Appendix A. Habitat Assessment Manual For Indiana Bat and Gray Bat

Gray Bat (*Myotis grisescens*)

Species Description

Gray bat was listed as **endangered** on April 28, 1976.

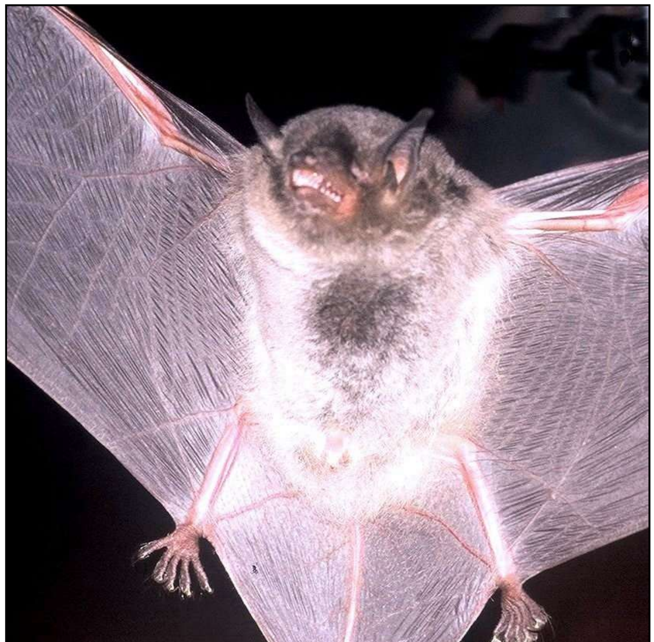

Photo Credit: Todd McDaniel, HMB Professional Engineers, Inc.

The gray bat is a small, gray colored bat generally weighing between 7-10 grams with an average total length of between 80-105 mm. Gray bats can be distinguished from other *Myotis* species by its uniform-colored dorsal fur from base to tip and by its attachment of wing membrane at ankle, not at base of toe.

Gray bats are described as a year-round, cave-dwelling species. During the winter when their food source (primarily aquatic insects) is unavailable, gray bats hibernate (torpor) in caves (known as hibernacula) that serve as cold air traps, where they form tightly packed clusters of thousands of hibernating bats. Upon emergence from hibernation in the spring (usually March) they migrate to suitable summer cave habitat, forming maternity colonies of up to 20,000 individuals. Females give birth to a single young in late May or early June. These reproductive females use caves or cave-like habitats that trap warm air in domed ceilings and are almost always located less than 1 mile from a stream or lake. Males and non-reproductive females form colonies in less suitable caves or cave-like habitats often as far as 18-20 miles from maternity sites. In September and October the bats return to the area surrounding the hibernacula to mate, and to forage in order to build up fat reserves for the winter hibernation. Normally, the bats have entered the hibernacula by early November.

Appendix A. Habitat Assessment Manual For Indiana Bat and Gray Bat

<u>Habitat Description</u>

Summer & Winter Habitat: Gray bats use caves or cave-like habitats year-round, moving seasonally between warm and cold caves. Cave-like habitats include coal and limestone mines, large storm sewers, bridges, and tunnels. Gray bats hibernate during the winter in deep limestone caves that act as cold air traps. Very few caves meet the specific temperature requirements required for hibernating gray bats. Maternity colonies are almost always located in caves as well. During the spring and fall migration a wider variety of caves and cave-like habitats are used as roosts. Gray bats are also known to roost at bridge or culverts. These structures can provide places for bats to rest with protection from predators and adverse weather conditions.

Potential adverse impacts associated with transportation projects may include disturbance of winter or summer caves or cave-like habitats and changes to foraging areas. Construction activities such as fill, blasting, diversion of water away from or toward a cave system (which could affect access), altering of airflow or temperature regimes within the system, and altering cave passages are all potential impacts. The replacement of bridges or culverts that are being used by gray bats could result in direct mortality or at the very least habitat loss. Bridge and culvert construction can also affect stream foraging areas either through the loss of riparian habitat or the production of in-stream sediment that reduces aquatic insect production.

Foraging Habitat: Gray bats forage for flying insects over streams and lakes that are bordered by forest or at least have an intact riparian zone, often up to 12-15 miles from their roost. They prefer to fly through forest canopy between caves and feeding areas, traveling considerable distances out of their way to reach a foraging area, in order to take advantage of the cover provided by even scattered trees along fencerows. These travel corridors are important to connect roost sites to feeding areas. Foraging habitat is almost always over water (streams, lakes, or wetlands) with an intact, forested riparian zone. Smaller wooded stream corridors, wooded fencerows, and connecting woodlots are used as travel lanes to reach foraging areas. Ponds and lakes with some riparian zone are used to a similar degree.

Appendix A. Habitat Assessment Manual For Indiana Bat and Gray Bat

Foraging habitat can be impacted through tree clearing that removes forested travel corridors that connect foraging sites to roost sites, or removes forested borders from lakes or streams. New corridor construction, widening that requires clearing, bridge replacements that require tree removal, and borrow or fill areas that are located in wooded or partially wooded areas, are all activities that could impact gray bats. Stream relocations and riparian vegetation removal can impact gray bat foraging habitat. Any cumulative impacts (changes that are likely to occur in the reasonably foreseeable future) to gray bat habitat, as a result of the project, should be considered as well.

Wetlands or reservoirs with a forested border are foraging habitat for gray bats. These bats fly along the edges of the water, under the protection of overhanging branches, and hunt for flying insects.

