrotunda*	Longsolid	T	T	No	OKNP
Mussels	*Lampsilis abrupta*	Pink mucket	E	E	N/A	OKNP
Mussels	*Lampsilis ovata*	Pocketbook	N	E	-	OKNP

Taxa	Scientific Name	Common Name	ESA Status[1]	State Status[2]	Critical Habitat[3]	Source
Mussels	*Leaunio lienosus*	Little spectaclecase	N	T	-	OKNP
Mussels	*Leaunio vanuxemensis*	Mountain creekshell	N	E	-	OKNP
Mussels	*Ligumia recta*	Black sandshell	N	S	-	OKNP
Mussels	*Obovaria retusa*	Ring pink	E	E	N/A	OKNP
Mussels	*Pleurobema oviforme*	Tennessee clubshell	N	E	-	OKNP
Mussels	*Pleurobema plenum*	Rough pigtoe	E	E	N/A	OKNP
Mussels	*Ptychobranchus subtentus*	Fluted kidneyshell	E	E	No	KDFWR
Mussels	*Theliderma cylindrica*	Rabbitsfoot	T	E	No	OKNP
Mussels	*Toxolasma lividum*	Purple lilliput	N	E	-	OKNP
Mussels	*Venustaconcha troostensis*	Cumberland bean	E	E	N/A	OKNP
Plants	*Aconitum uncinatum*	Blue monkshood	N	E	-	KDFWR
Plants	*Adiantum capillus-veneris*	Southern maidenhair-fern	N	T	-	KDFWR
Plants	*Euphorbia mercurialina*	Mercury spurge	N	S	-	KDFWR

Sources: USFWS IPaC (Project Code: 2024-0069739), OKNP BAT Report, and KDFWR Species Search by Quad (Cumberland City Quad).

[1] ESA Status Code: E= Listed Endangered; T = Listed Threatened; XN = Listed Experimental Population, Non-Essential; C = Candidate Species; PE = Proposed Endangered; PT = Proposed Threatened

[2] State Status Code: E= Listed Endangered; T = Listed Threatened; S = Special Concern

[3] Yes = within existing critical habitat; No = not within existing critical habitat; N/A = No critical habitat has been designated for this species

* Proposed endangered or threatened species are not protected by the take prohibitions of Section 9 of the ESA until the rule to list is finalized. Under section 7(a)(4) of the ESA, federal agencies must confer with USFWS if their action will jeopardize the continued existence of a proposed species.

Migratory Birds and Eagles

Certain birds are protected under the Migratory Bird Treaty Act (1918) and the Bald and Golden Eagle Protection Act (1940). The USFWS IPaC tool identified four migratory Birds of Conservation Concern (BCC) with potential to occur within the Project Area (Table 5; USFWS 2025a).

Table 5. Migratory Birds of Conservation Concern Potentially Found in the Project Area, Wayne County, Kentucky.

Common Name	Scientific Name	Breeding Season	Months likely to be present	Nearest eBird Sighting (mile)
Bald Eagle	*Haliaeetus leucocephalus*	1 September - 31 July	Early June	0.28
Chimney Swift	*Chaetura pelagica*	15 March - 25 August	Late June	1.6
Field Sparrow	*Spizella pusilla*	1 March - 15 August	Mid-late January, mid-January, early May, late June, early September, and late November	1.6
Prothonotary Warbler	*Protonotaria citrea*	1 April - 31 July	Early June	0.65
Rusty Blackbird	*Euphagus carolinus*	Breeds Elsewhere	Late January	0.9
Wood Thrush	*Hylocichla mustelina*	10 May - 31 August	Early /Late June	1.6

Source: USFWS IPaC Resource List, accessed 5/05/2025 at https://ipac.ecosphere.fws.gov.

The IPaC tool did identify bald eagles as likely present within the Project Area (USFWS 2025a). Should an active nest be discovered within proximity to the Project Area, an avoidance buffer of up to 660 feet for certain activities during nesting season would be required per the Bald and Golden Eagle Protection Act. The Bald and Golden Eagle Protection Act prohibits anyone who lacks a permit to take, possess, sell, purchase, barter, offer to sell, transport, export, or import a bald or golden eagle, dead or alive, including an egg or a part of a nest (16 U.S.C. 668-668c and 50 CFR Part 22).

Bald eagle habitat includes estuaries, large lakes, reservoirs, rivers, and some seacoasts and marshes where they forage for fish (USFWS 2025b). Bald eagles will also feed on waterfowl, turtles, rabbits, snakes, other small animals, and carrion. Bald eagles require a combination of readily available prey, perching areas, and nesting sites. In the winter, bald eagles congregate near open water in tall trees for spotting prey and for night roosts.

Copperhead completed a ground-based survey on May 18, 2025, to document bald eagle nests within the Project Area and 0.5-mile buffer, and non-eagle raptors within the Project Area. All public roads within the Project Area and a 0.5-mile buffer were driven by Copperhead biologists, and all forested habitat was scanned for nests using binoculars. Three non-eagle raptors (one red-tailed hawk and two American kestrels) were observed within the Project Area. No bald eagle or non-eagle raptor nests were observed within the Project Area or a 0.5-mile buffer (Copperhead Environmental Consulting 2025a). Should any bald eagle or raptor nests be discovered during Project construction activities, a 660-foot buffer around the nest would be required, and an incidental take permit would be needed.

HABITAT ASSESSMENT

The habitat assessment was conducted from May 15 to 18, 2025, by Copperhead to evaluate the presence of potential habitat for listed plant and wildlife species and to record listed species observations. Plant and wildlife species were documented through visual confirmation.

The Project Area is mainly comprised of agricultural land and mixed hardwood forest. Most of the Project Area has been significantly disturbed by agricultural and livestock practices. The mixed hardwood forests along Potts Creek were dominated by a canopy and midstory of sugar maple (*Acer saccharum*), bitternut hickory (*Carya cordiformis*), winged elm (*Ulmus alata*), American elm (*Ulmus americana*), and yellow buckeye (*Aesculus flava*). The agricultural fields were planted with soybeans, while pasturelands were dominated by disturbed grassland species such as orchard grass (*Dactylis glomerata*), tall false rye grass (*Schedonorus arundinaceus*), musk thistle (*Carduus nutans*), and oxeye daisy (*Leucanthemum vulgare*).

STATUS OF SPECIES AND EVALUATION

Species analyzed in the following sections include federally listed species identified by the IPaC and state-listed species identified by the KDFWR Quad Search (Cumberland City Quad) and the OKNP BAT Report.

The following sections provide a brief overview of each federally listed species with the potential to occur identified by the IPaC and the considerations associated with Project development.

Federally Listed Species

Whooping Crane

The whooping crane (*Grus americana*) was originally listed as endangered under the ESA in 1970 due to population declines from shooting and destruction of nesting habitat. Additional influencing factors to the listing include low population numbers, slow reproductive potential, cyclic nesting and winter habitat suitability, a hazardous migration route, and human pressures. The whooping crane is known to occur in the U.S. in Kansas, Louisiana, Montana, Nebraska, North Dakota, Oklahoma, South Dakota, and Texas. There is only one self-sustaining wild population, which nests in Wood Buffalo National Park of Canada and winters in the coastal

marshes in Aransas, Texas. Additionally, there are experimental captive-raised populations (non-essential), including a small migratory population introduced at the beginning of 2001 that migrates between Wisconsin and Florida in an eastern migratory trajectory, and a non-migratory Florida population. The last remaining bird in the experimental Rocky Mountain population died in 2002 (USFWS ECOS 2025a).

Aptly named, the whooping crane alarm is a repeated loud, single-note vocalization (USFWS ECOS 2025a). Whooping cranes only occur in North America and are the tallest bird on the continent, with males reaching heights of up to five feet with a seven-foot wingspan. The weight of adult whooping cranes can vary from approximately 13.2 to 17.2 pounds in wild populations, with captive males averaging 16 pounds and captive females averaging 14 pounds. Adult plumage is typically snowy white, with a few deviations including black primary feathers, a crimson crown, black or grayish specialized feathers, sparse black feathers in the malar region, and a gray black nape.

Whooping cranes have life spans of up to 30 years in the wild, and 35 to 40 years in captivity (USFWS ECOS 2025a). They are monogamous birds, forming pair bonds around two or three years of age; however, the average age of first egg production is around five years of age. Whooping cranes tend to nest annually, but they have been documented to skip a year if they are nutritionally stressed or if there are unsuitable nesting habitat conditions. Eggs are typically laid in late April to mid-May, with an average clutch size of two eggs. Both parents participate in incubation and brood-rearing, with at least one member of the pair always remaining on the nest. The male defends the nest and territory primarily, while females take on feeding responsibilities and care for the young. The migratory behavior of whooping cranes varies, with some birds that live and travel alone, some in pairs, or some in flocks of 50 or more birds, which can include sandhill cranes.

Various habitat types for breeding, migration, and winter include coastal marshes and estuaries, inland marshes, lakes, open ponds, wet meadows and rivers, and pastures and agricultural fields (USFWS ECOS 2025a). Prey items include large larval forms of insects, frogs, rodents, small birds, minnows, and berries. The winter diet of the whooping crane consists primarily of blue crabs, clams, and Carolina wolfberry.

In Kentucky, whooping cranes have been documented wintering in Hopkins, Hardin, Hickman, and Barren counties (ICF 2025). Since the Project Area is not located within these counties, impacts to the species and its habitat from the proposed project are unlikely.

Monarch Butterfly

The monarch butterfly (*Danaus plexippus*) was federally proposed as threatened on December 12, 2024 (USFWS 2024a). There are approximately 4,395 acres (1,778 hectares) of proposed critical habitat for this species in Alameda, Marin, Monterey, San Luis Obispo, Santa Barbara, Santa Cruz, and Ventura counties, California.

Monarchs are a large butterfly with a wingspan between 86-124 mm (Lotts & Naberhaus 2025). The upper side of males is bright orange with wide black borders and black veins, and the hindwing has a patch of scent scales. The upper side of females is orange-brown with wide black borders and blurred black veins. Both sexes have white spots on the borders and apex. The monarch can be found in much of North America, in open habitats from Canada to South America. Monarchs are known for their annual migration and are the only butterfly to regularly migrate north and south (Pyle 1981). Monarchs in central and eastern North America migrate to the mountainous forests of central Mexico, while those in the western portions of North America migrate to the California coast. Monarch habitat is complex but generally includes virtually all patches of milkweed in North America. Overwintering habitats include high-altitude Mexican conifer forests or coastal California conifer and eucalyptus groves, which are critical for the species. Land management changes that impact milkweed include increased herbicide use, excessive roadside mowing, and urban development, among others (USFWS 2024a).

The Project Area contains open prairies, meadows, roadsides, and grassy areas that could provide suitable habitat for the monarch butterfly. Several pollinator-friendly plants were documented within the Project Area during the delineation, such as giant ironweed (*Vernonia gigantea*) and New York ironweed (*Vernonia noveboracensis*). Based on the time of year the habitat assessment and delineation were conducted, milkweed had not yet sprouted; however, proper habitat conditions are present for common milkweed. Therefore, the development of the Project Area could impact monarch individuals. The Applicant is planning to establish a patch of pollinator-supporting plants, which would mitigate the loss of milkweed from the development of the Project Area.

Virginia Big-Eared Bat

The Virginia big-eared bat (*Corynorhinus townsendii virginianus)* was listed as endangered under the ESA on November 30, 1979 (USFWS 1979) and is listed as endangered in the state of Kentucky (OKNP 2019). Designated critical habitat for this subspecies includes Cave Mountain Cave, Hellhole Cave, Hoffman School Cave, and Sinnett Cave in Pendleton County, West Virginia, and Cave Hollow Cave in Tucker County, West Virginia (USFWS 1979).

This bat is an isolated subspecies of Townsend's big-eared bat (*Corynorhinus townsendii*) and is only known from Kentucky, North Carolina, Tennessee, Virginia, and West Virginia (USFWS ECOS 2025b), with the majority of the population in West Virginia (USFWS 2008). In Kentucky, the Virginia big-eared bat is known to occur in ten counties in the eastern portion of the state, but could potentially occur in nine additional counties (USFWS ECOS 2025b). The species is a year-round resident on the northern half of the Daniel Boone National Forest, and the largest known hibernacula for this subspecies in Kentucky are Stillhouse Cave and Cave Hollow Cave in Lee County, Kentucky (USFWS 2008). Several additional summer sites are also known from Lee County and the surrounding counties.

The Virginia big-eared bat roosts in caves and cave-like features year-round and may use the same feature or different features during the winter and summer (USFWS 1984a). These features are typically located in karst areas dominated by oak-hickory and beech-maple-hemlock forests (USFWS 2008). The species is most commonly found in limestone caves; however, it has also been found in schist caves, abandoned mines, rock houses, and cliff lines (Clark 1987, Lacki et al. 1994, Johnson et al. 2005). Maternity colonies typically roost in locations that are farther from the entrance than those used during hibernation.

Foraging habitat occurs in many different forest overstory types but is commonly associated with sandstone and limestone cliff lines and ridgetops. This species also forages over grassy forest openings (old fields) and along forest edges. Forest openings may provide uncluttered foraging space where preferred prey species occur and can be more easily captured. Sandstone rock shelters and small caves are utilized as temporary feeding roosts.

Based on a review of aerial imagery, there are approximately 70 acres of forested habitat within the Project Area (Figure 9), and results of the desktop review identified much of the Project Area as intense karst (Figure 3). Additionally, one potentially suitable portal for bat winter hibernacula was identified within the Project Area by the wetland field crew during the delineation. An additional field investigation conducted by Taylor Culbertson (USFWS Permit ES 948949-2 for listed bat species) deemed the portal unsuitable for bat use. An official report documenting the findings of the portal assessment was submitted to the USFWS Kentucky Field Office (KFO), and final concurrence was received on October 9, 2024.

A mist net survey was also conducted for the Project from May 15-18, 2025. Copperhead biologist Ian Burns (USFWS Permit ES 948949-2 for listed bat species) collected eight individuals from two listed species (six eastern red bats and two evening bats). This suggests the listed species are not likely present within the Project Area during the maternity season or are present in numbers too low to be detected by approved USFWS protocols; therefore, this species will not likely be affected by the proposed project.

Gray Bat

The gray bat (*Myotis grisescens*) was federally listed as endangered on 28 April 1976 (USFWS 1976a) and is listed as threatened in the state of Kentucky (OKNP 2019). This species is primarily found in the cave regions of Alabama, Arkansas, Kentucky, Missouri, and Tennessee, with smaller populations known from Florida, Georgia, Illinois, Indiana, Kansas, Mississippi, North Carolina, Oklahoma, Virginia, and West Virginia (USFWS 2009). The largest concentrations of gray bats are found in and around Mammoth Cave National Park in Edmonson County, located in south-central Kentucky. No critical habitat has been designated or is currently proposed for this species.

The gray bat typically roosts in caves year-round and is often found in large numbers, with colonies of over one million individuals reported (Brady et al. 1982). Habitat requirements for roosts are highly specific, with fewer than five percent of caves representing suitable habitat

(Tuttle 1979). The gray bat utilizes varying types of caves during different times of the year, including caves with deep vertical shafts that provide a cold air trap during winter (hibernacula) and caves with domed ceilings that trap warm air during summer. Hibernacula typically have multiple entrances, good air flow (Martin 2007), and temperatures between 1° and 9° Celsius (C), although 1° to 4° C seems to be preferred (Tuttle & Kennedy 2005). Approximately 95 percent of the total species population hibernates in only nine caves. Maternity colonies are typically found in caves with temperatures between 14° and 25° C that are located within one to four kilometers of a stream or water body (Tuttle 1976, Tuttle & Kennedy 2005). Other caves, known as dispersal caves, are used as roosting sites during migration from maternity caves to hibernacula.

Gray bats are also known to use bridges and culverts as roosting habitat during the spring, summer, and fall. Concrete structures seem to be preferred due to their tendency to retain heat longer than other materials; however, metal and wood structures may also be used with less frequency. Gray bats have been observed using bridges and culverts as both day and night roosts. Bridges used as day roosts are typically constructed of concrete and contain vertical crevices, expansion joints, or other locations that allow bats to retreat into the bridge deck or superstructure (Keeley & Tuttle 1999, Feldhamer et al. 2003, Cleveland & Jackson 2013). Bridges with a concrete deck and concrete or metal girders seem to be preferred as night roosts (Keeley & Tuttle 1999, Kiser et al. 2002). This bridge type retains heat into the night, and the chambers between the girders trap heat rising from under the bridge and provide protection from wind, weather, and predators. Night-roosting bats are typically found on the vertical surface of the girder at the intersection with the underside of the deck, often near the bridge abutments. Areas over land seem to be preferred more than the central portion of the bridge and areas spanning water. Bridges that lack crevices/expansion joints or girders are rarely used as day or night roosts (Ormsbee et al. 2007, Adam & Hayes 2000, Feldhamer et al. 2003); however, structures with cave-like areas or other unique features that provide suitable roosting locations can also provide suitable roosting habitat.

Culverts utilized by gray bats are typically concrete box culverts between five and 10 feet in height; however, this species may also use metal culverts with similar dimensions. These structures are generally 50 feet or longer and provide dark zones, protection from high winds, and are not susceptible to frequent flooding. Roosting locations preferred by gray bats include dark areas with crevices and structural imperfections. Culverts less than five feet high are not generally used as roosting habitat (USFWS 2009).

Gray bats usually forage in riparian areas or over open water bodies such as rivers, streams, lakes, or reservoirs. While foraging, the gray bat consumes a variety of insects, most of which are aquatic-based (Brack & Laval 2006). Studies in Indiana, Kentucky, Alabama, and Missouri have revealed that Trichoptera (caddisflies), Lepidoptera (moths), Coleoptera (beetles), and Diptera (flies) are most frequently consumed, with a total of 14 insect orders documented as prey for this species (Brack et al. 1984, Whitaker et al. 2001, Brack & Laval 2006). Commuting habitat for the gray bat primarily consists of wooded corridors used to travel between roosting and foraging

habitat. Gray bats of all ages, including newly volant young, typically travel in the tree canopy while commuting, which may provide protection from predators (Brady et al. 1982).

Based on a review of aerial imagery, there are approximately 70 acres of forested habitat within the Project Area (Figure 9), and results of the desktop review identified much of the Project Area as intense karst (Figure 3). Additionally, one potentially suitable portal for bat winter hibernacula was identified within the Project Area by the wetland field crew during the delineation. An additional field investigation conducted by Taylor Culbertson (USFWS Permit ES 948949-2 for listed bat species) deemed the portal unsuitable for bat use. An official report documenting the findings of the portal assessment was submitted to the USFWS Kentucky Field Office (KFO), and final concurrence was received on October 9, 2024.

A mist net survey was also conducted for the Project from May 15-18, 2025. Copperhead biologist Ian Burns (USFWS Permit ES 948949-2 for listed bat species) collected eight individuals from two listed species (six eastern red bats and two evening bats). This suggests the listed species are not likely present within the Project Area during the maternity season or are present in numbers too low to be detected by approved USFWS protocols; therefore, this species is not likely to be affected by the proposed project.

Northern Long-eared Bat

The northern long-eared bat (*Myotis septentrionalis*) was federally listed as threatened under the ESA with an interim 4(d) Rule in May 2015, and the final 4(d) Rule was issued in January 2016 (USFWS 2015a, USFWS 2016). On 22 March 2022, the USFWS announced a proposal to reclassify the northern long-eared bat as endangered under the ESA, which was finalized in November 2022 and became effective on 31 March 2023, thus nullifying the 4(d) Rule (USFWS 2022a). This species is listed as endangered in the state of Kentucky (OKNP 2019). No critical habitat has been designated or is currently proposed for this species.

The range of the northern long-eared bat includes the eastern, southern, and north-central United States and all Canadian provinces west to the southern Yukon Territory and eastern British Columbia (USFWS ECOS 2025c). In the United States, the species can be found in the District of Columbia and 38 states, ranging from Maine west to Montana, south to eastern Kansas, eastern Oklahoma, Arkansas, and east to South Carolina (USFWS 2016a, USFWS ECOS 2025c). Historically, northern long-eared bats were most common in the eastern parts of their range and have rarely been captured in the western parts of their range (Caceres & Barclay 2000). However, northern long-eared bat populations in the east have greatly diminished with the arrival of white-nose syndrome, and it is now estimated that the eastern range only supports 17% of the population (USFWS 2016a).

In Kentucky, the northern long-eared bat has been recorded throughout most of the state and likely occurs statewide (KDFWR SWAP 2025). Summer occurrences have been recorded in approximately three-quarters of the counties in the state, with reproductive records (i.e., captures of juveniles or pregnant, lactating, or post-lactating females) in approximately half of the counties.

