BIOLOGICAL ASSESSMENT FOR KENTUCKY GLADE CRESS, DESIGNATED CRITICAL HABITAT FOR KENTUCKY GLADE CRESS, GRAY BAT, INDIANA BAT, NORTHERN LONG-EARED BAT, AND FRESHWATER MUSSELS

LG&E Bullitt County Transmission Pipeline Project

February 27, 2024

Prepared for:

a PPL company

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J16X404800

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Executive Summary

The Louisville Gas & Electric Company (LG&E) is proposing to construct a pipeline in Bullitt County, Kentucky, approximately 12 miles in length to maintain service reliability and meet the growing demand for natural gas within the service area (the Project). The Project starts approximately one mile east of the intersection of Grigsby Lane and Rummage Road and extends west and south, ending on the east side of Interstate 65 and north of Chapeze Lane (see Appendix A – Figure 1). The majority of the project would have a 50-foot permanent easement with exception of an approximate 938-foot length near Deatsville Road between Mile Post (MP) 7.5 and MP 8.0 where the easement would be 30-foot permanent easement. Other exceptions to the 50-foot width include: road crossings which have no easement width, main line valve site, regulator station site, and interconnection site.

LG&E submitted a pre-construction notification to the U.S. Army Corps of Engineers (USACE) for proposed impacts to jurisdictional streams and wetlands within the Project area. The USACE sought U.S. Fish and Wildlife Service (USFWS) input on the project to comply with section 7 of the Endangered Species Act (ESA) and both agreed to use the *Process for Section 7 Consultation in Small Federal Handle Situations*. The USFWS indicated that the following federally listed species may be present within the Project area: Kentucky glade cress, gray bat, Indiana bat, northern long-eared bat, clubshell, fanshell, orangefoot pimpleback, pink mucket, rabbitsfoot, and ring pink mussels. Additionally, federally designated Kentucky glade cress critical habitat was identified within the Project area. Formal ESA consultation was requested by USACE for a "may affect, likely to adversely affect" determination for the Indiana bat and Kentucky glade cress as a result of the Project. USFWS issued a Biological Opinion in 2021 for the Project, which concluded that the Project is not likely to jeopardize the continued existence of the Indiana bat or Kentucky glade cress. At the time of the 2021 Biological Opinion, Project impacts to the northern long-eared bat were being addressed via the 4(d) rule for the species.

On April 20, 2022, the USACE requested to reinitiate formal ESA consultation with USFWS for the Project. The primary reason for reinitiating consultation was to provide a project-specific evaluation of the northern long-eared bat in light of a March 2022 proposal to reclassify the northern long-eared bat as endangered under the ESA. The final rule reclassifying the northern long-eared bat as endangered was published on November 30, 2022, and became effective on March 31, 2023. In a June 10, 2022 letter to LG&E, the USACE requested that LG&E submit a revised Biological Assessment (BA) that provides a project-specific evaluation of impacts to the northern long-eared bat and other updated information. This BA has been revised to provide information in response to the USACE request.

For this Project, the area directly affected by the action is the Maximum Disturbance Limits (MDL, i.e., all temporary and permanent work areas) where all construction, operation, and maintenance activities will occur over the life of the Project. The area indirectly affected by the Project includes the MDL and a 1-kilometer (km; 0.6 mile) buffer of the MDL on either side. The 1-km buffer is the area that is reasonably likely to be subject to temporary lighting, construction noise and vibration, and temporary changes to water quality. Based on the extent of the impacts that may occur, the action area for the Project includes the MDL and the 1-km buffer.

Surveys for the Kentucky glade cress were completed to support this BA. These surveys were completed to better understand populations within the MDL and to assist in avoidance and the analysis of effects to federally designated critical habitat. Impacts to Kentucky glade cress outside of the MDL are not expected to occur. Similarly, the Project has been developed to exclude designated critical habitat for the Kentucky glad cress from the MDL in order to avoid direct impacts to designated critical habitat. The analysis found that the Project May Affect, is Likely to Adversely Affect the Kentucky glade cress and May Affect, Not Likely to Adversely Modify critical habitat for the Kentucky glade cress.

Surveys for gray bat, Indiana bat, and northern long-eared bat habitat occurred concurrent with wetland surveys, Kentucky glade cress surveys, and other onsite Project site visits. During these site visits, personnel collected data in regard to summer roosting (trees), winter hibernacula (caves and karst features), and summer roosts specific for gray bats (caves). These were pedestrian visual surveys of the project MDL. No roosting habitat has been identified within the action area for the gray bat and thus a determination of May Affect Not Likely to Adversely Affect is appropriate. As discussed in more detail in Section 4 below, based on tree removal occurring regardless of season for construction of the Project and the likely direct and indirect impacts within the action area for Indiana bat and northern long-eared bats a determination for both bats of May Affect, Likely to Adversely Affect is appropriate.

No specific surveys for mussels were performed. Direct impacts to mussel species are limited to stream crossings within the MDL of which 17 are considered perennial streams. Cox Creek and its associated tributaries exhibit wide floodplains, lower gradients, and smaller diameter substrates that may be more suitable for mussel species. Other perennial streams exhibited high gradients and an increase in bedrock and cobble substrates not conducive to freshwater mussels. Cox Creek and Rocky Run will not be directly impacted during the project because of the utilization of HDD method to construct at this location near MP 2.25. The majority of the streams present in the Project MDL are small, ephemeral and intermittent, and have substrates dominated by bedrock and cobble. Indirect impacts to tributaries to Cox Creek are expected to be minimized by the use of best management practices during construction to minimize impacts due to sedimentation. A determination of May Affect, Not Likely to Adversely Affect is presented for mussel species.

1 Introduction

The Louisville Gas & Electric Company (LG&E) is proposing to construct a pipeline in Bullitt County, Kentucky, approximately 12 miles in length, to maintain service reliability and meet the growing demand for natural gas within the service area. The Bullitt County Transmission Pipeline Project (the "Project") starts approximately one mile east of the intersection of Grigsby Lane and Rummage Road and extends west and south, ending on the east side of Interstate 65 and north of Chapeze Lane (see Appendix A – Figure 1). The majority of the project would have a 50-foot permanent easement with exception of an approximate 938-foot length near Deatsville Road between Mile Post (MP) 7.5 and MP 8.0 where a 30-foot permanent easement will be established. Other exceptions to the 50-foot width include: road crossings which have no easement width, main line valve site, regulator station site, and interconnection site.

This biological assessment (BA) has been completed for the purposes of coordination under the Endangered Species Act (ESA) for the Project. The species, status, and potential effects addressed in this BA are for the following species based on ongoing consultation with the United States Fish and Wildlife Services (USFWS) and the current list of threatened and endangered species provided by the USFWS's Information for Planning and Consultation (IPaC) webservice (February 20, 2024 Project Code:2023-0052626; Appendix B):

- Kentucky glade cress (*Leavenworthia exigua laciniata*) – threatened
- Designated Critical Habitat for Kentucky Glade Cress
- Indiana bat (*Myotis sodalis*) – endangered
- Northern long-eared bat (*Myotis septentrionalis*) – endangered
- Gray bat (*Myotis grisescens*) – endangered
- Various mussels (see Section 4)

In addition to the species in referenced above, the tricolored bat is included in this BA due to its potential listing as federally endangered (FWS-R5-ES-2021-0163). This species was not included on the February 20, 2024, IPaC report; however, the tricolored bats range and habitat does include Bullitt County, Kentucky.

On February 28, 2019, LG&E submitted a Pre-Construction Notification (PCN) letter to the United States Army Corps of Engineers (USACE) Louisville District for the Project and was assigned USACE Project Number LRL-2017-1046. The PCN provided detail regarding the proposal to permanently impact 18 linear feet of an intermittent tributary and permanent conversion of 0.16 acres of a forested wetland to emergent wetland. The PCN further identified temporary impacts to streams and wetlands anticipated due to pipeline construction; however, these areas will be returned to original conditions following construction.

Formal ESA consultation was requested by USACE for a "may affect, likely to adversely affect" determination for the Kentucky glade cress, Indiana bat, and northern long-eared bat as a result of the Project. The USFWS and USACE agreed to use the *Process for Section 7 Consultations in Small Federal Handle Situations* for the Project. The USFWS and the USACE determined that the approach is appropriate based on 1) legitimate federal nexus to a larger project outside of the activities subject to Clean Water Act (CWA) jurisdiction that are unavoidable; 2) active participation in section 7 consultation by LG&E and the request for the entirety of the Project to be addressed by the USACE; and the effects considered in this Biological Assessment (BA) are appropriately within the scope and purpose of the section 7 consultation.

The USACE jurisdiction for the Project includes all Waters of the United States, which are detailed in Section 5, and a 100-foot buffer. LG&E is responsible for all other activities beyond the USACE jurisdiction.

The USFWS issued a Biological Opinion in 2021 for the Project, which concluded that the Project is not likely to jeopardize the continued existence of the Indiana bat or Kentucky glade cress. At the time of the 2021 Biological Opinion, Project impacts to the northern long-eared bat were being addressed via the 4(d) rule for the species.

On April 20, 2022, the USACE requested to reinitiate formal ESA consultation with USFWS for the Project. The primary reason for reinitiating consultation was to provide a project-specific evaluation of the northern long-eared bat in light of a March 2022 proposal to reclassify the northern long-eared bat as endangered under the ESA. The final rule reclassifying the northern long-eared bat as endangered was published on November 30, 2022, and became effective on March 31, 2023. In a June 10, 2022, letter to LG&E, the USACE requested that LG&E submit a revised BA that provides a project-specific evaluation of impacts to the northern long-eared bat and other updated information. This BA has been revised to provide information in response to the USACE request. Consultation will continue to use the *Process for Section 7 Consultations in Small Federal Handle Situations* for the Project.

2 Project Description

LG&E is proposing to construct a natural gas pipeline within Bullitt County, Kentucky to maintain service reliability and meet the growing demand for gas service in the service area. LG&E's Bullitt County Transmission Pipeline is a new 12-inch nominal diameter pipeline, approximately 12 miles in length, which will transport natural gas through the eastern portion of Bullitt County.

Starting at the eastern terminus, the Project begins at Mile Post (MP) 0.0 located on the south side of Grigsby Lane approximately 4,575 feet east of the intersection of Grigsby Lane and United States Route 31 East (US31E). The Project begins in a wide expanse floodplain associated with Cox Creek and its tributaries. The land use between the first two MPs is associated with agricultural tilled crop and hay production. The Project between MP 2 and MP 7 sweeps to the north of a residential area. The MDL is primarily a mixed-use landscape in between these MPs made up primarily of residential use with agricultural as well. The Project from MP 7 to approximately MP 7.7 at Deatsville Road is mixed-use with agriculture and limited residential land-uses. It is at this point (MP 7.7) to MP 9.5 that the Project parallels an existing electric transmission line where the landscape becomes characterized by long steep slopes and mature forest landscape, which is common among the local knob landforms. The Project continues to parallel the existing electric transmission line from MP 9.5 to MP 12 as it passes through a primarily forested landscape with scattered roadway crossings and residential areas before reaching its western terminus in an agricultural field directly east of Interstate 65 (I-65) and directly across the interstate from the Bullitt County Welcome Center/Rest Area (southbound). Appendix A – Figures 1 and 2 provides an overview of the Project location.

2.1 Construction

LG&E has not established a start date for the project. The start of construction is dependent upon obtaining all permits and easements. Construction duration is expected to take six to nine months with an expected need to return after one winter (i.e., freeze/thaw cycles) to restore areas where the grade has settled, or vegetation did not adequately germinate. During construction, topsoil will be segregated (in open trench construction areas) from subsoil by bulldozer and will be temporarily staged on the distant side of the

excavation within the construction workspace. Tree clearing involving mechanical and hand clearing methods will occur. Stumps will be cut flush to ground and, where necessary, removed so they do not interfere with construction. Debris from clearing (i.e., logs, limbs, mulch, and roots) will be removed from site. However, mulch could be lightly distributed in adjacent wooded areas if it is agreeable to landowners and would result in no impacts to waterways. Mulch, limbs, and timber may be provided to the landowner upon request but will be moved to a location outside the MDL on the landowner's property. Installation of the pipe will be by both open trench, horizontal directional drills (HDD), and conventional bores. The trench will be excavated using a track-mounted backhoe or trencher to approximately three to five feet wide and a minimum cover depth of three feet. After installation, the trench will be backfilled entirely with clean native soil. If necessary, manufactured limestone sand may be added around the pipe and the remaining top of trench filled with clean native soil. The exposed ground surface will be planted with a seed mix and stabilized with temporary mulch to complete restoration of the right-of-way (ROW). Wetlands and Kentucky glade cress areas will be planted with a native seed mix appropriate for those areas.

The development of access roads will be finalized by the contractor during construction. In general, access roads will use existing roads or trails and are included in the MDL. Access roads will be approximately 12 to 20 feet wide, depending on the contractor's need for equipment movement. Where necessary, gravel or stone will be placed as a base and removed after construction is complete in compliance with permit conditions. However, if a landowner requests for the gravel or stone base to remain, and there are no permit compliance issues, the contractor and LG&E may allow the base to remain in place. Where necessary, roadway construction entrances to MDL may necessitate the use of temporary culverts (in accordance with permits). The use of a stabilized construction entrance to access the MDL will serve as a best management practice for access points. The intent of stabilized construction entrances is to displace the majority of mud and dirt from construction equipment tires/tracks before entering a paved roadway. The use of other erosion and sediment control such as silt fencing and geotextile will be employed where necessary and prescribed by permit conditions.

In-stream work will occur during low-flow conditions using an open cut/dry flume method with pump-around. Stream crossings will be kept to 10 feet in width or less, including the trench backfilling, and stabilized as soon as practicable. Conventional bore pipeline construction will require two bore pits to be excavated on either side of a road, utility, or stream that will be crossed. Equipment will be placed in one bore pit and will auger a hole to allow the pipeline to be pushed across to the opposing bore pit. Similarly, HDD will utilize two bore pits. Drilling equipment will be used to bore through the rock and soil. After the bore hole has been fully prepared, the pipeline will be pulled from the exit bore pit to the dry entry pit. With both conventional and HDD the cuttings will be removed and the pits backfilled with native material. The contractor will determine when each method is appropriate for crossings to minimize surface disturbances at those locations following permit conditions outlined in Nationwide Permit 12, the Kentucky Water Quality Certification, and the Project Stormwater Pollution Prevention Program plan. Restoration of each stream crossing permitted will include restoring preconstruction contours and use of native material, per permit conditions.

The typical permanent right-of-way (ROW) limits will be approximately 100 feet wide from MP 0 to MP 6.8 and 75 feet wide from MP 6.8 to the Project terminus. These widths include both temporary and permanent ROW easement during construction. The Project will also include construction of permanent valve sites and support infrastructure, as well as temporary pipe storage yards, access roads, and contractor yards.

2.2 Operation

The Project will be operated by LG&E in accordance with applicable laws and regulations to provide safe and reliable product delivery to the service area. Operation would be completely subsurface for transmission of natural gas in the enclosed installed pipeline, except at the regulator station and interconnection site, for an estimated minimum 50-year life of the Project.

2.3 Maintenance

The Project will be maintained by LG&E in a manner consistent with federal, state, and local laws and regulations to provide a safe, continuous supply of natural gas. Maintenance activities would include regularly scheduled site monitoring and ground surveys, signs, marker posts, and decals would be painted or replaced to ensure that the pipeline location would be visible above ground. These markers would help prevent unintentional damages from construction activities, erosion, possible encroachment on the ROW, and other problems that may affect the safety and operation of the facilities. Other maintenance functions would include:

- Routine ROW mowing, erosion repairs, line marker replacement.
- Periodic inspection of valves (MLVs), water crossings and erosion control devices;
- Maintenance activities related to installation of leak repair clamps/sleeves, emergency pipe replacement, and other equipment needed for repair activities;
- Periodic internal inspection with in-line inspection tools or “pigs;” and
- Calibration and replacement and/or installation of communications equipment.

Herbicide and pesticide use for the clearing or maintenance of the MDL will be in accordance with appropriate regulations. A cathodic protection system for the pipeline may be constructed and maintained. Exact locations for both the anode bed(s) and test stations would be determined as the Project design progresses. In areas where the pipeline intersects high-voltage electric transmission lines, an alternating current mitigation system would be implemented as necessary to reduce stray current, prevent possible shock to personnel during post-construction activities, and prevent interference with the cathodic protection system.

3 Action Area

The “action area” is defined as “all areas to be affected directly or indirectly by the federal action and not merely the immediate area involved in the action” (50 CFR §402.02). Effects of the action “are all consequences to listed species or critical habitat that are caused by the proposed action “… A consequence is caused by the proposed action if it would not occur but for the proposed action and it is reasonably certain to occur. Effects of the action may occur later in time and may include consequences occurring outside the immediate area involved in the action” (50 CFR §402.02). An action area includes the area of a project in which the limit of measurable or detectable changes in the environment may elicit a response in the species or designated critical habitat. The federal action for this Project is the USACE issuance of a Department of Army (DA) authorization (LRL-2017-1046) for impacts to Waters of the United States that are necessary for construction of the Project (see Section 2).

For this Project, the area directly affected by the action is the Maximum Disturbance Limits (MDL, i.e., all temporary and permanent work areas) where all construction, operation, and maintenance activities will occur over the life of the Project. The area indirectly affected by the Project includes the MDL and a 1-kilometer (km; 0.6 mile) buffer of the MDL. The 1-km buffer is the area that is reasonably likely to be subject to temporary lighting, construction noise and vibration, and temporary changes to water quality.

- Temporary construction lighting may be utilized during early morning and early evening hours during construction when daylight hours are not enough to finish sensitive connections such as HDD tie-ins and other weld locations throughout construction of the Project. This temporary lighting may be visible from immediately outside the MDL but is expected to be minimal. Lighting is further discussed in sections 5.4.1 and 5.5.1.

- Temporary construction noise and vibration generated during construction will vary in intensity and duration. Noise is anticipated to extend outside the MDL to approximately one kilometer. Noise analysis is further discussed in sections 5.4.1 and 5.5.1.

- Stream crossings using the trench/isolation method are designed to minimize impacts to the water quality. Permanent changes in water quality are not expected to occur with the implementation of BMPs. However, there may be minor discharges of sediment during construction and maintenance that could cause minor deposition of sediment within receiving waters. These discharges are authorized by the Clean Water Act (CWA) 404 permit. Water quality is further discussed in Section 5 for all three bat species and mussels.

Based on the areas that will be directly and indirectly affected by the proposed action, the action area includes the MDL and a 1-km buffer of the MDL. The action area limits are depicted on the figures in the appendices.

Consistent with both 50 CFR § 402.17 (2019) and the previous regulations, 50 CFR § 402.02 (1986), the action area for the Project does not include areas beyond the Project, such as the locations of residential, commercial, or industrial end users of natural gas to be supplied by the pipeline.

4 Species Considered

Section 7 of the ESA requires federal agencies, in consultation with the USFWS, to ensure that actions they authorize, fund, or carry out are not likely to jeopardize the continued existence of any federally listed species or result in the destruction or adverse modification of federally designated critical habitat of such species. The USACE, as the lead federal agency in review of the Project pursuant to a DA NWP, initiated consultation with USFWS. On their behalf, the permit applicant, LG&E, has provided this applicant-sponsored BA.

Informal consultation was initiated with the USFWS through IPaC regarding federally listed species that may occur within the Project area. The IPaC was updated on February 20, 2024 (Appendix B). The USFWS identified that the Project, or portions of the Project, were within proximity of known Kentucky glade cress populations and federally designated critical habitat for the Kentucky glade cress as well as within proximity of Indiana bat, northern long-eared bat, and gray bat records for summer and winter habitat. The USFWS IPaC also identified freshwater mussel species, including the clubshell (*Pleurobema clava*), fanshell (*Cyprogenia stegaria*), orangefoot pimpleback (*Plethobasus cooperianus*), pink mucket (*Lampsilis abrupta*), rabbitsfoot (*Quadrula cylindrica cylindrica = Theliderma cylindrica*), ring pink (*Obovaria retusa*), and the

proposed endangered salamander mussel (*Simpsonaias ambigua*). This section provides a description of the natural history and status of each federally listed species potentially occurring within the Action Area.

Additional species listed on the IPaC report include the whooping crane (*Grus americana*) and the monarch butterfly (*Danaus plexippus*). The whooping crane status is that of an experimental population, non-essential and is considered a species proposed for listing under the ESA unless the action is located on a National Wildlife Refuge or National Park. No habitat for this species is located within the Project MDL and thus no impacts are expected. Similarly, the monarch butterfly is currently a candidate species and is not afforded protection under the ESA at this time.

Lastly, on September 13, 2022, the USFWS issued a proposed rule for the tricolored bat that would add this species to the List of Endangered and Threatened Wildlife and extend the ESA's protections to the species if finalized (FWS-R5-ES-2021-0163). This species was not included on the February 20, 2024, IPaC report; however, the tricolored bats range and habitat does include Bullitt County, Kentucky. The tricolored bat is included in this BA because of the potential listing.

4.1 Kentucky Glade Cress

4.1.1 SPECIES LISTING AND CRITICAL HABITAT

Kentucky glade cress was listed as a threatened species by the USFWS on May 6, 2014 (79 FR 25683-25688). Critical habitat for the Kentucky glade cress was also designated on May 6, 2014 (79 FR 25689-25707).

4.1.2 LIFE HISTORY

Kentucky glade cress can be found in open gravelly soils near rock outcrops within the Caneyville-Crider soil association but seems to be adapted to shallow soils intermixed with flat-bedded, Silurian dolomite and dolomitic limestone (Whitaker and Waters 1986, Evans and Hannan 1990). Kentucky glade cress can be found in areas that lack soil and plant competition, as well as rock near or at the surface. Cedar and limestone glades are the habitat of this species, due to their thin soils and underlying limestone. These habitats are generally wet from late winter to early spring and become dry in late spring and early summer (Evans and Hannan 1990).

Kentucky glade cress is a member of the mustard family (Brassicaceae) and is endemic to Kentucky. It is a winter annual with seed germination occurring in September and October. Seeds of this species were found to be dormant at any temperature, and once dormancy was broken, high temperatures prevented germination regardless of the moisture levels. This trait helps the Kentucky glade cress prevent germination following short summer showers and thus avoid the heat and dryness of summer. The seeds of Kentucky glade cress undergo physical changes that move them from dormancy to conditional dormancy, then finally break dormancy for fall germination (Baskin and Baskin 1985). In the winter, Kentucky glade cress persists as rosettes (Evans and Hannan 1990). Flowering generally starts in late February to early March, with seeds setting and plants dying in April and May when the glade habitats dry out (Baskin and Baskin 1985). The flowering timeframe is highly variable by year as it is weather dependent. Weather events such as late season snow, heavy rainfall events, frosting or unseasonable temperature highs and lows can alter the timing of a typical flowering and seeding timeline for a given year.

4.1.3 RANGE AND DISTRIBUTION

Kentucky glade cress is only known to occur in northeastern Bullitt County and southeastern Jefferson County (Evans and Hannan 1990, Jones 2005, White 2004). Currently, there are 88 total known occurrences of Kentucky glade cress, with 21 of those being historical occurrences that are considered extirpated. According to the Office of Kentucky Nature Preserves (OKNP), 43 of the 67 extant occurrences are considered poor quality (KSNPC 2016). There are no population estimates for the Kentucky glade cress as plant numbers tend to fluctuate naturally from year to year.

4.1.4 SPECIES OCCURRENCE WITHIN THE ACTION AREA

The action area consists of various landforms and habitats. LG&E conducted a Kentucky glade cress habitat assessment to identify high potential habitat within the action area in 2018. Surveys were coordinated with the USFWS to ensure that surveys were conducted during the flowering period when detection likelihood was at peak (Appendix D). This assessment and field survey found that between MP 0 and MP 5, the MDL action area is primarily agricultural fields. The routine disc and till, use of herbicides, monoculture vegetation, and thick well-developed soils do not meet the habitat type needed to maintain populations of Kentucky glade cress.

Between MP 5 and MP 7.5, the Project MDL is composed of a mixed land use including residential, light pasturing, and hay production. These areas have thinner soils and a multi-use landscape that may be suitable to Kentucky glade cress populations. Federally designated critical habitat for the Kentucky glade cress occurs within proximity to this portion of the Project MDL.

West of Deatsville Road, from MP 7.5, the Project MDL becomes a more densely forested landscape punctuated with steep slopes, narrow stream floodplains, and a consistently thick duff layer. The historical land type of dense hardwood forest and steep slopes is not typical Kentucky glade cress habitat. The Project MDL is adjacent to an existing electric transmission right-of-way and the landscape is characterized by long, steep slopes and mature forest landscape, which is common among the local knob landforms. These slopes and well-drained soils have developed many stream features throughout the Project MDL and limit suitable habitat for Kentucky glade cress.

A newly discovered population area was discovered in 2022 by the OKNP along Clarks Lane (population 2-D; see Appendix A – Figure 4). This population area is located along both sides of the roadways edge and is part of an existing occurrence of the species. The Project MDL traverses this location from east to west between MP 3.75-MP 4.00.

LG&E used survey results to categorize the acreages of Kentucky glade cress populations within the Project MDL (Appendix A – Figures 3). This information was used to revise the Project alignment to avoid p0opulations of Kentucky glade cress where possible and minimize impacts to 10 areas where populations were identified (see Appendix A – Figure 4 and Appendix D – Kentucky Glade Cress Habitat US Fish and Wildlife Communications). These 10 “areas” are part of six “occurrences” with several areas included in an occurrence[1]. The approximate acreage of the 10 areas and the approximate acreage within the MDL are presented in Table 1.

[1] The 2020 Kentucky glade cress Species Status Assessment had identified a total of 95 occurrences. The occurrences were ranked by population size, quality of habitat, and acreage of habitat (USFWS 2020).

Table 1. Approximate Acreage of Identified Kentucky Glade Cress Populations Within the MDL and Action Area.

Identified Population	Approximate Acreage within MDL	Approximate Acreage within Action Area	Figure 4 (Appendix A)
POP 1-B	0.24	0.61	Page 1 of 8
POP 2-C	0.10	0.26	Page 2 of 8
POP 2-D	0.44	3.91	Page 3 of 8
POP 3-C	0.74	1.65	Page 4 of 8
POP 4-B	0.91	1.09	Page 5 of 8
POP 5-C	1.18	1.86	Page 6 of 8
POP 6-B	0.27	1.95	Page 6 of 8
POP 7-D	0.85	0.99	Page 7 of 8
POP 8-C	0.02	0.11	Page 7 of 8
POP 8-D	0.05	0.12	Page 8 of 8

4.2 Designated Critical Habitat For Kentucky Glade Cress

4.2.1 CRITICAL HABITAT DESIGNATION

Critical habitat for the Kentucky glade cress was designated on May 6, 2014 (79 FR 25689-25707). In total, approximately 2,053 acres in Bullitt and Jefferson counties are designated critical habitat for the Kentucky glade cress. Six designated units were identified: Unit 1-McNeely Lake, Unit 2-Old Mans Run, Unit 3-Mount Washington, Unit 4-Cedar Creek, Unit 5-Cox Creek, and Unit 6-Rocky Run. At the time of designation all six units and 18 subunits were occupied (79 FR 25689-25707).

4.2.2 CRITICAL HABITAT OCCURRENCE WITHIN THE ACTION AREA

The Project occurs in the area of Unit 4-Cedar Creek, Unit 5-Cox Creek, and Unit 6-Rocky Run. Unit 4 consists of 547 acres and includes eight subunits (subunits 4A – H). The Cedar Creek unit is generally located between Cedar Grove Road to the south, Clarks Lane to the east, Ridge Road to the north, and Foley Road to the west. Subunit 4H is located between Cedar Grove Road and Deatsville Road (79 FR 25689-25707). The MDL parallels Subunit 4F for approximately 575 feet between MP 5.75 and MP 6.00. Similarly, the MDL parallels Subunit 4G between roughly MP 6.45 and Cedar Grove Road for approximately 900 feet. The other closest subunits include Subunit 4C (approx. 625 feet), Subunit 4E (approx. 388 feet), and Subunit 4H (281 feet). Subunit 5A of Unit 5-Cox Creek occurs to the north of the eastern portion of the Project area. The Project MDL does not intersect any of the critical habitat units; however, it directly abuts subunits 4F and 4G. Occurrence of the subunits are shown on Figure 2a and Figure 3a.