Streams with forested riparian areas are foraging habitat for gray bats. These bats fly along the edges of the stream, under the protection of overhanging branches, and hunt for flying insects. Gray bat feeding areas have not been found along sections of stream where adjacent forest has been cleared.

Appendix A. Habitat Assessment Manual For Indiana Bat and Gray Bat

Particular attention should be paid along stream valley walls.

Sinkhole openings can be level with the ground, and may be hidden from view by vegetation or debris. Gray bats may still be using these partially blocked sinkhole openings.

Some cave openings may be hidden from view by vegetation or debris.

Bridges are sometimes used as roosts by gray bats. These bridges mimic cave conditions and provide a protected shelter for the bats. Most bridges used by gray bats are located over water.

Cave openings will not always have a typical, recognizable, appearance.

Appendix A. Habitat Assessment Manual For Indiana Bat and Gray Bat

Critical Habitat

None

Range

The range of the gray bat extends from southern Illinois, Indiana, and Ohio, east to western West Virginia, Virginia, and North Carolina, south to south western Georgia, northwestern Florida, southern Alabama, and northwest Arkansas, and west to western Missouri, northeastern Oklahoma, and southeastern Kansas, encompassing all of Kentucky and Tennessee. The gray bat was listed as potentially occurring statewide in Kentucky (all counties) during 2016.

Assessment Methods

Office Assessment:

Review geologic quads for karst and cave features, presence of karst bearing strata (Ordovician and Mississippian age limestone), underground quarry sites, and mine adits. Review any mapping that indicates vegetation and presence of streams and reservoirs, including aerial photography, topographic quadrangles, right-of-way strip maps, and plan sheets.

Field Assessment:

When on site, walk the scope of the project to locate any known openings within 1 km of the project disturbance limits and confirm their presence or absence and condition, as well as the location of any unknown openings (wildcat mines, collapsed audits, etc.). Pay particular attention to vertical cliff-lines adjacent to stream valleys which may have cave openings. Look for highway and railway bridges and storm sewers that have a cave-like appearance. Current and former landowners of subject parcels are a good source of information. NOTE: *Do not enter mines or caves.*

Look for streams and reservoirs that have forested borders, as well as forested areas, like fencerows, that connect streams to caves or cave-like habitats, and verify the presence or absence of these features with an on-site visit.

Appendix A. Habitat Assessment Manual For Indiana Bat and Gray Bat

Decision Key

1) Do any of the following occur within the project area or within 1 km of the project area:

    - Limestone strata
    - Karst features (caves, sinkholes)
    - Inactive underground mining (coal, limestone)

    a. Yes: Contact SME
    b. No: Go to Step 2

2) Will the project directly impact streams with wooded banks or open water wetlands?

    a. Yes: Contact SME
    b. No: Prepare a No Effect finding

Literature Cited

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Appendix A. Habitat Assessment Manual For Indiana Bat and Gray Bat

Indiana Bat (*Myotis sodalis*)

<u>Species Description</u>

The Indiana bat was listed as an **endangered** species on March 11, 1967.

The Indiana bat is a small, brown bat generally weighing between 5-11 grams with an average total length of between 75-102 mm. Its physical characteristics are similar to that of the little brown bat (*Myotis lucifugus*) and northern long-eared bat (*Myotis septentrionalis*); however, the Indiana bat is distinguished by its presence of a keeled calcar, coloration, and absence of long toe hairs.

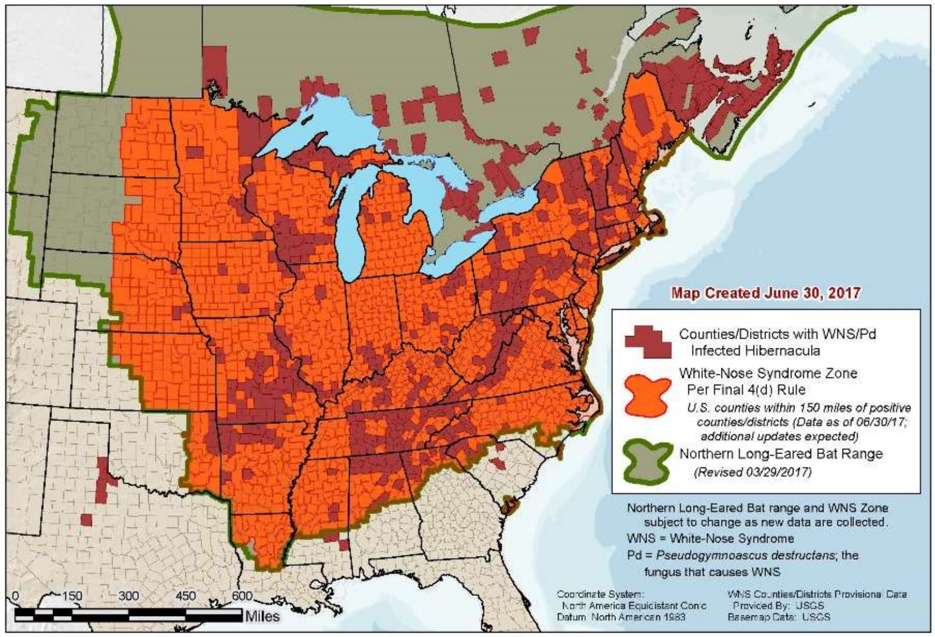
Photo Credit: http://www.nrs.fs.fed.us/sustaining_forests/conserve_enhance/wildlife_fish/habitat_resource_selection/

This species uses different habitats during the summer (forest-dwelling) and winter (cave-dwelling) months. In addition, male and female bats may use different habitat types. Both sexes overwinter in caves or open mines. During late spring/early summer, female bats form maternity colonies in characteristic trees (*Habitat Description*, Figure 1). Males roost singly or in small groups in trees and small caves and require less specific roost habitat. During mid-fall the bats migrate to their winter habitat and begin the mating behavior known as swarming. Both males and females require forested areas and wetland/riparian areas for foraging.