This species has been found in the majority of Kentucky hibernacula known to harbor bats (USFWS 2015b).

The northern long-eared bat utilizes different habitats during the summer and winter months. Hibernacula, used in winter, vary from large caves and abandoned mines with large entrances and passages to smaller features. Preferred features have relatively constant, cool temperatures (0 to 9° C), high humidity, and minimal air currents (Raesly & Gates 1987, Caceres & Pybus 1997). This species typically roosts in small crevices and cracks in walls and ceilings; however, individuals have also been observed roosting in the open, although less frequently (Caceres & Pybus 1997, Whitaker & Mumford 2009). In addition to mines, northern long-eared bats have been found hibernating in other cave-like, man-made structures (USFWS 2015c).

The USFWS Kentucky Field Office (KFO) provides maps of known habitat in Kentucky for the Indiana and northern long-eared bats (USFWS KFO 2025a, USFWS KFO 2025b). The proposed Project falls within a Swarming 2 area, which is areas used by Indiana bats for swarming (priority three and priority four) and by northern long-eared bats as hibernacula.

Based on a review of aerial imagery, there are approximately 70 acres of forested habitat within the Project Area (Figure 9), and results of the desktop review identified much of the Project Area as intense karst (Figure 3). Additionally, one potentially suitable portal for bat winter hibernacula was identified within the Project Area by the wetland field crew during the delineation. An additional field investigation conducted by Taylor Culbertson (USFWS Permit ES 948949-2 for listed bat species) deemed the portal unsuitable for bat use. An official report documenting the findings of the portal assessment was submitted to the USFWS Kentucky Field Office (KFO), and final concurrence was received on October 9, 2024.

A mist net survey was also conducted for the Project from May 15-18, 2025. Copperhead biologist Ian Burns (USFWS Permit ES 948949-2 for listed bat species) collected eight individuals from two listed species (six eastern red bats and two evening bats). This suggests the listed species are not likely present within the Project Area during the maternity season or are present in numbers too low to be detected by approved USFWS protocols; therefore, this species is not likely to be affected by the proposed project.

Indiana Bat

The Indiana bat (*Myotis sodalis)* was originally listed as in danger of extinction under the ESA, and formally attained endangered species status on 11 March 1967 (USFWS 2007) and is listed as endangered in the state of Kentucky (OKNP 2019). The USFWS identified critical habitat for the species, which consists of mines and caves found in Illinois, Indiana, Kentucky, Missouri, Tennessee, and West Virginia (USFWS 1976b). In Kentucky, there are two caves listed as critical habitat: Bat Cave in Carter County and Coach Cave in Edmonson County. The USFWS and the Indiana Bat Recovery Team developed an Indiana Bat Recovery Plan in 1983 (USFWS & Indiana Bat Recovery Team 1983), which was revised in 1996, was published as an agency draft in 1999 (USFWS 1999), and finalized for publication in April 2007 (USFWS 2007).

The species ranges from Michigan and parts of New York in the north, west of the Appalachian Mountains, south to the northern half of Alabama, and west to Arkansas, Missouri, and southern Iowa (USFWS ECOS 2025d). In Kentucky, the Indiana bat may occur statewide, and there is one hibernaculum record currently in Wayne County, identified as the "Wind" hibernaculum (USFWS 2019a).

Indiana bats use different habitat types in the winter and summer. In the winter months, Indiana bats hibernate in large numbers in a few caves that provide an adequate microclimate (USFWS 2007). The most successful hibernacula have temperatures between 37.4–45°F (3.0-7.2°C) and have a chimney-effect air flow between at least two entrances (Tuttle and Kennedy 2002). Brack and LaVal (2006) suggest hibernacula below 41°F (5°C) are too cold. Humidity could be an important hibernacula characteristic (USFWS 2007); however, Tuttle & Kennedy (2002) document that it was not as important as temperature. Indiana bats typically form large, dense clusters on cave ceilings and will also congregate in small clusters (Laval & LaVal 1980, Brack 1983, Hicks & Novak 2002, Johnson et al. 2002). Hibernation occurs from October to late April and early May (Hall 1962).

During summer months, Indiana bats roost in a variety of habitats, including riparian zones, bottomland and floodplain habitats, wooded wetlands, and upland communities (Humphrey et al. 1977, MacGregor et al. 1999, Gumbert 2001, Britzke et al. 2003, USFWS 2007). Carter et al. (2002) found that roosting areas contained more surface water features (e.g., ponds, lakes) than randomly chosen sites.

Roosts are typically located within canopy gaps, fencerows, or along wooded edges (USFWS 2007). Most known maternity roosts have been found in or near wooded areas where some light gap is present, allowing full or partial solar exposure to the roost site. Range-wide, Indiana bats have been found to roost in over 33 species of trees (Kurta 2005). While Indiana bats probably utilize tree species according to their availability, roost choice is probably more a reflection of roost character (i.e., condition, usable bark, amount of solar exposure, tree size, distance to water resources, elevation) than species (Humphrey et al. 1977, Gardner et al. 1991a, Callahan et al. 1997, USFWS 2007). Roosting characteristically occurs under the exfoliating bark of dead or live trees, but Indiana bats have also been found to use cavities or crevices of live-damaged trees (Gardner et al. 1991a, Kurta & Williams 1992, Gumbert 2001) and artificial roost structures (e.g., BrandenBark™, (Gumbert et al. 2013)). There is some evidence that suggests Indiana bats exhibit fidelity to summer roosting areas and even specific trees from year to year (Garner & Gardner 1992, Gumbert 2001).

The Indiana bat is an insectivorous species, consuming a variety of small, soft-bodied flying insects. Food sources are predominantly Lepidoptera (moths), but also include Coleoptera (beetles), Diptera (flies), Trichoptera (caddisflies), and Plecoptera (stoneflies) (Laval & LaVal 1980, Thomson 1982). Foraging is concentrated in wooded areas (LaVal et al. 1977, Gardner et al. 1991b, Butchkoski & Hassinger 2002). LaVal et al. (1977) found that during summer, females

and juveniles forage within or near the tree foliage of riparian and floodplain areas, but adult males typically forage over densely wooded areas along ridges and hillside forests (Kiser & Elliot 1996). This species also forages over clearings with early successional habitat, such as clearcuts, and along the edges of forest openings (Gardner et al. 1991a).

The USFWS KFO provides maps of known habitat in Kentucky for the Indiana and northern long-eared bats (USFWS KFO 2025a, USFWS KFO 2025b). The Project Area is located within known non-maternity Indiana bat habitat. Non-maternity habitat is considered suitable summer habitat that is used by non-reproductive adult females and/or males. The proposed Project falls within a Swarming 2 area, which is areas used by Indiana bats for swarming (priority three and priority four) and by northern long-eared bats as hibernacula. The Project Area is also located within a Swarming 1 area (priority one and priority two hibernacula swarming areas). Indiana at priority one hibernacula is defined as being essential to the recovery and long-term conservation of Indiana bats, a current and/or historically observed winter population of greater than or equal to 10,000 individuals and currently has suitable and stable microclimates. Priority two hibernacula are defined as contributing to the recovery and to the long-term conservation of Indiana bats, having a current or observed historic population of 1,000 or greater but fewer than 10,000 and an appropriate microclimate (USFWS 2007).

Based on a review of aerial imagery, there are approximately 70 acres of forested habitat within the Project Area (Figure 9), and results of the desktop review identified much of the Project Area as intense karst (Figure 3). Additionally, one potentially suitable portal for bat winter hibernacula was identified within the Project Area by the wetland field crew during the delineation. An additional field investigation conducted by Taylor Culbertson (USFWS Permit ES 948949-2 for listed bat species) deemed the portal unsuitable for bat use. An official report documenting the findings of the portal assessment was submitted to the USFWS Kentucky Field Office (KFO), and final concurrence was received on October 9, 2024.

A mist net survey was also conducted for the Project from May 15-18, 2025. Copperhead biologist Ian Burns (USFWS Permit ES 948949-2 for listed bat species) collected eight individuals from two listed species (six eastern red bats and two evening bats). This suggests the listed species are not likely present within the Project Area during the maternity season or are present in numbers too low to be detected by approved USFWS protocols; therefore, this species is not likely to be affected by the proposed project.

Tricolored Bat

The tricolored bat (*Perimyotis subflavus*) was federally listed as proposed endangered on 13 September 2022 (USFWS 2022b) and is listed as threatened in the state of Kentucky (OKNP 2019). Along with the Indiana and northern long-eared bats, tricolored bats have been heavily impacted by white-nose syndrome, and it is the main reason for their proposed listing.

Tricolored bats are geographically located from southeastern Canada south to Honduras and west through Oklahoma (Silvis et al. 2016). Tricolored bats are generally regional migrants but

can also display partial and differential migratory behavior (Fraser et al. 2012, Samoray et al. 2019). They typically leave their hibernacula from mid-April to early May and arrive at their maternity colonies shortly thereafter (Whitaker 1998, Silvis et al. 2016). Parturition occurs around late May to early July to one or two pups, with juveniles volant after about a month (Whitaker 1998). Fall migration may be in mid-August, with bats entering their hibernacula between late September to mid-October (Silvis et al. 2016). Like other eastern U.S. bats, mating occurs in the fall, and sperm is stored until after spring emergence.

Tricolored bats typically roost in dead or live foliage in the summer (Veilleux et al. 2003, Perry & Thill 2007) and hibernate in caves, culverts, rock crevices, and mines (USFWS 2022b). They have also been documented using bridges, decks, and buildings, as well as artificial roost structures such as rocket boxes and bat houses in the summer (Whitaker 1998, Cervone et al. 2016). While habitat availability is not a limiting factor for the species (Silvis et al. 2016), Perry and Thill (2007) found that tricolored bats prefer mature hardwood forests that contain abundant midstory hardwoods. Perry & Thill (2007) also found that tricolored bat roosts were primarily in unharvested greenbelts, which contained abundant midstory hardwoods. Silvis et al. (2016) suggest that while habitat availability is not a limiting factor for the species, tree felling activities and habitat manipulation should be limited during the active maternity season.

Based on a review of aerial imagery, there are approximately 70 acres of forested habitat within the Project Area (Figure 9), and results of the desktop review identified much of the Project Area as intense karst (Figure 3). Additionally, one potentially suitable portal for bat winter hibernacula was identified within the Project Area by the wetland field crew during the delineation. An additional field investigation conducted by Taylor Culbertson (USFWS Permit ES 948949-2 for listed bat species) deemed the portal unsuitable for bat use. An official report documenting the findings of the portal assessment was submitted to the USFWS Kentucky Field Office (KFO), and final concurrence was received on October 9, 2024.

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Spectaclecase

The spectaclecase (*Cumberlandia monodonta*) was listed as endangered effective 12 April 2012 (USFWS 2012a) and is listed as endangered in the state of Kentucky (OKNP 2019). Habitat degradation and destruction through impoundment, siltation, and pollution are major contributors to this species' decline and continued persistence (KDFWR SWAP 2025). Approximately 1,839 river kilometers comprising twelve units were designated as proposed critical habitat for the spectaclecase on 13 December 2024 (USFWS 2024c). Within Kentucky, 125

river kilometers are designated on the Green River in Hart, Edmonson, Warren, and Butler Counties.

A relatively large mussel, the spectaclecase often reaches at least 23.5 cm in length (USFWS 2022c). The exterior of the shell is elongate, roughly textured, and dark in color. The nacre is white, and the teeth are poorly developed. Confirmed host species for spectaclecase mussel larvae include mooneye (*Hiodon tergisus*) and goldeye (*H. alosoides*), with natural infestations also observed on bigeye chub (*Hybopsis amblops*) and pealip redhorse (*Moxostoma pisolabrum*) (USFWS 2024c). Females are short-term brooders, spawning in the spring and releasing glochidia in the late summer or fall (USFWS 2022c). Juvenile spectaclecase mussels may reach sexual maturity at four to seven years of age, and individuals may live up to 50 years.

The spectaclecase is known from the Upper Mississippi, Lower Missouri, Ohio, Cumberland, Tennessee, and Lower Mississippi River systems, with a historic range that spans much of the eastern and central United States (USFWS 2012a). The current range of the spectaclecase in Kentucky includes the Lower Cumberland, Lower Mississippi-Memphis, Lower Ohio, Lower Ohio-Bay, Lower Tennessee, South Fork Cumberland, Upper Cumberland-Lake Cumberland, and Upper Green watersheds (KDFWR SWAP 2025). The Project Area is located within the Upper Cumberland watershed, which is within the "Historic Only" range for this species.

The spectaclecase inhabits substrates from mud and sand to gravel, cobble, and boulders in quiet water near the interface with swift currents (USFWS 2022c). Specimens have been reported in tree stumps, in root masses, and in beds of rooted vegetation where it can be locally abundant. The species is generally restricted to large streams, often in deep water.

The Project Area is located within the Upper Cumberland watershed, which is within the known historic range for this species (KDFWR SWAP 2025). The spectaclecase is extirpated from greater than 50% of its historically occupied drainages in Kentucky (Haag & Cicerello 2016). Therefore, the spectaclecase is not likely to be found within the Project Area, and impacts to the species and its habitat as a result of the proposed project are unlikely.

Fanshell

The fanshell (*Cyprogenia stegaria*) was listed as endangered in 1990 (USFWS 1990) and is listed as endangered in the state of Kentucky (OKNP 2019). No critical habitat has been designated or is currently proposed for this species.

These mussels are most often associated with stable substrates of firm sand and gravel (KDFWR SWAP 2019). They are usually found at depths of less than three feet in strongly flowing water in medium-sized to large streams. In Kentucky, historic records are known from the Ohio, Salt, Licking, Big Sandy (doubtful record), Tygarts, Kentucky, Red, Cumberland, Tennessee, Green, Barren, and Clarks River systems. The fanshell is extirpated from greater than 50% of its historically occupied drainages in Kentucky and only three known populations remain in Kentucky (apart from a reintroduction in the Tennessee River), which include a short stretch of

the Rolling Fork River and likely the two largest populations of this species on Earth, the Green River and Licking River (Haag & Cicerello 2016). The current range for this species in Kentucky includes the Barren, Licking, Lower Tennessee, Middle Green, Middle Ohio-Laughery, Rolling Fork, and Upper Green watersheds (KDFWR SWAP 2025). The Project Area is located within the Upper Cumberland watershed, which is within the "Historic Only" range for this species.

The Project Area is located within the Upper Cumberland watershed, which is within the known historic range for this species. Nine intermittent streams and two perennial streams, including one named waterbody (Potts Creek), were identified during the wetland and stream delineation (Copperhead Environmental Consulting 2025b). However, the Project Area does not intersect with the Tennessee, Rolling Fork, Green, or Licking Rivers, which are home to the three known extant populations in Kentucky. Therefore, the fanshell is not likely to be found within the Project Area, and impacts to the species and its habitat as a result of the proposed project are unlikely.

Dromedary Pearlymussel

The dromedary pearlymussel (*Dromus dromas*) was listed as endangered under the ESA on 14 June 1976 (USFWS 1976c) and is listed as endangered by the state of Kentucky (OKNP 2019). The species range includes Kentucky, Tennessee, and Virginia. In Kentucky, it is only believed to occur in the South Fork Cumberland watershed (KDFWR SWAP 2025). The Project Area is located within the Upper Cumberland watershed, which is within the "Historic Only" range for this species. Water quality degradation (pollution, siltation), habitat loss due to channel dredging, impoundment of rivers and tributaries, and invasive species are cited reasons for the species' endangerment. No critical habitat has been designated or is currently proposed for this species.

The Project Area is located outside the current range for this species; therefore, impacts to the species and its habitat as a result of the proposed project are unlikely.

Cumberlandian Combshell

The Cumberlandian combshell (*Epioblasma brevidens*) was listed as endangered under the ESA on 10 January 1997 (USFWS 1997) and is listed as endangered by the state of Kentucky (OKNP 2019). Habitat degradation related to siltation and pollution is considered a major cause of historic population declines and remains a threat to the species' persistence (USFWS 2019b). Critical habitat for the Cumberlandian combshell is designated across five states (Alabama, Kentucky, Mississippi, Tennessee, and Virginia) in seven units (USFWS 2004a). Within Kentucky, the critical habitat includes approximately 102 river kilometers of occupied habitat within Big South Fork and its tributaries in McCreary County and Buck Creek in Pulaski County.

The species ranges across watersheds in Alabama, Kentucky, Mississippi, Tennessee, and Virginia. Within Kentucky, the species occurs primarily in the middle Cumberland River drainage in Pulaski and McCreary counties, and one historic Red River system population is presumed extirpated (Haag & Cicerello 2016).

Cumberlandian combshell is yellow to tawny brown with broken green rays covering the exterior of its shell (USFWS 2004b). The nacre is white, and the periostracum is smooth. The species displays sexual dimorphism, with females exhibiting inflated shells with serrations along a portion of the shell margin. This species typically inhabits relatively large stream sections with high-energy flows, high water quality, and rocky substrates with coarse sand, gravel, cobble, and boulders (USFWS 2004b). Spawning occurs in the fall, and glochidia may be released throughout the year. Host fish species for glochidia include darters (Percidae) and sculpins (Cottidae) (Haag & Cicerello 2016).

The Project Area is located outside the current range for this species; therefore, impacts to the species and its habitat as a result of the proposed project are unlikely.

Oyster Mussel

The oyster mussel (*Epioblasma capsaeformis*) was listed as endangered under the ESA effective on 10 February 1997 (USFWS 1997) and is listed as endangered in the state of Kentucky (OKNP 2019). Pollution, siltation, and gravel mining are major sources of habitat degradation that have contributed to the decline of this species throughout its range. Critical habitat was designated for the oyster mussel on 30 September 2004 (USFWS 2004a). Approximately 324 river kilometers comprise 10 units of designated critical habitat for this species. Within Kentucky, 101 river kilometers of unoccupied designated habitat occur along the main stem of the Big South Fork in McCreary County and Buck Creek in Pulaski County.

This species, now considered to be a species complex comprised of at least two morphologically differentiated species (Haag & Cicerello 2016), historically occurred across six states, including Alabama, Georgia, Kentucky, North Carolina, Tennessee, and Virginia. The oyster mussel is believed to be extirpated from the Cumberland River drainage, and no known extant populations occur within the state of Kentucky (USFWS 2024b, Haag & Cicerello 2016).

The oyster mussel has a dullish, yellow to green shell with numerous narrow dark green rays, and the nacre is whiteish to bluish white. Mantle pad colorations within the species complex may vary from white to blue to greyish or black (USFWS 2004a). Spawning occurs in the fall, and larvae overwinter within brooding females until the spring. Spawning females move to the substrate surface and deploy small lure-like projections to attract host fish species (USFWS 2004b). Females may be reproductively active as early as 5 years of age, and confirmed host fish species for larvae include darters (Percidae) and sculpin (Cottidae).

This species inhabits small to large rivers in areas with coarse sand, gravel, and boulder substrates and moderate to swift currents. It may occur in gravel pockets along bedrock ledges and has been found in association with beds of water-willow (*Justicia americana*) (USFWS 2004a).

The Project Area is located outside the current range for this species, and there are no known extant populations of this species within the State of Kentucky; therefore, impacts to the species and its habitat as a result of the proposed project are unlikely.

Snuffbox

The snuffbox (*Epioblasma triquetra*) was listed as endangered under the ESA on February 14, 2012 (USFWS 2012b) and is listed as endangered in the state of Kentucky (OKNP 2019). Approximately 3,979 river kilometers in 38 units are proposed as critical habitat for this species (USFWS 2024c). The critical habitat in Kentucky does not intersect the Project Area.

This species is usually found in small- to medium-sized streams but does not penetrate far into headwater streams (Haag & Cicerello 2016). They can be found in water as shallow as two inches to two feet, usually in shallower areas of moderate to swiftly flowing water. In Kentucky, the snuffbox is associated with the river systems of the Licking, Green, Tygarts, Kinniconick, Little Sandy, Red(s), Barren, Cumberland, Salt, Rolling Fork, and parts of the Rockcastle River. Distribution is sporadic and nearly statewide. In Kentucky, there are only eight surviving populations, all of which are small and in decline (Haag & Cicerello 2016).

The Project Area is located outside the current range for this species; therefore, impacts to the species and its habitat as a result of the proposed project are unlikely.