4.3 Gray Bat

4.3.1 SPECIES LISTING AND CRITICAL HABITAT

On April 28, 1976, the gray bat was listed as an endangered species (41 FR 17736). No Critical Habitat has been designated for the gray bat at this time. A recovery plan was published by the USFWS in July 1982

(USFWS 1982). A description of the species physical appearance and a discussion of taxonomy can be found in the recovery plan (USFWS, 1982).

4.3.2 LIFE HISTORY

Gray bats typically live in caves throughout the year. Gray bats hibernate in deep, vertical caves in the winter and roost in caves along rivers or reservoirs in the summer. These rivers and reservoirs are the waters over which the gray bats forage. Mating occurs in September to October, but adult females store the sperm through hibernation and do not become pregnant until they emerge in the spring. Females enter hibernation first, usually by early October. Males and juveniles begin hibernation by early November. Female gray bats emerge from hibernation in late March to early April and migrate from wintering caves, while the males and juveniles emerge and migrate after them in mid-April to mid-May (Tuttle 1976). Gray bats tend to habitually return to their summer and winter caves (Kennedy and Tuttle 2005).

Young are born in late May to early June, and most begin flying within 20 to 35 days after birth. Larger colonies and roosts near over-water foraging habitat are crucial to the growth and survival of young gray bats. Maternity colonies can consist of a couple of hundred to several thousands of individuals. The maternity caves usually have waterways within them. Forested areas surrounding streams and lakes have been found to provide protection for gray bats. The young often feed and take shelter in these forested areas near the cave entrance (Tuttle 1979).

4.3.3 RANGE AND DISTRIBUTION

The gray bat is found in limestone karst areas in the southeastern United States. Gray bats are primarily located in Alabama, northern Arkansas, Kentucky, Missouri, and Tennessee, but a few can be found in adjacent states. Gray bat hibernacula generally consist of individuals from a large portion of their summer range. They have been documented to migrate from 10 to 270 miles between summer maternity sites and winter hibernacula (Tuttle 1976). There are few caves that provide the roost requirements of the gray bat, which has led to approximately 95 percent of the range-wide population hibernating in less than 20 caves (Tuttle 1979).

White-nose syndrome (WNS) is still a threat to the long-term recovery of gray bats. However, the 2009 5-Year Review of the gray bat showed that 13 of the 29 Priority 1 maternity caves listed in the 1982 approved Gray Bat Recovery Plan had been stable or increasing over the 5-year period leading up to the review (Martin 2007, Sasse et al. 2007, and Elliott 2008). A study by Dr. Michael Harvey of Tennessee Technological University has estimated that gray bats increased from approximately 1,575,000 to about 2,678,000 in 2002 and 3,400,000 in 2004. It was reported that there has been a 104 percent increase in gray bat population levels since 1982 (Martin 2007). Although gray bat population levels have fluctuated, several studies have documented population increases in some of the major hibernacula.

Coach Cave, Kentucky saw gray bat population increases from zero in 1995 to 337,750 in 2007; the Blanchard Springs Caverns, Arkansas population increased from 33 in 1985 to 128,005 in 2006; Cave Mountain Cave, Arkansas increased from 205 in 1988 to 139,740 in 2006; and Bellamy Cave, Tennessee increased from 347 in 1965, to 139,364 in 2006 (Martin 2007). Gray bat populations at Coffin Cave, Missouri increased from about 250,000 in 1977-1979 to 561,000 in 2005 (Martin 2007, Elliott 2008). The population increases at some hibernacula could be due to the movement of gray bats from other caves, but in general, populations have increased throughout many parts of the gray bat's range (Tuttle 1987; Tuttle and Kennedy 2005; Martin 2007; Sasse et al. 2007).

4.3.4 SPECIES OCCURRENCE WITHIN THE ACTION AREA

There are no occurrence records for the gray bat within the action area. No known caves supporting summer or winter habitat for gray bats have been documented within the action area. The Kentucky Speleological Society (KSS) provided location of three caves present within five miles of the Project. Informal consultation discussions with USFWS indicated that these caves are not known to support gray bat populations. According to data supplied by KSS, the closest cave is approximately 1,600 feet from the Project MDL along Colyer Lane. This cave (T10) was found to lack passages and was more of a rockshelter than a true cave and not appropriate for winter habitat (see Appendix E). The other two caves (T6 and Hobbes Cave) are each located outside the action area.

No caves were identified during field surveys within the MDL in 2023. Additionally, no cave-like features such as large culverts or bridges that may provide roosting habitat for the gray bat are located within the MDL. There are two bridges that cross over Rocky Run and Cox Creek that may provide roosting habitat for the gray bat within the action area. The nearest bridge to the MDL is approximately 1,700 feet south of the HDD location of Cox Creek and Rocky Run near MP 2.00. The Project MDL between MP 0 and MP 5.5 is in proximity of the Cox Creek drainage to the Salt River. While no caves supporting gray bats are known in the action area, the gray bat is known to forage up to 12.4 miles from their summer roosts to feed on aquatic and terrestrial flying insects. Cox Creek and Rocky Run both cross the MDL near MP 2.25. These perennial streams have the potential to support foraging gray bats by providing cover, a drinking resource, and prey production (i.e., aquatic insects).

4.4 Indiana bat

4.4.1 SPECIES LISTING AND CRITICAL HABITAT

The Indiana bat was listed as an endangered species on March 11, 1967 (32 FR 4001), under the Endangered Species Preservation Act of October 15, 1966 (80 Stat. 926; 16 U.S.C. 668aa[c]). In 1973, the Endangered Species Preservation Act was subsumed by the Endangered Species Act and the Indiana bat was extended full protection under this law. Critical habitat was designated for the species on September 24, 1976 (41 FR 14914). Thirteen hibernacula, including 11 caves and two mines in six states, were listed as critical habitat. In October 1996, the Indiana Bat Recovery Team released a Technical Draft Indiana Bat Recovery Plan. In 2007, revised version entitled “Indiana Bat Recovery Plan: First Revision” was released (USFWS 2007).

The Indiana bat is a temperate, insectivorous, and migratory bat that hibernates in caves and mines in the winter and spends the summer in wooded areas. A description of the species physical appearance and a discussion of taxonomy can be found in the Indiana Bat Draft Recovery Plan: First Revision (USFWS 2007).

4.4.2 LIFE HISTORY

The Indiana Bat Draft Recovery Plan: First Revision (USFWS 2007) provides a comprehensive discussion of Indiana bat life history. A summary of the life history follows (citation for information in the summary is USFWS 2007 unless otherwise noted).

In winter Indiana bats hibernate in caves or mines, often with other species. The period of hibernation varies across the range of the species, among years, and among individuals. On a range-wide basis, the months of October through April capture the hibernation period of most individuals.

In spring, Indiana bats emerge from hibernation. Female Indiana bats emerge first, generally late March and through April, and most males emerge later. The timing of annual emergence varies, depending in part on latitude and annual weather conditions. Shortly after emerging from hibernation, females become pregnant via delayed fertilization from the sperm that has been stored in their reproductive tracts through the winter. Most reproductive females appear to initiate migration to their summer habitat quickly after emerging from hibernation. Females migrate to their traditional roost sites, where they find other members of their maternity colony. Members of the same maternity colony may come from many different hibernacula. A hibernaculum is the location, most often a cave or cave-like structure, where bats spend their winter in hibernation.

Female Indiana bats exhibit strong site fidelity to summer roosting and foraging areas where they form maternity colonies in forested areas where they bear and raise their pups. Most documented maternity colonies have 50 to 100 adult female bats; average colony size of 80 adult females (Whitaker and Brack 2002) is a widely used estimate. Maternity colony habitats include riparian forests, bottomland and floodplain habitats, wooded wetlands, and upland forest communities. Maternity roost sites are most often under the exfoliating bark of dead trees that retain peeling bark. Live trees, especially shagbark hickory, are also used if they have flaking bark under which the bats can roost. Primary roosts, those used frequently by large numbers of female bats and their young, are usually large diameter snags (dead trees). Roost trees are often in mature mostly closed-canopy forests, but in trees with solar exposure (i.e., sunlight on the roost area for at least part of the day) – these may be in canopy gaps in the forest, in a fence line, or along a wooded edge. Indiana bats typically forage in forested habitats, forest edges, and riparian areas.

Fecundity, the potential reproductive output, is low with female Indiana bats producing only one pup per year in late June to early July. Young bats become volant about four weeks of age. Cohesiveness of maternity colonies begins to decline after young bats become volant. That is, the bats tend to roost together in the same roosts less frequently and at lower densities. A few bats from maternity colonies may commence fall migration in August, although at many sites some bats remain in their maternity colony area through September and even into October. Members of a maternity colony do not necessarily hibernate in the same hibernacula and may migrate to hibernacula that are over 300 km (190 mi) apart (Kurta and Murray 2002, Winhold and Kurta 2006).

Indiana bats arrive at their hibernacula in preparation for mating and hibernation as early as late July; usually adult males or nonreproductive females make up most of the early arrivals (Brack 1983). The number of Indiana bats active at hibernacula increases through August and peaks in September and early October (Cope and Humphrey 1977, Hawkins and Brack 2004, Hawkins et al. 2005). Return to the hibernacula begins for some males as early as July, but most females arrive later. After fall migration, females typically do not remain active outside the hibernaculum as long as males. Males may continue swarming through October in what is believed to be an attempt to breed with late arriving females. Swarming is a critical part of the life cycle when Indiana bats converge at hibernacula, mate, and forage until sufficient fat reserves have been deposited to sustain them through the winter (Hall 1962). Swarming behavior typically involves large numbers of bats flying in and out of cave entrances throughout the night, while most of the bats continue to roost in trees during the day.

Swarming continues for several weeks, and mating may occur on cave ceilings or near the cave entrance during the latter part of the period. Limited mating activity occurs throughout the winter and in spring before the bats leave hibernation (Hall 1962). Adult females store sperm through the winter and become pregnant via delayed fertilization soon after emergence from hibernation. Young female bats can mate in their first autumn and have offspring the following year (although how many do so is variable), whereas males may not mature until the second year.

4.4.3 RANGE AND DISTRIBUTION

Indiana bats are found over most of the eastern half of the United States. The recovery program for the Indiana bat delineates four Recovery Units (RUs): the Ozark-Central, Midwest, Appalachian Mountains, and Northeast RUs (see USFWS 2007 for explanation of RU boundaries). In 2017, approximately 34% of Indiana bats (180,583 of 530,705) hibernated in caves in southern Indiana. Other states which supported populations of over 50,000 hibernating Indiana bats included Illinois, Missouri, and Kentucky. Additional states within the current winter range of the Indiana bat include Alabama, Arkansas, Georgia, Michigan, New Jersey, New York, Ohio, Oklahoma, Pennsylvania, Tennessee, Vermont, Virginia, and West Virginia. Approximately 46% of the population hibernated in the Midwest Recovery Unit. The 2017 population estimate (530,705) is almost 400,000 bats less than when the species was listed as endangered in 1967 (approximately 900,000).

The known summer distribution of the Indiana bat covers a broader geographic area than its winter distribution. For more detailed information on current summer distribution reference the Indiana Bat Draft Recovery Plan: First Revision – Appendix 2 (USFWS 2007); Appendix 2 details the distribution of approximately 270 known Indiana bat maternity colonies. Based on an estimated total Indiana bat population of 530,705 in 2017 and an average maternity colony size of 80 adult females, the USFWS estimates that there are about 6,634 maternity colonies of Indiana bats. Of these, the location of approximately 270 colonies is known, which is less than 5% of the colonies that are estimated to exist.

Range-wide, the population trend is decreasing since the time of listing. Winter surveys of hibernacula from 2003 to 2007 indicated a period of Indiana bat number increase. However, after 2007 white-nose syndrome (WNS) has caused the population to decrease again (USFWS 2019). The draft revised Recovery Plan (USFWS 2007) includes a detailed discussion of threats, but primary threats to the species include the loss of habitat, disturbance of hibernating bats, and impacts due WNS. WNS is a fatal disease caused by the fungus *Pseudogymnoascus destructans*. WNS has caused recent catastrophic declines among multiple species of bats in eastern North America (Lorch et al. 2011, Cryan et al. 2013) including large declines in Indiana bat populations (Turner et al. 2011). WNS is now recognized as the most significant threat to the Indiana bat. The range-wide population estimate for the Indiana bat was 537,297 in 2019 (USFWS 2019). This estimate represents an approximate 19 percent decline since 2007 and the introduction of WNS (USFWS 2019).

4.4.4 SPECIES OCCURRENCE WITHIN THE ACTION AREA

There are no occurrence records for the Indiana bat from within the action area. The Project MDL has a variety of suitable summer roosting, foraging, and commuting habitat for Indiana bats including forested habitats, tree-lined fence rows, and pasture shade trees. Additionally, rockshelter faces were observed outside the Project MDL, but within the action area that may provide temporary roosting opportunities for Indiana bats foraging in the area. The western portion of the Action Area occurs within Known Summer 1 (maternity) habitat (Appendix A – Figure 5) and the eastern portion is considered within Potential Habitat as defined by USFWS (2016). No caves were identified within the MDL (Appendix E). Information obtained from the KSS indicate that there are three known cave features within five miles of the Project. One of these caves occurs within the action area (Appendix A – Figure 5). This cave (T10) was found to lack passages and was more of a rockshelter than a true cave and not appropriate for winter habitat (see Appendix E). The other two caves are located outside the action area.

4.5 Northern Long-eared Bat

4.5.1 SPECIES LISTING AND CRITICAL HABITAT

On April 2, 2015, the USFWS published a final rule to list the northern long-eared bat as a threatened species under the ESA (80 FR 17974). On January 14, 2016, the USFWS published a final 4(d) rule in the federal register regarding the protections necessary or advisable to conserve the NLEB (81 FR 1900). The northern long-eared bat does not have critical habitat designated at this time (81 FR 24707). On March 23, 2022, the Service published a proposal to reclassify the northern long-eared bat as endangered under the Endangered Species Act. On November 29, 2022, the USFWS published a final rule to reclassify the northern long-eared bat as endangered. The reclassification will nullify the 4(d) rule as these rules are only applied to threatened species. The reclassification took effect on March 31, 2023.

The NLEB is a temperate, insectivorous, and migratory bat that hibernates primarily in caves and abandoned mines in the winter and spends the summer in wooded areas. Both hibernacula and summer habitat can vary for this species. A description of the species physical appearance and a discussion of taxonomy can be found in the 2022 Species Status Assessment Report for the Northern Long-eared Bat (USFWS 2022).

4.5.2 LIFE HISTORY

Northern long-eared bats predominantly overwinter in hibernacula that include caves and abandoned mines. Hibernacula used by northern long-eared bat are typically large, with large passages and entrances (Raesly and Gates 1987), relatively constant, cooler temperatures (0 to 9 °C; 32 to 48 °F) (Raesly and Gates 1987, Brack 2007), and with high humidity and no air currents (Fitch and Shump 1979, Raesly and Gates 1987). Northern long-eared bats are typically found roosting in small crevices or cracks in cave or mine walls or ceilings, often within the tighter recesses of hibernacula (Griffin 1940, Barbour and Davis 1969, Caire et al. 1979, Van Zyll de Jong 1985, Whitaker and Mumford 2009). Northern long-eared bats are also found roosting in the open, although this occurs less frequently than in cracks and crevices (Barbour and Davis 1969, Whitaker and Mumford 2009). To a lesser extent, northern long-eared bats have been found overwintering in other types of habitats such as abandoned railroad tunnels or culverts, especially in areas where caves or mines are not present (Griffin 1945, Goehring 1954, Kurta and Teramino 1994).

Northern long-eared bats typically use mature, intact interior forest for roosting, though younger, managed forests are also used; roost selection is adaptable and variable depending on forest characteristics in an area (Broders et al. 2006, Carter and Feldhamer 2005, Ford et al. 2006, Foster and Kurta 1999, Henderson et al. 2008, Lacki and Schwierjohann 2001, Loeb and O'Keefe 2006, Perry and Thill 2007). The northern long-eared bat appears to prefer continuous forests with older forest stands (Owen et al. 2003, Loeb and O'Keefe 2006), but have been found in fragmented landscapes (Yates and Muzika 2006).

Similar to the variation in landscape characteristics, many studies suggest that northern long-eared bats use a variety of tree species for roosts based largely on the tree species' proportional availability on the local landscape, roosting in the types of trees in an area that offer the necessary structural characteristics (Foster and Kurta 1999, Krynak 2010, Menzel et al. 2002, Sasse and Pekins 1996, Schultes 2002). The northern long-eared bat generally lives in small groups in tree cavities or under bark, switching roosts often, which include live and dead trees, but also includes artificial roosts (Lacki and Schwierjohann 2001, Menzel et al. 2002, Carter and Feldhamer 2005, Whitaker et al. 2006). Northern long-eared bats are more flexible in roost

selection than the Indiana bat using smaller trees and with less solar exposure and may be more variable than once thought (Laki et al. 2008, Timpone et al. 2009, Silvis et al. 2015b).

The species apparently tolerates dense forest stands more than other bat species during foraging but may prefer small openings (Putriquin and Barclay 2003, Sheets et al. 2013). These bats have also been documented using scattered woodlots in an otherwise open habitat if continuous forest is unavailable (Brack and Whitaker 2001, Brack et al. 2004, Owen et al. 2003). They are also known to sometimes glean prey from plants (Brack and Whitaker 2001).

4.5.3 RANGE AND DISTRIBUTION

The known range of the northern long-eared bat includes a total of 37 states and covers a larger area than the Indiana bat (20 states), from Maine to Montana and from Canada to just north of Florida (Whitaker and Hamilton 1998). The northern long-eared bat ranges across much of the eastern and north-central United States, and all Canadian provinces west to the southern Yukon Territory and eastern British Columbia (Nagorsen and Brigham 1993, p. 89; Caceres and Pybus 1997).

The northern long-eared bat is known to hibernate in 29 out of 37 states within the species' range (USFWS 2016). Hibernacula include caves, mines, and possibly rock outcroppings with the bats found in cracks and crevices as individuals or in small groups (Boyles et al. 2009, Feldhamer et al. 2015). Information on the migration of the northern long-eared bat is limited. Northern long-eared bats are considered to only migrate a relative short distance, approximately 50 miles or less. Migration begins in late August to September where bats swarm and mate at hibernacula and leave in the spring in mid-March (Whitaker et al 2007, Feldhamer et al. 2015).

There are no firm population size estimates for the northern long-eared bat rangewide; however, a rough estimate of the population size in a portion of the Midwest has been calculated. That estimate shows there may have been more than four million bats in the six-State area that includes the States of Illinois, Indiana, Iowa, Ohio, Michigan, and Missouri (USFWS 2015). Taking into account the documented effects of WNS in the Midwest to date (declines currently limited primarily to Ohio and Illinois), there may still be several million bats within the six-State area (USFWS 2015). Though reliable population estimates are not available for the NLEB, it is generally assumed that a rangewide downward trend in number is occurring as a result of WNS (USFWS 2015).

4.5.4 SPECIES OCCURRENCE WITHIN THE ACTION AREA

There are no occurrence records for the northern long-eared bat from within the action area. The Project MDL has a variety of suitable roosting, foraging, and commuting habitat for northern long-eared bats including forested habitats, tree-lined fence rows, and pasture shade trees. Additionally, rockshelter faces were observed outside the Project MDL, but within the action area that may provide temporary roosting opportunities for northern long-eared bats foraging in the area. The western portion of the Action Area occurs within Known Summer 1 (maternity and non-maternity) habitat (Appendix A – Figure 5) and the eastern portion is considered within Potential Habitat as defined by USFWS (2016). No caves were identified within the MDL (Appendix E). However, information obtained from the KSS indicate that there are three known cave features within five miles of the Project. One of these caves (T10) occurs within the action area (Appendix A – Figure 5). This cave (T10) was found to lack passages and was more of a rockshelter than a true cave and not appropriate for winter habitat (see Appendix E). The other two caves are located outside the action area.

4.6 Mussels

The mussel species identified on the USFWS IPaC included *Pleurobema clava*, *Cyprogenia stegaria*, *Plethobasus cooperianus*, *Lampsilis abrupta*, *Quadrula cylindrica cylindrica* (= *Theliderma cylindrica*), and *Obovaria retusa*. The USFWS listings state that these species only need to be considered if the project significantly impacts the Salt River mainstem, and/or any of its following tributaries: Beech Fork, and/or Rolling Fork. The Project does not directly impact any of these streams, with greater than two river miles between Salt River (the closest listed stream) and the only direct tributary to this river located within the project area, Cox Creek. Direct impacts to Cox Creek are not proposed and indirect effects to these receiving watersheds will be minimized through the installation and maintenance of erosion and sediment control measures as required by Project permits (e.g., section 404 and 401 of Clean Water Act).

Furthermore, these mussel species only inhabit perennial streams. The only perennial streams within the Project MDL which contain suitable habitat for these species will be avoided by directionally drilling the pipeline under the streams through this area. Construction BMPs will limit secondary impacts to these species by limiting off-site sedimentation. Therefore, it is anticipated that these species will not be adversely affected by the Project; therefore, mussel species are not addressed in more detail in this BA.

4.7 Tricolored Bat

The USFWS published a 90-day finding to a petition received on June 14, 2016, to list the tricolored bat as endangered or threatened and to designate critical habitat. The 90-day finding found that the action warrants a review of the status of this species (82 Federal Register [FR] 60362-60366, December 20, 2017). After the completion of this review, the tricolored bat was proposed to be federally listed as endangered on September 14, 2022 (87 FR 56381-56393). A final rule is expected to be published within the Federal Register by the end of 2023. In anticipation of that decision, an assessment of the tricolored bat in reference to this Project is provided in Appendix C. LG&E requests that the USACE conference with USFWS for the tricolored bat consistent with 40 CFR 402.10, and that USFWS provide a Conference Opinion for the tricolored bat with the Biological Opinion for the Project. This information is intended to be considered for conferencing on the Project.

5 Effects Analysis

5.1 Kentucky Glade Cress

Three Kentucky glade cress federally designated habitat units are located within the action area (Appendix A – Figure 3).

- Unit 4 Cedar Creek, subunits 4C, 4D, 4E, 4F, 4G, and 4H.
- Unit 5 Cox Creek, subunit 5A
- Unit 6 Rocky Run (no subunits)

The project alignment was modified during the design phase in order to avoid Kentucky glade cress critical habitat near the Project MDL. However, a total of 10 Kentucky glade cress sites were identified during species surveys, representing six USFWS identified occurrences, located within the Project MDL.

Habitat alteration may occur due to excavation, grading, and tree removal during construction. Substrate could be disrupted through removal, mixing, and addition of soil layers, which may have a negative impact on identified Kentucky glade cress populations. Also, sediment may move from disturbed areas to the Kentucky glade cress habitat, which could result in conditions unsuitable for the species since it grows in shallow soils. It is possible that tree removal will benefit the species in some locations by opening the canopy and promoting shallower soil conditions. Removing soil during construction could uproot, displace, or bury Kentucky glade cress individuals and displace or bury seeds in disturbed substrate. Soil removal may also be beneficial though if leaf litter and excess soil removed makes way for the thin soil habitat that the Kentucky glade cress prefers.

LG&E will use BMPs to complete the Project and, to the extent practicable, avoid impacting populations of Kentucky glade cress during construction activities. Seed mixtures identified by the USFWS will be used in areas of known Kentucky glade cress populations that consist of species not expected to directly compete with or displace the Kentucky glade cress. These seed mixtures will also help prevent colonization of the population sites by invasive species. Based on this proposed construction methodology, the avoidance of designated critical habitats, and the minimization of impacts to the species, it is expected that the Project will minimize overall impacts to the species.

Tables 2 – 4 below provide a summary of the stressors and effects for Kentucky glade cress. Table 5 summarizes the effects determination based on the assessment of the project related to Kentucky glade cress.

Table 2. Kentucky Glade Cress – Effects Pathway for Habitat Alteration

Activity: Construction	
Stressor: Habitat Alteration	
Exposure (time)	Short-term to perpetuity
Exposure (space)	Maximum Disturbance Limits (MDL)
Resource affected	Individuals within the MDL.
Individual response	Reduced vitality, reduced germination rates, mortality
Effect	Adverse
Conservation Measures	The Project alignment was sited to avoid populations of Kentucky glade cress, where possible, to minimize impacts to the species. LG&E will provide mitigation for unavoidable impacts to the Kentucky glade cress by voluntarily contributing to the Kentucky Natural Lands Trust's (KNLT) mitigation fund for the species. Use of Best Management Practices (BMPs) and sediment and erosion control measures such as silt fencing to minimize off-site sediment damage. Affected areas will be restored to preconstruction contours.
Interpretation	Kentucky glade cress individuals in patches within the MDL may be uprooted, crushed, or displaced. The final restored condition of the known and other potential Kentucky glade cress habitat is likely to be similar to existing conditions, which may allow seeds to germinate and persist if seeds are not damaged during topsoil separation and construction; however, such natural recolonization is not assured. Voluntary contribution to the KNLT's mitigation fund will provide funding for management of existing Kentucky glade cress populations outside of the MDL.

Table 3. Kentucky Glade Cress – Effects Pathway for Soil Removal in Occupied Areas

Activity: Construction	
Stressor: Soil removal	
Exposure (time)	Short term to perpetuity
Exposure (space)	Maximum Disturbance Limits (MDL)
Resource affected	Identified and unidentified plants and seed within the MDL.
Individual response	Reduced germination rates, mortality
Effect	Adverse
Conservation Measures	The Project alignment was altered to avoid populations of Kentucky glade cress where possible and minimize impacts where populations were identified. LG&E will provide mitigation for unavoidable impacts to the Kentucky glade cress by voluntarily contributing to the Kentucky Natural Lands Trust's (KNLT) mitigation fund for the species.
Interpretation	If soil or leaf litter is removed in areas where known Kentucky glade cress is present, it may also remove individual plants or banked seed. Seed may also be buried to a depth which does not allow the establishment of new plants through soil movement on the site. Voluntary contribution to the KNLT's mitigation fund will provide funding for management of existing Kentucky glade cress populations outside of the MDL.

Table 4. Kentucky Glade Cress – Effects Pathway for Vegetation Maintenance

Activity: Maintenance	
Stressor: Vegetation maintenance, mowing	
Exposure (time)	Seasonal; on-going
Exposure (space)	Permanent right-of-way
Resource affected	Plants, seeds
Individual response	Reduced germination rates, plant damage, premature seed dropping, and/or mortality
Effect	Insignificant
Conservation Measures	The Project alignment was altered to avoid populations of Kentucky glade cress where possible and minimize impacts where populations were identified. A modified seed mix will be used within the known Kentucky glade cress areas when re-vegetating and as recommended by the USFWS. LG&E will provide mitigation for unavoidable impacts to the Kentucky glade cress by voluntarily contributing to the Kentucky Natural Lands Trust's (KNLT) mitigation fund for the species.
Interpretation	Voluntary contribution to the KNLT mitigation fund will provide opportunities for recovering the species from the Endangered Species Act list. The seed mix will aid in vegetation management in areas of known occurrence and help limit competition from other species that may out compete Kentucky glade cress.

Table 5. Kentucky Glade Cress – Summary of Stressors and Effects on the Kentucky Glade Cress

Stressors	Adverse	Insignificant/Discountable
Habitat Alteration	X	
Soil Removal in Occupied Areas	X	
Vegetation maintenance		Insignificant

5.2 Designated Critical Habitat For Kentucky Glade Cress

Three Kentucky glade cress federally designated habitat units are located within the action area (Appendix A – Figure 3).

- Unit 4 Cedar Creek, subunits 4C, 4D, 4E, 4F, 4G, and 4H.
- Unit 5 Cox Creek, subunit 5A
- Unit 6 Rocky Run (no subunits)

The project alignment was modified during the design phase in order to avoid Kentucky glade cress critical habitat near the Project MDL.

Designated critical habitat for Kentucky glade cress is located adjacent to the MDL at two locations. The MDL parallels Subunit 4F for approximately 575 feet between MP 5.75 and MP 6.00. Similarly, the MDL parallels Subunit 4G between roughly MP 6.45 and Cedar Grove Road for approximately 900 feet. The other closest subunits include Subunit 4C (approx. 625 feet), Subunit 4E (approx. 388 feet), and Subunit 4H (281 feet). The Project alignment was modified during the design phase to move all of the proposed disturbance limits outside mapped designated critical habitat for the Kentucky glade cress. Silt fencing will be used to protect designated critical habitat from sedimentation due to construction activity and required temporary fencing along these areas during construction will be used to further identify the construction limits and prevent incidental construction activity within mapped designated critical habitat. These measures are expected to minimize effects on federally designated critical habitat as a result of the Project. In the unlikely event that an erosion control BMP fail or an unforeseen action near mapped designated critical habitat occur that impacts the federally designated critical habitat, LG&E will take corrective action to repair/restore a failed BMP to see that impacts are minimal and temporary.