<u>Habitat Description</u>

Winter Habitat: Caves, or deep mines (including coal and limestone as well as other mineral recovery operations) are the typical wintering habitat for Indiana bats.

Threats to the species vary with its annual cycle. At the hibernacula, threats include modifications to the caves, mines, and surrounding areas that result in changes in airflow and alteration of the microclimates in the hibernacula. Human disturbance and vandalism pose significant threats to the species during hibernation by inducing arousal and consequent depletion of fat reserves and through direct mortality. Natural catastrophes (flooding and freezing events) can also have a significant effect on the population during winter because of the large number of individuals that hibernate in a relatively few sites. The Indiana bat hibernates colonially in caves and mines in the winter. During the winter months, Indiana bats are restricted to suitable underground hibernacula typically consisting of caves located in karst areas of the east-central United States; however, this species also hibernates in cave-like locations, including abandoned mines. Hibernacula tend to have large volumes with large rooms and vertical or extensive passages, often below the lowest entrance. Cave volume and complexity help buffer the cave environment against rapid and extreme changes in outside temperature, and vertical relief helps provide a range of temperatures and roost sites. Most Indiana bats hibernate in caves or mines where the ambient temperature is relatively stable and remains below 10°C (50.0°F) but infrequently drops below freezing. In these caves, tight groups are formed that can consist of hundreds to thousands of individuals. It is generally accepted that most Indiana bats return to the same hibernaculum each year. These bats also tend to hibernate in the same cave or mine at which they swarm, although there are exceptions to this pattern. Colonization of new hibernacula has been documented, indicating that this species has some capacity to exploit unoccupied habitats and expand their winter distribution.



Cluster density may also be limiting for hibernating bats. Indiana bats roost in dense clusters in hibernacula, potentially for thermal benefits or the conservation of water. Although the link between cluster size and overwinter survival has not been quantified, there are several benefits to being a member of a large hibernating population, including the social and energetic advantages of roosting in dense clusters, and having many individuals available during fall swarming to help ensure reproductive success. A new threat to bats emerged in upstate New York in the winter of 2006 and has since spread far across the eastern and Midwestern U.S. Referred to as White Nose Syndrome (WNS), given the name because of the white fungal growth observed on affected bats, it is caused by the bats contracting a fungus identified as *Pseudogymnoascus destructans (Pd).* In as little as four years WNS has claimed the lives of at least a million bats and infected hibernacula in the northeast, resulting in mortality rates upwards of 95 percent. It's not clearly known, but the fungus appears to disrupt bats hibernation by causing them to repeatedly awaken, thereby depleting essential fat reserves. Once the fat reserves have been depleted bats attempt to emerge early to forage and are met with unfavorable weather conditions that almost always leads to mortality.

During summer months, possible threats relate to the loss and degradation of forested habitat. Migration pathways and swarming sites can also be affected by habitat loss and degradation. Habitats surrounding swarming sites may be particularly important in that these sites are discrete areas that apparently must be suitable to support large numbers of bats that, in addition to engaging in swarming activities, must forage to build up sufficient fat reserves to sustain them through the hibernation period.

Summer Habitat: Indiana bat summer habitat includes any tree greater than or equal to 5" dbh that possesses any or all of the following characteristics; exfoliating bark (e.g., shagbark hickory), dead or dying trunk/limbs (species of vegetation which do not normally possess exfoliating bark can develop this characteristic as the bark dies and begins to separate from the dying trunk/branch), cavities and fissures (e.g. woodpecker holes, lightning damage, heart rot). These trees can be found in various landscapes including floodplains and bottomlands, slopes and ridges, as well as upland areas. Some representative pictures of suitable Indiana bat summer roosting habitat in Figure 1.

Primary roosts usually receive direct sunlight for more than half the day. Roost trees are typically within canopy gaps in a forest, in a fence line, or along a wooded edge. Habitats in which maternity roosts occur include riparian zones, bottomland and floodplain habitats, wooded wetlands, and upland communities.

The most likely impacts associated with transportation projects are disturbance and removal of forested summer habitat, disturbance of caves and cave-like openings, and alterations to foraging habitat. The loss of summer habitat could result in direct mortality if the area being cleared is inhabited by bats at the time of clearing. Foraging habitat can also be impacted through tree clearing that removes forested travel corridors that potentially connect foraging sites to roost sites or removes forested borders from streams or other water bodies. New corridor construction, widening of an existing roadway that requires clearing, bridge replacements that require tree removal, and excess fill areas that are located in wooded or partially wooded areas are all activities that could impact Indiana bats. Bridge and culvert construction can also affect stream foraging areas either through the loss of riparian vegetation or the production of in-stream sediment that could potentially reduce the aquatic insect production of that waterway.

Construction activities such as blasting, diversion of surface water away from or toward a cave or mine system, altering of airflow or temperature within a cave system, and altering cave or mine passages are all potential impacts to Indiana bat winter habitat.