Tan Riffleshell

The tan riffleshell (*Epioblasma florentina walkeri*) was listed as endangered under the ESA on 23 August 1997, effective 26 September 1977 (USFWS 1977), and is listed as endangered by the state of Kentucky (OKNP 2019). Historically, habitat degradation and destruction through siltation, inundation, and pollution have contributed to declines of this subspecies (USFWS 1984b). No critical habitat has been designated or is currently proposed for this species.

Historic records of the tan riffleshell are known from the Tennessee and Cumberland River drainages in Tennessee, Kentucky, and Virginia (USFWS 2021b). However, extant populations are known only from a two-mile stretch of Indian Creek in Virginia and a single 12-mile reach of the Big South Fork in Tennessee and Kentucky.

The tan riffleshell has a dull brownish green to yellow-green exterior, the valves are covered in faint green rays, and the nacre is a bluish white (USFWS 1984b). Female shells are inflated posteriorly and may appear multi-lobed. Confirmed host fish species for tan riffleshell larvae include various darters (Percidae) and sculpins (Cottus) (Rogers et al. 2001). The species is considered a long-term brooder, spawning in the fall and releasing glochidia the following summer in May and June. Individuals may live less than 15 years (Rogers et al. 2001). The tan riffleshell inhabits creeks to medium rivers, often residing in the shoals of main channels on gravel and sand substrates (Haag & Cicerello 2016).

The Project Area is located outside the current range for this species; therefore, impacts to the species and its habitat as a result of the proposed project are unlikely.

Longsolid

The longsolid (*Fusconaia subrotunda*) was listed as threatened with a 4(d) rule under the ESA on 9 March 2023 (USFWS 2023a) and is listed as a species of special concern by the state of Kentucky

(OKNP 2019). Threats to this species include habitat degradation from siltation, pollution, and inundation, as well as the spread of invasive species such as the zebra mussel (*Dreissena polymorpha*).

The longsolid ranges throughout the Ohio, Cumberland, and Tennessee River Basins, and is considered extirpated from the Great Lakes Basin (USFWS 2023a). It occurs across Alabama, Kentucky, New York, North Carolina, Ohio, Pennsylvania, Tennessee, Virginia, and West Virginia, and approximately 60 known populations persist today (USFWS 2022d). Within Kentucky, the species is known to occur in the Green River, Kentucky River, Licking River, and Big Sandy River drainages, with the largest remaining populations in Green and Licking Rivers (Haag & Cicerello 2016). USFWS designated critical habitat for the longsolid on 9 March 2023 (USFWS 2023a). Approximately 1,794 river kilometers comprise 12 units of designated critical habitat in Pennsylvania, Kentucky, West Virginia, Virginia, Tennessee, and Alabama. Within Kentucky, approximately 320 river kilometers were designated in two units along the Green and Licking Rivers.

The longsolid reaches lengths up to 125 mm (USFWS 2022d). Shells are light brown with a dull sheen but tend to elongate and darken noticeably with age. Juveniles may have a bold green ray pattern near the dorsal margin. Individuals from different habitats may exhibit varying degrees of shell inflation, with more compressed morphotypes occurring closer to headwaters. Like in other members of the genus *Fusconaia*, larvae of the longsolid are presumed to parasitize minnows (Cyprinidae), stonerollers (Campostoma), shiners (*Cyprinella, Notropis,* and *Luxulis*), and sculpins (*Cottus*) (Haag & Cicerello 2016, USFWS 2022d). It is a short-term brooder, and females are typically gravid from May - July. Lifespans likely average 25 to 35 years, but some individuals may live up to 50 years in the wild (USFWS 2022d).

The longsolid inhabits gravel and sand substrates of medium to large-sized streams, occupying primarily main-channel habitat (Haag & Cicerello 2016). The species is generally associated with deeper, slow-moving habitats, and may be found at depths ranging from less than one to more than six meters.

The Project Area is located outside the current range for this species; therefore, impacts to the species and its habitat as a result of the proposed project are unlikely.

Pink Mucket

The pink mucket (*Lampsilis abrupta*) was listed as endangered under the ESA on 14 June 1976 (USFWS 1976c) and is listed as endangered in the state of Kentucky (OKNP 2019). Threats to this species include invasive species, reduction in host fish populations, alteration of water flow, population isolations, and river channelization (Strayer 2009). No critical habitat has been designated or is currently proposed for this species.

This species is a freshwater mussel with a thick, oval to elongated shell that is up to four inches (10.2 cm) in length (INHS 2025a). Sexual dimorphism is present within this species, resulting in

females being more inflated than males. The periostracum is smooth and has varying colorations ranging from yellow-green to dark brown. In younger individuals, green rays are more prominent. The nacre is bright pink to salmon in color, and the overall shell color and shape can fluctuate between populations; however, the nacre coloration remains consistent (Parmalee & Boga 1998, Watters et al. 2009).

The pink mucket is reliant on host species to allow the glochidia to become attached to the gills, allowing for metamorphosis to reach fruition, enabling the mussels to become juveniles. To lure fish in, the female has lures that mimic prey species and attract the potential host fish, such as smallmouth bass (*Micropterus dolomieu*) and largemouth bass (*Micropterus salmoides*) (USFWS 2024d, Watters et al. 2009). The pink mucket utilizes large rivers that have moderate to swift currents that contain cobble, sand, and gravel substrates in shallow water. This species is found in riffle areas and shoals as they provide optimal conditions for reproduction and feeding. Clean, well-oxygenated, stable habitats are needed as this species is susceptible to siltation, water quality deterioration, and damming (Vaughn & Hakenkamp 2001, NatureServe 2025a).

Historically, this species was widespread throughout the Mississippi River, Cumberland River, and Tennessee River systems. However, the pink mucket is extirpated from greater than 50% of its historically occupied drainages in Kentucky (Haag & Cicerello 2016). Only isolated populations survive in the Green River, Rockcastle River, Buck Creek, and Upper Big South Fork in Kentucky, and the Duck River, Pickwick Landing Dam, Guntersville Reservoir, and the Lower Big South Fork in Tennessee (NatureServe 2025a). Reduced populations have been recorded in the Lower Ohio River, specifically near dam outflows. Sporadic population accounts have been recorded in the St. Francis River in Missouri (USFWS 2024d).

The Project Area is located outside the current range for this species; therefore, impacts to the species and its habitat as a result of the proposed project are unlikely.

Ring Pink

The ring pink (*Obovaria retusa*) was listed as endangered under the ESA on 29 September 1989 (USFWS 1989) and is listed as endangered in the state of Kentucky (OKNP 2019). The ring pink is extremely sensitive to habitat fragmentation, siltation, pollution, river impoundment, dam construction, and channel modification (Strayer 2008). No critical habitat has been designated or is currently proposed for this species.

This species is a freshwater mussel that has a thick, inflated shell that ranges from 5 to 7 cm in length. The periostracum is subtriangular to rounded in shape with a smooth and pronounced umbonal ridge. The coloration ranges from yellow-brown to green-brown in juveniles; in adults, the coloration darkens and appears browner. The nacre has a pink to reddish hue and occasionally can be iridescent along the margins. The shell has well-developed teeth on the hinge (Parmalee & Bogan 1998, Watters et al. 2009).

The ring pink is reliant on host fish species for reproduction as it attaches glochidia to the gills, where they will remain until they become juveniles. The specific host species is unknown for the ring pink, highlighting a significant obstacle for species recovery (USFWS 1989). Historically, this species inhabited Alabama, Kentucky, Tennessee, Indiana, Illinois, and Ohio. Currently, the only known populations are in the Wilson Reservoir in northern Alabama (USFWS 1989, NatureServe 2025b). This species thrives in deep, medium to large rivers that have sandy or stable gravel substrates and moderate or swift current flows.

The Project Area is located outside the current range for this species; therefore, impacts to the species and its habitat as a result of the proposed project are unlikely.

Rough Pigtoe

The rough pigtoe (*Pleurobema plenum*) was listed as endangered under the ESA on 14 June 1976 (USFWS 1976c) and is listed as endangered in the state of Kentucky (OKNP 2019). No critical habitat has been designated or is currently proposed for this species.

This species is a freshwater mussel with a thick, heavy shell that is oval to subquadrate in shape. This species ranges from 6 to 10 cm in length, and the periostracum ranges in coloration from yellow brown to dark brown. With age, the shell can develop a rough, granular texture, more prominently seen in males (NatureServe 2025c). The posterior ridge is prominent and can have bumps or tubercles. The nacre is white to bluish white and displays subtle iridescence (Parmalee & Bogan 1998).

Like many freshwater mussels, the rough pigtoe reproduces by attaching glochidia to the gills of host fish before the larvae metamorphose into juveniles. The specific host species for the rough pigtoe has not been confirmed; however, it is suspected to utilize small-bodied benthic species such as darters (Percidae) and minnows (Cyprinida*e*) (USFWS 1976c, Watters et al. 2009). This species thrives in medium to large rivers that have moderate to swift currents and provide substrates of sand or stable gravel. Well-oxygenated waters are required with no occurrence of siltation, both of which make the species highly vulnerable to land use changes and upstream sediment inputs (Strayer 2008).

The rough pigtoe is endemic to Cumberland, Ohio, and Tennessee river systems but has been reduced in range to small areas within the Green River, Duck River, and Clinch River due to pollution, habitat alteration, damming, and channelization (USFWS 1976ca, NatureServe 2025c).

The Project Area is located outside the current range for this species; therefore, impacts to the species and its habitat as a result of the proposed project are unlikely.

Fluted Kidneyshell

The fluted kidneyshell (*Ptychobranchus subtentus*) was listed as federally endangered on September 26, 2013 (USFWS 2013a) and is listed as endangered in the state of Kentucky (OKNP 2019). Approximately 1,899 river kilometers comprising 24 units were designated as critical

habitat for this species on 26 September 2013 (USFWS 2013b). Within Wayne County, critical habitat was designated on a 65.5 river kilometer section of the Little South Fork Cumberland River.

The fluted kidneyshell reaches about 13 cm in length, is roughly oval and elongate, and the valves are moderately inflated. The posterior slope of each valve features a series of flutings. Shells are smooth, shinier, and greenish yellow in young specimens, and grow duller and browner with age. They have both pseudocardinal teeth, which are stumpy and triangular, and lateral teeth that are nearly straight. The nacre is bluish-white to dull white with some salmon color in the beak cavity (Parmalee & Bogan 1998).

The habitat for the fluted kidneyshell is primarily shoal in small to large rivers. It can be found in substrates mixed with sand and gravel, and occasionally found near or under cobble and boulders that have smaller substrates near margins. It does not tend to do well in lentic habitats or areas with heavy deposits of fine material (Parmalee & Bogan 1998). The range for this species spans across Alabama, Kentucky, Tennessee, and Virginia. It is known to or is believed to occur in eleven Kentucky counties, including Wayne County.

The Project Area is located within the Upper Cumberland watershed, which is within the "Historic Only" range for this species (KDFWR SWAP 2025); however, USFWS has identified Wayne County, Kentucky, as a county in which this species is known or believed to occur and has identified critical habitat within the county. Nine intermittent streams and two perennial streams, including one named waterbody (Potts Creek), were identified during the wetland and stream delineation (Copperhead Environmental Consulting 2025b). The streams located within the Project Area may contain suitable habitat for the fluted kidneyshell. However, no instream work would occur during the development of the Project Area, and a 50 ft setback would be applied to all water features identified in the Project Area. Therefore, it is unlikely that there would be impacts to this species or its habitat as a result of the proposed project.

Rabbitsfoot

The rabbitsfoot (*Theliderma cylindrica*) was listed as endangered under the ESA on January 10, 1997 (USFWS 1997) and is listed as endangered in the state of Kentucky (OKNP 2019). The rabbitsfoot is sensitive to habitat degradation, invasive species, damming, habitat fragmentation, decreasing host species populations, and declining suitability in range locations (USFWS 2013d, Strayer 2008, Vaughn & Hakenkamp 2001). Approximately 2,312 river kilometers in Alabama, Arkansas, Illinois, Indiana, Kansas, Kentucky, Mississippi, Missouri, Ohio, Oklahoma, Pennsylvania, and Tennessee were designated as critical habitat for this species on April 30, 2015 (USFWS 2015d). The critical habitat does not intersect the Project Area.

This species is a freshwater mussel that has a slightly elongate oval to cylindrical shell ranging from 5 to 13 cm in length. The periostracum is yellow-green to brown, displaying wavy, fine green rays. With age, the rays may fade and become less prominent, and the shell becomes worn and dark. The nacre is white to bluish white and is slightly iridescent; this iridescence becomes

more prominent towards the posterior margin. The shell is thin and compressed, more so in females, which develop an expanded posterior end (Parmalee & Bogan 1998, Watters et al. 2009).

The rabbitsfoot reproduces by internally fertilizing eggs and attaching the glochidia larvae to the gills of host fish, on which it is reliant. The larvae will stay on the gills of species such as bluegill (*Lepomis macrochirus*), spotted bass (*Micropterus punctulatus*), white crappie (*Pomoxis annularis*), and freshwater drum (*Aplodinotus grunniens*) until they reach the juvenile stage and will subsequently drop off into the substrate below (USFWS 2013d, Watters et al. 2009). The rabbitsfoot mussel requires medium to large rivers that provide free-flowing, well-oxygenated waters with stable sand and gravel substrates, although it will shallowly burrow in substrate and is commonly found in river runs or riffles with moderate current velocity (Vaughn & Spooner, 2006). The species is currently found in various rivers throughout North America, four in Arkansas, three in Mississippi, four in Missouri, two in Ohio, three in Oklahoma, two in Tennessee, one in Indiana, and two in Kentucky (USFWS 2013d, NatureServe 2025d).

The Project Area is located outside the current range for this species; therefore, impacts to the species and its habitat as a result of the proposed project are unlikely.

Cumberland Bean

The Cumberland bean (*Villosa trabalis*) was listed as federally endangered on 14 September 1976 (USFWS 1976c) and is listed as endangered in the state of Kentucky (OKNP 2019). This species is endangered by excessive siltation, pollution, and habitat loss due to impoundments. No critical habitat has been designated for this species.

The Cumberland bean inhabits clean, fast-flowing water and depths less than one meter in substrate, which contain relatively firm rubble, gravel, and sand swept-free from siltation. It can be found buried in shallow riffles and shoal areas under large rocks that must be removed to inspect the habitat (Gordon & Layzer 1989). One known host species is the buck darter (*Etheostoma nebra*), which has also undergone range reduction (Near & Thomas 2015).

The range for this species spans across Kentucky and Tennessee. The species is endemic to the upper Cumberland River drainage, with populations restricted to Buck Creek, Rockcastle River, and Big South Fork. (Haag & Cicerello 2016).

The Project Area is located outside the current range for this species; therefore, impacts to the species and its habitat as a result of the proposed project are unlikely.

State Listed Species

Although state-listed species in Kentucky are not protected by legislation or regulation, Copperhead reviewed each species identified through the KDFWR Species Search by Quad (Cumberland City Quad), and the OKNP BAT. The KDFWR Cumberland City quad search identified thirteen state-listed species, and the OKNP BAT report identified six state-listed species. One species, the pyramid pigtoe (*Pleurobema rubrum*), was eliminated from this list

because this species has been extirpated from greater than 50% of its historically occupied drainages within Kentucky, including the Cumberland River by the Wolf Creek Dam (Haag & Cicerello 2016). The remaining state-listed species are described in further detail below.

Henslow's Sparrow

The Henslow's sparrow (*Centronyx henslowii*) is listed as a species of special concern in Kentucky (OKNP 2019). This species is a migratory bird that prefers open habitats with thick vegetation, such as fallow fields and pastures, during the breeding season (NatureServe 2025e). During the migration and non-breeding seasons, they prefer grassy areas near pines and second-growth woods. The Henslow's sparrow is a small bird covered in an olive-brown color, with a dark spot behind the eyes. They also have dark stripes along their crown and rusty colored wing tips (National Audubon Society 2025).

Based on a record search and site reconnaissance, the Project Area does appear to contain suitable habitat for the Henslow's sparrow. Additionally, the nearest eBird sighting of Henslow's sparrow is approximately 4.07 miles southeast of the Project Area (Sullivan et al. 2009). The Project Area contains fallow fields and pastures that this species may utilize during the breeding season. The proposed project would include the construction of a solar facility in these areas; therefore, this species could be impacted by the proposed project. Individuals would likely use available similar habitat nearby.

Dark-eyed Junco

The dark-eyed junco (*Junco hyemalis*) is listed as a species of special concern in Kentucky (OKNP 2019). This species is a medium-sized sparrow characterized by a rounded head, a long tail, and a relatively small, pale bill (Cornell University 2025). All juncos have prominent white outer tail feathers. Dark-eyed juncos are birds of the ground; they hop around the bases of trees and shrubs in forests or venture out onto lawns looking for fallen seeds. They generate high chip notes while foraging or intensifying as they take short, low flights through cover. Dark-eyed juncos breed in coniferous or mixed-coniferous forests in the Appalachians. During winter, they can be found in open woodlands, fields, parks, roadsides, and backyards.

Based on a record search and site reconnaissance, the Project Area does appear to contain suitable habitat for the dark-eyed junco. Additionally, the nearest eBird sighting of a dark-eyed junco is 1.59 miles west of the Project Area (Sullivan et al. 2009). Although the Project Area lacks coniferous forests, it does contain fields that this species may utilize during the winter. The proposed project would include the construction of a solar facility in these areas; therefore, this species could be impacted by the proposed project. Individuals would likely use available similar habitat nearby.

Northern Shoveler

The northern shoveler (*Spatula clypeata*) is listed as endangered in the state of Kentucky (OKNP 2019). This species is a medium-sized duck that is known for its spoon or shovel-shaped bill (Cornell University 2025). The northern shoveler can be found nesting on the ground within

grasslands and freshwater wetlands during the breeding season and in a variety of habitats during winter and migration (NatureServe 2025f). These habitats include wetlands, flooded agricultural fields, coastal lagoons, estuaries, freshwater marshes, lakes, and reservoirs. Non-breeding males are mottled brown with a slightly darker head, while breeding males can have a green head, white breast, and chestnut-brown sides (Cornell University 2025). Females are mottled brown/gray, with a lighter brown head with an eyestripe behind the eye. Both breeding males and females have a blue patch on their upper wings, although it can be duller in females.

Based on a record search and site reconnaissance, the Project Area does appear to contain suitable habitat for the northern shoveler. Additionally, according to eBird, a northern shoveler was observed inside the Project Area on March 1, 2016 (Sullivan et al. 2009). The Project Area contains freshwater wetlands that this species may utilize during the breeding season or during winter and migration; however, the Applicant plans to avoid these areas and implement a 50-foot setback from all water features. Therefore, it is unlikely that there would be impacts to this species or its habitat.

Lake Sturgeon

The lake sturgeon (*Acipenser fulvescens*) is listed as endangered in the state of Kentucky (OKNP 2019). This species is one of the largest freshwater fish in North America (USFWS 2025c). Typically, adults weigh 30 to 80 pounds, are about four to six feet long, and live to be between 50 and 100 years old; however, the largest and oldest can weigh 200 to 300 pounds, be about 7 feet long, and live to be 150 years old. They have a long, plate-covered, torpedo-shaped body, with a pointed snout that has a ventral facing mouth, and four protruding sensory organs, or barbells.

Lake sturgeon are benthic fish that live at the bottom of deep channels and pools of medium to large rivers and reservoirs with sand, silt, and small gravel substrates (KDFWR SWAP 2025a, USFWS 2025c). They spend the majority of their time in lakes and coastal areas, but adults migrate into large, swift-moving, gravel shoals in rivers to spawn. Large sections of unimpounded river are necessary for adults to complete their spawning migration. Larval sturgeon hatch and typically stay in the river for a year before migrating out to lakes, where they will remain until they reach maturity, which can be anywhere between 10 to 30 years. Juveniles prefer substrates of sand and mud with high densities of macroinvertebrates.

The Project Area is located in the Upper Cumberland watershed, which is within the current known range of this species. However, based on a record search and site reconnaissance, the Project Area does not appear to contain suitable habitat for the lake sturgeon. Therefore, impacts to the species and its habitat as a result of the proposed project are unlikely.

Pallid Shiner

The pallid shiner (*Hybopsis amnis*) is listed as endangered in the state of Kentucky (OKNP 2019). This species is a small 2.5-to-3.25-inch silver fish that has a dark line that runs from the snout, through the eye, and into the tail fin. The pallid shiner is typically found in medium to large

rivers, quiet waters over sandy-silty bottoms, and often at ends of sand and gravel bars (Lee et al. 1980, Page & Burr 2011).