Table 6 provides a summary of the stressors and effects for Kentucky glade cress designated critical habitat. Table 7 summarizes the effects determination based on the assessment of the project related to Kentucky glade cress.

Table 6. Kentucky Glade Cress Designated Critical Habitat – Effects Pathway for Habitat Alteration

Activity: Construction	
Stressor: Habitat alteration or destruction	
Exposure (time)	Short-term to perpetuity
Exposure (space)	Outside Maximum Disturbance Limits (MDL)
Resource affected	federally designated critical habitat
Individual response	Loss or degradation of glades and glade-like habitat and surrounding vegetated land
Effect	Discountable
Conservation Measures	The Project has been designed to avoid designated critical habitat for the Kentucky glad cress within the MDL. Best Management Practices (BMPs) and sediment and erosion control measures will be used to minimize off-site sediment damage. Construction fencing will be installed to delineate construction limits to contractors working near Kentucky glade cress designated critical habitat at two locations abutting the MDL.
Interpretation	Kentucky glade cress designated critical habitat abuts the MDL at two locations. The first location is approximately 581 feet between MP 5.75 and MP 6. The second location is near MP 6.5 to MP 6.75 for approximately 947 feet. The use of construction BMPs such as silt fencing to prevent erosion and sediment issues as well as construction fencing to maintain no-access to specific areas will reduce the likelihood of impacts to Kentucky glade cress critical habitat adjacent to the Project area.

Table 7. Kentucky Glade Cress Designated Critical Habitat– Summary of Stressors and Effects

Stressors	Adverse	Insignificant/Discountable
Habitat alteration or destruction		Discountable

5.3 Gray Bat

A desktop review of the action area was conducted that included data from the KSS, previous sinkhole assessments, geological maps, aerial imagery, historical literature, and other publicly available information (see Appendix E). Data received from the KSS identified three cave features within five miles of the Project MDL. The general location of these cave resources in relation to the Project MDL are depicted on Figure 5 in Appendix A. The northern most cave feature near the Salt River is identified as T6 Cave. The southern-most feature is Hobbes Cave, located near the community of Clermont. Lastly, the third cave feature is identified as T10 Cave. The T10 Cave is just outside the MDL, but within the action area, where an existing access road along Colyer Lane will be used. Photos of this feature show T10 Cave to be a rockshelter with no corridors into the hillside (Appendix E). No other KSS cave feature photographs are available. Visual surveys were performed within the Project MDL for caves or other potential winter habitat during an April 2023 site visit (Appendix E). Access outside of the MDL was not practicable at the time of the survey so biologists focused the survey on the MDL and relied on visually assessing areas outside of the MDL as far as they were able. No caves or winter habitat were identified within the Project MDL.

LG&E observed visual evidence of sinkholes within the Project MDL. The observed sinkholes were newly formed, actively caving in, and narrow mouthed and did not provide the necessary cave/cave-like environment for gray bats. These observations occurred during a winter bat habitat assessment where these features were assessed, and results coordinated with USFWS (Appendix E).

Because this project is located within a karst geologic area, there is a chance that one or more unknown hibernacula exist within the action area. According to the USFWS data, the nearest known gray bat maternity site is roughly 14 miles from the project's nearest disturbance limits and the nearest known gray bat hibernaculum is approximately 20 miles away. While there are records of gray bats occurring in Bullitt County (KYDFWR 2017), there are no known hibernacula within Bullitt County (Martin 2007), therefore, no hibernacula are expected to occur within the action area. Holliday et al (2023) modeled the migration and movement of gray bats throughout their range and found that Bullitt County was on the outer tier and lowest likelihood of supporting gray bats. The closest known hibernaculum is located across the Ohio River in Indiana.

In general, the Project MDL is sited along existing utility rights of way and occurs in a rural area where roads cross the Project MDL often. During Project development several landowners indicated that cave resources occur on their property. These features were evaluated for potential gray bat habitat. Those resources identified were generally surface depressions, sinkholes or rock shelters that did not provide suitable habitat for summer or winter populations of gray bats. Many of the surface depressions were filled with debris (i.e., porcelain toilets, rugs, concrete) placed by property owners or past owners. The rockshelter was found to lack passages and was not a true cave and not appropriate for winter habitat (see Appendix E). Consultation with the USFWS additionally did not result in identified gray bat resources within the Action area. With this information in mind, it is presumed that any unknown gray bat resource is likely to be small. Known swarming gray bat activity is not expected to occur based on lack of species documentation near the action area. For this reason, the potential effect of an unknown cave and swarming bats is consistent with impacts evaluated under other stressors and pathways. No additional impacts to the species beyond what are already considered in these other effects pathways is anticipated.

In total, 16,416 linear feet of streams (USACE jurisdictional perennial, intermittent, and ephemeral streams) were identified within the MDL. A total of 0.28 acres of pond open water and 1.11 acres of wetlands were identified within MDL, with 0.50 acres of this forested wetland. Water quality degradation has the potential to

affect foraging bats by reducing aquatic insect populations that make up part of the gray bat diet. This impact is anticipated to be short-term and minor due to implementation of BMP's as required by federal and state permits (i.e., sections 404 and 401, NPDES, and others).

Gray bats typically forage within larger riparian corridors. The only area where these corridors exist within the Project MDL surrounds Cox Creek and Rocky Run. Tree clearing will occur at this location (0.07 ac along Cox Creek and 0.161 along Rocky Run; see Appendix A – Figure 6a) near approximate MP 2.25 will be limited to a maximum of 50 feet permanent right-of-way. Gray bat foraging corridors will remain within this large floodplain bottomland during and after construction of the Project. The noise and disturbances of clearing and construction is not expected to affect the gray bat's roosting or foraging behavior as there are no known caves within the MDL (see Appendix E). No known caves suitable for roosting gray bats occur within the action area at this location. From approximately MP 2.18 to MP 2.55 an HDD construction method will be used to avoid impacts to Cox Creek and Rocky Run while also avoiding trenching impacts to the approximate 150-foot hillside along the west bank of Rocky Run. Directional drilling the pipeline through this area will further reduce impacts to gray bats potentially using the action area. Gray bats are not expected to be active within the Project MDL during active construction which will occur during daytime hours.

The effects pathways for gray bats are limited to aquatic resources (i.e., prey and drinking water sources) and roosts. Table 8 provide a summary of the stressors and effects for the gray bat. Table 9 summarizes the effects determination based on the assessment of the project related to gray bats.

Table 8. Gray Bat – Effects Pathway for Aquatic Resource Degradation

Activity: Construction	
Stressor: Aquatic Resource Degradation	
Exposure (time)	Construction phase during active time of year (April 1 – November 15).
Exposure (space)	Aquatic foraging habitat in and downstream of Maximum Disturbance Limits (MDL)
Resource affected	Aquatic food sources (aquatic insects) and of drinking water quality.
Individual response	Increased foraging effort that could result in additional energy expenditure and associated decreased fitness, however this is likely to be minor for any individual bat, and unlikely to be measurable
Effect	Insignificant
Conservation Measures	BMPs associated with the 404/401 authorization and SWPPP will limit impacts to streams within the MDL and downstream aquatic resources. BMPs for control of stormwater flowing onto and through the Project may include slope breakers, temporary drainage ditches, French drains, and enhanced drains. Other soil stabilization measures will include temporary and permanent seeding, use of silt fencing, and erosion control blanket to help minimize soil erosion that may cause sedimentation in receiving waters. Restoration measures on temporarily impacted streams and wetlands will restore temporary loss in function following state and federal permitting conditions. Restoration of the site to preconstruction contours, use of native material for backfilling within the riparian zone. Cox Creek and Rocky Run utilize the horizontal directional drilling (HDD) construction method to avoid direct impacts to aquatic resources and water quality.
Interpretation	Based on the low number of perennial streams (n=17) within the MDL, the use of HDD of the two primary larger streams (Cox Creek and Rocky Run), and implementation of federal, state, and local waterway permits, it is anticipated that impacts to aquatic resources will be insignificant. Construction and restoration of the final right of way near stream crossings will be short in duration and monitored for compliance with permit conditions.

Table 9. Summary of Stressors and Effects on the Gray Bat

Stressors	Adverse	Insignificant/Discountable
Aquatic resource loss and degradation		Insignificant

5.4 Indiana Bat

No federally designated critical habitat is present within the action area for the Indiana bat. In general, the forested habitat found within the action area is suitable roosting, foraging, and commuting habitat for the Indiana bat. Additionally, coordination with the USFWS indicated that Known Summer 1 habitat (i.e., known Indiana bat maternity habitat) for the Indiana bat is present in the western half of the action area. Other Summer 1 records occur outside of the action area to the northeast and northwest of the Project as well. Additionally, there is a Summer 2 record directly south of the eastern half of the Project. Summer 2 refers to Indiana bat non-maternity records. The eastern portion of the Project MDL is considered potential habitat

based on the presence of suitable summer roosting habitat. Based on USFWS records, the nearest known Indiana bat hibernaculum is a P1 in southern Indiana roughly 20 miles away from the Project MDL.

5.4.1 SUMMER/FALL/SPRING HABITAT

Spring emergence occurs in early spring with females emerging in early to mid-March and males mid-April to early May. Spring staging is considered to occur between April 1 and May 14 (USFWS 2016). At this time, swarming habitat within one mile of Priority 1 (P1; current or historical population ≥10,000 Indiana bats) and Priority 2 (P2; current or historical population ≥1,000 Indiana bats) hibernacula entrances and within one-half mile of P3 and P4 hibernacula entrances are considered to be occupied. Summer maternity occurs between May 15 and August 15. Migration and swarming habitats are considered occupied between August 16 and October 15, unless they are within 10 miles of a P1 or P2 hibernaculum and five miles from a Priority 3 (P3; current or historical population of 50-1,000 Indiana bats) or Priority 4 (P4; current or historical population <50 Indiana bats) hibernaculum and then they are considered occupied until November 15.

Habitat use during non-hibernating periods is primarily within forested areas (April to October). Impacts to forested habitat during this time may cause take of the Indiana bat. Effects would consist of killing, injuring, harassing, or otherwise harming individuals residing in trees that are cleared in the MDL. Indiana bats roosting outside of the MDL but within the action area may be subject to affects from noise and vibration that may result in harassment as a form of take.

Tree clearing will be targeted between November 15 and March 31 when forested habitats are unoccupied by Indiana bats. The Project timing, landowner restrictions, preconstruction preparation, and other factors may not allow for all tree clearing to occur between November 15 and March 31 time frame. Because it is likely that clearing between April 1 and November 14 may be necessary for construction, Indiana bats may be present[2] during tree clearing operations and more vulnerable to disturbance. Areas of tree clearing are shown in Appendix A – Figure 6. Conservation measures regarding tree clearing for the project as it relates to the Indiana bat are presented in section 6.4.

Based on tree clearing locations for the Project, a total of 39.46 acres of tree clearing will occur for the Project. Tree clearing within the Summer 1 Indiana bat habitat is 26.27 acres while 13.19 acres will be cleared in the Potential Indiana bat habitat area. Approximately 13.18 acres of Summer 1 Indiana bat habitat occurs within 100 feet of USACE jurisdictional features while approximately 2.90. acres of Potential Indiana habitat occurs within 100 feet of USACE jurisdictional features. These clearing acreages are distributed throughout the 12-mile Project MDL and are not solely located in one area.

The clearing of 39.46 acres is small in comparison to the approximate 4,400 acres occurring throughout the action area. The MDL where clearing will occur is a mosaic of habitat types and fragmented on the eastern half of the Project. The western half parallels an existing cleared utility corridor and widens the gap between wooded areas. Cleared rights-of-ways have been found to provide foraging opportunities while traveling on the landscape between roosts and primary foraging grounds (Brown and Brack, 2003). Other studies have found the Indiana bat to commonly use fragmented landscapes (Carter et al 2002, Gardner et al 1991, Brack 1983).

[2] Forested habitat between April 1 and November 14 can be defined as potential, summer occupied (April 1 – August 15), potential, swarming and potential occupied (August 16 – October 14) and, swarming occupied (October 15 – November 14). See Appendix B of USFWS 2016.

In total, 16,416 linear feet of streams (USACE jurisdictional perennial, intermittent, and ephemeral streams) were identified within the Project MDL. A total of 0.28 acres of pond open water and 1.11 acres of wetlands were identified within Project MDL, with 0.50 acres of this forested wetland. Water quality degradation has the potential to affect foraging bats by reducing aquatic insect populations that make up part of the Indiana bat diet. This impact is anticipated to be short-term and minor due to implementation of BMP's as required by federal and state permits (i.e., sections 404 and 401, NPDES, and others).

Noises and vibrations related to tree clearing and construction are the Project impacts which are likely to travel farthest outside the workspace. Construction activities including clearing, grading, trenching, and drilling are all likely to generate noise above background levels during the active season. The distance that noise travels is dependent on many variables, including equipment type, vegetative cover, topography, etc. Multiple environmental factors help to dampen sound as it is created during the construction of the Project including point-source sound propagation, ground acoustical absorption, air acoustical absorption, forest attenuation, and occluding terrain.

Because roosting bats are found in the forest, it is reasonable to assume that vegetative cover will nearly always be intervening between the source of construction noise and the bat itself. Indiana bats also roost under bark and within cavities, which can reasonably be assumed to further reduce the amount of noise that reaches them. Further, the western portion of the Project is located in a relatively hilly area, and terrain will frequently occlude the noise between a source and the receiving point. To be conservative, a maximum buffer distance of 1 kilometer from the MDL was utilized to define the action area for effects analysis. That distance is dictated primarily by the noise level associated with rock trenching and hammering.

Early literature on noise and bats indicated that Indiana bats may seek roost sites away from noise sources. Indiana bats, especially reproductive females, have been shown to typically roost farther from noisy paved roads and highways than they do from quieter gravel ones (Gardner 1991). However, factors other than noise may also contribute to this correlation; gravel roads may be narrower and present less risk of predation, as an open space barrier for travel and foraging activities, or may have fewer streetlamps, or carry less risk of injury and death via collision with vehicles or may have less surrounding human development. Gardner (1991) suggested that noise and exhaust from machinery may disturb colonies of roosting bats, though he noted that such disturbances would have to be severe to cause roost abandonment.

Subsequent studies generally indicate that bats are very tolerant of anthropogenic noise, including persistent and sudden noises. Documented instances can be found of bats roosting in very noisy circumstances: near airports (FAA 1992), near highways (Brack et al. 2004), regularly crossing major highways (3D/E 1995), roosting under concrete road bridges and underpasses (Kiser et al. 2002), and roosting and foraging on active military bases where construction and training activities take place during the active season (3D/E 1996). All seem to indicate that noise and vibration of many source types are conditions which either do not bother roosting bats or are at least easily adjusted to.

Another consideration to take into account when analyzing the effect of noise on roosting bats is the biology of an Indiana bat's hearing. Indiana bats likely hear frequencies in the same range as the very similar little brown bat (*Myotis lucifugus*), approximately 10 kHz – 120 kHz (Grinnell 1963), and their own echolocation calls are quite loud, often up to or exceeding 120 dbA. While construction noises may certainly occupy a wide frequency range, it is likely that the loudest activity, rock trenching, has its greatest effect at frequencies which are not ultrasonic in nature. High frequency sounds also attenuate more quickly than low frequency sounds, and may not travel as far, particularly when obstacles like vegetation and topography intervene, both of which are present within the action area.

Based on the available literature and Project description, it is likely that only those bats roosting near trenching/rock hammering activity will be disturbed by loud, sudden noise. Blasting is not proposed as part of the Project construction process. The quieter, more persistent noises associated with regular construction activities, such as truck operation, pipe welding and setting, are expected to have minimal impact on Indiana bats if they are roosting within the action area. If bats are present in the immediate vicinity of targeted rock trenching/hammering activities, they may awaken, expending more energy than their typical day-roosting baseline. In some cases, bats may temporarily abandon their roost. Because very loud construction noise is expected to be brief at any one area (one season), these bats may return to their roost within the same season when louder construction noise moves locations or the following season when construction noise is less impactful, though permanent abandonment may occur. Nonvolant pups may be harmed by temporary abandonment by their mothers, though female Indiana bats have been known to transport their pups while changing roosts, and adult females are known to return for pups left behind during emergency roost switching (Belwood 2002).

During construction of the pipeline, the felling of trees and operation of heavy equipment and tools will produce noise and vibrations. The noise and disturbances of clearing and construction may impact the Indiana bat's behavior or cause bats to flush from their roosts. Tree removal occurring on the site will reduce habitat for the Indiana bat in the action area, thus individuals exposed to noise and vibration will be limited to those that could be using habitat on the margins of the construction limits of this project. No blasting or extensive impacts beyond those immediately adjacent to the construction limits are expected.

The nearest known hibernaculum is roughly 20 miles away from the MDL. Surveys conducted throughout the MDL did not identify any winter habitat for the Indiana bat (Appendix E). Survey of the entire action area outside of the MDL was not practicable and/or not available at the time of the survey. In lieu of walking outside of the MDL, the biologists visually assessed as far as they could see. Although they did not observe any winter habitat outside of the MDL, there is the potential for presence of an unidentified hibernaculum outside of the MDL but within the action area. Any unknown hibernaculum is likely to be qualified as P4 (<50 bats historically) because most larger hibernacula have been identified within the state by various surveys and monitoring efforts. The presence of a potential hibernaculum could result in the forested areas within the action area being used as potential swarming habitat, although no known swarming habitat is documented in the action area.

Swarming habitat consists of various forest types, water sources, wetlands, and food sources associated with the vegetation and water habitats in the action area. Based on review of NLCD data (Dewitz and USGS 2021), the action area contains approximately 7,741 acres of habitat that may be suitable for swarming. However, the MDL represents only 1.28 percent of potential swarming habitats within the action area (Table 10).

Table 10. Indiana bat suitable swarming habitat in acres within the action area (collectively MDL and 1-km buffer) and with the 5-mile (8-km) buffer area.

Habitat Type	MDL	Action Area	5-mile (8-km) Buffer	% Action Area	%5-mile (8-km) Buffer
Deciduous Forest	49.27	4,425.47	48,730.41	1.10%	0.09%
Evergreen Forest	2.01	633.00	3,290.26	0.32%	0.05%
Mixed Deciduous/Evergreen Forest	10.71	1,677.23	12,496.92	0.63%	0.08%
Open Water	0.00	25.55	611.66	0.00%	0.00%
Wetlands (PEM/PSS)	0.00	25.57	2,813.54	0.00%	0.00%
Agriculture	39.58	954.55	9,148.18	3.98%	0.39%
Total	**101.57**	**7,741.37**	**77,090.97**	**1.28%**	**0.12%**

The Project will remove a total of 39.46 acres of forest within the MDL that could be used by swarming Indiana bats. Based on NLCD analysis, there are approximately 6,736 acres of forest area within the action area. Removal of 39.46 acres is approximately 0.6 percent of forest resources within the action area (Table 10).

Artificial lighting during nighttime hours has been demonstrated to affect bat activity. Light-sensitive species have been demonstrated to have a lower activity level near light sources, while more light-tolerant species have been demonstrated to utilize certain types of lighting as foraging opportunities due to the concentration of insect activity (Spoelstra et al. 2017). Indiana bats are likely to be light sensitive (Rydell and Racey 1995) and may be negatively impacted if artificial lighting is used in otherwise suitable foraging or roosting habitat.

Artificial lighting is not planned as part of the Project. However, some nighttime construction may be necessary at different construction locations during times of year when daylight is minimized. This lighting will be angled downward and inward toward the construction area to limit light pollution outside of the work area. No regular pipeline construction activities are planned outside of the daylight hours, with the potential exception of wetland and stream crossings.

5.4.2 WINTER HABITAT

A request to the KSS for information regarding any caves within five miles of the Project MDL resulted in identification of three caves. The KSS provided the location of the three caves, but no other information regarding the caves (i.e., depth, size) was provided. The information KSS provided indicated that the closest cave is approximately 1,600 feet from the pipeline location and along Colyer Lane. This cave (T10) is not considered winter habitat as it was found to be a rockshelter with no passages and exposed to the freezing in the winter (Appendix E). Two other cave locations were provided, each located greater than 1.5 miles from the action area. These caves are not known as hibernacula for Indiana bats.

Visual surveys were performed within the Project MDL for caves or other potential winter habitat. Access outside of the MDL was not practicable during field efforts in 2023 so biologists focused the survey on the MDL and relied on visually assessing areas outside of the MDL in the action area as far as they were able (see Appendix E). In accordance with the Range- Wide Indiana Bat & Northern Long-Eared Bat Survey Guidelines Appendix H: Potential Hibernaculum Survey Guidance, underground openings can be deemed

unsuitable as a hibernaculum and dismissed from further assessment and surveys under the following conditions:

a) There is only one horizontal opening, and it is less than six inches (15.2 cm) in diameter;

b) Vertical shafts are less than one foot (0.3 m) in diameter; Passage continues less than 50 feet (15.2 m) and terminates with no visible fissures that bats can access;

c) Openings are prone to flooding, collapsed shut and completely sealed, or otherwise are inaccessible to bats; and

d) Openings that have occurred recently (i.e., within the past 12 months) due to human activity or subsidence.

LG&E observed visual evidence of sinkholes within the Project MDL. The observed sinkholes appeared to be newly formed, actively caving in, and narrow mouthed. Soil cover at these sinkholes appeared to be thin and less than five feet thick (Appendix E). Using the guidance, these observed sinkholes were deemed unsuitable as hibernaculum.

Upon review of the geologic data for the Project area, additional sinkholes may form during construction as small voids are breached. Sinkholes that form during construction within 15 feet of the pipeline will be stabilized with an inverted rock filter (see Appendix E – Figure 5). Sinkholes outside of 15 feet, but within the right-of-way will be evaluated by a Project engineer regarding need for stabilization in the same manner. The inverted rock filter is designed to allow water to flow interstitially through various sizes of rock and nonwoven geotextile.

Sinkholes encountered during construction because of excavation (i.e., subsidence sinkhole) are not expected to be suitable for bat use. Subsidence sinkholes result when water (subsurface in this circumstance) dissolved cavities in bedrock fractures resulting in the overlying unstable soil to move downward into the cavity.

Because this project is located within a karst geologic area, there is a chance that an unknown hibernaculum exists within the action area. Any unknown hibernaculum is likely to be qualified as P4 (<50 bats historically) because most larger hibernacula have been identified within the state by various surveys and monitoring efforts. Additionally, visual surveys of the MDL and the immediate area outside the MDL were assessed in 2023 and no winter habitat was identified or areas that appear to support complex cave systems (see Appendix E). Impacts to an undiscovered hibernaculum are not expected. Most sinkholes occurring in the action area are located on thin soils and shallow bedrock. Bedrock collapse is rare and is considered a rare formation event. Most sinkholes occur due to cover-collapse when the unstable soil becomes too thin to support the weight of the material above and a filter through fractures in limestone bedrock by dissolution of the material and limestone conduits (KGS 2023). These features are not likely to be large enough to support the microclimate necessary for hibernation of large numbers of Indiana bats. Microhabitat for hibernating Indiana bats include stable ambient temperatures between 37.4° and 45°F (USFWS 2007). Karst features that are a result of water movement can be ecological traps. Flooding and severe freezing events can cause mortality of Indiana bats (USFWS 2007). For this reason, Indiana bats will spontaneously arouse and seek new positions within a hibernaculum to meet ambient temperature needs (USFWS 2007).

The nearest known hibernaculum for Indiana bats is roughly 20 miles away from the action area. Indiana bats hibernating outside of the MDL are not expected to be impacted by sound or substrate vibration during

construction. Hibernating bats would not be subject to above surface construction and potential disturbance. Blasting is not planned for use during construction.

Potential impacts associated with an unknown hibernaculum and its associated swarming habitat within the action area are accounted for within the impacts evaluated under other stressors and pathways in section 5.4.3. No additional impacts to the species beyond what is already considered in these other effects pathways are anticipated. While impacts are considered to Indiana bat winter habitat based on the assumption that an undiscovered hibernaculum may be present, the Project is not expected to adversely affect hibernating Indiana bats.

5.4.3 EFFECTS PATHWAYS FOR INDIANA BAT

Tables 11 – 16 provide a summary of the stressors and effects for the Indiana bat. Table 17 summarizes the effects determination based on the assessment of the Project related to Indiana bats.

Table 11. Indiana Bat – Effects Pathway for Tree Removal, Mortality

Activity: Construction	
Stressor: Tree removal while bats are present	
Exposure (time)	During construction between April 1 and November 14 (including non-volant and swarming periods)
Exposure (space)	Up to 39.46 acres of forested habitat to be removed within the Maximum Disturbance Limits (MDL)
Resource affected	Individuals (adults and juveniles)
Individual response	Bats roosting within trees to be removed during construction may be injured or killed when struck by equipment or crushed when tree falls. Removal of roosts may result in increased effort to find new suitable roosting habitat requiring additional energy expenditure that may reduce fitness and result in reduced survival and/or reproductive success. Maternity colony fragmentation could decrease thermoregulation efficiency/decreased foraging efficiency impacting fitness and result in reduced survival and reproductive success. Maternity colony fragmentation may increase the risk of predation.
Effect	Harm
Conservation Measures	Tree clearing will be targeted between November 15 and March 31 when forested habitats are unoccupied by Indiana bats. Voluntary financial contribution to the Imperiled Bat Conservation Fund.
Interpretation	Bats occupying trees that are removed may be injured or killed. Injured bats may subsequently die. Those that survive will have to spend extra energy in addition to what is necessary for foraging, pup rearing, social interactions, or other activities. The use of additional energy in response to habitat loss, especially when combined with the energy needs associated with normal life cycle processes (e.g., migration, pregnancy, lactation, etc.) or other stressors (e.g., WNS), is likely to reduce fitness and subsequently reduce survival and reproductive success.

Table 12. Indiana Bat – Effects Pathway for Tree Removal, Loss of Roost Trees

Activity: Construction	
Stressor: Tree clearing while bats are absent	
Exposure (time)	Removal during construction between November 15 and May 31 will expose Indiana bats to affects the following active season (April 1 to November 14).
Exposure (space)	Up to 39.46 acres of forested habitat to be removed within the Maximum Disturbance Limits (MDL)
Resource affected	Habitat (roost trees), used by individuals (adults)
Individual response	Increased effort to find new suitable roosting habitat requires extra energy expenditure that can reduce fitness and result in reduced survival/reproductive success. Colony fragmentation could result in Indiana bats using suboptimal roosts that may decrease thermoregulation efficiency/decreased foraging efficiency that can decrease fitness and result in reduced survival/reproductive success. Colony fragmentation can increase the risk of predation.
Effect	Harm
Conservation Measures	Tree clearing will be targeted between November 15 and March 31 when forested habitats are unoccupied by Indiana bats and northern long-eared bats. Voluntary financial contribution to the Imperiled Bat Conservation Fund.
Interpretation	Adult Indiana bats will experience adverse effects after they arrive at their summer roosting habitat the first year after tree removal. The extra energy to find new habitat is in addition to what is necessary for foraging, pup rearing, social interactions, or other activities. The use of additional energy in response to habitat loss, especially when combined with the energy needs associated with normal life cycle processes (e.g., migration, pregnancy, lactation, etc.) or other stressors (e.g., WNS), is likely to result in adverse effects. Indiana bats are expected to adapt to this stressor in subsequent years after new suitable habitat is found.

Table 13. Indiana Bat – Effects Pathway for Tree Removal, Forest Loss, and Fragmentation.

Activity: Construction	
Stressor: Tree removal, forest loss and fragmentation	
Exposure (time)	During construction phase of Project.
Exposure (space)	39.46 acres removed within the Maximum Disturbance Limits.
Resource affected	Forested habitat, used by individuals (adults, juveniles)
Individual response	Alteration of behavior by increasing effort to access sufficient foraging resources causing reduced survival and reproductive success. Increased visibility to predators resulting in increased predation.
Effect	Insignificant
Conservation Measures	Avoidance or minimization of clearing within forested areas where possible. Completion of mitigation for impacts with the consultation of the USFWS Kentucky Ecological Services Field Office through contribution to the KNLT Imperiled Bat Conservation Fund.
Interpretation	The proposed tree removal is not anticipated to significantly impact bat behavior in the area. The final maintained corridor width of 50 feet or less is not a significant gap and would not prohibit dispersal or foraging behavior. It is expected that Indiana bats that currently use this area would continue to do so. The pipeline will follow existing utility right-of-way where possible to limit creating new gaps in forested areas.