Foraging Habitat: Commuting habitat that connects summer foraging and roosting areas is necessary to maximize foraging success and conserve energy. As a general rule, the Indiana bat does not cross large open areas and will follow tree lines or fencerows to reach foraging areas despite increased energy expenditures and commuting distances, although exceptions to this have been noted. Variable distances to foraging areas may be attributed to range wide differences in habitat type, interspecific competition, and landscape terrain. Fall swarming also requires the presence of suitable roost trees, foraging areas, and water in the vicinity of each occupied hibernaculum. Adequate habitat connectivity is needed to allow for movement of bats among these various elements.

Foraging habitat for both sexes is comprised of closed to semi-open forest and forest edges. There does not appear to be a preference for the type of wooded habitat, and foraging has been noted in multiple wooded habitat types including floodplain, riparian, lowland, and upland forests. Although some observations of foraging have been documented from open areas, numerous studies have shown the dominant use of wooded edge habitat over open areas.

The Indiana bat shows fidelity to summer roosting and foraging areas. Benefits of site familiarity include reduction in time spent searching for new sites, more profitable exploitation of local food resources, and greater awareness of resident predators. Whenever roosts and foraging sources are eliminated, bats are forced to seek new habitat and expand their foraging range, potentially reducing foraging success and exposing bats to increased predation and competition. Availability of traditional roosting and foraging areas, at least at the landscape level, are important to survival and productivity.

Appendix A. Habitat Assessment Manual For Indiana Bat and Gray Bat

The minimum size of a forest patch that will sustain Indiana bat maternity colonies has not been established. However, in highly fragmented landscapes the loss of connectivity among forested blocks may degrade the quality of the habitat for the Indiana bat. Patterson et al. (2003) noted that the mobility of bats, associated with flight, allows them to exploit fragments of habitat. However, they cautioned that reliance on already diffuse resources (e.g., roost trees) leaves bats highly vulnerable, and that energetics may preclude the use of overly patchy habitats.

Connectivity of habitats has been demonstrated to be important to this species. Murray and Kurta (2004) noted that bats within their maternity habitat in Michigan did not fly over open fields but traveled along wooded corridors, even though use of these corridors increased commuting distance by over 55 percent. Sparks et al. (2005) also noted the importance of a wooded riparian travel corridor to the Indiana bat in the maternity colony at their study site in Indiana. In addition, the distance and wooded connectivity between roosts and foraging areas may be limiting for this species at some sites.

Figure 1: Pictures of suitable Indiana bat roosting habitat

Appendix A. Habitat Assessment Manual For Indiana Bat and Gray Bat

Critical Habitat

Critical habitat was designated for the species on September 24, 1976 and included 11 caves and 3 mines in six states. In Kentucky, these critical habitat designations include Bat Cave (Carter County) and Coach Cave (Edmonson County). Five of the 23 Priority 1 hibernacula identified in the Indiana bat Draft Recovery Plan (2007) lie within Kentucky's borders. Three of these hibernacula occur within the Mammoth Cave system. The two other Priority 1 hibernacula occur in Kentucky's eastern coalfields with Bat Cave in the northeast portion of the state and Line Fork Cave in the southeast.

Range

The range of the Indiana bat includes Alabama, Arkansas, Connecticut, Florida, Georgia, Illinois, Indiana, Iowa, Kentucky, Maryland, Massachusetts, Michigan, Missouri, New Jersey, New York, North Carolina, Ohio, Oklahoma, Pennsylvania, Tennessee, Vermont, Virginia, West Virginia, and Wisconsin. Most capture records of reproductively active female and juvenile Indiana bats have occurred in the upper Midwest including southern Iowa, northern Missouri, much of Illinois, most of Indiana, southern Michigan, western Ohio, and in Kentucky. Even though the winter range is dispersed across the eastern U.S., over 90 percent of the estimated range-wide population (in 2005) hibernated in just five states: Indiana, Missouri, Kentucky, Illinois, and New York. The Indiana bat is assumed present statewide (all counties) in Kentucky.

Habitat Assessment Methods

Office Assessment:

Review geologic quads for indications of potential winter habitat such as karst/cave features, presence of karst bearing strata (Ordovician and Mississippian age limestone), quarry sites, mine adits, and elevations of coal seams within 1 km of the project's disturbed limits. Review should also include accessing Energy and Environment Cabinet (EEC) Division of Mines' GIS layer for the presence of active and abandoned deep mines near the project area. Begin with best available remote-sensing data including; aerial photography, topographic quadrangles, right-of-way strip maps, plan sheets indicating vegetation, etc.

Field Assessment:

On-site inspections should include walking the project area (any areas that would be directly or indirectly impacted by the project) to locate potential winter and/or summer roosting habitat. Known openings identified during office assessment as well as identifying the presence of unknown openings (wildcat mines, collapsed adits, open-throat sinkholes, etc.) should be documented.

Appendix A. Habitat Assessment Manual For Indiana Bat and Gray Bat

<u>Decision Key</u>

1) Does the project require the removal of any tree(s) greater than or equal to 5” diameter at breast height regardless of the structure and characteristics of the tree(s)?

    a. Yes: Contact a DEA Subject Matter Expert

    b. No: Go to Step 2

2) Did survey of the project area, USGS quad, or any other resource (document all resources consulted or agency coordination undertaken) identify any of the following within 1 km of the project area?