Pallid shiners spawn between late winter and early spring (NatureServe 2025g). During the breeding season, males will grow small, rounded breeding growths, or tubercles, along their heads, gill covers, and pectoral fin rays. The only known extant population of this species in Kentucky is in the Big Fork Cumberland River, where it occurs in pools with gentle current at depths of 30 to 75 cm near water willow (*Justicia* sp.) with minimal siltation.

The Project Area is located in the Upper Cumberland watershed, which is within the known historic range of this species. However, the Project Area is outside the current range for this species and does not appear to contain suitable habitat for the pallid shiner. Therefore, impacts to the species and its habitat as a result of the proposed project are unlikely.

Rafinesque's Big-Eared Bat

Rafinesque's big-eared bat (*Corynorhinus rafinesquii*) is listed as a species of special concern in the state of Kentucky (OKNP 2019). This species is a year-round resident in Kentucky that occurs locally across the state but is most common along the western edge of the Cumberland Plateau and Mammoth Cave regions (KDFWR 2025). This species uses a variety of roost sites, with most in Kentucky hibernating in caves. Between spring and fall, this species is most often found in sandstone rock shelters along cliff lines and in small caves, but abandoned buildings are used in some areas. Additionally, there are occurrences of roots under bridges, in cisterns, and in large, hollow trees as summer roosts. Maternal colonies range from a few individuals to several dozen and are present from May through August or September. Males may roost singly or in small clusters at different sites from the females and young. Rafinesque's big-eared bats are believed to use forest and forest edges for foraging, preying mostly on moths.

Results of the desktop review identified much of the Project Area as intense karst (Figure 3). One potentially suitable portal/underground feature for bat winter hibernacula was identified by wetland field crews within the Project Area. An additional field investigation conducted by Taylor Culbertson (USFWS Permit ES 948949-2) deemed the portal unsuitable for bat use. An official report documenting the findings of the portal assessment was submitted to the USFWS KFO, and final concurrence was received on October 9, 2024.

Based on a review of aerial imagery, there are approximately 70 acres of forested habitat within the Project Area (Figure 9), and results of the desktop review identified much of the Project Area as intense karst (Figure 3). Additionally, one potentially suitable portal for bat winter hibernacula was identified within the Project Area by the wetland field crew during the delineation. An additional field investigation conducted by Taylor Culbertson (USFWS Permit ES 948949-2 for listed bat species) deemed the portal unsuitable for bat use. An official report documenting the findings of the portal assessment was submitted to the USFWS Kentucky Field Office (KFO), and final concurrence was received on October 9, 2024.

A mist net survey was also conducted for the Project from May 15-18, 2025. Copperhead biologist Ian Burns (USFWS Permit ES 948949-2 for listed bat species) collected eight individuals from two listed species (six eastern red bats and two evening bats). This suggests the listed species are not likely present within the Project Area during the maternity season or are present in numbers too low to be detected by approved USFWS protocols; therefore, this species is not likely to be affected by the proposed project.

Eastern Small-Footed Bat

The Eastern small-footed bat (*Myotis lebeii*) is listed as a species of special concern in the state of Kentucky (OKNP 2019). This species is a small, glossy-brown bat with a dark "mask" over the face and keeled calcars. They can weigh anywhere between three and six grams (Morgan 2019). Their habitat includes hilly or mountainous areas near ponds or streams where they can forage. In the summer, they roost in areas such as talus fields, outcrops, rocky ridges, boulders, spoil piles, strip mines, and other various rocky areas. They have also been found to roost in manmade structures. These structures include but are not limited to buildings, bridges, dams, mines, transmission, and pipeline clearings (USFWS 2013c). In the winter, they will migrate short distances to caves, mines, rock outcrops, and road culverts, where they will hibernate.

Based on a review of aerial imagery, there are approximately 70 acres of forested habitat within the Project Area (Figure 9), and results of the desktop review identified much of the Project Area as intense karst (Figure 3). Additionally, one potentially suitable portal for bat winter hibernacula was identified within the Project Area by the wetland field crew during the delineation. An additional field investigation conducted by Taylor Culbertson (USFWS Permit ES 948949-2 for listed bat species) deemed the portal unsuitable for bat use. An official report documenting the findings of the portal assessment was submitted to the USFWS Kentucky Field Office (KFO), and final concurrence was received on October 9, 2024.

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Pheasantshell

The pheasantshell (*Actinonaias pectorosa*) is listed as a species of special concern in the state of Kentucky (OKNP 2019). The current range for this species in Kentucky includes the Powell, Red, Rockcastle, South Fork Cumberland, Upper Cumberland, and Upper Cumberland-Lake Cumberland watersheds (KDFWR SWAP 2025). The Project Area is located within the Upper Cumberland watershed.

The pheasantshell is a large freshwater mussel with a thick, roughly elliptical shell (Parmalee & Bogan 1998). Mature individuals may reach lengths of 140 to 150 mm. This species exhibits some

sexual dimorphism, as the posterior margin is somewhat rounder in females than the males. The periostracum is golden brown with broken green rays; however, in some older individuals, the periostracum may be brown or black. The nacre ranges from bluish to creamy silvery/white with iridescence along the margins.

Like other freshwater mussel species, the pheasantshell is reliant on host fish species for reproduction as it attaches glochidia to the gills, where they remain until they become juveniles. Females are long-term brooders, being gravid in September and having ripe glochidia in May (Parmalee & Bogan 1998). The habitat of the pheasantshell is associated with its host fishes, which include the black basses (*Micropterus* spp.). In Kentucky, the pheasantshell is typically found in flowing medium to large rivers in main channels over firm sand and gravel substrates (KDFWR SWAP 2025).

The Project Area is located within the Upper Cumberland watershed, which is within the current range for this species (KDFWR SWAP 2025). Nine intermittent streams and two perennial streams, including one named waterbody (Potts Creek), were identified during the wetland and stream delineation (Copperhead Environmental Consulting 2025b). The streams located within the Project Area may contain suitable habitat for the pheasantshell. However, no instream work would occur during the development of the Project Area, and a 50 ft setback would be applied to all water features identified in the Project Area. Therefore, it is unlikely that there would be impacts to this species or its habitat.

Elktoe

The elktoe (*Alasmidonta marginata*) is listed as threatened in the state of Kentucky (OKNP 2019). The current range for this species in Kentucky includes the Barren, Licking, Little Sandy, Lower Kentucky, Rockcastle, South Fork Licking, Upper Green, and Upper Kentucky watersheds (KDFWR SWAP 2025). The Project Area is located within the Upper Cumberland watershed, which is within the "Historic Only" range for this species.

The elktoe shell is elongated, somewhat rhomboid, and inflated (Parmalee & Bogan 1998). Young individuals will have thin shells that will become thick and solid as they age. Mature elktoe attain an average length of 75 mm. The periostracum is yellowish-brown to greenish and is typically marked with many greenish or blackish rays and spots. The nacre is bluish-white with slight iridescence, with occasional shades of pink.

Like other freshwater mussel species, the elktoe is reliant on host fish species for reproduction as it attaches glochidia to the gills, where they remain until they become juveniles. Females are long-term brooders, as the reproductive season extends from mid-July to mid-June (Parmalee & Bogan 1998). The habitat of the elktoe is associated with its host fishes, suckers (Catostomidae), including the white sucker (*Catostomus commersoni*), northern hog sucker (*Hypentelium nigricans*), and shorthead redhorse (*Moxostoma macrolepidotum*), and sunfishes (Centrarchidae), including rockbass (*Ambloplites rupestris*), and warmouth (*Lepomis gulosus*). In Kentucky, the elktoe is

typically found in the flowing waters of medium to large river channels over firm sand and gravel (KDFWR SWAP 2025).

The Project Area is located outside the current range for this species; therefore, impacts to the species and its habitat as a result of the proposed project are unlikely.

Elephantear

The elephantear (*Elliptio crassidens*) is listed as a species of special concern in the state of Kentucky (OKNP 2019). The current range for this species in Kentucky includes the Barren, Big Sandy, Blue-Sinking, Highland-Pigeon, Kentucky Lake, Licking, Little Sandy, Little Scioto-Tygarts, Lower Cumberland, Lower Green, Lower Mississippi-Memphis, Lower Ohio, Lower Ohio-Bay, Lower Ohio-Little Pigeon, Lower Tennessee, Middle Green, Middle Ohio-Laughery, Ohio Brush-Whiteoak, Raccoon-Symmes, Rolling Fork, Rough, Salt, Silver-Little Kentucky, South Fork Cumberland, and Upper Green watersheds (KDFWR SWAP 2025). The Project Area is located within the Upper Cumberland watershed, which is within the "Historic Only" range for this species.

The elephantear is a large freshwater mussel with a thick, heavy, solid shell (Parmalee & Bogan 1998). Older individuals have valves that are nearly rhomboid and elongated. Mature individuals may reach a length of 150 mm, even though some may inhabit smaller rivers. The periostracum is thick and reddish-brown to black, with some younger individuals having dark green rays. The nacre ranges from white to salmon to purple.

Like other freshwater mussel species, the elephantear is reliant on host fish species for reproduction as it attaches glochidia to the gills, where they remain until they become juveniles. Females are short brooders, with the reproductive period lasting only June and July (Parmalee & Bogan 1998). The habitat of the elephantear is associated with its host fish, the freshwater drum (*Aplodinotus grunniens*). Historically, the species is considered a "big river" species, but individuals and small, non-breeding populations have established in smaller streams (Parmalee & Bogan 1998). This species may occur at depths of 20 feet or more and is associated with strong currents and substrates of sand, coarse gravel, and often a high percentage of mud. In Kentucky, the elephantear is typically found in the flowing waters of medium to large rivers in main channels over firm sand, gravel, and mud substrates (KDFWR SWAP 2025).

The Project Area is located outside the current range for this species, and the waterbodies identified during the delineation do not meet the habitat qualifications this species is associated with; therefore, impacts to the species and its habitat as a result of the proposed project are unlikely.

Pocketbook

The pocketbook (*Lampsillis ovata*) is listed as endangered in the state of Kentucky (OKNP 2019). The current range for this species in Kentucky includes the Barren, Blue-Sinking, Highland-Pigeon, Kentucky Lake, Licking, Little Scioto-Tygarts, Lower Cumberland, Lower

Mississippi-Memphis, Lower Ohio, Lower Ohio-Bay, Lower Ohio-Little Pigeon, Lower Tennessee, Middle Green, Middle Ohio-Laughery, Ohio Brush-Whiteoak, Raccoon-Symmes, Rockcastle, Rolling Fork, Saline, Silver-Little Kentucky, South Fork Cumberland, Upper Cumberland-Lake Cumberland, Upper Green, and Upper Mississippi-Cape Girardeau watersheds (KDFWR SWAP 2025). The Project Area is located within the Upper Cumberland watershed, which is within the "Historic Only" range for this species.

The juveniles of this species are very thin, fragile, and smooth; however, the shells of mature adults become solid, heavy, and rough with age due to concentric rest lines (Parmalee & Bogan 1998). Mature individuals can reach lengths of 160 to 170 mm. Juveniles are a pale yellow, whereas adults are a yellowish-green to dark olive. Some individuals exhibit narrow, faint dark green rays on the umbo and disc. The nacre is pearly white and iridescent posteriorly.

Like other freshwater mussel species, the pocketbook is reliant on host fish species for reproduction as it attaches glochidia to the gills, where they remain until they become juveniles. Females are believed to be long-term brooders, with evidence of retained glochidia from early August through the following July (Parmalee & Bogan 1998). The habitat of the pocketbook is associated with its host fishes, smallmouth bass (*Micropterus dolomieu*), largemouth bass (*M. salmoides*), bluegill (*Lepomis macrochirus*), white crappie (*Pomoxis annularis*), yellow perch (*Perea flavescens*), and sauger (*Sander canadensis*) (KDFWR SWAP 2025, Parmalee & Bogan 1998). The pocketbook is typically found in flowing waters of medium to large rivers in main channels over firm sand and gravel substrates. However, this species may be found in large rivers (reservoirs) at depths of 15 to 20 feet and in small streams in less than two feet of water. Although usually found in moderate to strong currents, it can survive in standing water (KDFWR SWAP 2025).

The Project Area is located outside the current range for this species; therefore, impacts to the species and its habitat as a result of the proposed project are unlikely.

Little Spectaclecase

The little spectaclecase (*Villosa lienosa*) is listed as threatened in the state of Kentucky (OKNP 2019). The current range for this species in Kentucky includes the Barren, Bayou De Chien-Mayfield, Highland-Pigeon, Little Sandy, Lower Green, Lower Kentucky, Lower Levisa, Lower Tennessee, Middle Fork Kentucky, Middle Green, Obion, Ohio Brush-Whiteoak, Pond, Rockcastle, Rolling Fork, Rough, South Fork Kentucky, Upper Green, Upper Kentucky watersheds (KDFWR SWAP 2025). The Project Area is located within the Upper Cumberland watershed, which is within the "Historic Only" range for this species.

The shell of the little spectaclecase is sub-elliptical, oval, or oblong and is often thin, but strong and stout (Parmalee & Bogan 1998). The periostracum is yellowish-brown to dark brown/black, but some younger individuals may be olive green, and some may have green rays. The nacre varies from white, salmon, pink, or purple and is iridescent posteriorly. This species can grow between five and eight inches in length. The shell can be dark brown to black, sometimes faintly,

with green rays. It has a distinct double-looped beak sculpture and a pointed or truncated posterior end (INHS 2025b).

Like other freshwater mussel species, the little spectaclecase is reliant on host fish species for reproduction as it attaches glochidia to the gills, where they remain until they become juveniles. Females are long-brooders, with reports of gravid females during November (Parmalee & Bogan 1998). The habitat of the little spectaclecase is associated with its host fishes, sunfishes (*Lepomis* spp.) (Hagg & Cicerello 2016).

The little spectaclecase is generally considered present nearly statewide in Kentucky but localized and conspicuously absent from most of the Bluegrass physiographic region (Haag & Cicerello 2016). In Kentucky, the little spectaclecase occurs in sluggish, lowland streams within the Mississippi Embayment in depositional environments; however, in the rest of the state, the species occurs in cool upland streams in riffles with sand and gravel substrates (Haag & Cicerello 2016).

The Project Area is located outside the current range for this species; therefore, impacts to the species and its habitat as a result of the proposed project are unlikely.

Mountain Creekshell

The mountain creekshell (*Leaunio vanuxemensis*) is listed as endangered in the state of Kentucky (OKNP 2019). The current range for this species in Kentucky includes the Lower Cumberland and Red watersheds (KDFWR SWAP 2025). The Project Area is located within the Upper Cumberland watershed, which is within the "Historic Only" range for this species.

The mountain creekshell varies from elliptical to somewhat obovate, and the shell is solid and inflated (Parmalee & Bogan 1998). This species exhibits strong sexual dimorphism in which the male shells are elongated, elliptical in outline, with the posterior margin rather than sharply pointed, whereas female shells are marked by prominent marsupial swelling along the posterior ventral margin. The maximum shell length for this species rarely exceeds 70 mm. The periostracum varies from tan or olive to dark brown, becoming black with age, and the rays are either indistinct or absent. The nacre color varies from light lavender to shades of copper or dark purple.

Like other freshwater mussel species, the mountain creekshell is reliant on host fish species for reproduction as it attaches glochidia to the gills, where they remain until they become juveniles. Females are long-term brooders, holding glochidia from September until their release in May (Parmalee & Bogan 1998). The habitat of the mountain creekshell is associated with its host fishes, sculpins (Cottoidea). Historically, the mountain creekshell is found in riffles with gravel and sand substrates and along the edges of water willow (*Justicia*) beds in clean water, at depths of less than three feet (Parmalee & Bogan 1998). In Kentucky, the mountain creekshell is typically found in small, flowing streams over firm sand and gravel substrates (KDFWR SWAP 2025).

The Project Area is located outside the current range for this species; therefore, impacts to the species and its habitat as a result of the proposed project are unlikely.

Black Sandshell

The black sandshell (*Ligumia recta*) is listed as a species of special concern in the state of Kentucky (OKNP 2019). The current range for this species in Kentucky includes the majority of the state (except for portions of eastern Kentucky), including the Upper Cumberland watershed, where the Project Area is located (KDFWR SWAP 2025).

The black sandshell can grow up to 10 inches long and has a long, elliptical shell that can range from dark green to brown to black. The nacre of the shell can also range in color from whitish pink to pink to purple (Haag & Cicerello 2016).

Like other freshwater mussel species, the mountain creekshell is reliant on host fish species for reproduction as it attaches glochidia to the gills, where they remain until they become juveniles. The habitat of black sandshell is associated with its host fishes, darters (Percidae), sauger (*Sander canadensis*), and walleye (*Sander vitreus*). The black sandshell is typically found in the flowing waters of small streams over firm sand and gravel substrates (KDFWR SWAP 2025); however, it has been recorded statewide in medium-sized to large streams (Haag & Cicerello 2016).

The Project Area is located within the Upper Cumberland watershed, which is within the current range for this species (KDFWR SWAP 2025). Nine intermittent streams and two perennial streams, including one named waterbody (Potts Creek), were identified during the wetland and stream delineation (Copperhead Environmental Consulting 2025b). The streams located within the Project Area may contain suitable habitat for the black sandshell. However, no instream work would occur during the development of the Project Area, and a 50 ft setback would be applied to all water features identified in the Project Area. Therefore, it is unlikely that there would be impacts to this species or its habitat.

Tennessee Clubshell

The Tennessee clubshell (*Pleurobema oviforme*) was listed as proposed endangered under the ESA on 22 August 2023 (USFWS 2023b) and is listed as endangered by the state of Kentucky (OKNP 2019). Historically, the Tennessee clubshell ranged widely throughout the Tennessee and Cumberland River drainages in Kentucky, Virginia, Tennessee, Alabama, North Carolina, and Georgia (USFWS 2023b), with some populations also known from northeastern Mississippi (Haag & Cicerello 2016, USFWS 2020). This species still occurs sporadically throughout portions of its historic range, though many populations in the region are considered extirpated. Within Kentucky, this mussel occurs only sporadically, with recent population declines or extirpations documented for the Red River, Little South Fork, and Horse Lick Creek (Haag & Cicerello 2016).

The Tennessee clubshell reaches lengths up to 9 cm. The shell is oval to triangular and typically tawny to brown, with wide, broken green rays (USFWS 2023b). Like other freshwater mussel species, the mountain creekshell is reliant on host fish species for reproduction as it attaches

glochidia to the gills, where they remain until they become juveniles. Confirmed host species for Tennessee clubshell larvae include the fantail darter (*Etheostoma flabellare*), stoneroller (*Campostoma anomalum*), striped shiner (*Luxilus chrysocephalus*), and river chub (*Nocomis micropogon*), with attachment observed on a variety of other darters (Percidae) and minnows (Cyprinidae) (USFWS 2020). Females are short-term brooders, spawning in spring and releasing glochidia in late summer. Individuals mature between 4 and 6 years of age and may live as long as 30 to 50 years.

The Tennessee clubshell typically inhabits riffles and shoals of small to medium-sized streams over gravel and sand substrates. Threats to the species include habitat degradation and destruction through pollution, siltation, and impoundment, but several recent population-level declines in Kentucky have indeterminate causes (Haag & Cicerello 2016).

The Project Area is located within the Upper Cumberland watershed, which is within the known historic range for this species (KDFWR SWAP 2025). Nine intermittent streams and two perennial streams, including one named waterbody (Potts Creek), were identified during the wetland and stream delineation (Copperhead Environmental Consulting 2025b). It is unknown whether the Tennessee clubshell exists in the Project Area. However, no instream work would occur during the development of the Project Area, and a 50 ft setback would be applied to all water features identified in the Project Area. Therefore, it is unlikely that there would be impacts to this species or its habitat.

Purple Lilliput

The purple lilliput (*Toxolasma lividum*) is listed as endangered in the state of Kentucky (OKNP 2019). The current range for this species in Kentucky includes the Licking, Lower Cumberland, Lower Tennessee, Rockcastle, Rolling Fork, Salt, South Fork Cumberland, Upper Cumberland Lake-Lake Cumberland, and Upper Green watersheds (KDFWR SWAP 2025). The Project Area is located within the Upper Cumberland watershed, which is within the "Historic Only" range for this species.

This species is a small mussel that seldom exceeds 35 mm in length (Parmalee & Bogan 1998). It has a smooth, round/oblong shell with an exterior that can range between green, tan, and brown in younger individuals, to black in older individuals. The nacre is usually a deep purple, but can sometimes be a creamy white, and becomes iridescent posteriorly.