Table 14. Indiana Bat – Effects Pathway for Aquatic Resource Degradation, Water Quality Degradation

Activity: Construction	
Stressor: Aquatic resource degradation; water quality degradation	
Exposure (time)	Construction phase during active time of year (April 1 – November 15)
Exposure (space)	Aquatic foraging habitat in and downstream of the Project Maximum Disturbance Limits (MDL)
Resource affected	Aquatic food sources (aquatic insects) and drinking water
Individual response	Impacts to aquatic food sources and drinking water quality may result in increased foraging effort requiring additional energy expenditure that can reduce fitness and result in reduced survival/reproductive success. Reduced foraging efficiency can result in reduced fitness and survival/reproductive success.
Effect	Insignificant
Conservation Measures	BMPs associated with the 404/401 authorization and SWPPP will limit impacts to streams within the MDL and downstream aquatic resources. BMPs for control of stormwater flowing onto and through the Project may include slope breakers, temporary drainage ditches, French drains, and enhanced drains. Other soil stabilization measures will include temporary and permanent seeding, use of silt fencing, and erosion control blanket to help minimize soil erosion that may cause sedimentation in receiving waters. Restoration measures on temporarily impacted streams and wetlands will restore temporary loss in function following state and federal permitting conditions. Restoration of the site to preconstruction contours, use of native material for backfilling within the riparian zone. Cox Creek and Rocky Run utilize the horizontal directional drilling construction method to avoid direct impacts to aquatic resources and water quality.
Interpretation	Based on the low number of perennial streams (n=17) within the MDL, the use of HDD of the two primary larger streams (Cox Creek and Rocky Run), and implementation of federal, state, and local waterway permits it is anticipated that impacts to aquatic resources will be insignificant. Construction and restoration of the final right of way near stream crossings will be short in duration and monitored for compliance with permit conditions. The effects of sedimentation on aquatic resources (food and water quality) are expected to be minimal due to the temporary nature of the activity and implementation of the conservation measures.

Table 15. Indiana Bat – Effects Pathway for Noise and Vibration During Active Time of Year

Activity: Construction	
Stressor: Noise and vibration	
Exposure (time)	Construction phase during the active time of year (April 1 – November 15)
Exposure (space)	Roosting and foraging habitat within the action area
Resource affected	Individuals (juveniles and adults)
Individual response	Flushing from roost trees which results in extra energy expenditure and associated decreased fitness of individuals and increased chances of predation on flushed individuals. Avoidance or determent from using action area to swarm.
Effect	Harm
Conservation Measures	Blasting will not be used for breaking rock in an effort to minimize impacts in the action area that may be associated with noise and vibration. Project construction will use rock trenchers and hammers in areas where the underlying limestone requires this method. Other areas of shale and soil will not require these methods or produce the noise/vibration levels of rock trencher/hammer.
Interpretation	Construction noise and vibration are unavoidable during construction of the Project during the active time of year. Noise and/or vibration may startle bats and cause them to flush from their roosts. Noise related to construction include trenching, tree clearing, and general construction movements will be generated from within the MDL but may affect bats throughout the action area. Blasting will not be used in an effort to reduce startling noises and vibrations. Indiana bats exposed to this stressor during habitat removal are likely to respond in a way that would lead to adverse effects including avoidance or abandonment of habitat potentially used for swarming. Indiana bats exposed to this stressor during the construction component after habitat removal would be exposed to lower levels of this stressor as the ground, vegetation, air, and source point are expected to attenuate noise levels.

Table 16. Indiana Bat – Effects Pathway for Noise and Vibration During Inactive Time of Year

Activity: Construction	
Stressor: Noise and vibration	
Exposure (time)	Construction phase during inactive time of year (November 15 – March 31)
Exposure (space)	Undocumented cave(s) outside of the Maximum Disturbance Limits (MDL), but within the action area.
Resource affected	Individuals (adults and juveniles) in hibernacula
Individual response	Forced arousal from torpor resulting in decreased fitness and fecundity, injury or mortality.
Effect	Discountable
Conservation Measures	Blasting will not be used for breaking rock in an effort to minimize impacts associated with noise and vibration. Project construction will use rock trenchers and hammers in areas where the underlying limestone requires this method. Other areas of shale and soil will not require these methods or produce the noise/vibration levels of rock trencher/hammer. This will be done to minimize noise/vibration impacts to bats. .
Interpretation	Construction noise and vibration are unavoidable during construction of the Project during the inactive time of year. Noise and/or vibration may cause bats to arouse from torpor to assess the new condition. However, noise and vibration are expected to be attenuated due to various environmental conditions such as substrate, vegetation, air, and source of noise/vibration (i.e., below ground level in trench). Blasting will not be used in an effort to reduce startling noises and vibrations. Indiana bats exposed to this stressor during construction are not likely to respond in a way that would lead to adverse effects but acclimate during periodic arousal and continue using the undocumented feature.

Table 17. Summary of Stressors and Effects on the Indiana Bat

Stressors	Adverse	Insignificant/Discountable
Tree removal, bat mortality (April 1 to November 14)	Harm	
Tree removal, loss of roost trees (November 15 to March 31)	Harm	
Tree Removal, Forest Loss, and Fragmentation		Insignificant
Aquatic resource loss and degradation		Insignificant
Noise and vibration (April 1 to November 14)	Harm	
Noise and vibration (November 15 to March 31)		Discountable

5.5 Northern Long-eared Bat

5.5.1 SUMMER/FALL/SPRING HABITAT

Clearing trees outside of the hibernations period (April 1 – November 15) is likely to affect the northern long-eared bat. This date range is considered the active time frame for the northern long-eared bat. During the active time of year, the northern long-eared bat is utilizing foraging, roosting and maternity trees and other aspects of the forested areas. Effects would consist of killing, injuring, harassing, or otherwise harming individuals residing in trees that are cleared in the Project MDL. Tree clearing necessary for Project construction could result in the incidental take of northern long-eared bat. Mitigation for tree clearing will be provided through a voluntary contribution to the Imperiled Bat Conservation Fund.

Tree clearing within the MDL will be targeted between November 15 and March 31 when forested habitats are unoccupied by northern long-eared bats. The project timing, landowner restrictions, and other factors may not allow for all tree clearing to occur during the November 15 to March 31 time frame. This time frame is outside of the maternity season in which females are birthing and young newly volant and are more vulnerable to disturbance. Tree clearing may occur during any time of year, therefore, northern long-eared bats may be present during tree clearing operations. Areas of tree clearing are shown in Appendix A – Figure 6.

Based on tree clearing locations, a total of 39.46 acres of tree clearing will occur for the Project (see Appendix A – Figure 6). Tree clearing within known Summer 1 northern long-eared bat habitat will total 23.21 acres while 16.25 acres will be cleared in the other areas containing potential northern long-eared bat habitat. Approximately 11.77 acres of Summer 1 northern long-eared bat habitat occurs within 100 feet of USACE jurisdictional features while approximately 4.31 acres of Potential northern long-eared bat habitat occurs within 100 feet of USACE jurisdictional features. These clearing acreages occur throughout the 12-mile Project MDL and are not solely located in one area (Appendix A – Figure 6).

The clearing of 39.46 acres is small in comparison to the approximate 4,400 acres occurring throughout the action area. The MDL where clearing will occur is a mosaic of habitat types and fragmented on the eastern half of the Project. The western half parallels an existing cleared utility corridor and widens the already existing gap between wooded areas. Cleared rights-of-ways have been found to provide foraging opportunities while traveling on the landscape between roosts and primary foraging grounds (Brown and Brack, 2003).

In total, 16,416 linear feet of streams (USACE jurisdictional perennial, intermittent, and ephemeral streams) were identified within the MDL. A total of 0.28 acres of pond open water and 1.11 acres of wetlands were identified within MDL, with 0.50 acres of this wetland forested. The water quality of these features may be temporarily reduced because of increased sedimentation during construction, which can negatively impact foraging habitat. Northern long-eared bats forage primarily in upland areas but will occasionally utilize stream corridors. Water quality degradation has the potential to minimally affect foraging northern long-eared bats by reducing aquatic insect populations that make up part of the northern long-eared bat diet, but this impact is anticipated to be short-term and minor.

Noises and vibrations related to tree clearing and construction are the Project impacts which are likely to travel farthest outside the workspace. Construction activities including clearing, grading, trenching, and drilling are all likely to generate noise above background levels during the active season. The distance that noise travels is dependent on many variables, including equipment type, vegetative cover, topography, etc. Multiple environmental factors help to dampen sound as it is created during the construction of the Project

including point-source sound propagation, ground acoustical absorption, air acoustical absorption, forest attenuation, and occluding terrain.

Because roosting northern long-eared bats are found in the forest, it is reasonable to assume that vegetative cover will nearly always be intervening between the source of construction noise and the bat itself. Northern long-eared bats also roost under bark and within cavities, which can reasonably be assumed to further reduce the amount of noise that reaches them. Additionally, there are numerous barns and garages that may be used by northern long-eared bats as roosts. The western portion of the Project is located in a relatively hilly area, and terrain will frequently occlude the noise between a source and the receiving point. To be conservative, a maximum buffer distance of 1 kilometer from the MDL was utilized to define the action area for effects analysis. That distance is dictated primarily by the noise level associated with rock trenching and hammering in the western portion of the MDL.

Studies have generally seemed to indicate that bats are very tolerant of anthropogenic noise, including persistent and sudden noises. Documented instances can be found of bats roosting in very noisy circumstances: near airports (FAA 1992), near highways (Brack et al. 2004), regularly crossing major highways (3D/E 1995), roosting under concrete road bridges and underpasses (Kiser et al. 2002), and roosting and foraging on active military bases where construction and training activities take place during the active season (3D/E 1996). A northern long-eared bat maternity colony in rural Pike County, Ohio was observed utilizing an emergency siren pole for a roost that was tested for one minute every Wednesday (J. Brown unpublished data). The colony did not react to the emergency siren during tests and returned over multiple years even when suitable forested habitat was present. These studies and observations indicate that noise and vibration of many source types are conditions which either don't bother roosting bats or are at least easily adjusted to.

Another consideration to take into account when analyzing the effect of noise on roosting bats is the biology of northern long-eared bat's hearing. Northern long-eared bats call frequency is shorter in duration, broader bandwidth and lower intensity than other Myotis species with a frequency range between 126 and 40 kHz (Caceres and Barclay 2000), and their own echolocation calls are quite soft at 60 dbA. While construction noises may certainly occupy a wide frequency range, it seems likely that the loudest activity, rock trenching, has its greatest effect at frequencies which are not ultrasonic in nature. High frequency sounds also attenuate more quickly than low frequency sounds, and may not travel as far, particularly when obstacles like vegetation and topography intervene, both of which are present within the action area.

Based on the available literature and Project description, it is likely that only those bats roosting near trenching/rock hammering activity will be disturbed by loud, sudden noise. Blasting is not proposed as part of the Project construction process. The quieter, more persistent noises associated with regular construction activities, such as truck operation, pipe welding and setting, are expected to have minimal impact on northern long-eared bats roosting within the action area. Bats which are present in the immediate vicinity of targeted rock trenching/hammering activities may awaken, expending more energy than their typical day-roosting baseline. In some cases, bats may temporarily abandon their roost. Because very loud construction noise is expected to be brief at any one area (one season), these bats may return to their roost within the same season when louder construction noise moves locations or the following season when construction noise is less impactful, though permanent abandonment may occur. Nonvolant pups may be harmed by temporary abandonment by their mothers, though female bats of the Myotis genus have been known to transport their pups while changing roosts, and adult females are known to return for pups left behind during emergency roost switching (Belwood 2002).

The nearest known hibernaculum is roughly 15 miles away from the action area. Surveys conducted throughout the MDL did not identify any winter habitat for the northern long-eared bat (Appendix E). However, survey of the entire action area outside of the MDL was not practicable and/or not available at the time of survey. In lieu of walking outside of the MDL, biologists visually assessed as far as they could see. Although they did not observe any winter habitat outside of the MDL, there is the potential for presence of an unidentified hibernaculum outside the MDL but within the action area. Any unknown hibernaculum is likely to be small (<50 individuals) because most larger hibernacula have been identified within the state by various surveys and monitoring efforts. The presence of a potential hibernaculum outside of the MDL but within the action area could result in the forested areas within the action area being used as potential swarming habitat; although no known swarming habitat is documented in the action area. Swarming habitat consists of various forest types, water sources, wetlands, and food sources associated with the vegetation and water habitats in the action area. Based on review of NLCD data (Dewitz and USGS 2021), the action area contains approximately 7,741 acres of habitat that may be suitable for swarming. However, the MDL represents only 1.28 percent of swarming habitats within the action area (Table 18).

Table 18. Northern long-eared bat swarming habitat in acres within the Action Area (collectively MDL and 1-km buffer) and with the 5-mile (8-km) buffer area.

Habitat Type	MDL	Action Area	5-mile (8-km) Buffer	%Action Area	%5-mile (8-km) Buffer
Deciduous Forest	49.27	4,425.47	48,730.41	1.10%	0.09%
Evergreen Forest	2.01	633.00	3,290.26	0.32%	0.05%
Mixed Deciduous/Evergreen Forest	10.71	1,677.23	12,496.92	0.63%	0.08%
Open Water	0.00	25.55	611.66	0.00%	0.00%
Wetlands (PEM/PSS)	0.00	25.57	2,813.54	0.00%	0.00%
Agriculture	39.58	954.55	9,148.18	3.98%	0.39%
Total	**101.57**	**7,741.37**	**77,090.97**	**1.28%**	**0.12%**

The Project will remove a total of 39.46 acres of forest within the MDL that could be used by swarming northern long-eared bats. Based on NLCD analysis, there are approximately 6,736 acres of forest area within the action area. Removal of 39.46 acres is approximately 0.6 percent of forest resources within the action area. Based on this review of available habitat, it is not expected to adversely affect the northern long-eared bat if a small subset of swarming habitat is removed within the MDL (Table 18).

Artificial lighting during nighttime hours has been demonstrated to affect bat activity. Light-sensitive species have been demonstrated to have a lower activity level near light sources, while more light-tolerant species have been demonstrated to utilize certain types of lighting as foraging opportunities due to the concentration of insect activity (Spoelstra et al. 2017). Northern long-eared bats are likely to be light sensitive and may be negatively impacted if artificial lighting is used in otherwise suitable foraging or roosting habitat (Rowse et al (2015).

Artificial lighting is not planned as part of the Project. However, some nighttime construction may be necessary at different construction locations during times of year when daylight is minimized. This lighting will be angled downward and inward toward the construction area to limit light pollution outside of the work

area. No regular Pipeline construction activities are planned outside of the daylight hours, with the potential exception of wetland and stream crossings.

5.5.2 WINTER HABITAT

A request to the KSS for information regarding any caves within five miles of the Project MDL resulted in identification of three caves. The KSS provided the location of the three caves, but no other information regarding the caves (i.e., depth, size) was provided. The information KSS indicated that the closest cave is approximately 1,600 feet from the MDL and along Colyer Lane. Two other cave locations were provided, each located greater than 1.5 miles from the action area. The cave closest to the MDL and located within the action area is a rock shelter with no suitable overwintering habitat for the northern long-eared bat (Appendix E).

Visual surveys were performed within the Project MDL for caves or other potential winter habitat. Access outside of the MDL was not practicable during field efforts in 2023 so biologists focused the survey on the MDL and relied on visually assessing areas outside of the MDL in the action area as far as they were able (see Appendix E).. In accordance with the Range-Wide Indiana Bat & Northern Long-Eared Bat Survey Guidelines Appendix H: Potential Hibernaculum Survey Guidance, underground openings can be deemed unsuitable as a hibernaculum and dismissed from further assessment and surveys if:

a) There is only one horizontal opening, and it is less than six inches (15.2 cm) in diameter;

b) Vertical shafts are less than one foot (0.3 m) in diameter; Passage continues less than 50 feet (15.2 m) and terminates with no visible fissures that bats can access;

c) Openings are prone to flooding, collapsed shut and completely sealed, or otherwise are inaccessible to bats; and

d) Openings that have occurred recently (i.e., within the past 12 months) due to human activity or subsidence.

LG&E observed visual evidence of sinkholes within the Project MDL. The observed sinkholes appeared to be newly formed, actively caving in, and narrow mouthed. Soil cover at these sinkholes appeared to be thin and less than five feet thick (Appendix F). Using the guidance, these observed sinkholes were deemed unsuitable as hibernaculum (see Appendix E).

Upon review of the geologic data for the Project area, it is anticipated that additional sinkholes may form during construction as voids are exposed during trenching. Voids exposed during construction may become sinkholes between trenching and placement of pipe. Any void/sinkhole feature within the trench or that forms within 15 feet of the pipeline will be stabilized with an inverted rock filter (see Appendix F – Figure 5). Sinkholes outside of 15 feet, but within the right-of-way will be evaluated regarding need for stabilization, location proximate to the MDL, and potential threat to the pipeline. The inverted rock filter does not “cut off” subterranean water flow but is designed to allow water to flow interstitially through various sizes of rock and nonwoven geotextile.

Voids encountered during construction as a result of excavation are not expected to be suitable for bat use. Based on guidance from the USFWS, newly opened voids generally meet one or more of the criteria above making them unusable by bats. Subsidence sinkholes result when water (subsurface in this circumstance) dissolved cavities in bedrock fractures resulting in the overlying unstable soil to move downward into the cavity.

Because this project is located within a karst geologic area, there is a chance that an undocumented hibernaculum exists within the action area. Any unknown hibernaculum is likely to support less than 50 northern long-eared bats. Impacts to an undiscovered hibernaculum are not expected. Most sinkholes occurring in the action area are not suitable bat habitat because they are located on thin soils and shallow bedrock. Bedrock collapse is rare and is considered a rare formation event (KGS 2023). Most sinkholes occur due to cover-collapse when the unstable soil becomes too thin to support the weight of the material above and a filter through fractures in limestone bedrock by dissolution of the material and limestone conduits (KGS 2023). These features are not likely to be large enough to support the microclimate necessary for hibernation of northern long-eared bats. Microhabitat for hibernating northern long-eared bats include stable ambient temperatures between 32° and 48°F, high humidity, and no air current (Raesly and Gates 1987, Brack 2007). Karst features that are a result of water movement can be ecological traps. Flooding and severe freezing events can cause mortality of northern long-eared bats (USFWS 2000). For this reason, northern long-eared bats generally hibernate in cracks and crevices where microclimate is stable but will spontaneously arouse and seek new positions within a hibernaculum to meet ambient temperature needs.

The nearest known hibernaculum is roughly 15 miles away from the action area. Surveys conducted throughout the MDL did not identify any winter habitat for the northern long-eared bat (Appendix E). While there are parts of the action area that are underlain with karst there is no evidence of hibernacula based on current information. Although the surveying biologists could not walk the area outside the MDL but within the action area, the biologists visually assessed as far as they could see and did not observe evidence of hibernacula. Nonetheless given the lack of certainty, the Project assumes that an undocumented hibernaculum may exist outside the MDL in the action area. Any undiscovered hibernaculum outside of the MDL but within the action area is assumed to be small (<50 individuals) because most larger hibernacula have been identified within the state by various surveys and monitoring efforts. Based on information presented in section 5.5.1, northern long-eared bats hibernating outside of the MDL are not expected to be impacted by sound or substrate vibration during construction. Hibernating bats would not be subject to above surface construction and potential disturbance as well.

Potential impacts associated with an unknown hibernaculum and its associated swarming habitat within the action area are accounted for within the impacts evaluated under other stressors and pathways in section 5.5.3. No additional impacts to the species beyond what are already considered in these other effects pathways is anticipated. While impacts are considered to northern long-eared bat winter habitat based on the assumption that an undiscovered hibernaculum may be present, the Project is not expected to adversely affect hibernating Indiana bats.

5.5.3 EFFECTS PATHWAYS FOR NORTHERN LONG-EARED BAT

Tables 19 – 24 provide a summary of the stressors and effects for the northern long-eared bat. Table 25 summarizes the effects determination based on the assessment of the project related to the northern long-eared bat.

Table 19. Northern Long-eared Bat – Effects Pathway for Tree Removal, Bat Mortality

Activity: Construction	
Stressor: Tree removal while bats are present	
Exposure (time)	During construction between April 1 and November 14 (including non-volant period and swarming periods)
Exposure (space)	Up to 39.46 acres of forested habitat to be removed within the Maximum Disturbance Limits (MDL)
Resource affected	Individuals (adults and juveniles)
Individual response	Bats roosting within trees to be removed during construction may be injured or killed when struck by equipment or crushed when tree falls. Removal of roosts may result in increased effort to find new suitable roosting habitat requiring additional energy expenditure that may reduce fitness and result in reduced survival and/or reproductive success. Colony fragmentation could decrease thermoregulation efficiency/decreased foraging efficiency impacting fitness and result in reduced survival and reproductive success. Colony fragmentation may increase the risk of predation.
Effect	Harm
Conservation Measures	Tree clearing will be targeted between November 15 and March 31 when forested habitats are unoccupied by northern long-eared bats. Voluntary financial contribution to the Imperiled Bat Conservation Fund.
Interpretation	Bats occupying trees that are removed may be injured or killed. Injured bats may subsequently die. Those that survive will have to spend extra energy in addition to what is necessary for foraging, pup rearing, social interactions, or other activities. The use of additional energy in response to habitat loss, especially when combined with the energy needs associated with normal life cycle processes (e.g., migration, pregnancy, lactation, etc.) or other stressors (e.g., WNS), is likely to reduce fitness and subsequently reduce survival and reproductive success.

Table 20. Northern Long-eared Bat – Effects Pathway for Tree Removal, Loss of Roost Trees

Activity: Construction	
Stressor: Tree removal while bats are absent	
Exposure (time)	Removal during construction between November 15 and May 31 will expose northern long-eared bats to effects the following active season (April 1 to November 14).
Exposure (space)	Up to 39.46 acres of forested habitat to be removed within the Maximum Disturbance Limits (MDL)
Resource affected	Habitat (roost trees), used by individuals (adults)
Individual response	Increased effort to find new suitable roosting habitat requires extra energy expenditure that can reduce fitness and result in reduced survival/reproductive success. Colony fragmentation could result in Indiana bats using suboptimal roosts that may decrease thermoregulation efficiency/decreased foraging efficiency that can decrease fitness and result in reduced survival/reproductive success. Colony fragmentation can increase the risk of predation.
Effect	Harm
Conservation Measures	Tree clearing will be targeted between November 15 and March 31 when forested habitats are unoccupied by northern long-eared bats. Voluntary financial contribution to the Imperiled Bat Conservation Fund.
Interpretation	Adult northern long-eared bats will experience adverse effects after they arrive at their summer roosting habitat the first year after tree removal. The extra energy to find new habitat is in addition to what is necessary for foraging, pup rearing, social interactions, or other activities. The use of additional energy in response to habitat loss, especially when combined with the energy needs associated with normal life cycle processes (e.g., migration, pregnancy, lactation, etc.) or other stressors (e.g., WNS), is likely to result in adverse effects. Northern long-eared bats are expected to adapt to this stressor in subsequent years after new suitable habitat is found.

Table 21. Northern Long-eared Bat – Effects Pathway for Tree Removal, Forest Loss, and Fragmentation.

Activity: Construction	
Stressor: Tree removal, forest loss and fragmentation	
Exposure (time)	During construction phase of Project.
Exposure (space)	39.46 acres removed within the Maximum Disturbance Limits.
Resource affected	Forested habitat, used by individuals (adults, juveniles)
Individual response	Alteration of behavior by increasing effort to access sufficient foraging resources causing reduced survival and reproductive success. Increased visibility to predators resulting in increased predation.
Effect	Insignificant
Conservation Measures	Avoidance and minimization of clearing within forested areas where possible. Completion of mitigation for impacts with the consultation of the USFWS Kentucky Ecological Services Field Office through contribution to the KNLT Imperiled Bat Conservation Fund.
Interpretation	The proposed tree removal is not anticipated to significantly impact bat behavior in the area. The final maintained corridor width of 50 feet or less is not a significant gap and would not prohibit dispersal or foraging behavior. It is expected that northern long-eared bats that currently use this area would continue to do so. The pipeline will follow existing utility right-of-way where possible to limit creating new gaps in forested areas.

Table 22. Northern Long-eared Bat – Effects Pathway for Aquatic Resource Degradation, Water Quality Degradation

Activity: Construction	
Stressor: Aquatic resource degradation; water quality degradation	
Exposure (time)	Construction phase during active time of year (April 1 – November 15)
Exposure (space)	Aquatic foraging habitat in and downstream of the Project Maximum Disturbance Limits (MDL)
Resource affected	Aquatic food sources (aquatic insects) and drinking water
Individual response	Impacts to aquatic food sources and drinking water quality may result in increased foraging effort requiring additional energy expenditure that can reduce fitness and result in reduced survival/reproductive success. Reduced foraging efficiency can result in reduced fitness and survival/reproductive success.
Effect	Insignificant
Conservation Measures	BMPs associated with the 404/401 authorization and SWPPP will limit impacts to streams within the MDL and downstream aquatic resources. BMPs for control of stormwater flowing onto and through the Project may include slope breakers, temporary drainage ditches, French drains, and enhanced drains. Other soil stabilization measures will include temporary and permanent seeding, use of silt fencing, and erosion control blanket to help minimize soil erosion that may cause sedimentation in receiving waters. Restoration measures on temporarily impacted streams and wetlands will restore temporary loss in function following state and federal permitting conditions. Restoration of the site to preconstruction contours, use of native material for backfilling within the riparian zone. Cox Creek and Rocky Run utilize the horizontal directional drilling construction method to avoid direct impacts to aquatic resources and water quality.
Interpretation	Based on the low number of perennial streams (n=17) within the MDL, the use of HDD of the two primary larger streams (Cox Creek and Rocky Run), and implementation of federal, state, and local waterway permits it is anticipated that impacts to aquatic resources will be insignificant. Construction and restoration of the final right of way near stream crossings will be short in duration and monitored for compliance with permit conditions. The effects of sedimentation on aquatic resources (food and water quality) are expected to be minimal due to the temporary nature of the activity and implementation of the conservation measures.

Table 23. Northern Long-eared Bat – Effects Pathway for Noise and Vibration During Active Time of Year

Activity: Construction	
Stressor: Noise and vibration	
Exposure (time)	Construction phase during the active time of year (April 1 – November 14)
Exposure (space)	Roosting and foraging habitat within the action area
Resource affected	Individuals (juveniles and adults)
Individual response	Flushing from roost trees which results in extra energy expenditure and associated decreased fitness of individuals and increased chances of predation on flushed individuals. Avoidance or determent from using action area to swarm.
Effect	Harm
Conservation Measures	Blasting will not be used for breaking rock in an effort to minimize impacts associated with noise and vibration. Project construction will use rock trenchers and hammers in areas where the underlying limestone requires this method. Other areas of shale and soil will not require these methods or produce the noise/vibration levels of rock trencher/hammer. This will be done to minimize noise/vibration impacts to bats.
Interpretation	Construction noise and vibration are unavoidable during construction of the Project during the active time of year. Blasting will not be used in an effort to reduce startling noises and vibrations. Noise and/or vibration may startle bats and cause them to flush from their roosts. Noise related to construction include trenching, tree clearing, and general construction movements will be generated from within the MDL but may affect bats throughout the action area. Northern long-eared bats exposed to this stressor during habitat removal are likely to respond in a way that would lead to adverse effects including avoidance or abandonment of habitat potentially used for swarming. Northern long-eared bats exposed to this stressor during the construction component after habitat removal would be exposed to lower levels of this stressor as the ground, vegetation, air, and source point are expected to attenuate noise levels.