- Caves
- Open throated sinkholes
- Mine adits
- Other karst features

    a. Yes: Contact a DEA Subject Matter Expert

    b. No: Prepare a No Effect finding

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Appendix B. Bats in Bridges Datasheet

BATS IN BRIDGES DATASHEET

KYTC Structure ID ______________________________ **KYTC Item No** ____________________________________

Bridge Location: ____

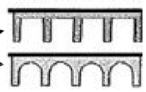
County: ______________________________ **Lat:** ________________________ **Long:** ________________________

Date: _____________ **Time of Survey:** ____________ **Investigator Name(s):** ___________________________________

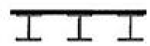
Bridge Type: (check one)

☐ Parallel Box Beam 

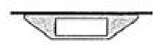
☐ Pre-stressed Girder 

☐ Cast in Place 

☐ Culvert – Box

☐ Steel I-beam 

☐ Flat Slab / Box 

☐ Trapezoidal Box 

☐ Culvert – Pipe/Round ☐ Other: ________________

Underdeck Material:

☐ Concrete

☐ Corrugated Steel

☐ Other: _____________

Road Type: (check one) ☐ Interstate ☐ U.S. Highway ☐ State Road ☐ County Road

Surrounding Habitat: (check all that apply)

☐ Residential ☐ Row Crop ☐ Commercial ☐ Woodland ☐ Grassland ☐ Pasture ☐ Riparian ☐ Mixed ☐ Wetland

Conditions Under Bridge: (check all that apply)

☐ Bare ground /sediment ☐ Concrete ☐ Rip rap ☐ Flowing water ☐ Standing water

☐ Open vegetation (not obstructing flight path) ☐ Closed vegetation (may obstruct flight path)

☐ Two lane road ☐ Four (or more) lane highway ☐ Dirt road ☐ Railroad

☐ Evidence of superstructure flooding Bridge height above water: ___________

Bat indicators: (check all that apply) ☐ Visual ☐ Smell ☐ Sound ☐ Staining ☐ Guano ☐ None

Use intensity: (check one) ☐ Minor (scattered, individual guano pellets and/or few small areas of staining covering <1 ft each - few bats or temporary usage)

☐ Major (guano piles and/or large areas of staining covering >1 ft each – semi permanent colony)

Bats Present: ☐ YES ☐ NO

Appendix B. Bats in Bridges Datasheet

Species Present (record number of individuals if known)

_________ Myotis septentrionalis (Northern long-eared)
_________ Myotis sodalis (Indiana)
_________ Myotis leibii (Eastern small-footed)
_________ Myotis lucifugus (Little brown)
_________ Myotis grisescens (Gray)
_________ Myotis austroriparius (Southeastern)
_________ Lasiurus cinereus (Hoary)
_________ Lasiurus borealis (Eastern red)
_________ Lasiurus seminolus (Seminole)
_________ Lasiurus noctivagans (Silver-haired)
_________ Perimyotis subflavus (Tri-colored)
_________ Eptesicus fuscus (Big brown)
_________ Nycticeius humeralis (Evening)
_________ Tadarida brasiliensis (Braz. free-tailed)
_________ Corynorhinus t. townsendii (Virginia)
_________ Corynorhinus rafinesquii (Rafinesque's)
_________ UNKNOWN

Roost description (If known, check all that apply): ☐ Day Roost ☐ Nursery Roost ☐ Night Roost ☐ Unknown

Number of roosts ______________________________

Roost feature: (check all that apply)

☐ Crack/crevice/expansion joint: underside of bridge ☐ Crack/crevice/expansion joint: top side of bridge

☐ Plugged drain ☐ Under/along the main bridge structure ☐ Rail ☐ Other:_________________________________

Human disturbance or traffic under bridge or at structure? ☐ High ☐ Low ☐ None

Evidence of bats using bird nests? ☐ Yes ☐ No (if yes, please describe and photograph nest location)

Areas Inspected: (check all that apply)

☐ Vertical surfaces on I-beams ☐ Vertical surfaces between concrete end walls and bridge deck

☐ Expansion joints ☐ Rough surfaces ☐ Guardrails ☐ Crevices ☐ Other:_____________________

Areas NOT Inspected because of safety or inaccessibility:

____

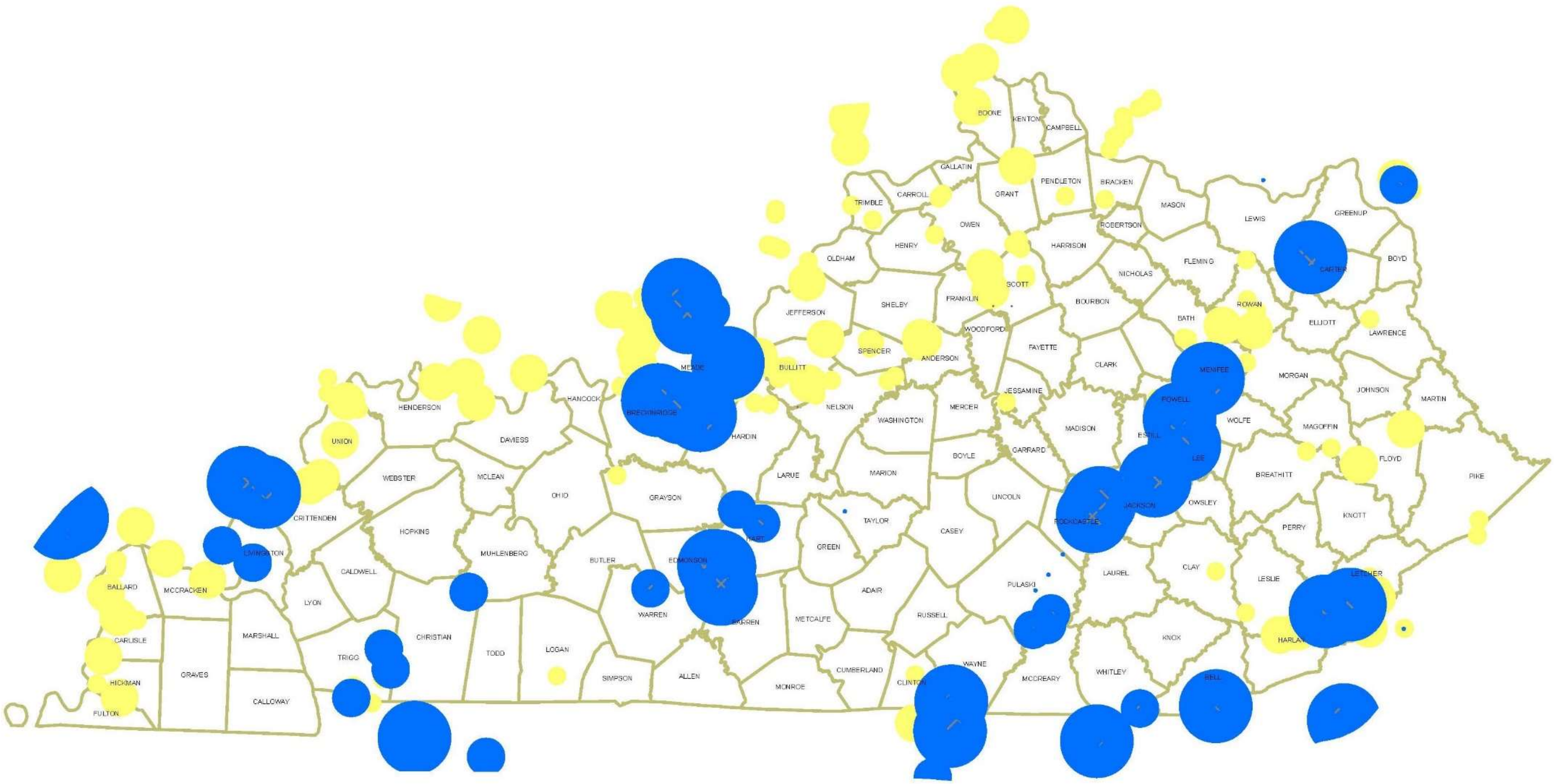
____

Additional Comments / Sketch:

____

____

Appendix C. Known Indiana Bat Habitat In Kentucky and Within 20 Miles (image provided by US Fish and Wildlife Service, August 2019)



Known Swarming Habitat

Known Summer Habitat

Unsurveyed Habitat

Appendix D. Best Management Practices

Sediment and Erosion Control Measures – Plans for the proposed project will include erosion control sheets that depict the Disturbed Drainage Areas (DDAs) and related information. These plan sheets will show the existing project conditions with areas delineated by DDAs within the right-of-way limits, discharge points, and areas that drain to each discharge point. Project managers and designers will analyze the DDAs and identify site-specific BMPs. The balance of the BMPs for the project will be listed in the bid documents for selection and use by the contractor on the project, with approval by the resident engineer. Erosion control sheets that do not have DDAs annotated will employ the same concepts for development and managing BMP plans.

The contractor and resident engineer will annotate the erosion control sheets showing location and type of BMPs for each of the DDAs that will be disturbed at the outset of the proposed project. This annotation will be accompanied by an order of work that reflects the order or sequence of major soil moving activities. The remaining DDAs are to be designated as "Do Not Disturb" until the contractor and resident engineer prepare the plan for BMPs to be employed. The initial BMPs shall be for the first phase (generally Clearing and Grubbing) and shall be modified as needed as the project changes phases. The BMP Plan will be modified to reflect disturbance in additional DDAs as the work progresses. All DDAs will have adequate BMPs in place before being disturbed.

Non-Structural BMPs – The following non-structural BMPs will be implemented throughout the project duration:

- Sediment control BMPs will be maintained when the sediment reaches 1/2 the depth of the BMP.
- Appropriate stock of straw erosion control blanket (ECB) and straw bales shall be available onsite at all times.
- Straw ECB or seeding mulched with blown straw followed by crimping shall be applied within seven days of the cessation of the land disturbing activity. If blown straw is used, the blower and crimping equipment shall be kept on-site during land disturbing activities.
- Disturbed areas shall be stabilized prior to a forecasted rain event.
- Erosion Prevention and Sediment Control/Stormwater Pollution Prevention Plan inspections shall be performed at least once a week and within 24 hours of the end of a rain event of 0.5 inches or greater.

Disturbed Drainage Areas – As DDAs are prepared for construction, the following will be addressed for the project as a whole or for each DDA, as appropriate:

- Construction Access – This is the first land-disturbing activity. As soon as construction begins, bare areas will be stabilized with straw ECB or straw followed by crimping, and designated construction entrances will be installed.

- Sources – At the beginning of the project, all DDAs for the project will be inspected for areas that are a source of storm water pollutants. Areas that are a source of pollutants will receive appropriate cover or BMPs to arrest the introduction of pollutants into storm water. Areas that have not been opened by the contractor will be inspected periodically (once per month) to determine if there is a need to employ BMPs to keep pollutants from entering storm water.