Like other freshwater mussel species, the purple lilliput is reliant on host fish species for reproduction as it attaches glochidia to the gills, where they remain until they become juveniles. The habitat of purple lilliput is associated with its host fishes, sunfishes (*Lepomis* spp.). This species is typically found in flowing waters of small-to medium-sized streams and rivers over firm sand, mud, and gravel substrates (KYSWAP 2025).

The Project Area is located outside the current range for this species; therefore, impacts to the species and its habitat as a result of the proposed project are unlikely.

Blue Monkshood

The blue monkshood (*Aconitum uncinatum*) is listed as endangered in the state of Kentucky (OKNP 2019). This species occurs in the eastern United States in the Appalachians, Piedmont, and rarely in the Coastal Plain from Maryland and southwestern Pennsylvania, south to Georgia and Alabama, with few occurrences in Illinois and in the Ozark Mountains of Missouri (NatureServe 2023, Weakley & Southeastern Flora Team 2023). The blue monkshood is considered "uncommon" in the center of its range (in the Appalachians and Piedmont of West Virginia, Virginia, North Carolina, and eastern Tennessee), and "rare" elsewhere throughout its range (NatureServe 2023, Weakley & Southeastern Flora Team 2023), with between 81 and 300 occurrences range-wide (GBIF 2023, NatureServe 2023). It is threatened by forest management practices, invasive species, land-use conversion, and habitat fragmentation (NatureServe 2023, Southern Appalachian Species Viability Project 2002). The blue monkshood prefers rich, shady soils along streams, especially in mountainous areas (NatureServe 2023, Weakley & Southeastern Flora Team 2023) as well as wet areas along streams, in springs, and less mesic locations in woods and clearings (FNA 1993a). They are found at elevations between approximately 655 and 6,560 feet.

Nine intermittent streams and two perennial streams, including one named waterbody (Potts Creek), were identified during the wetland and stream delineation (Copperhead Environmental Consulting 2025b). Additionally, elevations within the Project Area range between approximately 755 and 1,360 feet. Therefore, based on a record search and site reconnaissance, the Project Area does appear to contain suitable habitat for this species, and the development of the Project Area could impact the blue monkshood and its habitat. However, no instream work would occur during the development of the Project Area, and a 50 ft setback would be applied to all water features identified in the Project Area. Therefore, it is unlikely that there would be impacts to this species or its habitat.

Southern Maidenhair-fern

The southern maidenhair-fern (*Adiantum capillus-veneris*) is listed as threatened in the state of Kentucky (OKNP 2019). This species is present globally in tropical and warm-temperature regions, including Eurasia, Africa, the West Indies, Central America, Venezuela, and Peru (FNA 1993b). In North America, the range includes approximately the southern one-third of the United States, with additional populations in South Dakota and British Columbia. Hundreds to thousands of populations are extant range-wide (NatureServe 2025h). In Kentucky, at least 31 occurrences have been documented; however, several are general or unmappable records. One occurrence record is from the Daniel Boone National Forest, and sixteen are contained within the Lake Cumberland Wildlife Management Area, which is located in Clinton, McCreary, Pulaski, Russel, and Wayne Counties, Kentucky.

Southern maidenhair-fern occurs on moist, rocky areas, including moist cliffs and seeps, especially on calcareous rock, alkaline rocks, or in mineralized soils (Cronquist et al. 1972). They are found at elevations from 0 to 2,500 meters (FNA 1993b). They also occur in springs, wet stream

banks (Great Plains Flora Association 1986), adjacent to waterfalls (Lellinger 1985), on canyon walls in the southwestern U.S., on building foundations, and on storm drains (FNA 1993b). The primary habitats of this species are moist calcareous cliffs/slopes (FNA 1993b, Gleason & Cronquist 1963) and seepages, which are vulnerable to pollution, water diversion, and water loss (NatureServe 2025h). The threat of water diversion and loss is higher in more arid regions where water sources are more coveted. In Kentucky, the impoundment of rivers and streams has inundated large areas and created habitat for this species.

Results of the desktop review identify much of the Project Area as karst (Figure 6), likely providing the calcareous cliffs/slopes this species prefers. Additionally, nine intermittent streams and two perennial streams, including one named waterbody (Potts Creek), were identified during the wetland and stream delineation (Copperhead Environmental Consulting 2025b). Therefore, based on a record search and site reconnaissance, the Project Area does appear to contain suitable habitat for this species. However, a 50 ft setback would be applied to all water features identified in the Project Area. Therefore, it is unlikely that there would be impacts to this species or its habitat.

Mercury Spurge

The mercury spurge (*Euphorbia mercurialina*) is listed as threatened in the state of Kentucky (OKNP 2019). This species is restricted to the Cumberland Plateau and southern Appalachians, with disjunct occurrences in south-central North Carolina and the lower Piedmont (FNA 2016). The mercury spurge prefers dry to mesic wooded slopes of ravines with rich soils and elevations between approximately 330 and 1,970 feet.

The Project Area is not located within the Cumberland Plateau; however, elevations within the Project Area range between approximately 755 and 1,360 feet, and the majority of the site is underlain by loamy soils, which are all considered well-drained with the exception of Newark silt loam, occasionally flooded. The Project Area is underlaid by well-drained soils and is within the elevation range that this species prefers. However, no evidence of this species was recorded during the site reconnaissance. Additionally, there are no ravines or wooded slopes within the Project Area that would be developed. Therefore, it is unlikely that the proposed project would impact this species.

Migratory Birds

Bald Eagle

The bald eagle (*Haliaeetus leucocephalus*) is a threatened species in Kentucky. Bald eagle habitat includes estuaries, large lakes, reservoirs, rivers, and some seacoasts and marshes where they forage for fish (USFWS 2025b). Bald eagles will also feed on waterfowl, turtles, rabbits, snakes, other small animals, and carrion. This species requires a combination of readily available prey, perching areas, and nesting sites. In the winter, bald eagles congregate near open water in tall trees for spotting prey and for night roosts.

Copperhead completed a ground-based survey on May 18, 2025, to document bald eagle nests within the Project Area and 0.5-mile buffer, and non-eagle raptors within the Project Area. All public roads within the Project Area and a 0.5-mile buffer were driven by Copperhead biologists, and all forested habitat was scanned for nests using binoculars. Three non-eagle raptors (one red-tailed hawk and two American kestrels) were observed within the Project Area. No bald eagle or non-eagle raptor nests were observed within the Project Area or a 0.5-mile buffer (Copperhead Environmental Consulting 2025a). Should any bald eagle or raptor nests be discovered during Project construction activities, a 660-foot buffer around the nest would be required, and an incidental take permit would be needed.

Chimney Swift

The chimney swift (*Chaetura pelagica*) is a gray bird best known by its shape, often described as stubby at both ends, with scimitar-shaped wings (National Audubon Society 2025). This species prefers open sky, especially over cities and towns. It forages in the sky over any kind of terrain, wherever there are flying insects. Now, it is most common over towns and cities; within its range, few forests remain with hollow trees large enough to serve as nest sites.

The Project Area does contain foraging habitat for this species, including open sky and flying insects. The nearest eBird sighting of a chimney swift is approximately 1.6 miles northwest of the Project Area, near the intersection of Walnut Grove Road and Old York Chapel Road (Sullivan et al. 2009). The proposed project will include the installation of solar panels, which would not affect the foraging habitat of this species; therefore, this species is not likely to be affected by the proposed project.

Field Sparrow

Field sparrows (*Spizella pusilla*) are small birds with a pinkish cone-shaped bill and a rounded head. Adult field sparrows have a rusty colored eyeline patch, a distinctive white eye-ring, and a rusty colored crown on top of the head (Cornell University 2025). The diet for field sparrows consists of grass seeds in the winter and a blend of seeds and insects in warmer weather.

Field sparrows can be found in open habitats with low perches, such as orchards, nurseries, agricultural fields, pastures, fencerows, road edges, and forest edges and openings. They can be found in these habitats during both summer and winter seasons, but will generally avoid breeding in areas near where people live. Field sparrows nest about ten feet above the ground in blackberry bushes, St. John's wort, honeysuckle, coralberry, as well as several tree species (Cornell University 2025). In Kentucky, the field sparrow is considered a year-round resident and is within the range of breeding and wintering habitats.

Forest edges and agricultural lands are present within the Project Area; therefore, suitable habitat for both breeding and overwintering populations of field sparrows is present. The nearest eBird sighting of a field sparrow is approximately 1.6 miles northwest of the Project Area, near the intersection of Walnut Grove Road and Old York Chapel Road (Sullivan et al. 2009). The proposed project would include the construction of a solar facility in these areas; therefore, this

species could be impacted by the proposed project. Individuals would likely use available similar habitat nearby.

Prothonotary Warbler

The prothonotary warbler (*Protonotaria citrea)* has a golden yellow head and chest, blue-gray wings, and a tail with white spots and a white underside (National Audubon Society 2025). This species prefers wooded swamps and breeds in flooded river bottom hardwoods dominated by black willow (*Salix nigra*), ash (*Fraxinus* spp.), buttonbush (*Cephalanthus occidentalis*), sweetgum (*Liquidambar styraciflua*), red maple (*Acer rubrum*), hackberry (*Celtis occidentalis*), river birch (*Betula nigra*), and elm (*Ulmus* spp.); or wetlands with bay trees surrounded by cypress swamp. They will also nest near the borders of lakes, rivers, and ponds, typically only in areas with standing or slow-moving water. The prothonotary warbler winters in the tropics in lowland woods and mangrove swamps.

The Project Area lacks the wooded swamps and flooded river bottom hardwoods this species prefers; therefore, the Project Area does not appear to contain suitable habitat for this species and impacts to the species and its habitat as a result of the proposed project are unlikely. The nearest eBird sighting of a field sparrow is approximately 0.65 miles east of the Project Area, within riparian woodland along Otter Creek (Sullivan et al. 2009).

Rusty Blackbird

In most seasons, the rusty blackbird (*Euphagus carolinus*) is a dull black (male) or slaty (female) color with yellow eyes (National Audubon Society 2025). However, in the fall, they have distinctive rusty-colored feather edges and buff eyebrows. This species prefers river groves, wooded swamps, and muskegs in summer. They breed in the muskeg region in wet northern coniferous forests with many lakes and bogs. During migration and in the winter, they favor areas with trees near water, such as wooded swamps and riverside forests. In addition, this species will forage in open fields and cattle feedlots with other species of blackbird.

The Project Area contains open fields that could serve as suitable foraging habitat for this species. The nearest eBird sighting of a rusty blackbird is approximately 0.90 miles west of the Project Area, within an open field (Sullivan et al. 2009). The proposed project would include the construction of a solar facility in these areas; therefore, this species could be impacted by the proposed project. Individuals would likely use available similar habitat nearby.

Wood Thrush

Characteristics of wood thrushes (*Hylocichla mustelina*) include a potbelly body, short tail, straight bill, big head, and upright posture. They are small birds with reddish-brown above and white with bold black spots. Juveniles have the same pattern but are typically more muted (Cornell University 2025).

Wood thrushes can be found in mature deciduous and mixed forests in eastern North America, typically those with American beech, sweet gum, red maple, black gum, eastern hemlock,

flowering dogwood, oaks, or pines. Ideal habitat includes trees over 50 feet tall with a moderate understory of saplings and shrubs. Moist soil, decaying leaf litter, and water nearby are typical habitat conditions. Wood thrushes breed in North America, including Kentucky, but winter in portions of Mexico and Central America (NatureServe 2025i).

The Project Area does contain mature deciduous forests with water nearby; therefore, suitable habitat for the wood thrush is present. The nearest eBird sighting of a wood thrush is approximately 1.6 miles northwest of the Project Area near the intersection of Walnut Grove Road and Old York Chapel Road (Sullivan et al. 2009). The proposed project would include the construction of a solar facility in these areas; therefore, this species could be impacted by the proposed project. However, streams and water features would be avoided, and a 50-ft setback implemented, which would minimize impacts to available habitat. Additionally, individuals would likely use available similar habitat nearby.

POTENTIAL FURTHER SURVEYS FOR LISTED SPECIES

Surveys for Listed Bat Species

The USFWS IPaC tool identified the gray bat, Indiana bat, northern long-eared bat, tricolored bat, and the Virginia big-eared bat as having potential to occur in the Project Area. Forested areas within the Project Area are likely to provide suitable foraging, roosting, and commuting habitat for these listed bat species. As a result, a presence/probable absence mist-net survey was required for tree removal.

A mist net survey was conducted from May 15-18, 2025, by Copperhead. During the mist-net survey, six eastern red bats (*Lasiurus borealis*) and two evening bats (*Nycticeius humeralis*) were captured on the southern edge of the Project Area. No listed species were captured during the mist-net survey, suggesting the listed species are not likely present within the Project Area during the maternity season or are present in numbers too low to be detected by approved USFWS protocols.

Copperhead conducted a Phase I Portal Assessment on September 30, 2024, to determine the habitat suitability of one previously identified portal on the Project Area. This portal was determined not suitable winter bat habitat by Copperhead biologists, and concurrence on this suitability was received by USFWS on October 9, 2024 (Appendix C). No further surveys are required.

Monarch Butterfly

The monarch butterfly, currently a federally proposed threatened species, receives no statutory protection under the ESA; therefore, no surveys are currently planned to document monarch butterflies in the Project Area. Open prairies, meadows, roadsides, and grassed areas with the presence of milkweed plants within the Project Area would provide suitable habitat for the monarch butterfly.

Freshwater Mussel Survey

No federally listed mussel species were identified through the USFWS IPaC, therefore we are not anticipating any effects to these species.

There is potentially suitable habitat for state-listed mussel species. There are no mandated conservation measures or regulatory requirements for state-listed or sensitive species in Kentucky. Nine intermittent streams and two perennial streams, including one named waterbody (Potts Creek), were identified during the wetland and stream delineation (Copperhead Environmental Consulting 2025b). However, no relic shells or live mussels were observed during the site reconnaissance. At this time, Copperhead recommends a mussel survey at potential stream crossing sites to determine the presence/probable absence of listed mussel species.

CONCLUSIONS

The Project Area provides a variety of habitats for general wildlife and several federally and state-listed species. While no relic shells or live mussels were observed during the site reconnaissance, water in parts of the streams were too deep to determine the presence/absence of live shells. At this time, Copperhead recommends a mussel survey at potential stream crossing sites to determine the presence/probable absence of listed mussel species. While no migratory birds of conservation concern were observed during the field reconnaissance, the field sparrow and rusty blackbird could potentially utilize the Project Area. Per a ground-based eagle and raptor nest survey on March 18, 2025, no bald eagle or non-eagle raptor nests were observed within the Project Area boundary or with a 660-ft buffer (Copperhead Environmental Consulting 2025a). Should any bald eagle or raptor nests be discovered during Project construction activities, a 660-foot buffer around the nest would be required, and an incidental take permit would be needed.

As mentioned previously, forested areas within the Project Area are likely to provide suitable foraging, roosting, and commuting habitat for listed bat species. A mist net survey was conducted from May 15-18, 2025, by Copperhead, and no listed species were captured. This suggests the listed species are not likely present within the Project Area during the maternity season or are present in numbers too low to be detected by approved USFWS protocols.

No other federally or state-listed species were observed during the site reconnaissance.

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Appendix A: Figures

COPPERHEAD
ENVIRONMENTAL CONSULTING

Prepared for:

Barrelhead Solar, LLC

FIGURE 1:
Project Overview for the
Barrelhead Solar Project,
Wayne County, Kentucky.

Legend

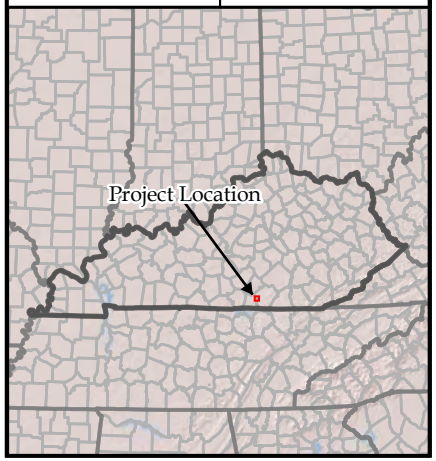
Project Boundary

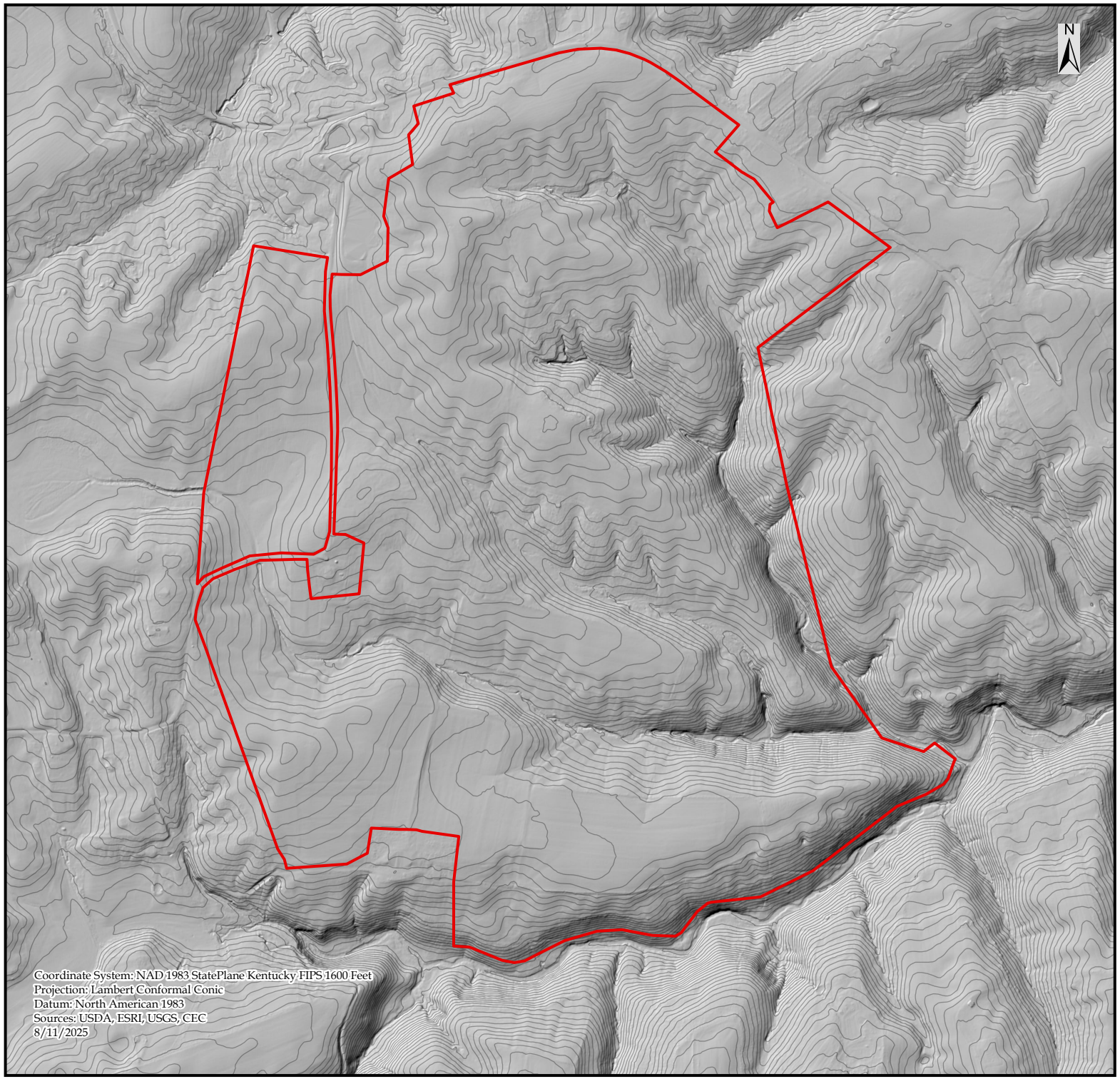
0 750 1,500
US Feet

Scale: 1 in = 750 ft

Prepared by :
Copperhead Environmental Consulting, Inc.
471 Main Street
P.O. Box 73
Paint Lick, Kentucky 40461

Drawn by:	CM	Date:	8/11/2025
Checked by:	KR	Revision:	03





COPPERHEAD
ENVIRONMENTAL CONSULTING

Prepared for:

Barrelhead Solar, LLC

FIGURE 2:
Digital Elevation Model
for the Barrelhead Solar Project,
Wayne County, Kentucky.