Table 24. Northern Long-eared Bat – Effects Pathway for Noise and Vibration during Inactive Time of Year

Activity: Construction	
Stressor: Noise and vibration	
Exposure (time)	Construction phase during inactive time of year (November 15 – March 31)
Exposure (space)	Undocumented cave(s) outside of the Maximum Disturbance Limits (MDL), but within the action area.
Resource affected	Individuals (adults and juveniles) in hibernacula
Individual response	Forced arousal from torpor resulting in decreased fitness and fecundity, injury, or mortality.
Effect	Discountable
Conservation Measures	Blasting will not be used for breaking rock in an effort to minimize impacts associated with noise and vibration. Project construction will use rock trenchers and hammers in areas where the underlying limestone requires this method. Other areas of shale and soil will not require these methods or produce the noise/vibration levels of rock trencher/hammer. This will be done to minimize noise/vibration impacts to bats.
Interpretation	Construction noise and vibration are unavoidable during construction of the Project during the inactive time of year. Tree clearing will be targeted between November 15 and March 31 when forested habitats are unoccupied by northern long-eared bats. Blasting will not be used in an effort to reduce startling noises and vibrations. Noise and/or vibration may cause bats to arouse from torpor to assess the new condition. However, noise and vibration are expected to be attenuated due to various environmental conditions such as substrate, vegetation, air, and source of noise/vibration (i.e., below ground level in trench). Northern long-eared bats exposed to this stressor during construction are not likely to respond in a way that would lead to adverse effects but acclimate during periodic arousal and continue using the undocumented feature.

Table 25. Summary of stressors and effects on the Northern Long-eared Bat

Stressors	Adverse	Insignificant Discountable
Tree Removal, Bat Mortality (April 1 to November 14)	Harm	
Tree Removal, Loss of Roost Trees (November 15 to March 31)	Harm	
Tree Removal, Forest Loss, and Fragmentation		Insignificant
Aquatic Resource Degradation, Water Quality Degradation		Insignificant
Noise and Vibration (April 1 to November 14)	Harm	
Noise and Vibration (November 15 to March 31)		Discountable

5.6 Mussels

Six mussel species were listed in the species list returned by the USFWS IPaC. The IPaC listings state that these species only need to be considered if the Project significantly impacts the Salt River mainstem, and/or any of its following tributaries: Beech Fork, and/or Rolling Fork. The project does not directly impact any of these three streams, with greater than two river miles between Salt River (the closest listed stream) and the only direct tributary to this river located within the project area.

Each of these mussel species have similar life histories and potential impacts to these species were minimized through construction means and methods. The waterways within the action area with potential habitat available for the listed mussels are Cox Creek and Rocky Run. These are tributaries to the Salt River, and have silty, sand, and clay substrates. The listed species require perennial streams with these substrates as habitat. Cox Creek and Rocky Run will not be directly impacted during the project because of the utilization of HDD method to construct at this location near MP 2.25. The majority of the streams present in the Project MDL are small, ephemeral and intermittent, and have substrates dominated by bedrock and cobble. These stream characteristics make for unsuitable habitat for the listed mussel species. Thus, LG&E does not expect the listed mussel species to be adversely affected by the Project.

6 Conservation Measures

6.1 Kentucky Glade Cress

Ten locations of Kentucky glade cress were identified within the Project MDL. The populations range in quantity and quality. The pipeline route was modified during the design phase to avoid Kentucky glade cress population areas as well as federally designated critical habitat for the Kentucky glade cress. Where impacts to Kentucky glade cress are unavoidable, LG&E will contribute to a mitigation fund and use a seed mix during to restore known habitats to maximize the likelihood of the species persisting in these areas post-construction. Conservation measures include:

- LG&E will provide mitigation for unavoidable impacts to the Kentucky glade cress by voluntarily contributing to the Kentucky Natural Lands Trust's (KNLT) mitigation fund for the species. LG&E's contribution will be $53,160.
- In areas where glade cress populations were identified, LG&E will remove topsoil and stockpile it, then re-spread this material following construction. Affected areas will be restored to preconstruction contours.
- LG&E will use a modified seed mix identified by the USFWS where Kentucky glade cress populations were identified to reduce the potential for aggressive species that may invade Kentucky glade cress habitat areas and compete with the species. Mulch may be placed in Kentucky glade cress areas; however, LG&E will not use fertilizer at these locations.
- LG&E will develop internal controls to avoid use of herbicides in known Kentucky glade cress areas.
- LG&E will use best management practices for sediment and erosion control in accordance with state's general permit per Kentucky Division of Water, Stormwater Discharge, the Hydrostatic Discharge, Pollutant Discharge Elimination System (KPDES) General Permits (401 KAR Chapter 5), during construction activities to avoid and minimize any offsite impacts associated with Project construction, especially near designated critical habitat areas adjacent to the ROW.

LG&E anticipates 4.80 acres of unavoidable impact to documented Kentucky glade cress habitat and populations for which mitigation will be applied. Of the 4.80 acres of unavoidable impacts, approximately 0.61 acre occur within 100 feet of USACE jurisdictional features (site 3C=0.43; site 8C=0.02; site 6B=0.11; site 5C=0.05; see Appendix A – Figure 3a). The remaining 4.19 acres of unavoidable impacts to Kentucky glade cress habitat and populations occur in upland areas of non-USACE jurisdiction.

LG&E will provide a voluntary contribution to the Kentucky Natural Land's Trust, which supports the management and protection of Kentucky glade cress habitat throughout its range. Based on unavoidable impacts to six occurrences within the MDL, the mitigation is calculated to be 7.36 acres (with areas below 1 acre being calculated at a minimum of 1 acre). Based on cost per acre, cost for fire management, and area of impact LG&E expects to contribute $53,160 in mitigation (see Table 26).

Table 26. LG&E Bullitt County Transmission Pipeline Kentucky Glade Cress Conservation Fund Mitigation Calculation.

USFWS Occurrence Number	Area of Impact (actual ac)	Area of Impact (minimum of 1 ac)	Cost/Acre	Fire Management	Mitigation Cost
96	0.24	1.00	$6,000	$1,500	$7,500
9	0.54	1.00	$6,000	$1,500	$7,500
58	0.74	1.00	$6,000	$1,500	$7,500
34	2.36	2.36	$6,000	$1,500	$15,660
60	0.87	1.00	$6,000	$1,500	$7,500
1	0.05	1.00	$6,000	$1,500	$7,500
Total	**4.80**	**7.36**			**$53,160**

6.2 Designated Critical Habitat For Kentucky Glade Cress

The Project will utilize erosion control BMPs and construction fencing in the vicinity of mapped federally designated critical habitat for the Kentucky glade cress.

- Silt fencing will be used to protect designated critical habitat from sedimentation due to construction activity and required temporary fencing along these areas during construction will be used to further identify the construction limits and prevent incidental construction activity within mapped designated critical habitat.
- Temporary silt fencing and temporary fencing will be inspected and maintained regularly during the Project construction to protect against accidental impacts.

These measures are expected to avoid impacts to the designated critical habitat, but, at a minimum, they will minimize the likelihood that impacts would be significant enough to result in the adverse modification of federally designated critical habitat as a result of the Project. In the unlikely event that an erosion control BMP fails or an unforeseen action near mapped designated critical habitat occurs that impacts the federally designated critical habitat, LG&E will take corrective action to repair/restore a failed BMP to see that impacts are minimized and temporary.

6.3 Gray Bat

LG&E located the pipeline alignment adjacent to existing upland utility corridors to minimize impacts to gray bat associated with riparian forest habitat removal and water quality degradation. The Project ROW also took into consideration unknown karst features that may provide winter hibernation sites for summer/maternity roost sites for gray bats within the action area. BMPs applied to the Project required by federal, state, and local permits will further protect aquatic habitats that the gray bat is primarily known to use during the spring, summer, and fall active seasons. Many of those BMPs are summarized in section 6.4. Restoration measures on temporarily impacted streams and wetlands will restore temporary loss in function following state and federal permitting conditions. Restoration of the site to preconstruction

contours will include use of native material for backfilling within the riparian zone. The use of horizontal directional drilling will occur at Cox Creek and Rocky Run to avoid direct impacts to aquatic resources and water quality.

6.4 Indiana Bat and Northern Long-eared Bat

LG&E located the pipeline alignment adjacent to existing utility corridors to minimize impacts to the Indiana bat and northern long-eared bat associated with forested habitat removal. The Project ROW also took into consideration unknown karst features that may provide winter hibernation sites for Indiana bat, northern long-eared bat, and summer/maternity roost sites for gray bats within the action area. The following conservation measures will also be implemented into the Project action.

- LG&E will avoid or minimize tree clearing within forested areas where possible.
    - Tree clearing will be targeted between November 15 and March 31 when forested habitats are unoccupied by Indiana bats and northern long-eared bats.
    - LG&E will provide mitigation for unavoidable impacts to the Indiana bat and northern long-eared bat by contributing to the Kentucky Natural Lands Trust's (KNLT) Imperiled Bat Conservation Fund (IBCF), consistent with the procedures described in the June 2016 *Revised Conservation Strategy for Forest-Dwelling Bats in Kentucky* (USFWS 2016).
        - Approximately 13.18 acres of Summer 1 Indiana bat/northern long-eared bat habitat occurs within 100 feet of USACE jurisdictional features while approximately 2.90 acres of Potential Indiana bat/northern long-eared bat habitat occurs within 100 feet of USACE jurisdictional features.
        - After project initiation, LG&E will track tree clearing acreage and dates to provide a quarterly update to the USFWS Kentucky Ecological Services Field Office so that the mitigation payment required to the KNLT IBCF can be tracked.
        - Monitoring and reporting regarding the habitat removed will be reported to the USFWS quarterly. Within 30 days of the submission of a quarterly monitoring report, the USACE will provide a receipt for the previous quarter's IBCF contribution. If delegated, LG&E will provide a single receipt for the Project encompassing clearing occurring within USACE jurisdiction and upland, non-jurisdictional areas.
    - LG&E will use best management practices for sediment and erosion control to avoid and minimize any offsite impacts associated with foraging habitat for bats related to Project construction.
    - If during construction a void is exposed, LG&E will follow the Project sinkhole mitigation plan to stabilize the soil with material that will continue to allow subsurface water conveyance without contributing additional soil material that may plug the conduit.

- Blasting will not be used in an effort to avoid noise/vibration effects associated with this method. Rock trenching/hammering will be used in substrate requiring such method when necessary, but, trenching via excavator will be preferred in effort to soften noise/vibration.

LG&E anticipates tree clearing within the potential and known habitat ranges for these species and expects to complete mitigation for impacts to the habitats. LG&E will provide a voluntary contribution to the Imperiled Bat Conservation Fund, which supports the acquisition and protection of forested bat habitat across Kentucky. LG&E will evaluate the total area cleared on the project and the required total Imperiled Bat Conservation Fund contribution amount on a quarterly basis and report this evaluation to the USFWS on the same schedule. Within two parcels on the project MDL (i.e., the Bernheim properties), LG&E will provide twice the contribution amount specified in the June 2016 Revised Conservation Strategy for Forest-Dwelling Bats (Conservation Strategy) as compensation for clearing impacts on this property, because the property was previously used to compensate for bat clearing impacts. BMPs associated with the Section 404 authorization and KPDES permit will also be implemented to limit impacts to aquatic resources that may serve as foraging habitat and drinking water for the Indiana bat and northern long-eared bat.

Table 27 presents the Imperiled Bat Conservation Fund contribution based on time of year habitat removal. As the tree clearing schedule becomes clearer, contributions will be provided based on date of tree clearing multiplier for all acres of forest removed. A total of 39.46 acres of forest habitat is expected to be removed. While the time of year calculations vary, LG&E expects to contribute between $257,114 and $575,280 (see Table 27). This contribution will apply to both Indiana bat and northern long-eared bat as specified in the Conservation Strategy. Additionally, the contribution will compensate for impacts to both the jurisdictional resources of the USACE and non-jurisdictional resources for which LG&E is responsible under the small federal handle procedure.

Table 27. LG&E Bullitt County Transmission Pipeline Bat Habitat Conservation Fund Mitigation Calculation

Known Summer 1 Habitat West			
Dates of Tree Clearing	**Multiplier**	**Acres Impacted**	**Cost**
8/1-8/15	2	20.8	$195,520.00
8/16-3/31	1.5	20.8	$146,640.00
4/1-5/30	2	20.8	$195,520.00
6/1-7/31	3	20.8	$293,280.00
Known Summer 1 Habitat Bernheim Property			
	Multiplier	Acres Impacted	Cost
8/1-8/15	4	5.67	$106,596.00
8/16-3/31	3	5.67	$79,947.00
4/1-5/30	4	5.67	$106,596.00
6/1-7/31	6	5.67	$159,894.00
Potential Habitat East			
	Multiplier	Acres Impacted	Cost
10/15-3/31	0.5	12.99	$30,526.50
4/1-5/30	1	12.99	$61,053.00
6/1-7/31	2	12.99	$122,106.00
8/1-10/14	1	12.99	$61,053.00
Total Acres		**39.46**	

6.5 Mussels

There are five named primary drainage patterns crossing through the Project MDL: Cox Creek, Cedar Creek, Greens Branch, Lickskillet Creek, and Buffalo Run. Seventeen streams within the MDL are classified as perennial streams; however, only two are considered potential habitat for listed mussels: Cox Creek and Rocky Run. Cox Creek and Rocky Run exhibit wide floodplains, lower gradients, and smaller diameter substrates that are more suitable for mussel species. Other perennial streams exhibited high gradients and an increase in bedrock and cobble substates not conducive to freshwater mussels. LG&E will use the horizontal directional drilling construction method to avoid direct impacts to Cox Creek and Rocky Run pipeline crossing in the MDL. This method will avoid direct impacts to the aquatic habitat and, as a result, prevent the Project from adversely affecting the listed mussel species that could occur downstream. Additionally, permit conditions required by the USACE related to the Project 404 permit, KPDES 401 permit, and local permit requirements will be implemented as required for each permit. Impacts to tributaries to Cox Creek are expected to be minimized by the use of best management practices identified in the Project Storm Water and Pollution Prevention Plan (SWPPP). Appropriate BMPs that also serve as conservation measures for mussels and their aquatic habitat include:

- In-stream work shall be scheduled to avoid high stream flow conditions, such as immediately following heavy periods of rain, to achieve a dry or low-flow condition. The total length of an excavated trench open at the stream crossing shall be minimized to the extent possible for those crossings that require more than one working day to construct. Effort shall be made to cross streams 10 feet in (bottom) width or less, including the trench backfilling, in one working day. The need for additional days will be evaluated on a case-by-case basis and will be completed consistent with permits.
- Silt fence barriers, or other approved BMPs, shall be placed to intercept runoff from construction storage yards to prevent silt from entering watercourses, wetlands, municipal storm sewers, road surfaces, off-ROW areas, and other sensitive areas. Silt fence shall be placed around the perimeter of construction storage yards, where effective to protect adjacent undisturbed wetlands and other water resources, road surfaces, and residential properties from sediment transported by sheet flow runoff.
- Equipment fueling and maintenance shall be performed away from watercourses, ditches, or storm drain inlets, in an area designated for that purpose per permit conditions. The designated area shall be equipped for catching spills.
- Equipment cleaning shall be limited to water washing in sediment and erosion-controlled areas as required to ensure reliable equipment operations while preventing the tracking of excessive dirt and mud from the project site.
- Bulk fuel containers shall be located at least 100 feet from any wetland or receiving water and shall be contained in a secondary containment device or double-walled tank.
- Vehicles and equipment shall be re-fueled off-site to the extent practicable. Fuel carriers (if applicable) and transported equipment shall be inspected on a daily basis for leaks prior to entering the site and shall not be allowed on site until leaks are repaired.
- The equipment construction storage yards shall be located away from surface waters and any private and municipal water wells per permit conditions.
- All construction equipment shall be inspected daily for leaks prior to start of work. Any leaking equipment shall be repaired, as necessary.
- If any soil is contaminated with hydrocarbons or other objectionable material, it shall be segregated and properly disposed of off-site.
- If concrete materials are used on-site, concrete washouts should be used. No washout of concrete materials will be permitted within wetland areas or other drainage ways.

7 Determination Of Effects

7.1 Kentucky Glade Cress

LG&E has taken extensive measures to avoid and minimize where practicable impacts to the Kentucky glade cress and its designated critical habitat. LG&E performed surveys for Kentucky glade cress in the Project MDL to identify suitable habitat and populations within the MDL.

Based on the above presented information, a **may affect, likely to adversely affect** determination is appropriate for the Kentucky glade cress because individual plants are expected to be impacted within the Project MDL.

7.2 Designated Critical Habitat For Kentucky Glade Cress

The Project has been planned around the designated critical habitat areas and will avoid these areas. Erosion control BMPs and construction fencing in the two areas adjacent to Kentucky glade cress designated critical habitat are proposed for the Project. Impacts to designated critical habitat are considered discountable (not expected to occur).

Based on the presented information in this BA regarding federally designated critical habitat, a **may affect, not likely to adversely modify designated critical habitat** determination is appropriate.

7.3 Gray Bat

A **may affect, not likely to adversely affect** determination is appropriate for the gray bat. The Project may result in minor and temporary degradation of aquatic environments that the gray bat relies on for aquatic food sources and drinking water. However, no summer or winter roosts are known to occur within the Project MDL; thus, no direct impacts are expected. Impacts by the Project after implementation of conservation measures for the gray bat are expected to be insignificant.

7.4 Indiana Bat

The project will result in adverse effects to the Indiana bat. Loss of potential foraging and roosting as well as the assumption of an undocumented hibernaculum that may occur within the action area. A **may affect, likely to adversely affect** determination is appropriate for the Indiana bat. Mitigation for the incidental take and the above conservation measures will be implemented.

7.5 Northern Long-eared Bat

The project will result in adverse effects to the northern long-eared bat. Loss of potential foraging and roosting as well as the assumption of an undocumented hibernaculum that may occur within the action area. A **may affect, likely to adversely affect** determination is appropriate for the northern long-eared bat. Mitigation for the incidental take and the above conservation measures will be implemented.

7.6 Mussels

The project is not expected to have direct impacts to the listed mussel species. The Project will not adversely affect the Salt River mainstem and/or the Beech Fork or Rolling Fork tributaries to the Salt River. The proposed construction method of horizontal directional drilling will help avoid possible impacts to Cox Creek and Rocky Run, which are the only waterways providing potential habitat for these species, and all other impacts to streams in these watersheds will be small, temporary, and subject to BMP installation per permit conditions. A **may affect, not likely to adversely affect** determination is appropriate for the clubshell, fanshell, orangefoot pimpleback, pink mucket, rabbitsfoot, ring pink, and salamander mussel.

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Appendix A Figures

A.1 Figure 1 – Project Location

A.2 Figure 2 – Project Limits

A.3 Figure 3 – Kentucky Glade Cress Survey

A.4 Figure 4 – Kentucky Glade Cress Population Areas

A.5 Figure 5 – Known Bat Habitat

A.6 Figure 6 – Proposed Tree Clearing

Appendix B USFWS IPAC Official Species List

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Kentucky Ecological Services Field Office
J C Watts Federal Building, Room 265
330 West Broadway
Frankfort, KY 40601-8670
Phone: (502) 695-0467 Fax: (502) 695-1024
Email Address: kentuckyes@fws.gov

In Reply Refer To: February 20, 2024
Project Code: 2023-0052626
Project Name: Bullitt County Gas Transmission Pipeline Project

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

To Whom It May Concern:

The enclosed species list identifies threatened, endangered, proposed and candidate species, as well as proposed and final designated critical habitat, that may occur within the boundary of your proposed project and/or may be affected by your proposed project. The species list fulfills the requirements of the U.S. Fish and Wildlife Service (Service) under section 7(c) of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 *et seq.*).

New information based on updated surveys, changes in the abundance and distribution of species, changed habitat conditions, or other factors could change this list. Please feel free to contact us if you need more current information or assistance regarding the potential impacts to federally proposed, listed, and candidate species and federally designated and proposed critical habitat. Please note that under 50 CFR 402.12(e) of the regulations implementing section 7 of the Act, the accuracy of this species list should be verified after 90 days. This verification can be completed formally or informally as desired. The Service recommends that verification be completed by visiting the IPaC website at regular intervals during project planning and implementation for updates to species lists and information. An updated list may be requested through the IPaC system by completing the same process used to receive the enclosed list.

The purpose of the Act is to provide a means whereby threatened and endangered species and the ecosystems upon which they depend may be conserved. Under sections 7(a)(1) and 7(a)(2) of the Act and its implementing regulations (50 CFR 402 *et seq.*), Federal agencies are required to utilize their authorities to carry out programs for the conservation of threatened and endangered species and to determine whether projects may affect threatened and endangered species and/or designated critical habitat.

A Biological Assessment is required for construction projects (or other undertakings having similar physical impacts) that are major Federal actions significantly affecting the quality of the

human environment as defined in the National Environmental Policy Act (42 U.S.C. 4332(2)(c)). For projects other than major construction activities, the Service suggests that a biological evaluation similar to a Biological Assessment be prepared to determine whether the project may affect listed or proposed species and/or designated or proposed critical habitat. Recommended contents of a Biological Assessment are described at 50 CFR 402.12.

If a Federal agency determines, based on the Biological Assessment or biological evaluation, that listed species and/or designated critical habitat may be affected by the proposed project, the agency is required to consult with the Service pursuant to 50 CFR 402. In addition, the Service recommends that candidate species, proposed species and proposed critical habitat be addressed within the consultation. More information on the regulations and procedures for section 7 consultation, including the role of permit or license applicants, can be found in the "Endangered Species Consultation Handbook" at:

https://www.fws.gov/sites/default/files/documents/endangered-species-consultation-handbook.pdf

Migratory Birds: In addition to responsibilities to protect threatened and endangered species under the Endangered Species Act (ESA), there are additional responsibilities under the Migratory Bird Treaty Act (MBTA) and the Bald and Golden Eagle Protection Act (BGEPA) to protect native birds from project-related impacts. Any activity, intentional or unintentional, resulting in take of migratory birds, including eagles, is prohibited unless otherwise permitted by the U.S. Fish and Wildlife Service (50 C.F.R. Sec. 10.12 and 16 U.S.C. Sec. 668(a)). For more information regarding these Acts, see https://www.fws.gov/program/migratory-bird-permit/what-we-do..

The MBTA has no provision for allowing take of migratory birds that may be unintentionally killed or injured by otherwise lawful activities. It is the responsibility of the project proponent to comply with these Acts by identifying potential impacts to migratory birds and eagles within applicable NEPA documents (when there is a federal nexus) or a Bird/Eagle Conservation Plan (when there is no federal nexus). Proponents should implement conservation measures to avoid or minimize the production of project-related stressors or minimize the exposure of birds and their resources to the project-related stressors. For more information on avian stressors and recommended conservation measures, see https://www.fws.gov/library/collections/threats-birds.

In addition to MBTA and BGEPA, Executive Order 13186: *Responsibilities of Federal Agencies to Protect Migratory Birds*, obligates all Federal agencies that engage in or authorize activities that might affect migratory birds, to minimize those effects and encourage conservation measures that will improve bird populations. Executive Order 13186 provides for the protection of both migratory birds and migratory bird habitat. For information regarding the implementation of Executive Order 13186, please visit https://www.fws.gov/partner/council-conservation-migratory-birds.

We appreciate your concern for threatened and endangered species. The Service encourages Federal agencies to include conservation of threatened and endangered species into their project planning to further the purposes of the Act. Please include the Consultation Code in the header of

this letter with any request for consultation or correspondence about your project that you submit to our office.

Attachment(s):

- Official Species List

OFFICIAL SPECIES LIST

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

This species list is provided by:

Kentucky Ecological Services Field Office
J C Watts Federal Building, Room 265
330 West Broadway
Frankfort, KY 40601-8670
(502) 695-0467

PROJECT SUMMARY

Project Code: 2023-0052626
Project Name: Bullitt County Gas Transmission Pipeline Project
Project Type: Pipeline - Onshore - New Constr - Below Ground
Project Description: Bullitt County, KY pipeline
Project Location:

The approximate location of the project can be viewed in Google Maps: https://www.google.com/maps/@37.96369595,-85.62312609886547,14z



Counties: Bullitt County, Kentucky

ENDANGERED SPECIES ACT SPECIES

There is a total of 13 threatened, endangered, or candidate species on this species list.

Species on this list should be considered in an effects analysis for your project and could include species that exist in another geographic area. For example, certain fish may appear on the species list because a project could affect downstream species. Note that 7 of these species should be considered only under certain conditions.

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

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

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

MAMMALS

NAME	STATUS
Gray Bat *Myotis grisescens*	Endangered

No critical habitat has been designated for this species.
This species only needs to be considered under the following conditions:
- The project area includes potential gray bat habitat.

Species profile: https://ecos.fws.gov/ecp/species/6329
General project design guidelines:
https://ipac.ecosphere.fws.gov/project/HORG4Y4BBZHF7OFJZ6CUDANCZI/documents/generated/6422.pdf

Indiana Bat *Myotis sodalis*	Endangered

There is **final** critical habitat for this species. Your location does not overlap the critical habitat.
This species only needs to be considered under the following conditions:
- The project area includes 'potential' habitat. All activities in this location should consider possible effects to this species.
- The project area includes known 'summer 1 (outer-tier)' habitat.

Species profile: https://ecos.fws.gov/ecp/species/5949
General project design guidelines:
https://ipac.ecosphere.fws.gov/project/HORG4Y4BBZHF7OFJZ6CUDANCZI/documents/generated/6422.pdf

Northern Long-eared Bat *Myotis septentrionalis*	Endangered

No critical habitat has been designated for this species.
Species profile: https://ecos.fws.gov/ecp/species/9045
General project design guidelines:
https://ipac.ecosphere.fws.gov/project/HORG4Y4BBZHF7OFJZ6CUDANCZI/documents/generated/6422.pdf

BIRDS

NAME	STATUS
Whooping Crane *Grus americana*	Experimental Population, Non-Essential

Population: U.S.A. (AL, AR, CO, FL, GA, ID, IL, IN, IA, KY, LA, MI, MN, MS, MO, NC, NM, OH, SC, TN, UT, VA, WI, WV, western half of WY)
No critical habitat has been designated for this species.
Species profile: https://ecos.fws.gov/ecp/species/758

CLAMS

NAME STATUS

Clubshell *Pleurobema clava* Endangered

Population: Wherever found; Except where listed as Experimental Populations
No critical habitat has been designated for this species.
This species only needs to be considered under the following conditions:
- The species may be affected by projects that significantly impact the Salt River mainstem, and/or any of its following tributaries: Beech Fork, and/or Rolling Fork.

Species profile: https://ecos.fws.gov/ecp/species/3789
General project design guidelines:
https://ipac.ecosphere.fws.gov/project/HORG4Y4BBZHF7OFJZ6CUDANCZI/documents/generated/5639.pdf

Fanshell *Cyprogenia stegaria* Endangered

No critical habitat has been designated for this species.
This species only needs to be considered under the following conditions:
- The species may be affected by projects that significantly impact the Salt River mainstem, and/or any of its following tributaries: Beech Fork, and/or Rolling Fork.

Species profile: https://ecos.fws.gov/ecp/species/4822
General project design guidelines:
https://ipac.ecosphere.fws.gov/project/HORG4Y4BBZHF7OFJZ6CUDANCZI/documents/generated/5639.pdf

Orangefoot Pimpleback (pearlymussel) *Plethobasus cooperianus* Endangered

No critical habitat has been designated for this species.
This species only needs to be considered under the following conditions:
- The species may be affected by projects that significantly impact the Salt River mainstem, and/or any of its following tributaries: Beech Fork, and/or Rolling Fork.

Species profile: https://ecos.fws.gov/ecp/species/1132
General project design guidelines:
https://ipac.ecosphere.fws.gov/project/HORG4Y4BBZHF7OFJZ6CUDANCZI/documents/generated/5639.pdf

Pink Mucket (pearlymussel) *Lampsilis abrupta* Endangered

No critical habitat has been designated for this species.
Species profile: https://ecos.fws.gov/ecp/species/7829
General project design guidelines:
https://ipac.ecosphere.fws.gov/project/HORG4Y4BBZHF7OFJZ6CUDANCZI/documents/generated/5639.pdf

Rabbitsfoot *Quadrula cylindrica cylindrica* Threatened

There is **final** critical habitat for this species. Your location does not overlap the critical habitat.
This species only needs to be considered under the following conditions:
- The species may be affected by projects that significantly impact the Salt River mainstem, and/or any of its following tributaries: Beech Fork, and/or Rolling Fork.

Species profile: https://ecos.fws.gov/ecp/species/5165
General project design guidelines:
https://ipac.ecosphere.fws.gov/project/HORG4Y4BBZHF7OFJZ6CUDANCZI/documents/generated/5639.pdf

Ring Pink (mussel) *Obovaria retusa* Endangered

No critical habitat has been designated for this species.

NAME	STATUS

This species only needs to be considered under the following conditions:

- The species may be affected by projects that significantly impact the Salt River mainstem, and/or any of its following tributaries: Beech Fork, and/or Rolling Fork.