Appendix D. Best Management Practices

- Clearing and Grubbing – The following BMPs will be considered and used where appropriate:
    - Leaving areas undisturbed when possible.
    - Silt basins to provide silt volume for large areas.
    - Silt Traps Type A for small areas.
    - Silt Traps Type C in front of existing and drop inlets that are to be saved.
    - Diversion ditches to catch sheet runoff and carry it to basins or traps, or to divert it around areas to be disturbed.
    - Brush and/or other barriers to slow and/or divert runoff.
    - Silt fences to catch sheet runoff on short slopes. For longer slopes, multiple rows of silt fence may be considered.
    - Temporary mulch for areas which are not feasible for the aforementioned types of protections.
    - Non-standard or innovative methods.
    - Spill Containment Areas to protect sinkholes and outfalls.

- Cut and FM and Placement of Drainage Structures – The BMP Plan will be modified to show additional BMPs, such as:
    - Silt Traps Type B in ditches and/or drainways as they are completed.
    - Silt Traps Type C in front of pipes after they are placed.
    - Channel lining.
    - ECB.
    - ECB and/or straw, seeding, and crimping for areas where construction activities will be ceased for 14 days or more.
    - Non-standard or innovative methods.

- Profile and X-Section in Place – The BMP Plan will be modified to show elimination of BMPs that had to be removed and the addition of new BMPs as the roadway was shaped. Probable changes include:
    - Silt Trap Type A, brush and/or other barriers, temporary mulch, and any other BMP that had to be removed for final grading to take place.
    - Additional Silt Traps Type B and Type C to be placed as final drainage patterns are put in place.
    - Additional Channel Lining and/or ECB and/or Turf Reinforcement Mats.
    - Temporary mulch and/or seeding for areas where construction activities will be ceased for 14 days or more.

- Finish Work (Paving, Seeding, Protect, etc.) – A final BMP Plan will result from modifications during this phase of construction. Probable changes include:
    - Removal of Silt Traps Type B from ditches and drainways if they are protected with other BMPs that are sufficient to control erosion, i.e. ECB, Turf Reinforcement Mats, or Permanent Seeding and Protection on moderate grades.
    - Permanent Seeding and Protection.
    - Placing Sod.

- Post Construction – BMPs, including Karst policy BMPs, to be installed during construction to control the pollutants in stormwater discharges that will occur after construction has been completed are:

    - Filter ditches: Filter ditches are grass swales placed at the outlets of some of the spill containment areas to promote infiltration and vegetative filtering.
    - Spill containment areas: Detention/containment basins for capturing accidental spills on the newly constructed roadway will be provided in accordance with KYTC's Design Policy.

Other Control Measures – The following control measures will be utilized during project construction:

- Solid Materials – No solid materials, including building materials, shall be discharged to waters of the Commonwealth, except as authorized by a Section 404 permit.

- Waste Materials – All waste materials that may leach pollutants (paint and paint containers, caulk tubes, oil/grease containers, liquids of any kind, soluble materials, etc.) will be collected and stored in appropriate covered waste containers. Waste containers shall be removed from the project site on a sufficiently frequent basis as to not allow wastes to become a source of pollution. All personnel will be instructed regarding the correct procedure for waste disposal. Wastes will be disposed in accordance with appropriate regulations. Notices stating these practices will be posted in the office.

- Hazardous Waste – All hazardous waste materials will be managed and disposed of in the manner specified by local or state regulation. The contractor shall notify the Resident Engineer if there are any hazardous wastes being generated at the project site and how these wastes are being managed. Site personnel will be instructed with regard to proper storage and handling of hazardous wastes when required. The KYTC will file for generator registration, when appropriate, with the Division of Waste Management and advise the contractor regarding waste management requirements.

- Spill Prevention – The following material management practices will be used to reduce the risk of spills or other exposure of materials and substances to the weather and/or runoff.

    - Good Housekeeping – The following good housekeeping practices will be followed onsite during the construction project:

        - An effort will be made to store only enough product required to do the job.
        - All materials stored onsite will be stored in a neat, orderly manner in their appropriate containers and, if possible, under a roof or other enclosure.
        - Products will be kept in their original containers with the original manufacturer's label.
        - Substances will not be mixed with one another unless recommended by the manufacturer.
        - Whenever possible, all of the product will be used up before disposing of the container.
        - Manufacturers' recommendations for proper use and disposal will be followed. The site contractor will inspect daily to ensure proper use and disposal of materials onsite.

- Hazardous Products – These practices will be used to reduce the risks associated with any and all hazardous materials:

  - Products will be kept in original containers, unless they are not re-sealable.
  - Original labels and material safety data sheets (MSDS) will be reviewed and retained.
  - Contractor will follow procedures recommended by the manufacturer when handling hazardous materials.
  - If surplus product must be disposed of, manufacturers' or state/local recommended methods for proper disposal will be followed.

- The following product-specific practices will be followed onsite:

  - Petroleum Products: Vehicles and equipment that are fueled and maintained on site will be monitored for leaks and receive regular preventative maintenance to reduce the chance of leakage. Petroleum products onsite will be stored in tightly sealed containers, which are clearly labeled and will be protected from exposure to weather. The contractor shall prepare an Oil Pollution Spill Prevention Control and Countermeasure plan when the project involves the storage of petroleum products in 55 gallon or larger containers with a total combined storage capacity of 1,320 gallons. This is a requirement of 40 CFR 112.