Legend

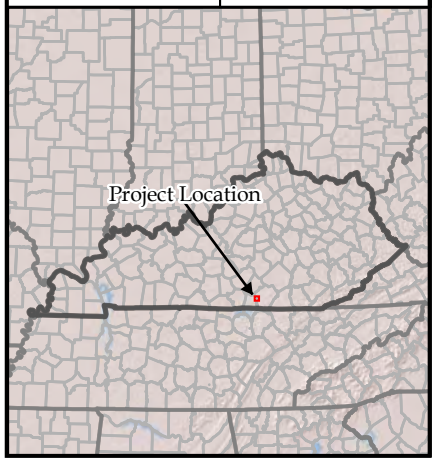
Project Boundary

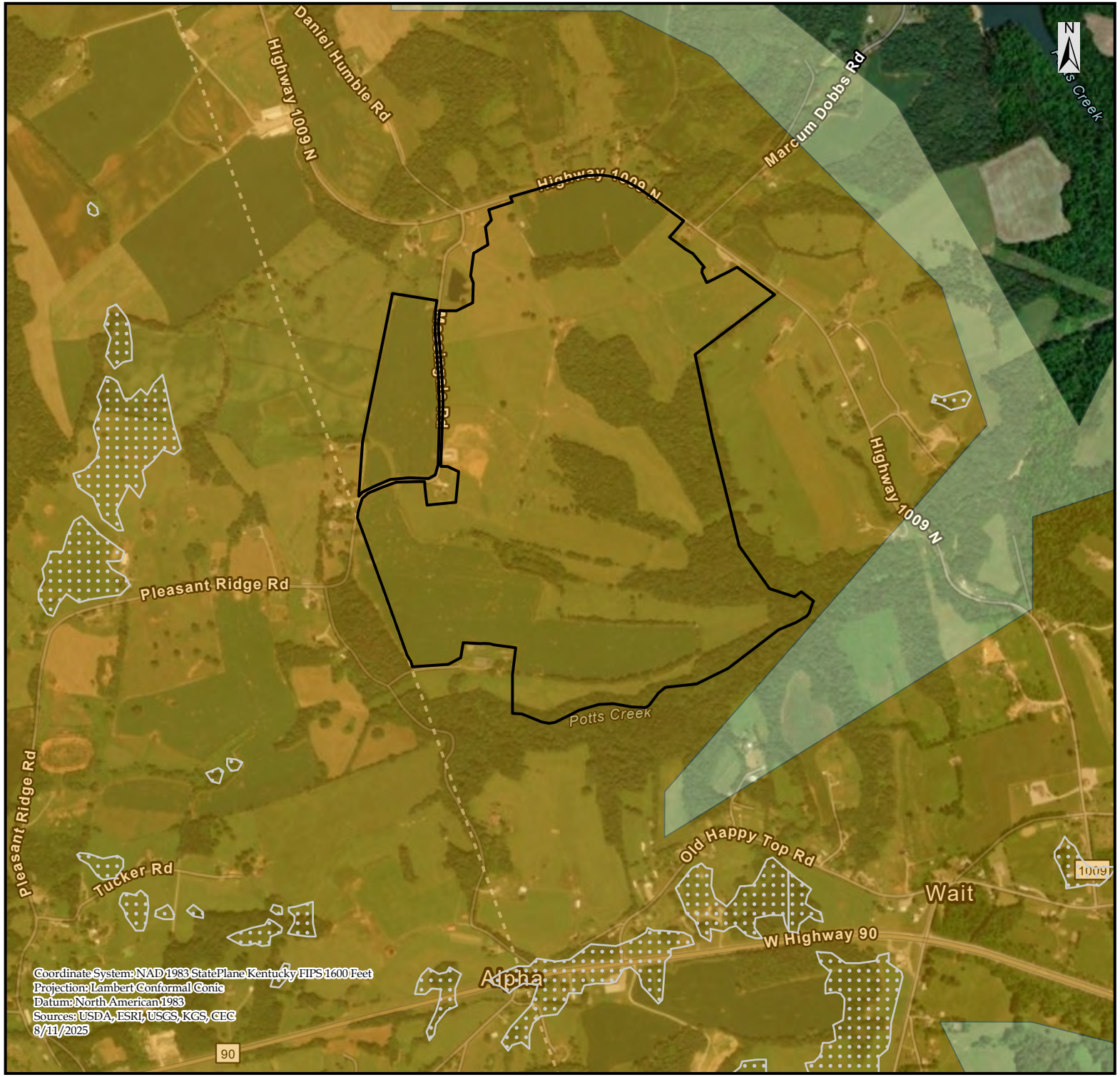
0 750 1,500
US Feet

Scale: 1 in = 750 ft

Prepared by :
Copperhead Environmental Consulting, Inc.
471 Main Street
P.O. Box 73
Paint Lick, Kentucky 40461

Drawn by:	CM	Date:	8/11/2025
Checked by:	KR	Revision:	03





COPPERHEAD
ENVIRONMENTAL CONSULTING

Prepared for:

Barrelhead Solar, LLC

FIGURE 3:
Karst Areas for the
Barrelhead Solar Project,
Wayne County, Kentucky.

Legend

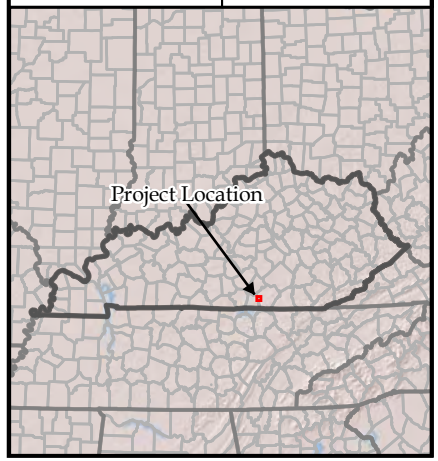
- Intensely Karst
- Prone to Karst
- Sinkhole
- Project Boundary

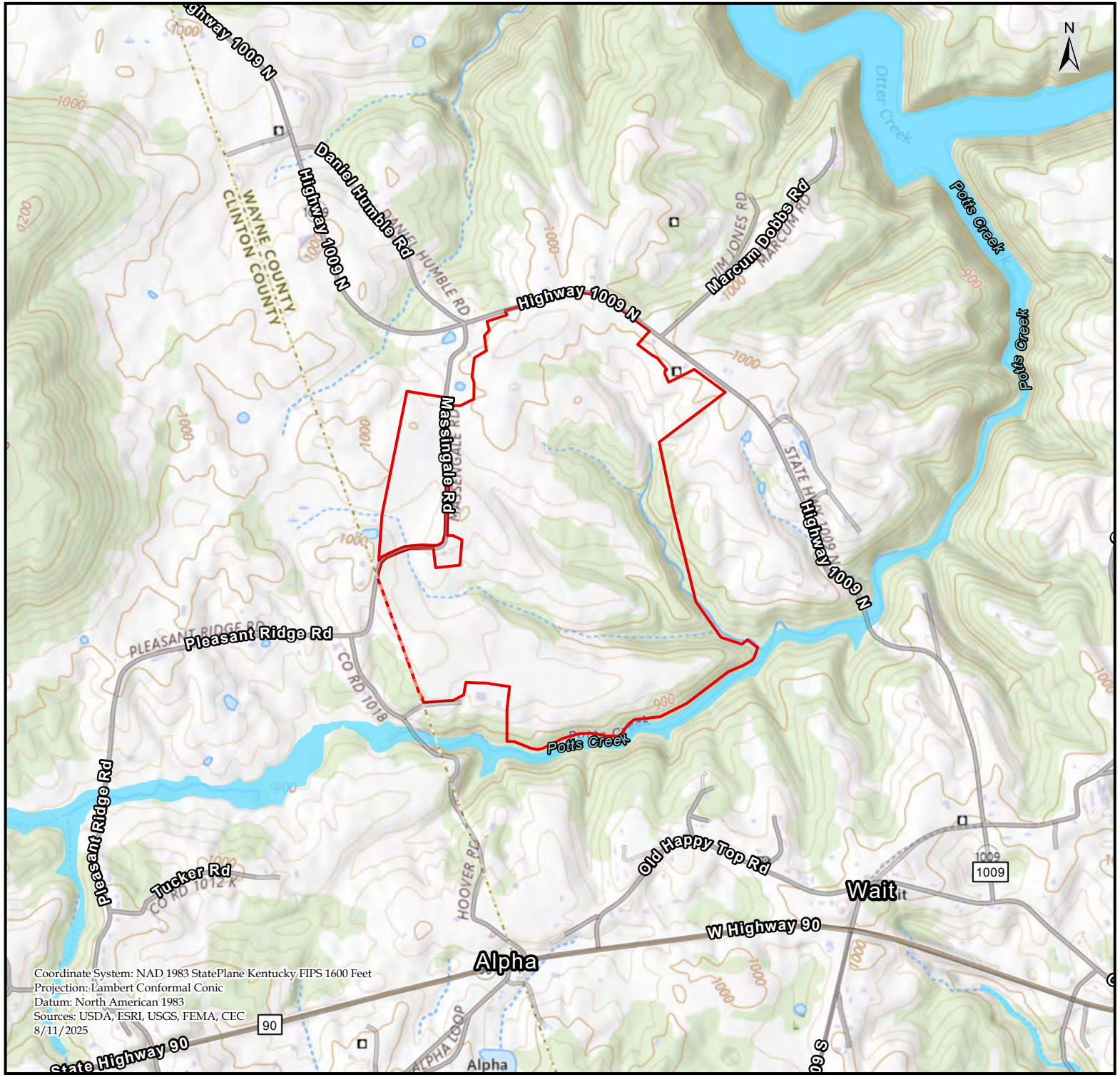
0 1,250 2,500
US Feet

Scale: 1 in = 1,250 ft

Prepared by :
Copperhead Environmental Consulting, Inc.
471 Main Street
P.O. Box 73
Paint Lick, Kentucky 40461

Drawn by:	CM	Date:	8/11/2025
Checked by:	KR	Revision:	03





Coordinate System: NAD 1983 StatePlane Kentucky FIPS 1600 Feet
Projection: Lambert Conformal Conic
Datum: North American 1983
Sources: USDA, ESRI, USGS, FEMA, CEC
8/11/2025

COPPERHEAD
ENVIRONMENTAL CONSULTING

Prepared for:

Barrelhead Solar, LLC

FIGURE 4:
FEMA NFHL for the
Barrelhead Solar Project,
Wayne County, Kentucky.

Legend

- 1% Annual Chance Flood Hazard
- Project Boundary

0 1,500 3,000
US Feet

Scale: 1 in = 1,500 ft

Prepared by :
Copperhead Environmental Consulting, Inc.
471 Main Street
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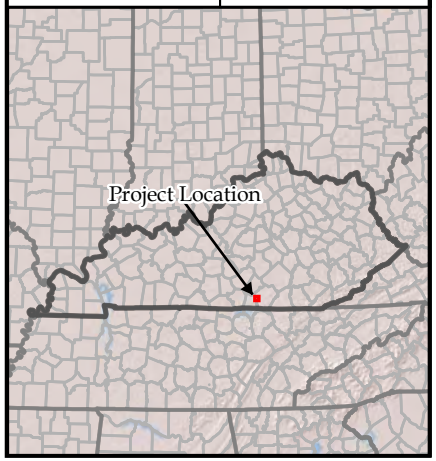
Paint Lick, Kentucky 40461

Drawn by:	CM	Date:	8/11/2025
Checked by:	KR	Revision:	03



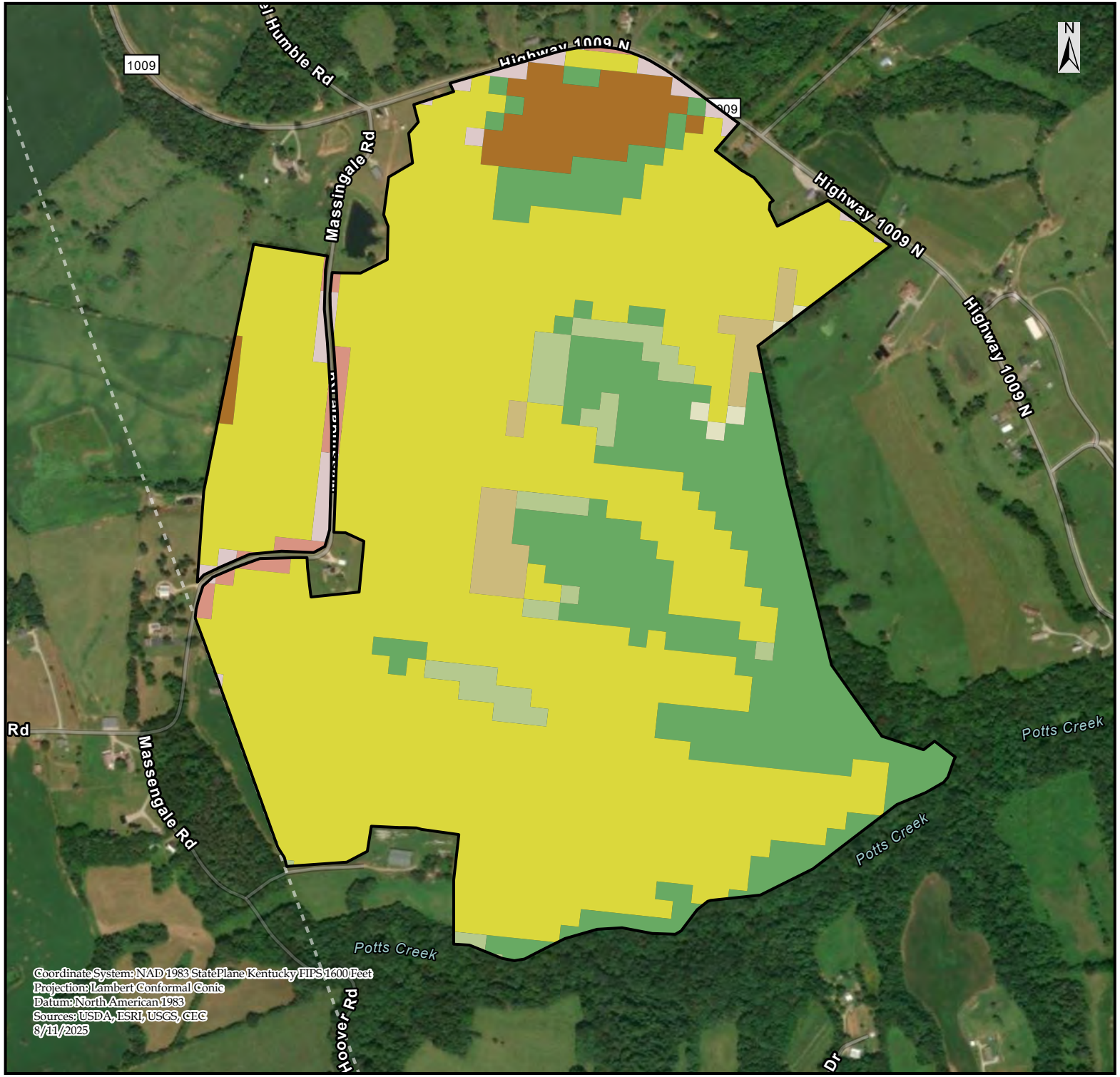


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FIGURE 5:
National Land Cover Dataset
for the Barrelhead Solar Project,
Wayne County, Kentucky.

Legend

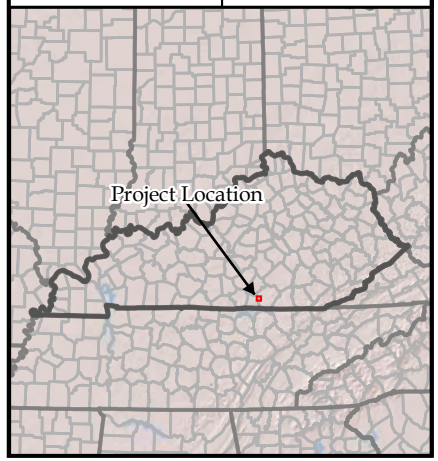
- Cultivated Crops
- Deciduous Forest
- Developed, Low Intensity
- Developed, Open Space
- Hay/Pasture
- Herbaceous
- Mixed Forest
- Shrub/Scrub
- Project Boundary

0 — 750 — 1,500
US Feet

Scale: 1 in = 750 ft

Prepared by :
Copperhead Environmental Consulting, Inc.
471 Main Street
P.O. Box 73
Paint Lick, Kentucky 40461

Drawn by:	CM	Date:	8/11/2025
Checked by:	KR	Revision:	03



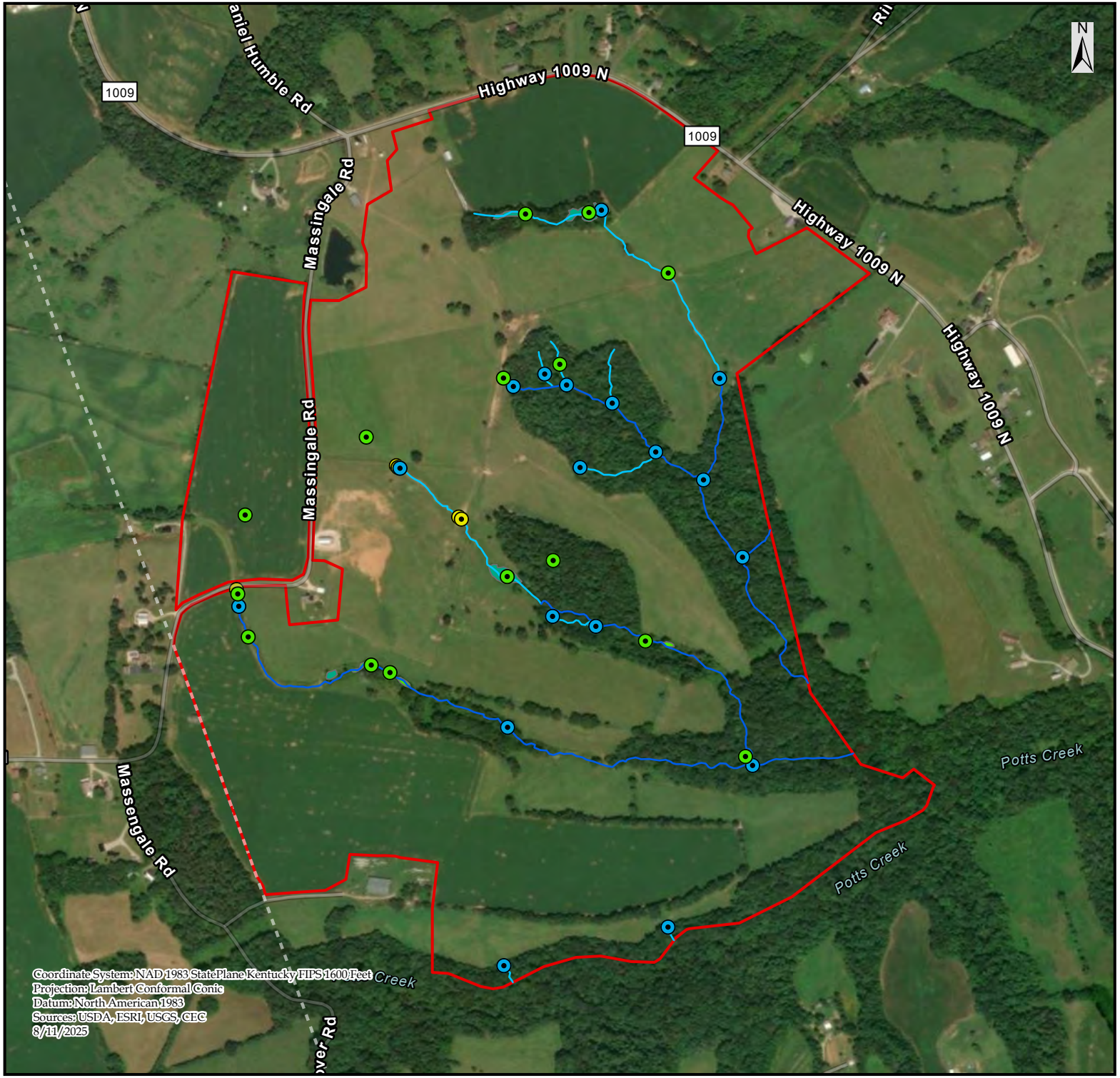


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FIGURE 6:
Wetland Delineation Overview
for the Barrelhead Solar Project,
Wayne County, Kentucky.