Species profile: https://ecos.fws.gov/ecp/species/4128
General project design guidelines:
https://ipac.ecosphere.fws.gov/project/HORG4Y4BBZHF7OFJZ6CUDANCZI/documents/generated/5639.pdf

Salamander Mussel *Simpsonaias ambigua* — Proposed Endangered

There is **proposed** critical habitat for this species. Your location does not overlap the critical habitat.
Species profile: https://ecos.fws.gov/ecp/species/6208

INSECTS

NAME	STATUS

Monarch Butterfly *Danaus plexippus* — Candidate

No critical habitat has been designated for this species.
Species profile: https://ecos.fws.gov/ecp/species/9743

FLOWERING PLANTS

NAME	STATUS

Kentucky Glade Cress *Leavenworthia exigua laciniata* — Threatened

There is **final** critical habitat for this species. Your location overlaps the critical habitat.
Species profile: https://ecos.fws.gov/ecp/species/698

CRITICAL HABITATS

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

NAME	STATUS

Kentucky Glade Cress *Leavenworthia exigua laciniata* — Final

https://ecos.fws.gov/ecp/species/698#crithab

IPAC USER CONTACT INFORMATION

Agency: Stantec Consulting Services Inc.
Name: Jeff Brown
Address: 9200 Shelbyville Road
Address Line 2: Suite 800
City: Louisville
State: KY
Zip: 40222
Email jeff.brown@stantec.com
Phone: 5138330450

LEAD AGENCY CONTACT INFORMATION

Lead Agency: Army Corps of Engineers

Appendix C Tricolored Bat Information for Conferencing

1 Species Considered

1.1 Tricolored Bat

1.1.1 SPECIES LISTING AND CRITICAL HABITAT

The USFWS published a 90-day finding to a petition received on June 14, 2016, to list the tricolored bat as endangered or threatened and to designate of critical habitat. The 90-day finding found that the action warrants a review of the status of this species (82 Federal Register [FR] 60362-60366, December 20, 2017). After the completion of this review, the tricolored bat was proposed to be federally listed as endangered on September 14, 2022 (87 FR 56381-56393). Currently, the USFWS is not proposing to designate critical habitat for the tricolored bat.

1.1.2 LIFE HISTORY

Tricolored bats typically use trees for summer maternity roosts, but also have the behavioral flexibility to use human-made structures such as houses and sheds (Whitaker 1998; Veilleux et al. 2003). In Missouri, some maternity colonies have also been observed in caves. Both colonies were positioned on the ceiling of a dome-like room and temperatures were 13.6˚ C (56.5˚ F) for one colony and 22.0˚ C (71.6˚ F) for the other (Humphrey et al. 1976). When tricolored bats use trees as roosts, the trees are usually located in upland forest areas and to a minor extent, riparian and bottomland (Veilleux et al. 2003; Perry and Thill 2007). Most maternity colonies and single males use foliage clusters of dead leaves and broken branches (Veilleux et al. 2003). The trees are typically alive, and the most common trees species are either oak (*Quercus* spp.), maple (*Acer* spp.), or pine (*Pinus* spp.; Perry and Thill 2007).

Bats associated with a maternity colony typically occupy 1 – 5 roost trees (Veilleux et al. 2003) and maternity colonies occupying structures will typically occupy 2 – 3 alternate roost locations (Whitaker 1998). Males will also switch roosts, but much less frequently (Perry and Thill 2007). Tricolored bats have been observed traveling distances of a maximum of 4.3 km (2.7 mi) and an average of 1.8 km (1.1 mi) from roosts to foraging areas (Veilleux et al. 2003). Maternity colonies start forming in spring, around mid-April. Tricolored bat maternity colonies are typically small, ranging from 1 – 6 adult females; however, they have been observed with as many as 29 adult females (Perry and Thill 2007). Maternity colonies tend to disband soon after pups are weaned (Whitaker 1998). Males have been observed exclusively roosting alone (Perry and Thill 2007).

Tricolored bats are typically found sharing hibernacula with other bat species, such as little brown bats, NLEBs, Indiana bats, and big brown bats (*Eptesicus fuscus*; WDNR 2017). This species is also present in greater than 6,200 caves where they are often the only bat present (Boyles et al. 2009). These bats are typically found in the deepest, warmest parts of caves and mines, roosting singly or in groups of no more than four, often with condensation on their fur (Briggler and Prather 2003; Brack 2007; Boyles et al. 2009). In the Preble Mine in Ohio, the average temperature documented in rooms with tricolored bats was 9.5 ±1.9˚C (49.1˚ ±3.4˚ F; Brack 2007). In hibernacula caves in Arkansas, the average winter temperature was 11.8˚ C (53.2˚ F) and the average spring temperature was 12.0˚ C (53.6˚ F; Briggler and Prather 2003).

Mating typically occurs in late summer/early fall at the entrances of caves during swarming events, similar to other cave bats (Boyles et al. 2009). Female tricolored bats delay fertilization by storing sperm in their uterus. When females wake in spring, fertilization occurs. Young are typically born from end of May through mid-July, with the peak of births occurring from mid-June to early July (Whitaker 1998). The gestation period ranges from 45 – 50 days and females often give birth to 2 pups (range of 1 – 3) in late June or early July (Boyles et al. 2009; WDNR 2017). The young become volant within approximately three weeks. Most tricolored bats reach sexually maturity in their second year (WDNR 2017). During studies of maternity colonies in human-made structures, Whitaker (1998) found a ratio of pup to adults to be less than 2:1, but typically greater than 1:1.

Tricolored bats primarily feed over water, in forest openings, edge habitats, and in fields (Boyles et al. 2009). An insectivorous generalist, their diet has been found to consist of caddisflies (Order: Trichoptera), scarab beetles (Order: Coleoptera, Family: Scarabaeidae), ichneumon wasps, and ants (Order: Hymenoptera), tiny flies (Order: Diptera), leaf hoppers (Order: Hemiptera, Family Cicadellidae), and moths (Lepidoptera) (Boyles et al. 2009; Feldhamer et al. 2009; WDNR 2017). These bats echolocate and capture prey while in flight (WDNR 2017).

Tricolored bat migration patterns are poorly understood. They are believed to be short distance, regional migrants who move from site to site in any direction, moving from hibernation sites to summer sites and between swarming/mating sites. A study using stable isotope methods found that at least some individuals of both sexes also participate in latitudinal migration, but it is more common in males than females (Fraser et al. 2012). An early banding study found that tricolored bats were capable of longer migrations when an individual in that study was banded in a winter cave and then found 136.8 km (85 mi) away in the summer (Griffin 1940). A more recent study using radio tracking observed a female tricolored bat traveling 243.0 km (151 mi) during spring migration over the course of several days. This evidence demonstrates that tricolored bats are capable of longer migration, but such a long distance is not necessarily common for the species (Samoray et al. 2019).

1.1.3 RANGE AND DISTRIBUTION

The tricolored bat can be found in 39 states, four Canadian provinces, Guatemala, Honduras, Belize, Nicaragua, and Mexico. This species occurs throughout the central and eastern United States, including Kentucky, but not in the western United States (USFWS 2021). Although it is thought most tricolored bats occupy the same range year-round, at least some individuals participate in some degree of seasonal migration.

As of 2021, the USFWS estimated there to be 67,898 tricolored bat individuals range wide (USFWS 2021). The abundance of tricolored bats in hibernation range-wide was estimated for 2007 using interpolation and totaled 140,547 individuals (USFWS 2021). A recent species status assessment (SSA) for tricolored bats estimates a decline of 53 percent range-wide from 2009 – 2020 (USFWS 2021). The SSA for the tricolored bat divides the species' range into three representative units using parameters such as biological traits, genetics, habitat niche diversity (USFWS 2021). The Action Area is within the Northern Representation Unit (NRU). According to the SSA, the maximum historical abundance of tricolored bats in NRU was 95,906 using 1,124 hibernacula and the current median abundance for tricolored bats in the NRU is 41,448 individuals (USFWS 2021).

1.1.4 SPECIES OCCURRENCE WITHIN THE ACTION AREA

The tricolored bat occurs throughout Kentucky year-round. The Kentucky Department of Fish and Wildlife Resources occurrence map indicates that records exist in Bullitt County and that the species is found hibernating throughout Kentucky (KDFWR 2022). The Project action area has suitable forested habitat for tricolored bats. Approximately 6,736 acres of deciduous, evergreen, and mixed forests are present within the action area of which only 39.46 acres are proposed for removal to build the Project.

No caves were identified within the Project MDL during surveys conducted in April 2023. However, information obtained from the Kentucky Speleological Society (KSS) indicate that there is a known cave feature within 1km of the MDL (Appendix A – Figure 5). However, this resource is a shallow rock shelter that has no passages where winter hibernation would be feasible for the species (Stantec 2023).

2 Effects Analysis

2.1 Tricolored Bat

2.1.1 SUMMER/FALL/SPRING HABITAT

In general, the forested habitat found within the action area is suitable roosting and foraging habitat for the tricolored bat. Habitat use during non-hibernating periods (i.e., April to October) is primarily within forested areas. Impacts to forested habitat during this time may impact the tricolored bat. Effects would consist of killing, injuring, harassing, or otherwise harming individuals residing in trees that are cleared in the MDL.

Tree clearing will be targeted between November 15 and March 31 when forested habitats are unoccupied by tricolored bats. The Project timing, landowner restrictions, preconstruction preparation, and other factors may not allow for all tree clearing to occur between November 15 and March 31 time frame. It is likely that clearing between April 1 and November 14 may be necessary for construction. Tricolored bats may be present during tree clearing operations that occur between April 1 and November 14 and would be more vulnerable to disturbance. Areas of tree clearing are shown in Appendix A – Figure 6.

Based on tree clearing locations for the Project, a total of 39.46 acres of tree clearing will occur for the Project. These clearing acreages are distributed throughout the 12-mile Project MDL and are not solely located in one area. The clearing of 39.46 acres is small in comparison to the approximate 4,400 acres occurring throughout the action area. The MDL where clearing will occur is a mosaic of habitat types and fragmented on the eastern half of the Project. The western half parallels an existing cleared utility corridor and widens the gap between wooded areas. Cleared rights-of-ways have been found to provide foraging opportunities while traveling on the landscape between roosts and primary foraging grounds (Brown and Brack, 2003). The USFWS (2021) SSA states that the tricolored bat will use both deciduous and evergreen trees for roosting and will change roosts often. The SSA also states that the tricolored bat is adaptive to using anthropomorphic features such as culverts and buildings but concluded that more research is needed to understand optimal quality habitat.

In total, 16,416 linear feet of streams (includes 6,395 linear feet of ephemeral streams) were identified within the Project MDL. A total of 0.28 acres of pond open water and 1.11 acres of wetlands were identified within Project MDL, with 0.50 acres of this forested wetland. Water quality degradation has the potential to affect foraging bats by reducing aquatic insect populations that make up part of the tricolored bat diet. This impact is anticipated to be short-term and minor due to implementation of BMP's as required by federal and state permits (i.e., sections 404 and 401, NPDES, and others) and because the tricolored bat is an insectivorous generalist (USFWS 2021).

Noises and vibrations related to tree clearing and construction are the Project impacts which are likely to travel farthest outside the workspace. Construction activities including clearing, grading, trenching, and drilling are all likely to generate noise above background levels during the active season. The distance that noise travels is dependent on many variables, including equipment type, vegetative cover, topography, etc. Multiple environmental factors help to dampen sound as it is created during the construction of the Project including point-source sound propagation, ground acoustical absorption, air acoustical absorption, forest attenuation, and occluding terrain.

Because roosting tricolored bats roost in wooded areas, it is reasonable to assume that vegetative cover will nearly always be intervening between the source of construction noise and the bat itself. The western portion of the Project is located in a relatively hilly area, and terrain will frequently occlude the noise between a source and the receiving point. To be conservative, a maximum buffer distance of 1 kilometer from the MDL was utilized to define the action area for effects analysis for bats. That distance is dictated primarily by the noise level associated with rock trenching and hammering.

There is little literature available regarding the impacts of noise on tricolored bats. Studies generally indicate that bats are very tolerant of anthropogenic noise, including persistent and sudden noises. Documented instances can be found of bats roosting in very noisy circumstances: near airports (FAA 1992), near highways (Brack et al. 2004), regularly crossing major highways (3D/Environmental 1995), roosting under concrete road bridges and underpasses (Kiser et al. 2002), and roosting and foraging on active military bases where construction and training activities take place during the active season (3D/Environmental 1996). All seem to indicate that noise and vibration of many source types are conditions which either do not bother roosting bats or are at least easily adjusted to.

Based on the available literature and Project description, it is likely that only those bats roosting near trenching/rock hammering activity will be disturbed by loud, sudden noise. Blasting is not proposed as part of the Project construction process. The quieter, more persistent noises associated with regular construction activities, such as truck operation, pipe welding and setting, are expected to have minimal impact on tricolored bats if they are roosting within the action area. If bats are present in the immediate vicinity of targeted rock trenching/hammering activities, they may awaken, expending more energy than their typical day-roosting baseline. Because very loud construction noise is expected to be brief at any one area (one season), these bats may return to their roost location within the same season when louder construction noise moves locations or the following season when construction noise is less impactful, though permanent abandonment may occur.

During construction of the pipeline, the felling of trees and operation of heavy equipment and tools will produce noise and vibrations. The noise and disturbances of clearing and construction may impact the tricolored bat's behavior or cause bats to flush from their roosts. Tree removal occurring on the site will reduce habitat for the tricolored bat in the action area, thus individuals exposed to noise and vibration will

be limited to those that could be using habitat on the margins of the construction limits of this project. No blasting or extensive impacts beyond those immediately adjacent to the construction limits are expected.

It is unknown where the nearest hibernaculum is located for the tricolored bat in relation to the Project action area. Surveys conducted throughout the MDL did not identify any winter habitat for the Indiana bat and northern long-eared bat (Appendix D). While hibernacula used by these two species have some differences from tricolored bat hibernacula needs the survey resulted in a finding of no winter habitat within the MDL. Survey of the entire action area outside of the MDL was not practicable and/or not available at the time of the survey. In lieu of walking outside of the MDL, the biologists visually assessed as far as they could see. Although they did not observe any winter habitat outside of the MDL, there is the potential for presence of an unidentified hibernaculum outside of the MDL but within the action area. The presence of a potential hibernaculum could result in the forested areas within the action area being used as potential swarming habitat; although no known swarming habitat is documented in the action area.

Swarming habitat consists of various forest types, water sources, wetlands, and food sources associated with the vegetation and water habitats in the action area. Based on review of NLCD data (Dewitz and USGS 2021), the action area (MDL and 1-km buffer) contains approximately 7,843 acres of habitat that may be suitable for swarming. However, the MDL represents only 1.28 percent of potential swarming habitats within the action area (Table 1).

Table 1. Tricolored bat suitable swarming habitat in acres within the action area (collectively MDL and 1-km buffer) and with the 5-mile (8-km) buffer area.

Habitat Type	MDL	Action Area (MDL & 1-km Buffer)	5-mile (8-km) Buffer	% Action Area	%5-mile (8-km) Buffer
Deciduous Forest	49.27	4,425.47	48,730.41	1.10%	0.09%
Evergreen Forest	2.01	633.00	3,290.26	0.32%	0.05%
Mixed Deciduous/Evergreen Forest	10.71	1,677.23	12,496.92	0.63%	0.08%
Open Water	0.00	25.55	611.66	0.00%	0.00%
Wetlands (PEM/PSS)	0.00	25.57	2,813.54	0.00%	0.00%
Agriculture	39.58	954.55	9,148.18	3.98%	0.39%
Total	101.57	7,741.37	77,090.97	1.28%	0.12%

The Project will remove a total of 39.46 acres of forest within the MDL that could be used by swarming tricolored bats. Based on National Land Cover Database (NLCD) analysis, there are approximately 6,736 acres of forest area within the action area. Removal of 39.46 acres is approximately 0.6 percent of forest resources within the action area. Based on this review of available habitat it is not expected to adversely affect the tricolored bat if a small subset of potential swarming habitat is removed within the MDL (Table 1).

Artificial lighting during nighttime hours has been demonstrated to affect bat activity. Light-sensitive species have been demonstrated to have a lower activity level near light sources, while more light-tolerant species have been demonstrated to utilize certain types of lighting as foraging opportunities due to the concentration of insect activity (Spoelstra et al. 2017). It is unknown if tricolored bats are light sensitive and may be negatively impacted if artificial lighting is used in otherwise suitable foraging or roosting habitat.

Artificial lighting is not planned as part of the Project. However, some nighttime construction may be necessary at different construction locations during times of year when daylight is minimized. This lighting will be angled downward and inward toward the construction area to limit light pollution outside of the work area. No regular pipeline construction activities are planned outside of the daylight hours, with the potential exception of wetland and stream crossings.

2.1.2 WINTER HABITAT

A request to the KSS for information regarding any caves within five miles of the Project MDL resulted in identification of three caves. The KSS provided the location of the three caves, but no other information regarding the caves (i.e., depth, size) was provided. The information KSS provided indicated that the closest cave is approximately 1,600 feet from the pipeline location and along Colyer Lane and is within the action area. This cave (T-10) is not considered winter habitat as it was found to be a rockshelter with no passages and exposed to the freezing in the winter (Appendix D). Two other cave locations were provided, each located greater than 1.5 miles from the action area.

Visual surveys were performed within the Project MDL for caves or other potential winter habitat. Access to private land outside of the Project MDL was limited and not practicable during field efforts in 2023. In lieu of walking outside of the MDL, biologists visually assessed as far as they could see within the action area. LG&E observed visual evidence of sinkholes within the Project MDL. The observed sinkholes appeared to be newly formed, actively caving in, and narrow mouthed. Soil cover at these sinkholes appeared to be thin and less than five feet thick (Appendix E). Using the guidance, these observed sinkholes were deemed unsuitable as hibernaculum.

Upon review of the geologic data for the Project area, additional sinkholes may form during construction as small voids are breached. Sinkholes that form during construction within 15 feet of the pipeline will be stabilized with an inverted rock filter (see Appendix E – Figure 5). Sinkholes outside of 15 feet, but within the right-of-way will be evaluated by a project engineer regarding need for stabilization in the same manner. The inverted rock filter is designed to allow water to flow interstitially through various sizes of rock and nonwoven geotextile.

Sinkholes encountered during construction because of excavation (i.e., subsidence sinkhole) are not expected to be suitable for bat use. Subsidence sinkholes result when water (subsurface in this circumstance) dissolved cavities in bedrock fractures resulting in the overlying unstable soil to move downward into the cavity.

Because this project is located within a karst geologic area, there is a chance that an unknown hibernaculum exists within the action area. Visual surveys of the MDL and the immediate area outside the MDL were assessed in 2023 and no winter habitat was identified or areas that appear to support complex cave systems (see Appendix D). Impacts to an undiscovered hibernaculum are not expected. Most sinkholes occurring in the action area are located on thin soils and shallow bedrock. Bedrock collapse is rare and is considered a rare formation event. Most sinkholes occur due to cover-collapse when the unstable soil becomes too thin to support the weight of the material above and a filter through fractures in limestone bedrock by dissolution of the material and limestone conduits (KGS 2023). Karst features that are a result of water movement can be ecological traps. Flooding and severe freezing events can cause mortality of tricolored bats (USFWS 2021). For this reason, tricolored bats will spontaneously arouse and seek new positions within a hibernaculum to meet ambient temperature needs (USFWS 2021).

Potential impacts associated with an unknown hibernaculum and its associated swarming habitat within the action area are accounted for within the impacts evaluated under other stressors and pathways in section 2.1.3. No additional impacts to the species beyond what is already considered in these other effects pathways is anticipated. While impacts are considered to tricolored bat winter habitat based on the assumption that an undiscovered hibernaculum may be present, the Project is not expected to adversely affect hibernating tricolored bats.

2.1.3 EFFECTS PATHWAYS FOR TRICOLORED BAT

Tables 1 – 4 provide a summary of the stressors and effects for the tricolored bat. Table 5 summarizes effects determination based on the assessment of the Project related to tricolored bats.

Table 2. Tricolored Bat – Effects Pathway for Tree Removal, Mortality

Activity: Construction	
Stressor: Tree removal while bats are present	
Exposure (time)	During construction between April 1 and November 14 (including non-volant period)
Exposure (space)	Up to 39.46 acres of forested habitat to be removed within the Maximum Disturbance Limits (MDL)
Resource affected	Individuals (adults and juveniles)
Individual response	Bats roosting within trees to be removed during construction may be injured or killed when struck by equipment or crushed when tree falls. Removal of roosts may result in increased effort to find new suitable roosting habitat requiring additional energy expenditure that may reduce fitness and result in reduced survival and/or reproductive success.
Effect	Harm
Conservation Measures	Tree clearing will be targeted between November 15 and March 31 when forested habitats are unoccupied by tricolored bats. Voluntary financial contribution to the Imperiled Bat Conservation Fund will be used to preserve/protect forested habitat that is shared by the tricolored bat.
Interpretation	Bats occupying trees that are removed may be injured or killed. Injured bats may subsequently die. Those that survive will have to spend extra energy in addition to what is necessary for foraging, pup rearing, social interactions, or other activities. The use of additional energy in response to habitat loss, especially when combined with the energy needs associated with normal life cycle processes (e.g., migration, pregnancy, lactation, etc.) or other stressors (e.g., Whitenose Syndrome [WNS]), is likely to reduce fitness and subsequently reduce survival and reproductive success.

Table 3. Tricolored Bat – Effects Pathway for Tree Removal, Loss of Roost Trees

Activity: Construction	
Stressor: Tree clearing while bats are absent	
Exposure (time)	Removal during construction between November 15 and May 31 may expose tricolored bats to effects the following active season (April 1 to November 14).
Exposure (space)	Up to 39.46 acres of forested habitat to be removed within the Maximum Disturbance Limits (MDL)
Resource affected	Habitat (roost trees), used by individuals (adults)
Individual response	The tricolored bat is a roost generalist using the foliage of both deciduous and evergreen trees. Minimal effort will be spent searching for a new roost location.
Effect	Insignificant
Conservation Measures	Tree clearing will be targeted between November 15 and March 31 when forested habitats are unoccupied by tricolored bats. Voluntary financial contribution to the Imperiled Bat Conservation Fund will be used to preserve/protect forested habitat that is shared by the tricolored bat.
Interpretation	Adult tricolored bats will experience insignificant effects after they arrive at their summer roosting habitat the first year after tree removal. The energy to identify a new roost will not adversely affect the tricolored bat because they are a foliage roosting bat. The remaining forested areas in the action area will continue to support the tricolored bat during the active season.

Table 4. Tricolored Bat – Effects Pathway for Aquatic Resource Degradation, Water Quality Degradation

Activity: Construction	
Stressor: Aquatic resource degradation; water quality degradation	
Exposure (time)	Construction phase during active time of year (April 1 – November 15)
Exposure (space)	Aquatic foraging habitat in and downstream of the Project Maximum Disturbance Limits (MDL)
Resource affected	Aquatic food sources (aquatic insects) and drinking water
Individual response	Impacts to aquatic food sources and drinking water quality may result in increased foraging effort requiring additional energy expenditure that can reduce fitness and result in reduced survival/reproductive success. Reduced foraging efficiency can result in reduced fitness and survival/reproductive success.
Effect	Insignificant
Conservation Measures	BMPs associated with the CWA section 404 authorization and 401 certification will limit impacts to streams within the MDL and downstream aquatic resources. Cox Creek and Rocky Run utilize the horizontal directional drilling construction method to avoid direct impacts to aquatic resources and water quality.
Interpretation	Based on the low number of perennial streams (n=17) within the MDL, the use of HDD of the two primary larger streams (Cox Creek and Rocky Run), and implementation of federal, state, and local waterway permits it is anticipated that impacts to aquatic resources will be insignificant. Construction and restoration of the final right of way near stream crossings will be short in duration and monitored for compliance with permit conditions. The effects of sedimentation on aquatic resources (food and water quality) are expected to be minimal due to the temporary nature of the activity and implementation of the conservation measures.

Table 5. Tricolored Bat – Effects Pathway for Noise and Vibration During Active Time of Year

Activity: Construction	
Stressor: Noise and vibration	
Exposure (time)	Construction phase during the active time of year (April 1 – November 14)
Exposure (space)	Roosting and foraging habitat within the action area
Resource affected	Individuals (juveniles and adults)
Individual response	Flushing from roost trees which results in extra energy expenditure and associated decreased fitness of individuals and increased chances of predation on flushed individuals. Avoidance or determent from using action area to swarm.
Effect	Harm
Conservation Measures	Blasting will not be used for breaking rock for the Project. Project construction will use rock trenchers and hammers in areas where the underlying limestone requires this method. Other areas of shale and soil will not require these methods or produce the noise/vibration levels of rock trencher/hammer. Trenching is expected to be up to 500 feet per day in harder limestone and up to 1,000 feet per day in shale and other softer substrate depending upon the equipment and resources utilized.
Interpretation	Construction noise and vibration are unavoidable during construction of the Project during the active times of year. Noise and/or vibration may startle bats and cause them to flush from their roosts. Noise related to construction include trenching, tree clearing, and general construction movements will be generated from within the MDL but may affect bats throughout the action area. Tricolored bats exposed to this stressor during habitat removal are likely to respond in a way that would lead to adverse effects including avoidance or abandonment of habitat potentially used for swarming. Tricolored bats exposed to this stressor during the construction component after habitat removal would be exposed to lower levels of this stressor as the ground, vegetation, air, and source point are expected to attenuate noise levels.

Table 6. Tricolored Bat – Effects Pathway for Noise and Vibration During Inactive Time of Year

Activity: Construction	
Stressor: Noise and vibration	
Exposure (time)	Construction phase during inactive time of year (November 15 – March 31)
Exposure (space)	Undocumented cave(s) outside of the Maximum Disturbance Limits (MDL), but within the action area.
Resource affected	Individuals (adults and juveniles) in hibernacula
Individual response	Forced arousal from torpor resulting in decreased fitness and fecundity, injury or mortality.
Effect	Discountable
Conservation Measures	Blasting will not be used for breaking rock for the Project. Project construction will use rock trenchers and hammers in areas where the underlying limestone requires this method. Other areas of shale and soil will not require these methods or produce the noise/vibration levels of rock trencher/hammer. A survey of the MDL was performed to identify areas of karst that may provide suitable winter habitat for the tricolored bat. No suitable sites were identified. Trenching is expected to be up to 500 feet per day in harder limestone and up to 1,000 feet per day in shale and other softer substrate depending upon the equipment and resources utilized.
Interpretation	Construction noise and vibration are unavoidable during construction of the Project during the active times of year. Noise and/or vibration may cause bats to arouse from torpor to assess the new condition. However, noise and vibration are expected to be attenuated due to various environmental conditions such as substrate, vegetation, air, and source of noise/vibration (i.e., below ground level in trench). Tricolored bats exposed to this stressor during construction are not likely to respond in a way that would lead to adverse effects but acclimate during periodic arousal and continue using the undocumented feature.

Table 7. Summary of Stressors and Effects on the Tricolored Bat

Stressors	Adverse	Insignificant/ Discountable
Tree removal, bat mortality (April 1 to November 14)	Harm	
Tree removal, loss of roost trees (November 15 to March 31)		Insignificant
Aquatic resource loss and degradation		Insignificant
Noise and vibration (April 1 to November 14)	Harm	
Noise and vibration (November 15 to March 31)		Discountable

3 Conservation Measures

3.1 Tricolored Bat

Conservation measures designed for the Indiana bat and northern long-eared bat will also conserve the tricolored bat. Those conservation measures are as follows:

- LG&E will avoid or minimize tree clearing within forested areas where possible.
- Tree clearing will be targeted between November 15 and March 31 when forested habitats are unoccupied by tricolored bats. Limited clearing between April 1 and November 14 may be necessary to complete the Project.
- LG&E will use best management practices for sediment and erosion control to avoid and minimize any offsite impacts associated with foraging habitat for bats related to Project construction.
- BMPs associated with the Section 404 authorization and KPDES permit will also be implemented to limit impacts to aquatic resources that may serve as foraging habitat and drinking water for the tricolored bat.
- If during construction a void is exposed, LG&E will follow the Project sinkhole mitigation plan to stabilize the soil with material, as needed, to continue to allow subsurface water conveyance without contributing additional soil material that may plug the conduit.

LG&E anticipates tree clearing within the potential and known habitat areas for the Indiana bat and northern long-eared bat and expects to complete mitigation for impacts to the habitats. LG&E will provide a voluntary contribution to the Imperiled Bat Conservation Fund, which supports the acquisition and protection of forested bat habitat across Kentucky. This mitigation effort will also benefit the tricolored bat and its conservation of habitat throughout Kentucky.