  - Fertilizers: Fertilizers will be applied at rates prescribed by the contract, standard specifications, or as directed by the resident engineer. Once applied, fertilizer will be covered with mulch or blankets or worked into the soil to limit exposure to storm water. Storage will be in a covered shed. The contents of any partially used bags of fertilizer will be transferred to a sealable plastic bin to avoid spills.

  - Paints: All containers will be tightly sealed and stored indoors or under roof when not being used. Excess paint or paint wash water will not be discharged to the drainage or storm sewer system but will be properly disposed of according to manufacturers' instructions or state and local regulations.

  - Concrete Truck Washout: Concrete truck mixers and chutes will not be washed on pavement, near storm drain inlets, or within 75 feet of any ditch, stream, wetland, lake, or sinkhole. Where possible, excess concrete and wash water will be discharged to areas prepared for pouring new concrete, flat areas to be paved that are away from ditches or drainage system features, or other locations that will not drain off site. Where this approach is not possible, a shallow earthen wash basin will be excavated away from ditches to receive the wash water.

  - Spill Control Practices: In addition to the good housekeeping and material management practices discussed in the previous sections of this plan, the following practices will be followed for spill prevention and cleanup:

- Manufacturers' recommended methods for spill cleanup will be clearly posted. All personnel will be made aware of procedures and the location of the information and cleanup supplies.
- Materials and equipment necessary for spill cleanup will be kept in the material storage area. Equipment and materials will include, as appropriate, brooms, dust pans, mops, rags, gloves, oil absorbents, sand, sawdust, and plastic and metal trash containers.
- All spills will be cleaned up immediately after discovery.
- The spill area will be kept well ventilated and personnel will wear appropriate protective clothing to prevent injury from contact with a hazardous substance.
- Spills of toxic or hazardous material will be reported to the appropriate state/local agency, as required by KRS 224 and applicable federal law.
- The spill prevention plan will be adjusted as needed to prevent spills from reoccurring and improve spill response and cleanup.
- Spills of products will be cleaned up promptly. Wastes from spill clean-up will be disposed in accordance with appropriate regulations. Spills will be addressed in the "dry" and will not be "washed away" to clean.

<u>Other State and Local Plans</u> – The BMP plan shall include any requirements specified in sediment and erosion control plans, storm water management plans, or permits that have been approved by other state or local officials. Upon submittal of the Notice of Intent, other requirements for surface water protection are incorporated by reference into and are enforceable under this permit (even if they are not specifically included in this BMP plan). This provision does not apply to master or comprehensive plans, non-enforceable guidelines or technical guidance documents that are not identified in a specific plan, or permit issued for the construction site by state or local officials.

<u>Maintenance</u> – The BMP plan shall include a clear description of the maintenance procedures necessary to keep the control measures in good and effective operating condition. Maintenance of BMPs during construction shall be a result of once a week and post-rain event inspections, with action being taken by the contractor to correct deficiencies within three working days. Post construction maintenance will be a function of normal highway maintenance operations. Following final project acceptance by the KYTC, district highway crews will be responsible for identification and correction of deficiencies regarding ground cover and cleaning of storm water BMPs. Post-construction BMP maintenance will be covered in the KYTC's MS4 permit under MCM 5 activities.

<u>Inspections</u> – Inspection and maintenance practices that will be used to maintain erosion and sediment controls include:

- All erosion prevention and sediment control measures will be inspected by the Contractor at least once a week and within 24 hours of the end of a rain event of 0.5 inches or greater.
- Inspections will be conducted by individuals that have received Kentucky Erosion Prevention and Sediment Control – Roadway Inspector (KEPSC-RI) training or other qualification as prescribed by the KYTC that includes instruction concerning erosion prevention and sediment control.
- Inspection reports will be written, signed, dated, and kept on file.

- Stabilization of disturbed areas shall be performed within 14 days of the cessation of the land disturbing activity.
- Disturbed areas shall be stabilized prior to a forecasted rain event.
- Sediment control BMPs will be maintained when the sediment reaches 1/2 the depth of the BMP.
- All measures will be maintained in good working order. If a repair is necessary, it will be initiated within 48 hours of being reported and completed within three working days.
- Silt fences will be inspected for bypassing, overtopping, undercutting, depth of sediment, tears, and to ensure attachment to secure posts.
- Diversion dikes and berms will be inspected and any breaches promptly repaired. Areas that are eroding or scouring will be repaired and re-seeded/mulched as needed.
- Temporary and permanent seeding and mulching will be inspected for bare spots, washouts, and healthy growth. Bare or eroded areas will be repaired as needed.
- All material storage and equipment servicing areas that involve the management of bulk liquids, fuels, and bulk solids will be inspected weekly for conditions that represent a release or possible release of pollutants to the environment.

Non-Storm Water Discharges – It is expected that non-storm water discharges may occur from the site during the construction period. Examples of non-storm water discharges include:

- Water from water line flushings.
- Water from cleaning concrete trucks and equipment.
- Pavement wash waters (where no spills or leaks of toxic or hazardous materials have occurred).
- Uncontaminated groundwater and rain water (from dewatering during excavation).

All non-storm water discharges will be directed to the sediment basin or to a filter fence enclosure in a flat vegetated infiltration area or be filtered via another approved commercial product.

Groundwater Protection Plan – This plan serves as the groundwater protection plan as required by 401 KAR 5:037.