Legend

- Culvert
- Stream Assessment Point
- Wetland Data Point
- Ephemeral Stream
- Jurisdictional Stream
- Isolated Wetland
- Jurisdictional Wetland
- Project Boundary

0 — 750 — 1,500
US Feet

Scale: 1 in = 750 ft

Prepared by :
Copperhead Environmental Consulting, Inc.
471 Main Street
P.O. Box 73
Paint Lick, Kentucky 40461

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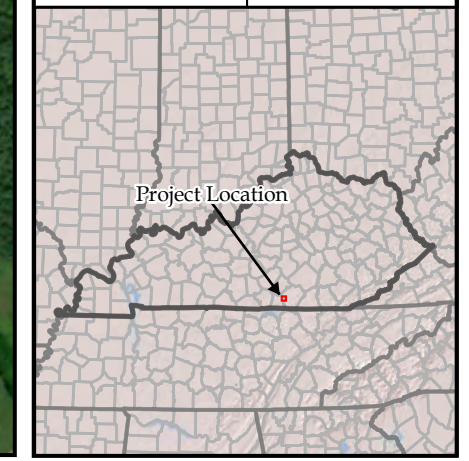

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Prepared for:

Barrelhead Solar, LLC

FIGURE 6.1:
Wetland Delineation Overview
for the Barrelhead Solar Project,
Wayne County, Kentucky.

Legend

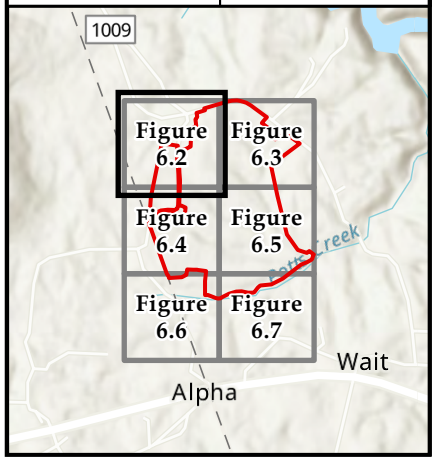
- Culvert
- Stream Assessment Point
- Wetland Data Point
- Ephemeral Stream
- Jurisdictional Stream
- Isolated Wetland
- Project Boundary

0 300 600
US Feet

Scale: 1 in = 333 ft

Prepared by :
Copperhead Environmental Consulting, Inc.
471 Main Street
P.O. Box 73
Paint Lick, Kentucky 40461

Drawn by:	CM	Date:	8/11/2025
Checked by:	KR	Revision:	03



COPPERHEAD
ENVIRONMENTAL CONSULTING

Prepared for:

Barrelhead Solar, LLC

FIGURE 6.2:
Wetland Delineation Overview
for the Barrelhead Solar Project,
Wayne County, Kentucky.

Legend

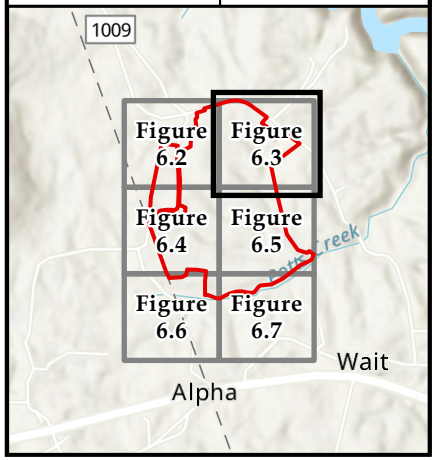
- Culvert
- Stream Assessment Point
- Wetland Data Point
- Ephemeral Stream
- Jurisdictional Stream
- Isolated Wetland
- Project Boundary

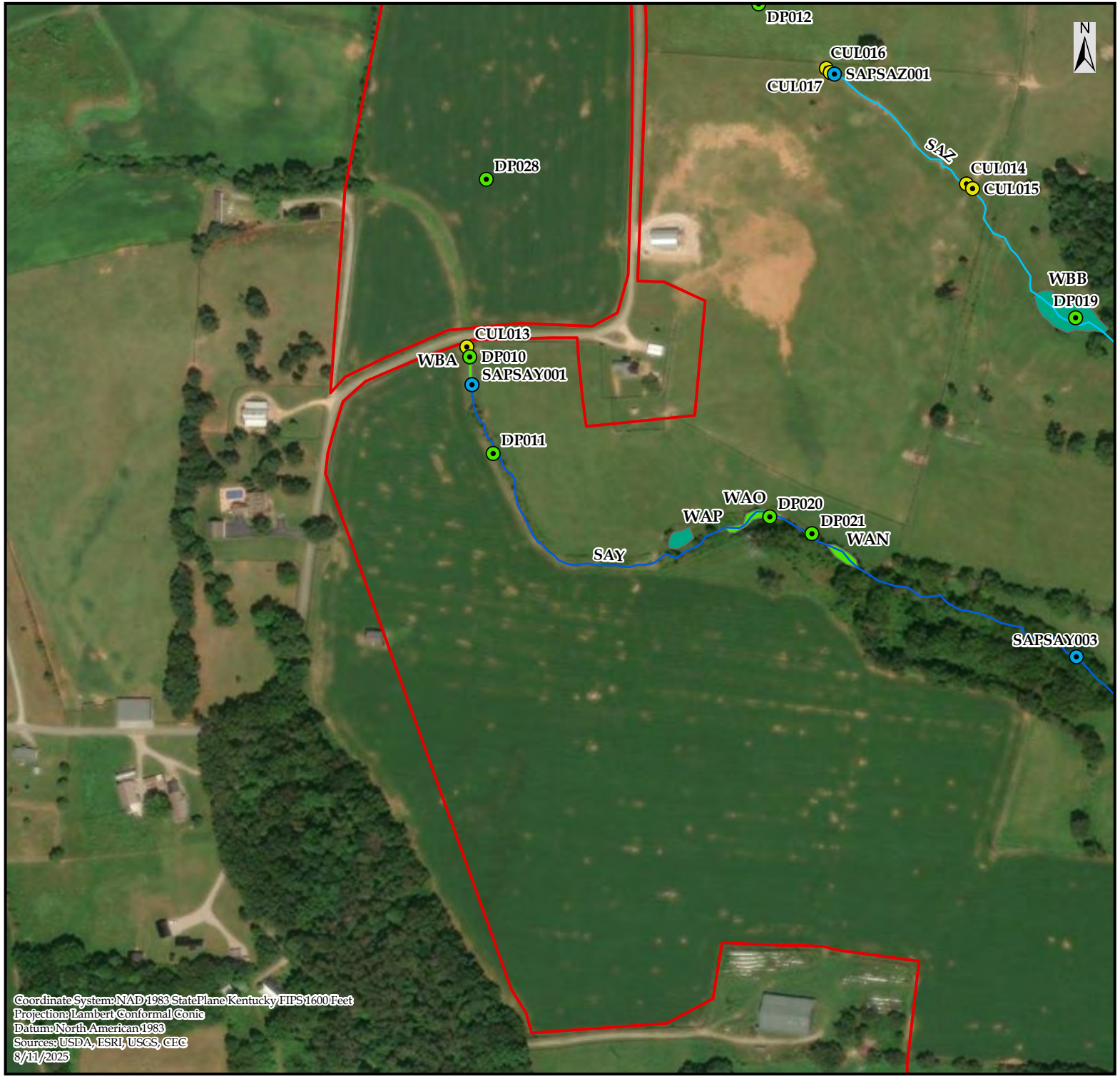
0 300 600
US Feet

Scale: 1 in = 333 ft

Prepared by :
Copperhead Environmental Consulting, Inc.
471 Main Street
P.O. Box 73
Paint Lick, Kentucky 40461

Drawn by:	CM	Date:	8/11/2025
Checked by:	KR	Revision:	03





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ENVIRONMENTAL CONSULTING

Prepared for:

Barrelhead Solar, LLC

FIGURE 6.3:
Wetland Delineation Overview
for the Barrelhead Solar Project,
Wayne County, Kentucky.

Legend

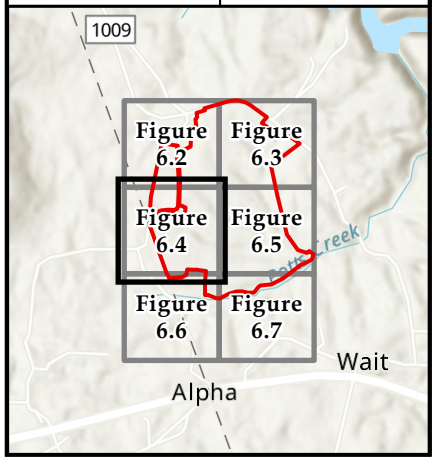
- Culvert
- Stream Assessment Point
- Wetland Data Point
- Ephemeral Stream
- Jurisdictional Stream
- Isolated Wetland
- Jurisdictional Wetland
- Project Boundary

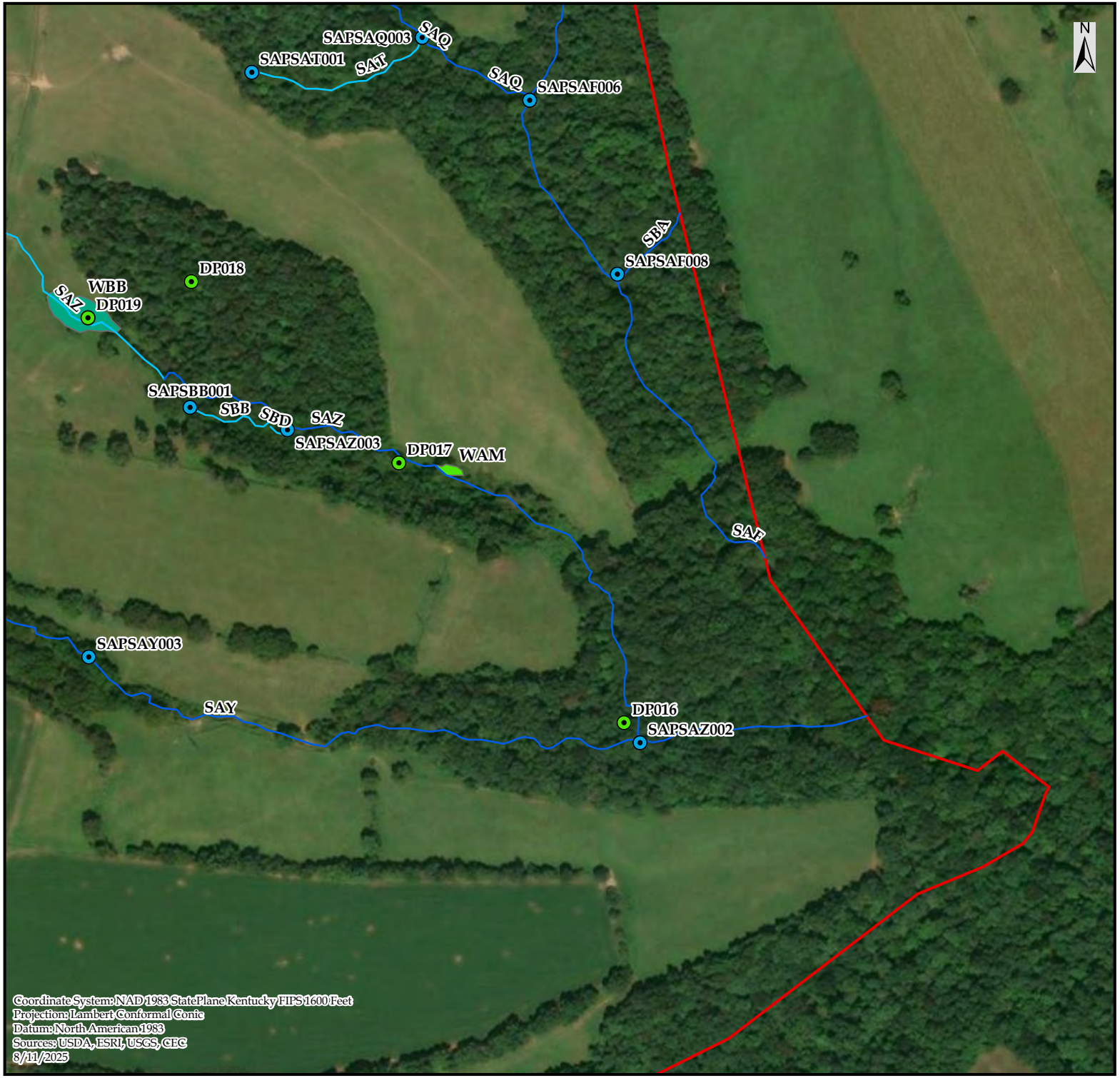
0 300 600
US Feet

Scale: 1 in = 333 ft

Prepared by :
Copperhead Environmental Consulting, Inc.
471 Main Street
P.O. Box 73
Paint Lick, Kentucky 40461

Drawn by:	CM	Date:	8/11/2025
Checked by:	KR	Revision:	03





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Prepared for:

Barrelhead Solar, LLC

FIGURE 6.4:
Wetland Delineation Overview
for the Barrelhead Solar Project,
Wayne County, Kentucky.

Legend

- Culvert
- Stream Assessment Point
- Wetland Data Point
- Ephemeral Stream
- Jurisdictional Stream
- Isolated Wetland
- Jurisdictional Wetland
- Project Boundary

0 300 600
US Feet

Scale: 1 in = 333 ft

Prepared by :
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P.O. Box 73
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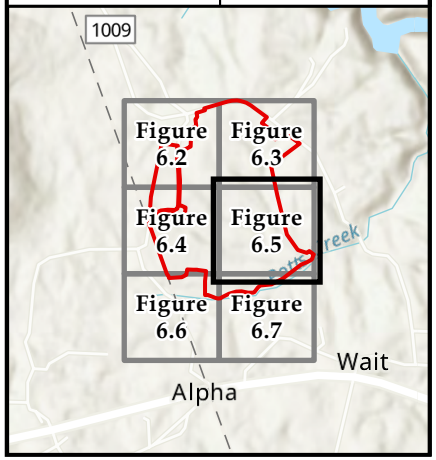
Drawn by:	CM	Date:	8/11/2025
Checked by:	KR	Revision:	03



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Prepared for:

Barrelhead Solar, LLC

FIGURE 6.5:
Wetland Delineation Overview
for the Barrelhead Solar Project,
Wayne County, Kentucky.

Legend

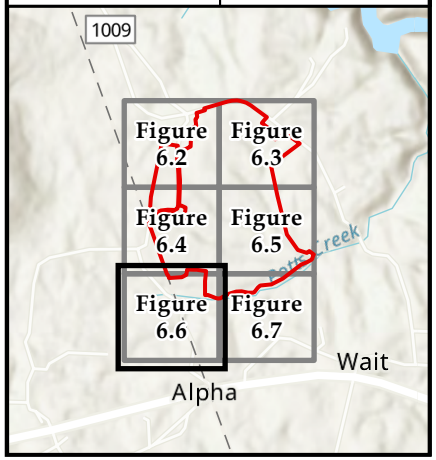
- Culvert
- Stream Assessment Point
- Wetland Data Point
- Ephemeral Stream
- Jurisdictional Stream
- Project Boundary

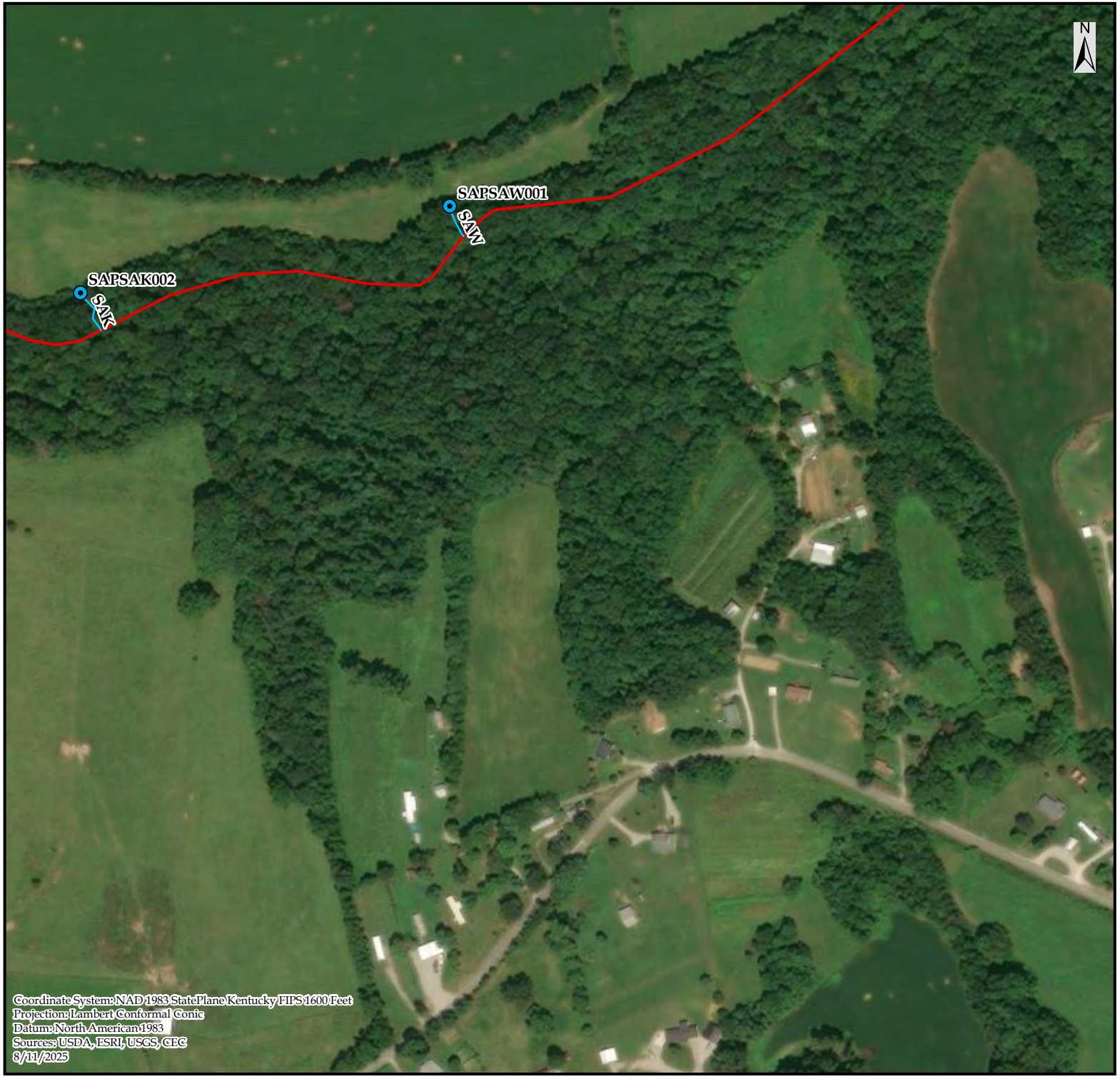
0 300 600
US Feet

Scale: 1 in = 333 ft

Prepared by :
Copperhead Environmental Consulting, Inc.
471 Main Street
P.O. Box 73
Paint Lick, Kentucky 40461

Drawn by:	CM	Date:	8/11/2025
Checked by:	KR	Revision:	03





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Prepared for:

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FIGURE 6.6:
Wetland Delineation Overview
for the Barrelhead Solar Project,
Wayne County, Kentucky.