4 Determination of Effects

4.1 Tricolored Bat

The USFWS has not published a final decision regarding the federal listing of the tricolored bat. However, it is anticipated that its final listing of Endangered will occur by December 31, 2023. If that occurs, the Project will likely result in adverse effects to the tricolored bat. Removal of occupied roosting habitat as well as noise impacts to occupied roosting habitat has the potential to adversely affect the tricolored bat.

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Appendix D 2018 Kentucky Glade Cress Habitat US Fish and Wildlife Service Communications

From: Garland, Jennifer
To: Beckman, Nate
Subject: Kentucky Glade Cress Flowering Period
Date: Monday, April 16, 2018 4:12:52 PM

EXTERNAL email. STOP and THINK before responding, clicking on links, or opening attachments.

Nate,

The best time to survey for KY Glade Cress is when the species is flowering, typically late February to early March. However, this is highly variable by year as it is weather dependent. Consistent with my email of February 28, 2018, for the 2018 survey season, April is the best month for surveys.

As of last week, the species is still in flower and has not yet gone to seed. We expect the plant to be readily identifiable for the rest of this month. Once the species goes to seed, the plants desiccate (dry up) and are gone from the landscape until late fall/early winter when those seeds start to germinate. I hope this answers your question regarding survey periods for the KY glade cress and if you need any additional information please let me know.

Jennifer

Jennifer M. Garland
Deputy Field Supervisor
U.S Fish and Wildlife Service
KY Ecological Services Field Office
330 W. Broadway, Room 265
Frankfort, KY 40601
[redacted]
**Check us out at https://www.fws.gov/frankfort/

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: Garland, Jennifer
To: Beckman, Nate
Subject: Re: Bullitt County Proposed Project - Glade Cress information
Date: Wednesday, February 28, 2018 3:25:41 PM

EXTERNAL email. STOP and THINK before responding, clicking on links, or opening attachments.

Thanks Nate. I spoke with the botantist at KSNPC yesterday and the Kentucky glade cress is still in rosette form, so early April is still a good target for survey work

Jennifer M. Garland
Deputy Field Supervisor
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**Check us out at https://www.fws.gov/frankfort/

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.

On Wed, Feb 28, 2018 at 3:18 PM, Beckman, Nate <[redacted]> wrote:

> Jenni – Thanks for your review of the previously submitted Habitat Assessment Document. I have attached an addendum which addresses your comments and also adds some planned areas within the route. Attached documents are:
>
> • Revised cover letter (addresses comment #1)
>
> • Addendum cover letter (summarizes changes to the previous PDF package)
>
> • Revised pdfs (addresses comment #3. Please reference Addendum cover letter for a code to changes).
>
> We appreciate your time in reviewing these documents as we prepare for the Spring survey work.
>
> Thanks,
> Nate
>
> **Nate Beckman**
> Environmental Scientist III | Environmental Affairs | LG&E and KU
>
> 220 West Main Street, Louisville, KY 40202
> [redacted]
> lge-ku.com

From: Garland, Jennifer [mailto [redacted]]
Sent: Thursday, February 22, 2018 10:50 AM
To: Beckman, Nate <[redacted]>
Subject: Re: Bullitt County Proposed Project - Glade Cress information

EXTERNAL email. STOP and THINK before responding, clicking on links, or opening attachments.

Nate,

Thank you for the opportunity to review the January 23, 2018 Habitat Assessment for Kentucky Glade Cress (*Leavenworthia exigua* var. *laciniata*). I have reviewed and offer the following comments/recommendations:

1. In the cover letter, Cardno references the proposed threatened status of Kentucky glade cress. Kentucky glade cress was listed as a threatened species under the Endangered Species Act on June 5, 2014. Critical Habitat for the species was designated concurrent with listing.

2. Milepost 0 – 5. Cardno has proposed not to survey in this area due to the predominance of heave agricultural landuse. The Service agrees with Cardno's assessment of this area and that that there is no need to survey areas in current crop use (tilled ground).

3. Milepost 5 – 7.5. Cardno has proposed to survey this area due the prevalence of suitable habitat. The Service agrees with this assessment, but is concerned with the large amount of ground excluded from survey in this reach, such as the excluded reaches shown on pages 13 and 14. We request that all areas not currently in tilled use for crops be surveyed for Kentucky glade cress.

4. Milepost 7.5 – 11.67. Cardno has determined that suitable habitat is not available in this area and therefore does not proposed to conduct surveys. The Service agrees with this assessment and has no concerns.

Please let me know if you have any questions or concerns and thank you for your coordination on these upcoming survey efforts.

Jennifer

Jennifer M. Garland

Deputy Field Supervisor

U.S Fish and Wildlife Service

KY Ecological Services Field Office
330 W. Broadway, Room 265

Frankfort, KY 40601

[redacted]

[redacted]

[redacted]

**Check us out at https://www.fws.gov/frankfort/

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On Fri, Jan 26, 2018 at 11:50 AM, Beckman, Nate <[redacted]> wrote:

> Ms. Garland – Attached is information pertaining to high potential for Kentucky glade cress (identified on the figures in the document as "areas to be surveyed") within our proposed pipeline route in Bullitt County. We would like to confirm the information in the report prior to the 2018 flowering season in order for us to complete presence surveys during that time. It is also possible that areas of the route will be altered between now and the spring flowering season. As we learn of changes to the route and areas that are planned for survey we will submit replacement pages to this document.
>
> Let me know if you need additional information in order to review the submitted information.
>
> Thanks,
> Nate
>
> **Nate Beckman**
> Environmental Scientist III | Environmental Affairs | LG&E and KU
>
> 220 West Main Street, Louisville, KY 40202
> [redacted]
> lge-ku.com
>
> ---------- The information contained in this transmission is intended only for the person or entity to which it is directly addressed or copied. It may contain material of confidential and/or private nature. Any review, retransmission, dissemination or other use of, or taking of any action in reliance upon, this information by persons or entities other than the intended recipient is not allowed. If you received this message and the information contained therein by error, please contact the sender and delete the material from your/any storage medium.

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Appendix E 2023 Winter Bat Habitat Assessment

Stantec

Memo

To:	Nate Beckman and Stephen Beatty Louisville, KY	From:	Jeff Brown and Josh Adams Louisville
Project/File:	J16X404800	Date:	July 12, 2023

Reference: LG&E Bullitt County Transmission Pipeline Project: Winter Bat Habitat Assessment

INTRODUCTION

The Louisville Gas & Electric Company (LG&E) is proposing to construct a pipeline in Bullitt County, Kentucky, approximately 12 miles in length, to maintain service reliability and meet the growing demand for natural gas within the service area. The project would have a 50-foot permanent easement throughout the majority of the Project. The Project starts approximately one mile east of the intersection of Grigsby Lane and Rummage Lane, extending west and south, ending on the east side of Interstate 65 and north of Chapeze Lane (see Attachment A – Figure 1-1c).

Background

On February 28, 2019, LG&E submitted a Pre-Construction Notification (PCN) letter to the United States Army Corps of Engineers (USACE) Louisville District for the Project and was assigned USACE Project Number LRL-2017-1046. The PCN provided detail regarding proposed permanent and temporary impacts to Waters of the United States.

Formal consultation under section 7 of the Endangered Species Act (ESA) was requested by the USACE for a "may affect, likely to adversely affect" determination for the Indiana bat and Kentucky glade cress as a result of the Project. The USFWS issued a Biological Opinion in 2021 for the Project, which concluded that the Project is not likely to jeopardize the continued existence of the Indiana bat or Kentucky glade cress. At the time of the 2021 Biological Opinion, Project impacts to the northern long-eared bat were addressed via the 4(d) rule for the species.

On April 20, 2022, the USACE requested to reinitiate formal ESA consultation with the USFWS for the Project. The primary reason for reinitiating consultation was to provide a project-specific evaluation of the northern long-eared bat in light of a March 2022 proposal to reclassify the northern long-eared bat as endangered under the ESA. The final rule reclassifying the northern long-eared bat as endangered was published on November 30, 2022, and is effective as of March 31, 2023.

The USACE requested that LG&E submit a revised Biological Assessment (BA) that provides an evaluation of impacts to the northern long-eared bat and other updated information regarding assessment of potential winter hibernacula in relation to the Project location for all bat species considered.

Purpose of the Report

This report was prepared to provide information regarding the potential for suitable winter habitat for the Indiana bat and northern long-eared bat within the Maximum Disturbance Limits[1] (MDL) of the Project. This report also considers winter habitat for the tricolored bat, a candidate species being considered for listing as federally endangered. The entirety of the MDL was reviewed during a pedestrian survey to provide accurate

[1] MDL is defined as the permanent right-of-way and all temporary and permanent work areas associated with construction including laydown yards and access roads.

information related to winter habitat for the Indiana bat, northern long-eared bat, and tricolored bat in support of the BA.

METHODS

Desktop Data Review

Prior to field assessment, Mr. Jeff Brown and Mr. Josh Adams of Stantec Consulting Services Inc. reviewed data that was previously acquired throughout the timeframe of Project development. Mr. Brown and Mr. Adams are both qualified biologists (per USFWS 2023[2]) who have held federal Fish and Wildlife Permits for federally listed bats, including Indiana bat and northern long-eared bat for over a combined 40 years. The data reviewed included sinkhole features from previous field efforts and information provided by the Kentucky Speleological Society (KSS). Additionally, various topographic, aerial, and geological maps were reviewed to assess where potentially occurring karst features may occur within the MDL. Biologists also reviewed current and historical literature related to the occurrence of Indiana bats and northern long-eared bats. Lastly, information from the USFWS and LG&E obtained during early project development was reviewed for any updates prior to field assessment.

Field Assessment

A pedestrian survey of the Project MDL was conducted between April 24 and 26, 2023 for potential winter habitat for Indiana bats and northern long-eared bats. Two federally permitted biologists with appropriate experience conducting field investigations for winter bat habitat systematically walked the entirety of the MDL alongside staff from LG&E. Access outside of the MDL was impracticable and/or not available at the time of survey at the time of survey. In lieu of walking outside of the MDL, biologists visually assessed as far as they could see. Locations where previously mapped sinkholes were identified in the MDL were assessed where the current MDL overlapped with those features. Additionally, surveyors reviewed the entirety of the MDL for any newly formed sinkholes or other karst features not previously identified. Photographs and data forms from the 2023 *USFWS Range-wide Indiana Bat & Northern Long-eared Bat Survey Guidelines Appendix H: Potential Hibernaculum Survey Guidance* were used to collect relevant data regarding features and took photographs of features for reference.

On April 26, 2023, during pedestrian surveys a member of the USFWS Kentucky Field Office familiar with bat habitat assessment accompanied LG&E's field effort to observe existing conditions and discuss conditions suitable for bat hibernacula.

RESULTS

Desktop Data Review

The Project occurs on the Shepherdsville and Samuels USGS Topographical quadrangles. Elevation along the MDL ranged from approximately 425 to 850 feet (see Attachment A – Figures 1a-1c). Data from field work conducted in 2018 identified a total of 11 sinkhole features. These data were reviewed prior to field assessment to understand where sinkhole features were most likely to occur in the Project MDL. Review of the data indicated that 10 of the 11 sinkhole features are now located outside of the MDL.

Data received from the KSS identified three cave features within five miles of the Project MDL. Figure 1 (Attachment A) depicts the general location of these cave resources in relation to the Project MDL. The

[2] A qualified biologist is an individual who holds a USFWS Recovery Permit (Federal Fish and Wildlife Permit) for Indiana bat and/or northern long-eared bat in the state/region in which they are surveying and/or has been authorized by the appropriate state agency to net and handle Indiana bat and /or northern long-eared bat.

northernmost cave feature near the Salt River is identified as T6 Cave. Hobbes Cave is located near the community of Clermont. Lastly, the third cave feature is identified as T10 Cave. The T10 Cave is located approximately 700 feet south of existing Colyer Lane. Colyer Lane will receive minor improvements to be used as an access road to the MDL during construction. Photos observed from previous surveys show this feature to be a recess cave with no corridors into the hillside (see Attachment B: Photos 16, 17, and 18). No other KSS cave feature photographs are available.

Field Assessment

No suitable winter habitat for Indiana bats or northern long-eared bats was identified within the Project MDL. During the pedestrian survey, six surface depressions and three sinkholes were identified within the MDL. A surface depression was defined as a concave depression in the ground with no obvious throat or opening. Sinkholes were defined as a depression in soil or bedrock that is formed by erosion and transport of material from below the surface. The sinkhole throat allows the surface runoff to infiltrate the soil and may vary in size. Lastly, a talus slope[3] was identified that was assessed for potential winter habitat. Biologists visually assessed as far as they could see outside the MDL and no additional features were observed.

Surface Depressions

Surface depressions 1 through 3 are located within a woodlot with moderately dense vegetation and within several feet of each other. These depressions did not provide winter habitat for bats. These surface depressions are shown on Figure 3B (Attachment A). Photographs are provided in Attachment B (Photos 3, 4, and 5).

Surface Depression 4 is in a field and may have been formed by cattle. This depression did not provide winter habitat for bats. This surface depression is shown on Figure 3c (Attachment A). A photograph is provided in Attachment B (Photo 6).

Surface depressions 5 and 6 are located in a proposed contractor storage yard. These depressions had concrete debris and rocks purposefully placed in them as fill. These depressions did not provide winter habitat for bats. These surface depressions are shown on Figure 3f (Attachment A). Photographs are provided in Attachment B (Photos 7, 8 and 9).

Sinkholes

Sinkhole 1 is located in an agricultural field that had several previously identified sinkhole features. Sinkhole 1 is located on the edge of the MDL and appears to be continuing to form. Evidence of this was the planted vegetation seen within the bowl of the sinkhole indicating it was actively collapsing during rain events. The throat of the sinkhole is eight inches round and recesses another 12 inches before ending in soil. This sinkhole appears to collect surface runoff that filters and dissolves soil while entering the groundwater. The sinkhole is located on top of a hill where the groundwater likely moves towards lower elevations through the earth. Other sinkholes appeared to have the same morphology and lacked suitability for bats. They are outside the MDL and not documented. Surveyors also noted what appeared to be several former sinkholes that were filled with soil and planted overtop. This sinkhole did not provide winter habitat for bats. Sinkhole 1 is shown on Figure 3d (Attachment A). Photographs are provided in Attachment B (Photos 10 and 11) and data sheets are provided in Attachment C.

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[3] Talus slope – An outward sloping and accumulated heap or mass of rock fragments of any size or shape (usually coarse and angular) derived from and lying at the base of a cliff or steep, rocky slope, and formed primarily by gravitational falling, rolling, or sliding (USGS 2023).

Sinkhole 2 is approximately 3,000 feet to the east of Sinkhole 1. Sinkhole 2 is located in an agricultural field where several other sinkholes exist outside the MDL to the south within 50 feet of each other. Other sinkholes appeared to have the same morphology and lacked suitability for bats. They are outside the MDL and not documented. The sides of the sinkhole are densely vegetated and obscure the throat of the sinkhole. The throat is approximately six inches round and recesses approximately six inches before ending in soil. Like Sinkhole 1, this sinkhole appears to gather surface runoff where it permeates the soil and combines with groundwater. Debris was present in the sinkhole including wood, rocks, and a porcelain toilet. This sinkhole did not provide winter habitat for bats. Sinkhole 2 is shown on Figure 3e (Attachment A). Photographs are provided in Attachment B (Photos 12 and 13) and data sheets are provided in Attachment C.

Sinkhole 3 is approximately 584 feet to the southeast of Sinkhole 2. Sinkhole 3 is located in an agricultural field and is located downslope of a swale. The sides of the sinkhole are densely vegetated, but the throat is visible. There is a small two-inch opening that goes down approximately two inches. This sinkhole is located at the end of the swale where it filters into the groundwater and erodes the edges. This sinkhole did not provide winter habitat for bats. Sinkhole 3 is shown on Figure 3e (Attachment A). Photographs are provided in Attachment B (Photos 14 and 15) and data sheets are provided in Attachment C.

Other Features

Throughout the western portion of the Project MDL from MP 7.75 to MP 11.75 various rock outcrops were visible during survey. These outcrops did not have fissures or openings that were suitable for winter bat habitat. Most often they were smooth and seamless with the ground around the feature or had small inset ledges that were not appropriate for hibernating bats. These were located sparsely throughout the area.

One southwestward facing slope from approximately MP 9.00 to MP 9.25 was primarily talus and had large rock outcrops with several recesses in them. These features were investigated and found not to provide winter bat habitat. This hillside appeared showing various levels of slope failure and thus creating cracks and crevices between large slabs of bedrock.

DISCUSSION

No suitable winter habitat was identified for the Indiana bat or northern long-eared bat during survey of the MDL. Access beyond the MDL to 0.5 mile was impracticable and/or not available at the time of survey. The pedestrian survey was performed by qualified, federally permitted bat biologists to visually review all landscape features that could potentially be used by Indiana bats and northern long-eared bats as hibernacula. The survey paid particular focus on sinkholes and their location in a geological area more conducive for karst features. However, the three identified sinkholes within the MDL did not provide suitable habitat for endangered bats, or any hibernating bats that may occur in the area.

Northern long-eared bats primarily hibernate in caves and abandoned mine sites (USFWS 2022; Brack et al. 2010; Whitaker and Hamilton 1998), though other landscape features have been used including abandoned railroad tunnels, storm sewer entrances, wells, and bunkers (USFWS 2022). These hibernacula typically have larger entrances and passages than those required by other species, cooler average temperatures (32° - 48° F [0° - 9° C]), high humidity, and little to no air currents (USFWS 2022).

Indiana bats, however, primarily hibernate in limestone caves, but abandoned mines are sometimes used or other “cave-like” structures (USFWS 2007). Cave (or mine) morphology strongly affects its suitability for hibernation (Buecher 1995; Humphrey 1978) by affecting airflow into and through the cave, and thus cave temperatures. Optimal hibernacula have temperatures between (39° - 46° F [4° - 8° C]). Hence, not all caves/mines are suitable as hibernacula for Indiana bats.

There are three KSS identified caves known to exist outside of the MDL. Two caves, T6 Cave and Hobbes Cave are approximately 3 miles and 1.5 miles away from the MDL. T10 Cave is approximately 0.25 mile from the MDL. Due to the long history of cave exploration and bat research in Kentucky, most hibernacula are known by the USFWS and Kentucky Department of Fish and Wildlife Resources (USFWS 2016). It is not unexpected that these caves are not known to support hibernating Indiana bats and northern long-eared bats. In general, cave configuration determines internal environmental conditions and larger more complex cave systems having multiple entrances are more likely to provide suitable habitat for the Indiana bat (Tuttle and Stevenson, 1978; LaVal and LaVal, 1980) and northern long-eared bat.

Lastly, the tricolored bat is currently under review for listing as federally endangered by the USFWS. A decision for listing is expected Fall of 2023. Tricolored bats hibernate in caves and mines, but may use culverts, abandoned water wells, and other anthropomorphic structures (USFWS 2021). The tricolored bat is often found hibernating individually, but occasionally in pairs or small clusters in warmer locations (50.5 – 52.5° F [10.3 – 11.4 ° C]) within their hibernaculum (USFWS 2021). This species is observed more in hibernacula with stable temperatures and may use caves and mines that are less suitable for other species of bats (USFWS 2021).

In general, sinkholes that are of the size and morphology of the features located within the Project MDL do not provide suitable habitat for Indiana bats and northern long-eared bats. Neither do these sinkholes provide suitable habitat for the tricolored bat. Based on the survey conducted in April 2023, it is reasonable to conclude that direct impacts to hibernating Indiana bats, northern long-eared bats are not expected to occur as winter habitat is absent from the MDL.

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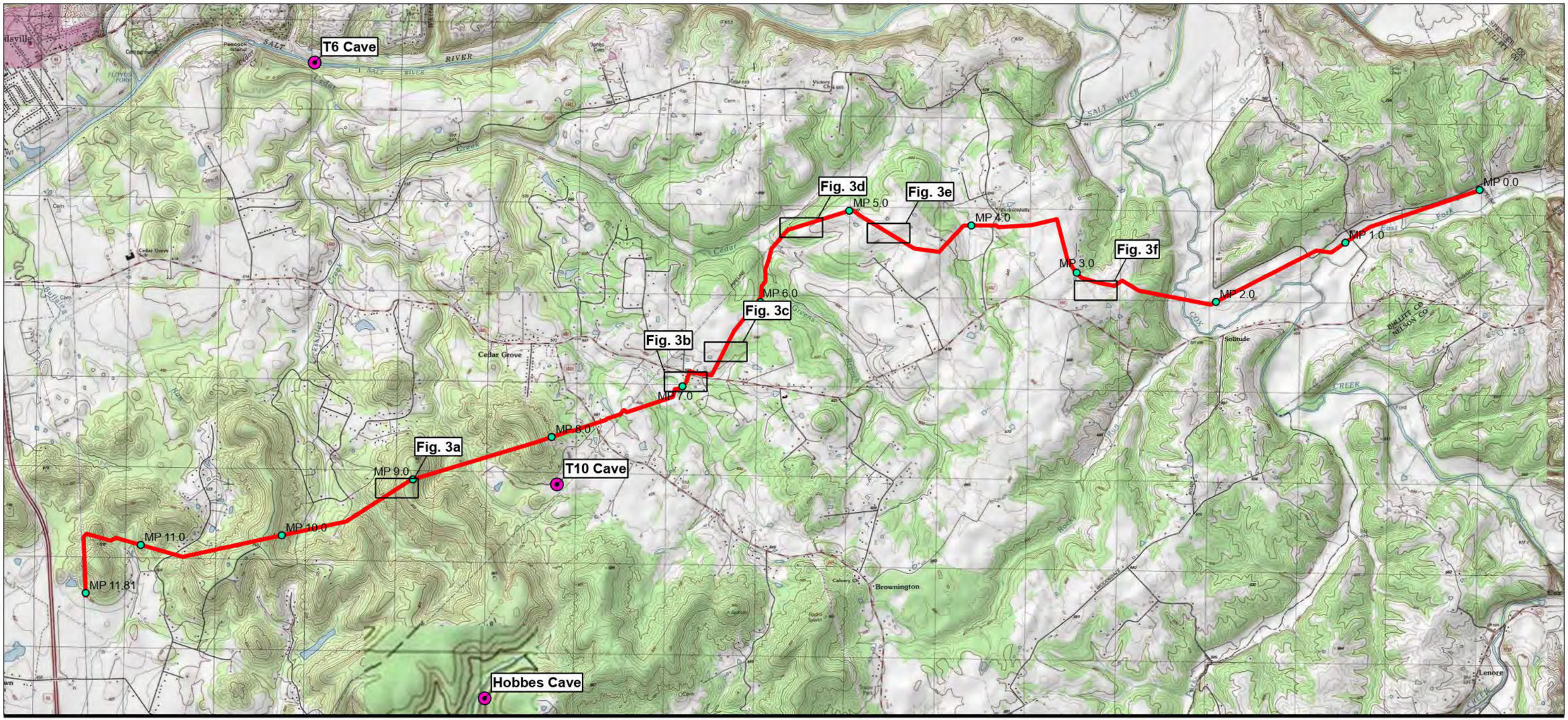
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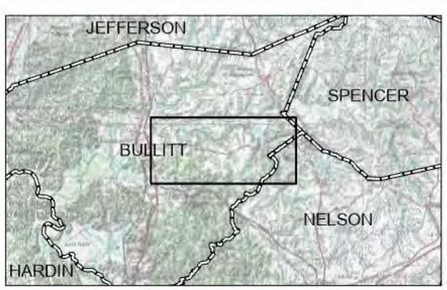
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Attachments: Attachment A – Figures; Attachment B – Photolog; Attachment C – Data Sheets

Attachment A - Figures





Legend

- KY Speliological Society Identified Cave
- Mile Post
- Proposed Pipeline

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Stantec

Project Location
Bullitt County, Kentucky

Prepared by TCN on 2023-05-19
TR by RJB on 2023-05-22
IR by JJA on 2023-05-XX

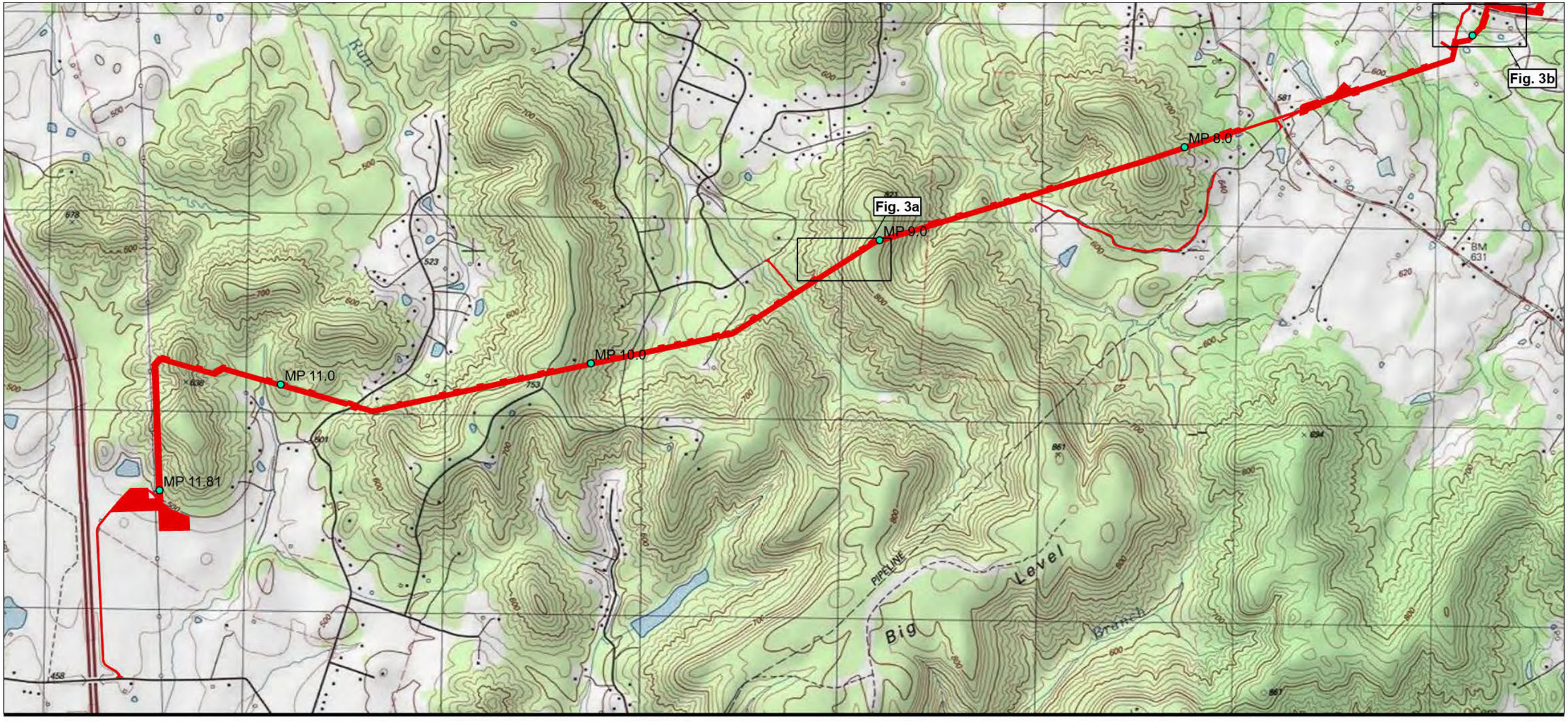
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Winter Bat Habitat Assessment

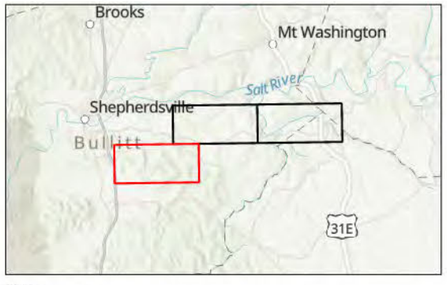
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Title
Project Topography - Overview

Notes
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2. Data Sources: Stantec, LG&E, KSS
3. Background: USGS Topographic Map

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Legend

- Maximum Disturbance Limits
- Mile Post

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Project Location
Bullitt County, Kentucky