Legend

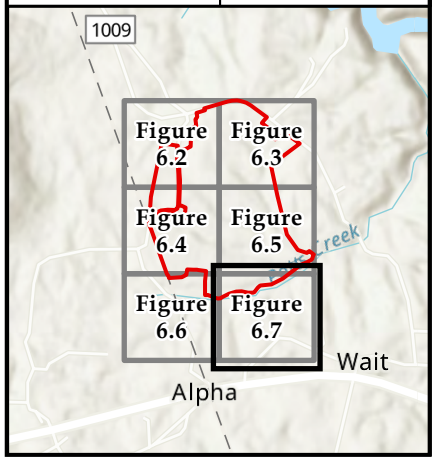
- Culvert
- Stream Assessment Point
- Wetland Data Point
- Ephemeral Stream
- Jurisdictional Stream
- Project Boundary

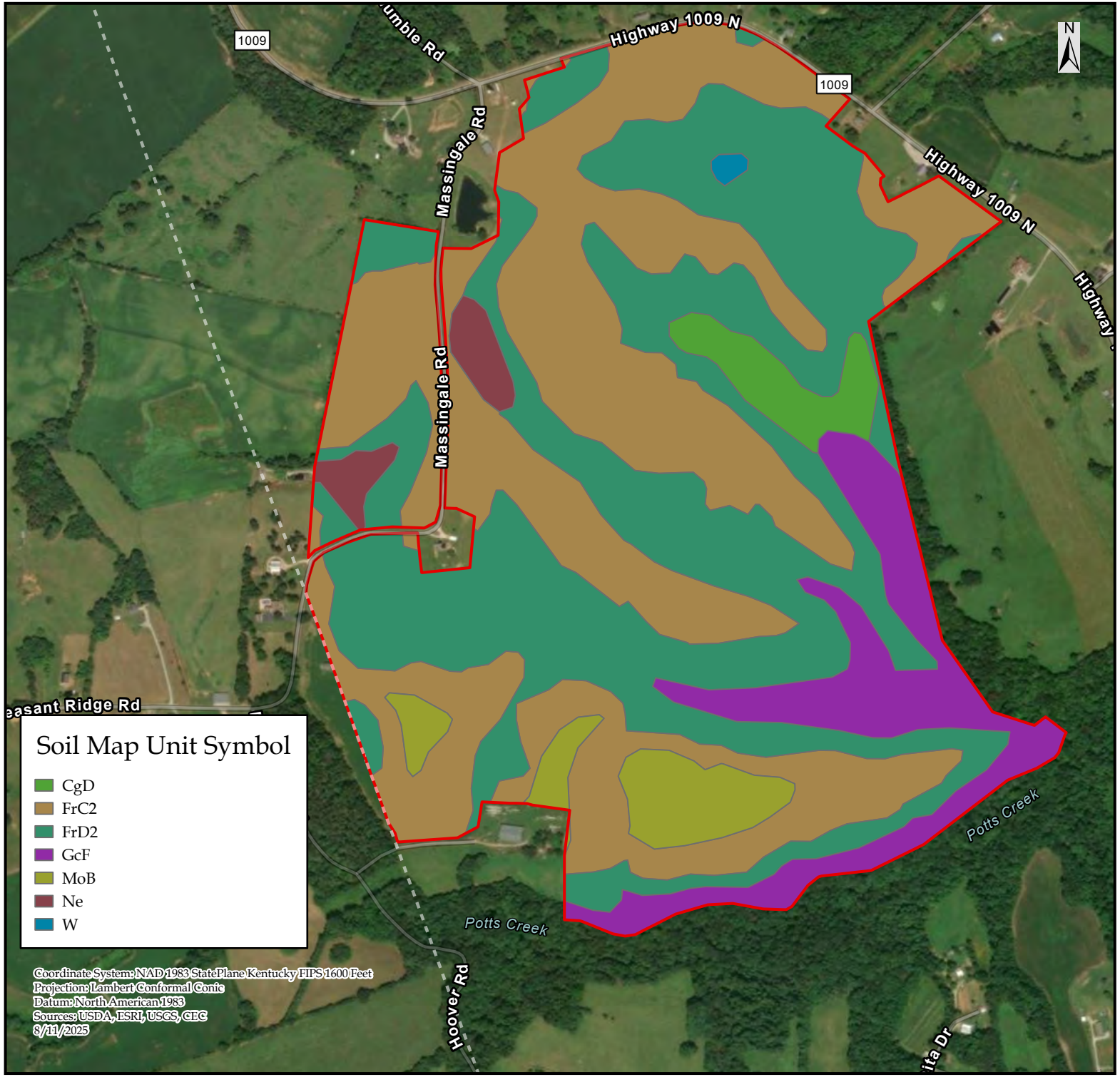
0 300 600
US Feet

Scale: 1 in = 333 ft

Prepared by :
Copperhead Environmental Consulting, Inc.
471 Main Street
P.O. Box 73
Paint Lick, Kentucky 40461

Drawn by:	CM	Date:	8/11/2025
Checked by:	KR	Revision:	03





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Prepared for:

Barrelhead Solar, LLC

FIGURE 7:
USDA SSURGO for the
Barrelhead Solar Project,
Wayne County, Kentucky.

Legend

Project Boundary

0 750 1,500
US Feet

Scale: 1 in = 750 ft

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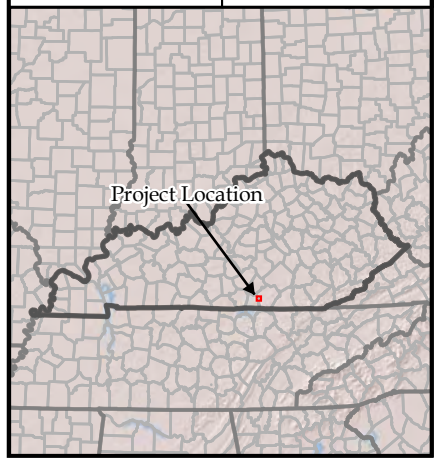
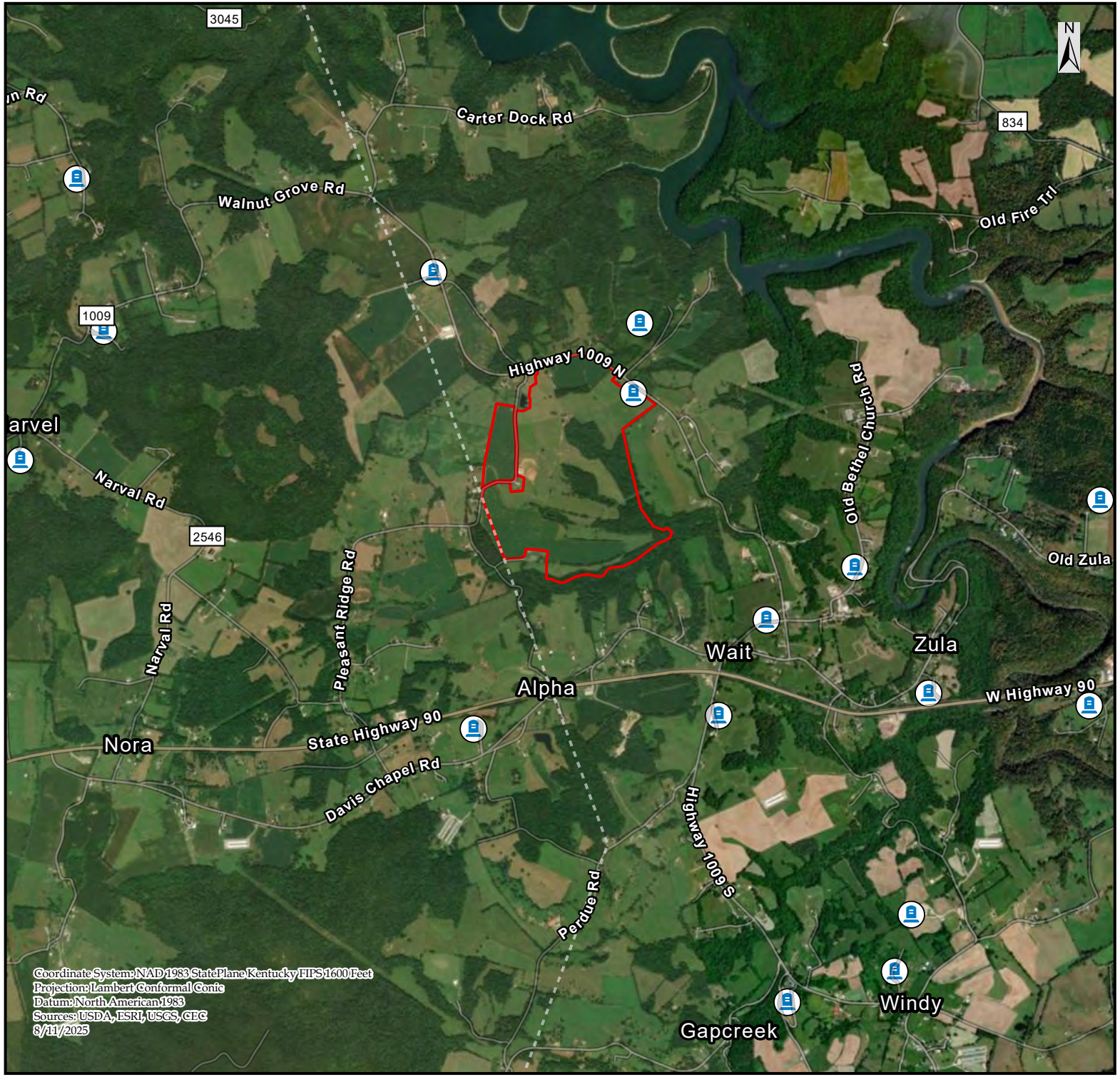
P.O. Box 73
Paint Lick, Kentucky 40461

Drawn by:	CM	Date:	8/11/2025
Checked by:	KR	Revision:	03





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Prepared for:

Barrelhead Solar, LLC

FIGURE 8:
Cemetery Locations for the
Barrelhead Solar Project,
Wayne County, Kentucky.

Legend

- Cemetery
- Project Boundary

0 3,000 6,000
US Feet

Scale: 1 in = 3,000 ft

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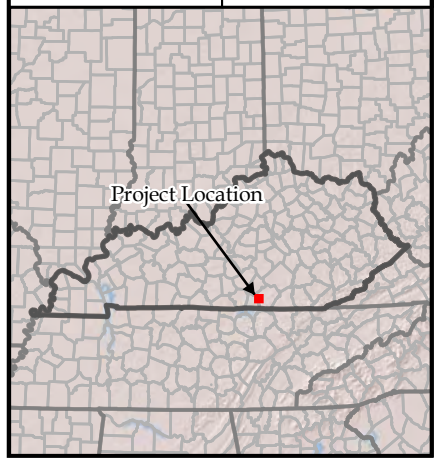
471 Main Street
P.O. Box 73
Paint Lick, Kentucky 40461

Drawn by:	CM	Date:	8/11/2025
Checked by:	KR	Revision:	03



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Barrelhead Solar, LLC

FIGURE 9:
Forested Areas for the
Barrelhead Solar Project,
Wayne County, Kentucky.

Legend

- Forested Area
- Project Boundary

0 750 1,500
US Feet

Scale: 1 in = 750 ft

Prepared by :
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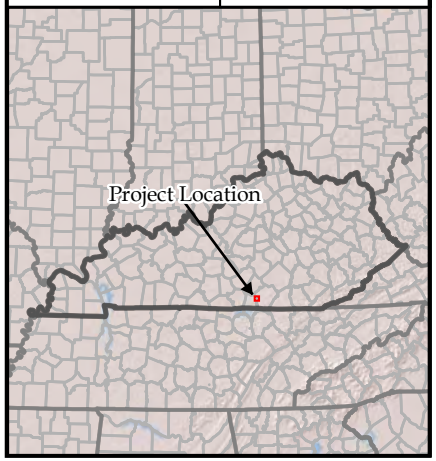
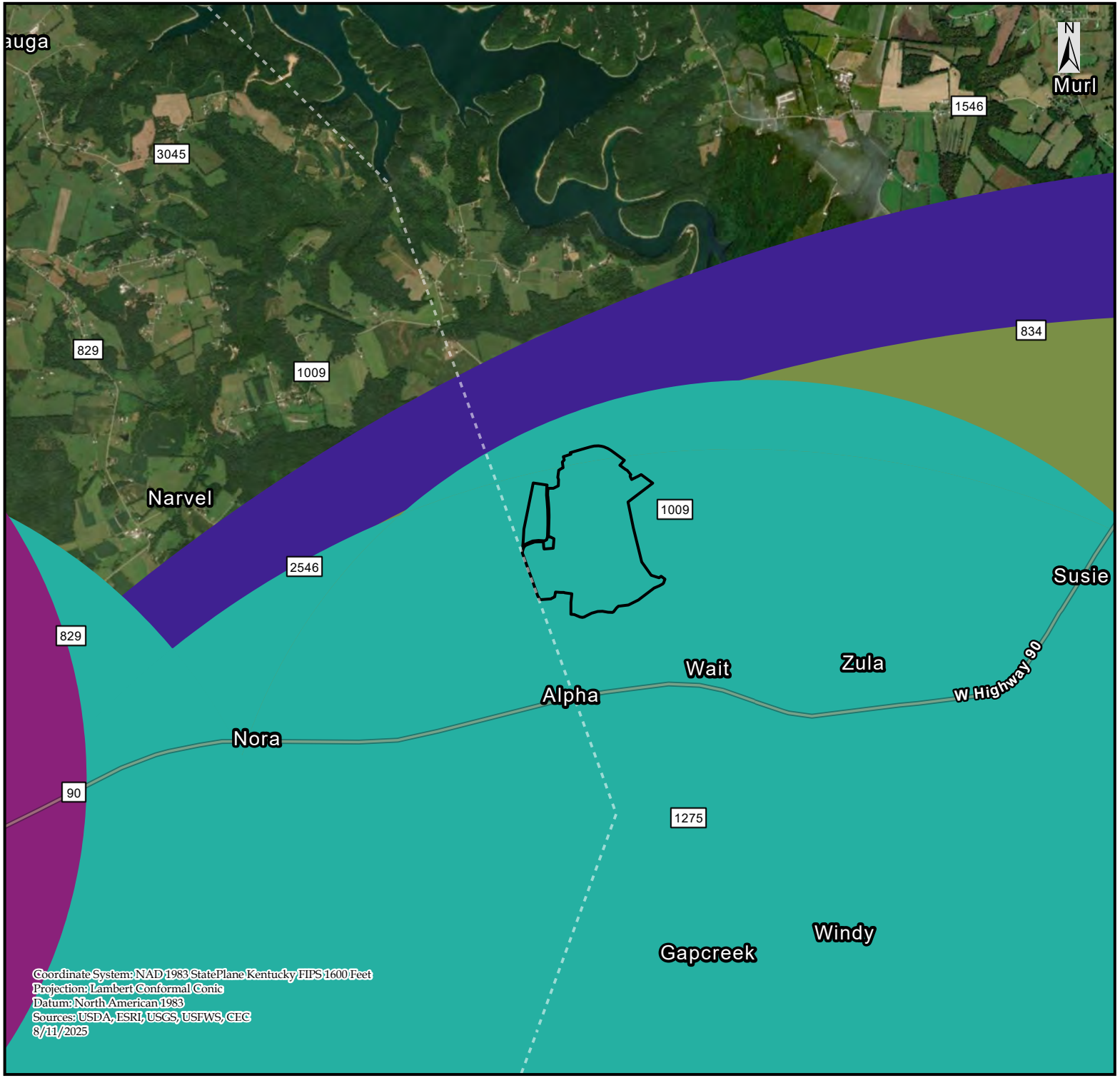
Drawn by:	CM	Date:	8/11/2025
Checked by:	KR	Revision:	03





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Prepared for:

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FIGURE 10:
Listed Bat Species Habitat
for the Barrelhead Solar Project,
Wayne County, Kentucky.

Legend

- Indiana Bat Swarming Habitat
- Indiana Bat Habitat
- Northern Long-eared Bat Habitat
- Indiana Bat Maternity Colony Buffer
- Project Boundary

0 4,000 8,000
US Feet

Scale: 1 in = 4,000 ft

Prepared by :
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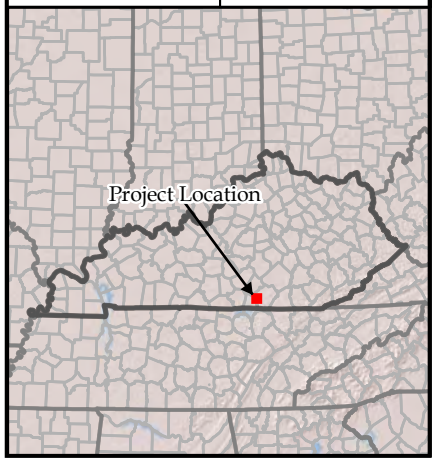

Appendix B: Photographic Record

Photo Number: 1

5/17/2025

Description:
Representative view of a grassy field.

Photo Number: 2

5/19/2025

Description:
Another representative photo of a grassy field.

Photo Number: 3

5/17/2025

Description:
Representative photo of a forested fenceline adjacent to grassy fields.

Photo Number: 4

5/19/2025

Description:
Representative view of an anthropogenic structure (barn) that could be considered suitable bat roosting habitat.

Photo Number: 5

5/30/2025

Description:
Representative photo of an agricultural field.

Photo Number: 6

5/17/2025

Description:
Another representative photo of an agricultural field.

Photo Number: 7

5/17/2025

Description:
Representative view of the existing transmission line within the Project Area.

Photo Number: 8

5/17/2025

Description:
Representative photo of emergent wetland habitat.

Photo Number: 9

5/19/2025

Description:
Another representative photo of emergent wetland habitat.

Photo Number: 10

5/19/2025

Description:
Representative photo of forested wetland habitat.

Photo Number: 11

5/19/2025

Description:
Another representative photo of forested wetland habitat.

Photo Number: 12

5/19/2025

Description:
Representative view of upland forested habitat.

Photo Number: 13

5/19/2025

Description:
Another view of upland forested habitat.

Photo Number: 14

5/17/2025

Description:
Representative view of an ephemeral feature within the Project Area.

Photo Number: 15

5/19/2025

Description:
Another representative view of an ephemeral feature within the Project Area.

Photo Number: 16

5/19/2025

Description:
Representative view of an ephemeral feature and rocky, cliff-like habitat.

Photo Number: 17

5/19/2025

Description:
Representative view of an intermittent stream within the Project Area.

Photo Number: 18

5/19/2025

Description:
Another representative view of an intermittent stream within the Project Area.

Photo Number: 19

5/19/2025

Description:
Upstream view of Potts Creek, a perennial stream.

Photo Number: 20

5/20/2025

Description:
Downstream view of Potts Creek, a perennial stream.

Photo Number: 21

5/16/2025

Description:
Representative view of a tributary to Potts Creek.

Photo Number: 22

5/16/2025

Description:
Representative view of a forested stream.

Photo Number: 23

5/17/2025

Description:
Overview of the portal located within the Project Area. This portal was deemed unsuitable.

Photo Number: 24

5/17/2025

Description:
Representative photograph of a potential bat roost tree.

Photo Number: 25

5/15/2025

Description:
Photo of the mist net setup within a flyway corridor.

Photo Number: 26

5/15/2025

Description:
Overview of another mist net setup within a fallow field adjacent to a mixed hardwood forest.

Photo Number: 27

5/15/2025

Description:
Eastern red bat (*Lasiurus borealis*) collected during the mist net survey. This is not a listed bat species.

Photo Number: 28

5/15/2025

Description:
Evening bat (*Nycticeius humeralis*) collected during the mist net survey. This is not a listed bat species.

Appendix C: Phase I Portal Concurrence

Outlook

Re: [EXTERNAL] Birch Creek Barrelhead Solar Portal Habitat Assessment

From Armstrong, Mike <mike_armstrong@fws.gov>
Date Wed 10/9/2024 10:48 AM
To Kelsie Eshler <keshler@copperheadconsulting.com>
Cc Zack Baer <zbaer@copperheadconsulting.com>; Marty Marchaterre <mMarchaterre@copperheadconsulting.com>; KentuckyES, FW4 <kentuckyes@fws.gov>; Bishop, Seth R <seth_bishop@fws.gov>

3 attachments (8 MB)
Outlook-a; Outlook-a; 1648 Birch Creek Barrelhead Solar Portal Habitat Assessment Survey Report_Final.pdf;

Morning Kelsie.

I have reviewed the subject survey report and cave/abandoned mine portal assessment summary and find it to be acceptable for probable absence of Indiana, northern long-eared, and tricolored bat during the winter in the project area given the lack of suitability of the 3 features identified on-site. Please be aware that my approval of these survey results is not a section 7(a)(2) concurrence and does not authorize implementation of any part of the proposed action or remove the applicant from the permitting requirements that may be required by other State and federal agencies. Please contact Seth Bishop and Kentuckyes@fws.gov if you have additional questions regarding the consultation.

Thanks,

Mike

Mike Armstrong
Southeast Region Bat Recovery Biologist
U.S. Fish & Wildlife Service
Kentucky Field Office
330 W. Broadway, Room 265
Frankfort, KY 40601
Cell: 502-229-4632
Office/Teams: 502-653-0498

**Check us out at https://www.fws.gov/office/kentucky-ecological-services

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

From: Kelsie Eshler <keshler@copperheadconsulting.com>
Sent: Wednesday, October 9, 2024 10:30 AM
To: Armstrong, Mike <mike_armstrong@fws.gov>
Cc: Zack Baer <zbaer@copperheadconsulting.com>; Marty Marchaterre

<mmarchaterre@copperheadconsulting.com>
Subject: [EXTERNAL] Birch Creek Barrelhead Solar Portal Habitat Assessment

This email has been received from outside of DOI - Use caution before clicking on links, opening attachments, or responding.

Hi Mike,

Please see attached a copy of our findings from the portal suitability assessment of the three previously identified portals in Wayne and Clinton counties, Kentucky.

Please let us know if you have any questions or if you need any additional information.

Thanks,

Kelsie R. Eshler
Biologist

Copperhead Environmental Consulting, Inc.
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