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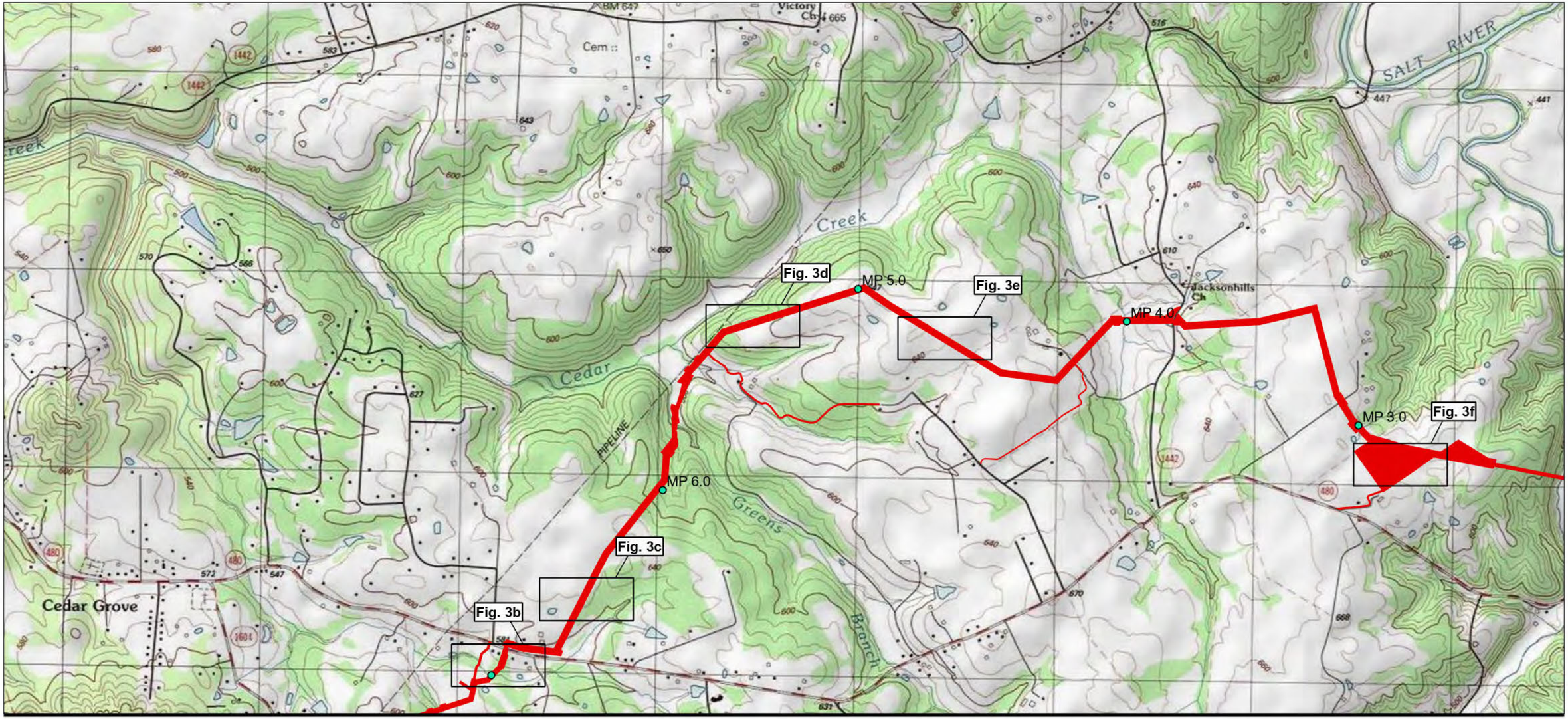
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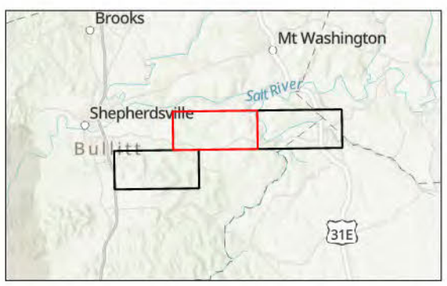
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Title
Project Topography

Notes
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2. Data Sources: Stantec, LG&E
3. Background: USGS Topographic Map

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Legend

- Maximum Disturbance Limits
- Mile Post

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Notes
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2. Data Sources: Stantec, LG&E
3. Background: USGS Topographic Map

Stantec

Project Location
Bullitt County, Kentucky

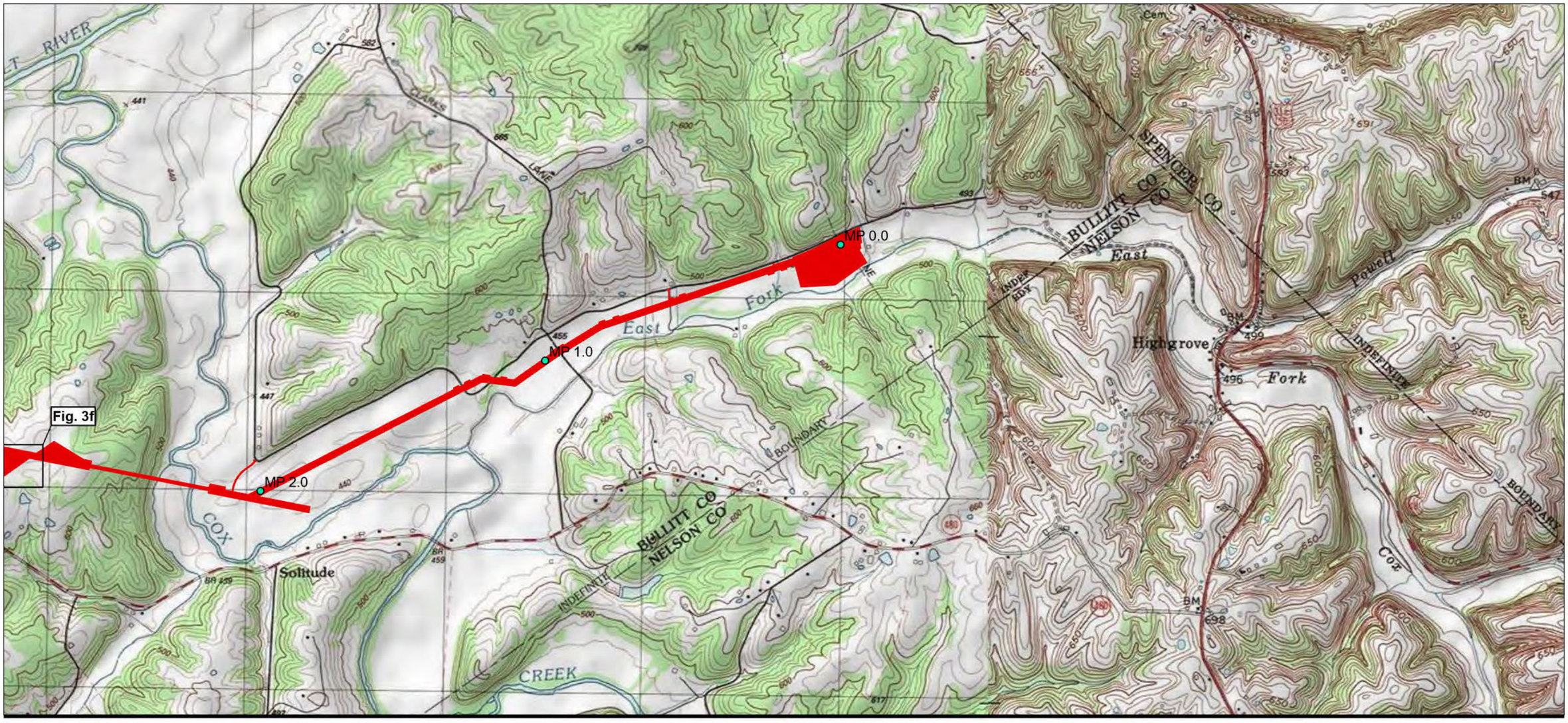
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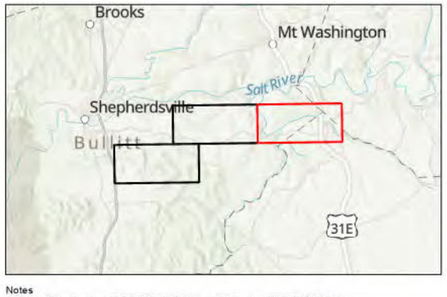
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Figure No.
1b

Title
Project Topography

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Legend

- Maximum Disturbance Limits
- Mile Post

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Notes
1. Coordinate System: NAD 1983 StatePlane Kentucky FIPS 1600 Feet
2. Data Sources: Stantec, LG&E
3. Background: USGS Topographic Map

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Project Location
Bullitt County, Kentucky

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Figure No.
1c

Title
Project Topography

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MP 7.0

MP 8.0

MP 9.0

MP 10.0

MP 11.0

MP 11.81



Legend

- Mile Post
- Photo Location
- Maximum Disturbance Limits
- KGS Sinkhole Data

Karst Feature Potential

- Low
- Moderate
- High

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Notes
1. Coordinate System: NAD 1983 StatePlane Kentucky FIPS 1600 Feet
2. Data Sources: Stantec, LG&E, KGS
3. Background: KGS 1:500k Karst Potential

Stantec

Project Location
Bullitt County, Kentucky

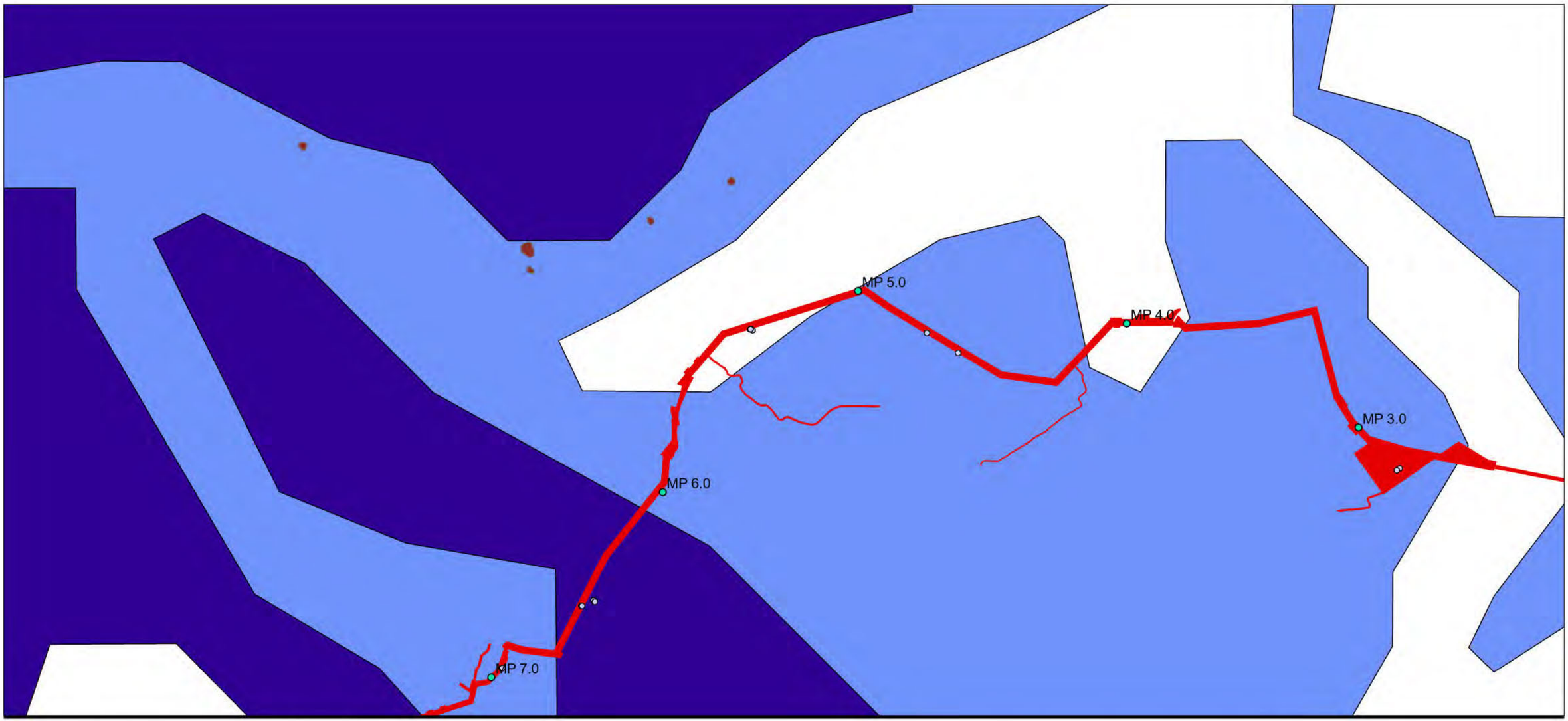
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Figure No.
2a

Title
Karst Feature Potential

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Legend
- Mile Post
- Photo Location
- Maximum Disturbance Limits
- KGS Sinkhole Data

Karst Feature Potential
- Low
- Moderate
- High

Notes
1. Coordinate System: NAD 1983 StatePlane Kentucky FIPS 1600 Feet
2. Data Sources: Stantec, LG&E, KGS
3. Background: KGS 1:500k Karst Potential

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Stantec

Project Location
Bullitt County, Kentucky

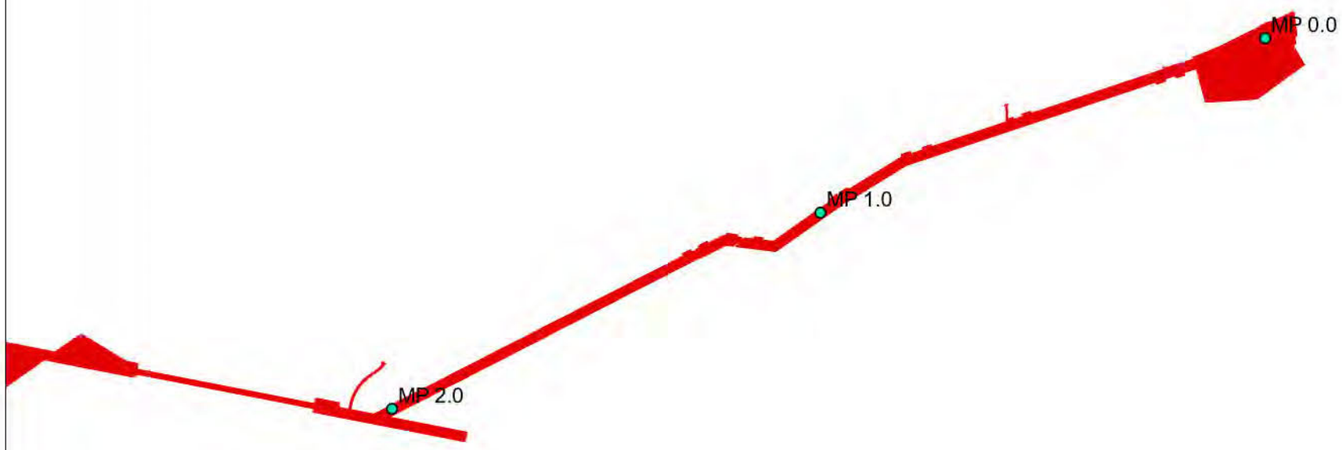
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Figure No.
2b

Title
Karst Feature Potential

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Notes
1. Coordinate System: NAD 1983 StatePlane Kentucky FIPS 1600 Feet
2. Data Sources: Stantec, LG&E, KGS
3. Background: KGS 1:500k Karst Potential

Legend
- Mile Post
- Photo Location
- Maximum Disturbance Limits
- KGS Sinkhole Data

Karst Feature Potential
- Low
- Moderate
- High

0 1,000 2,000 3,000 Feet
(At original document size of 11x17)
1:20,000

N

Stantec

Project Location
Bullitt County, Kentucky

Prepared by TCN on 2023-05-19
TR by RJB on 2023-05-22
IR by JJA on 2023-05-XX

Client/Project
Louisville Gas & Electric
Bullitt County Gas Transmission Pipeline Project
Winter Bat Habitat Assessment

Figure No.
2c

Title
Karst Feature Potential

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Legend

- Maximum Disturbance Limits
- Photo Location
- Previously Identified Feature
- Mile Post

0 50 100 150 Feet

(At original document size of 11x17)
1:1,500

N

Notes
1. Coordinate System: NAD 1983 StatePlane Kentucky FIPS 1600 Feet
2. Data Sources: Stantec, LG&E, KGS
3. Background: ESRI Aerial Imagery

Stantec

Project Location
Bullitt County, Kentucky

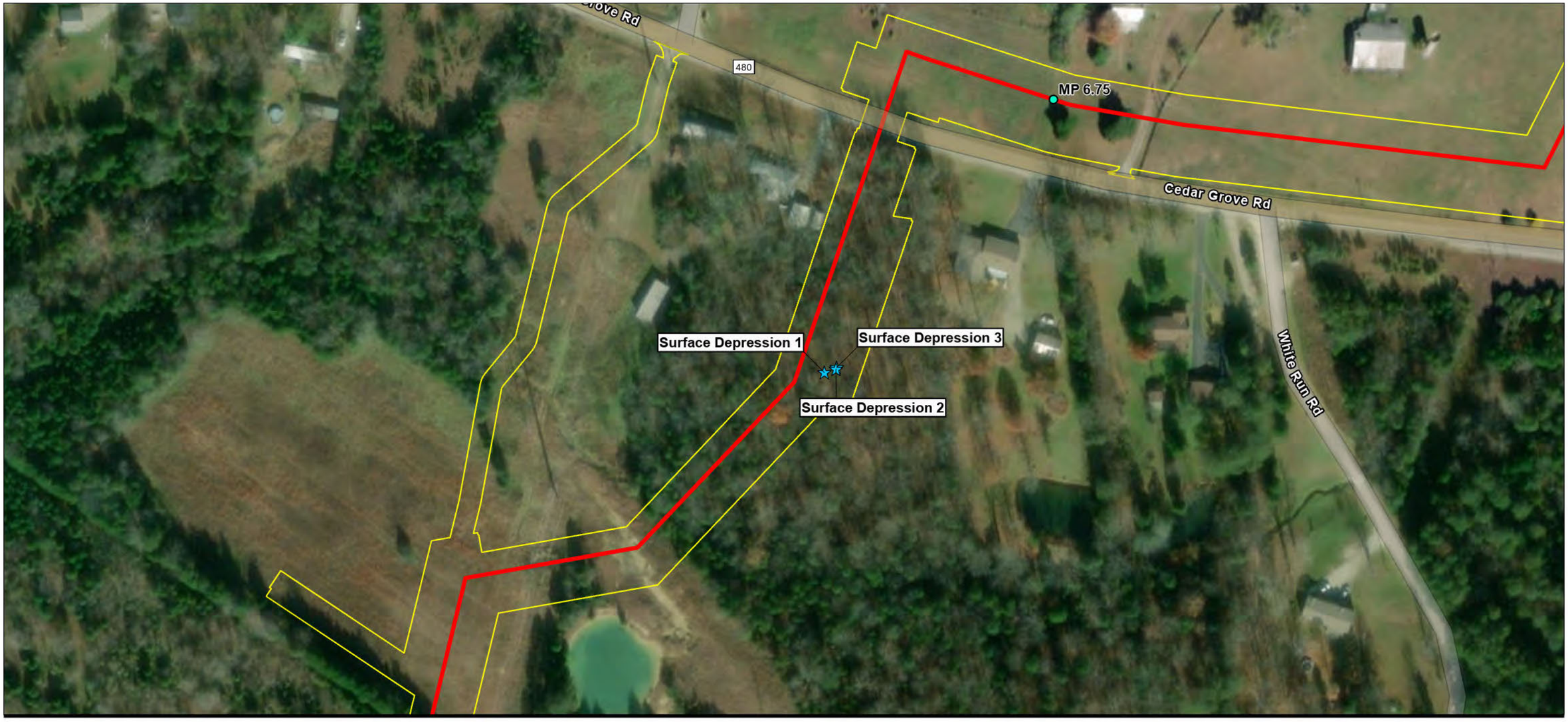
Prepared by TCN on 2023-05-22
TR by RJB on 2023-05-22
IR by JJA on 2023-05-XX

Client/Project
Louisville Gas & Electric
Bullitt County Gas Transmission Pipeline Project
Winter Bat Habitat Assessment

Figure No.
3a

Title
Observed Winter Bat Habitat Features

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Legend
- Maximum Disturbance Limits
- Photo Location
- Previously Identified Feature
- Mile Post

0 50 100 150 Feet
(At original document size of 11x17)
1:1,500

N

Notes
1. Coordinate System: NAD 1983 StatePlane Kentucky FIPS 1600 Feet
2. Data Sources: Stantec, LG&E, KGS
3. Background: ESRI Aerial Imagery

Stantec

Project Location
Bullitt County, Kentucky

Prepared by TCN on 2023-05-22
TR by RJB on 2023-05-22
IR by JJA on 2023-05-XX

Client/Project
Louisville Gas & Electric
Bullitt County Gas Transmission Pipeline Project
Winter Bat Habitat Assessment

Figure No.
3b

Title
Observed Winter Bat Habitat Features

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Legend
- Maximum Disturbance Limits
- Photo Location
- Previously Identified Feature
- Mile Post

0 50 100 150 Feet
(At original document size of 11x17)
1:1,500

N

Notes
1. Coordinate System: NAD 1983 StatePlane Kentucky FIPS 1600 Feet
2. Data Sources: Stantec, LG&E, KGS
3. Background: ESRI Aerial Imagery

Stantec

Project Location
Bullitt County, Kentucky

Prepared by TCN on 2023-05-22
TR by RJB on 2023-05-22
IR by JJA on 2023-05-XX

Client/Project
Louisville Gas & Electric
Bullitt County Gas Transmission Pipeline Project
Winter Bat Habitat Assessment

Figure No.
3c

Title
Observed Winter Bat Habitat Features

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Legend

- Maximum Disturbance Limits
- Photo Location
- Previously Identified Feature
- Mile Post

0 50 100 150 Feet
(At original document size of 11x17)
1:1,500

N

Notes
1. Coordinate System: NAD 1983 StatePlane Kentucky FIPS 1600 Feet
2. Data Sources: Stantec, LG&E, KGS
3. Background: ESRI Aerial Imagery

Stantec

Project Location
Bullitt County, Kentucky

Prepared by TCN on 2023-05-22
TR by RJB on 2023-05-22
IR by JJA on 2023-05-XX

Client/Project
Louisville Gas & Electric
Bullitt County Gas Transmission Pipeline Project
Winter Bat Habitat Assessment

Figure No.
3d

Title
Observed Winter Bat Habitat Features

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Legend
- Maximum Disturbance Limits
- Photo Location
- Previously Identified Feature
- Mile Post

0 50 100 150 Feet
(At original document size of 11x17)
1:1,500

N

Notes
1. Coordinate System: NAD 1983 StatePlane Kentucky FIPS 1600 Feet
2. Data Sources: Stantec, LG&E, KGS
3. Background: ESRI Aerial Imagery

Stantec

Project Location
Bullitt County, Kentucky

Prepared by TCN on 2023-05-22
TR by RJB on 2023-05-22
IR by JJA on 2023-05-XX

Client/Project
Louisville Gas & Electric
Bullitt County Gas Transmission Pipeline Project
Winter Bat Habitat Assessment

Figure No.
3e

Title
Observed Winter Bat Habitat Features

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Legend
- Maximum Disturbance Limits
- Photo Location
- Previously Identified Feature
- Mile Post

0 50 100 150 Feet
(At original document size of 11x17)
1:1,500

N

Notes
1. Coordinate System: NAD 1983 StatePlane Kentucky FIPS 1600 Feet
2. Data Sources: Stantec, LG&E, KGS
3. Background: ESRI Aerial Imagery

Stantec

Project Location
Bullitt County, Kentucky

Prepared by TCN on 2023-05-22
TR by RJB on 2023-05-22
IR by JJA on 2023-05-XX

Client/Project
Louisville Gas & Electric
Bullitt County Gas Transmission Pipeline Project
Winter Bat Habitat Assessment

Figure No.
3f

Title
Observed Winter Bat Habitat Features

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Attachment B - Photolog

Stantec

Photographic Log

Client:	**LG&E**	**Project:**	**Bullitt Co. Pipeline Project**
Site Location:	**Bullitt County, Kentucky**		

Photograph ID: 1

Direction:
Southward

Survey Date:
4/24/2023

Comments:
Talus slope located between MP 9.00 and MP 9.25



Photograph ID: 2

Direction:
Eastward

Survey Date:
4/24/2023

Comments:
Talus slope located between MP 9.00 and MP 9.25



Client:	**LG&E**	**Project:**	**Bullitt Co. Pipeline Project**
Site Location:	**Bullitt County, Kentucky**		

Photograph ID: 3

Direction:
West Northwest

Survey Date:
4/24/2023

Comments:
Surface Depression 1 located approximately 300 feet south of Cedar Grove Road



Photograph ID: 4

Direction:
Eastward

Survey Date:
4/24/2023

Comments:
Surface Depression 2 located approximately 300 feet south of Cedar Grove Road



Client:	**LG&E**	**Project:**	**Bullitt Co. Pipeline Project**
Site Location:	**Bullitt County, Kentucky**		

Photograph ID: 5 **Direction:** Eastward **Survey Date:** 4/24/2023 **Comments:** Surface Depression 3 located approximately 300 feet south of Cedar Grove Road	
Photograph ID: 6 **Direction:** Eastward **Survey Date:** 4/26/2023 **Comments:** Surface Depression 4 located between MP 6.25 and MP 6.50	

Client:	**LG&E**	**Project:**	**Bullitt Co. Pipeline Project**
Site Location:	**Bullitt County, Kentucky**		

Photograph ID: 7 **Direction:** East Northeast **Survey Date:** 4/25/2023 **Comments:** Surface Depression 5 located within proposed contractor storage yard between MP 2.75 and MP 3.00	
Photograph ID: 8 **Direction:** East Northeast **Survey Date:** 4/25/2023 **Comments:** Surface Depression 6 located within proposed contractor storage yard between MP 2.75 and MP 3.00	

Client:	**LG&E**	**Project:**	**Bullitt Co. Pipeline Project**
Site Location:	**Bullitt County, Kentucky**		

Photograph ID: 9 **Direction:** South Southwest **Survey Date:** 4/25/2023 **Comments:** Surface Depression 6 located within proposed contractor storage yard between MP 2.75 and MP 3.00	
Photograph ID: 10 **Direction:** Southwest **Survey Date:** 4/25/2023 **Comments:** Sinkhole 1 located between MP 5.25 and MP 5.50	

Client:	**LG&E**	**Project:**	**Bullitt Co. Pipeline Project**
Site Location:	**Bullitt County, Kentucky**		

Photograph ID: 11 **Direction:** West Southwest **Survey Date:** 4/25/2023 **Comments:** Sinkhole 1 bottom - located between MP 5.25 and MP 5.50	
Photograph ID: 12 **Direction:** South Southeast **Survey Date:** 4/25/2023 **Comments:** Sinkhole 2 at MP 4.75	

Client:	**LG&E**	**Project:**	**Bullitt Co. Pipeline Project**
Site Location:	**Bullitt County, Kentucky**		

Photograph ID: 13

Direction:
South Southeast

Survey Date:
4/25/2023

Comments:
Sinkhole 2 bottom - located at MP 4.75



Photograph ID: 14

Direction:
South Southeast

Survey Date:
4/25/2023

Comments:
Sinkhole 3 located between MP 4.50 and MP 4.75



Client:	**LG&E**	**Project:**	**Bullitt Co. Pipeline Project**
Site Location:	**Bullitt County, Kentucky**		

Photograph ID: 15

Direction:
South Southeast

Survey Date:
5/26/2023

Comments:
Sinkhole 3 bottom - located between MP 4.50 and MP 4.75



Photograph ID: 16

Direction:
Eastward

Survey Date:
9/27/2017

Comments:
T10 Cave



Client:	**LG&E**	**Project:**	**Bullitt Co. Pipeline Project**
Site Location:	**Bullitt County, Kentucky**		

Photograph ID: 17

Direction:
Southward

Survey Date:
9/27/2017

Comments:
T10 Cave interior



Photograph ID: 18

Direction:
Southward

Survey Date:
9/27/2017

Comments:
T10 Cave



Attachment C – Data Sheets

Phase I Habitat Assessment Sample Data Sheet

Location Sinkhole #1 → Not bat habitat

Observers (include permit numbers) Jeff Brown (TE 74592A-1) Josh Adams (TE 91733B-0)

Latitude 37.9839 **Longitude**[81] -85.5942

Date 4-25-2023 **Time** 15:16 h **Temp (outside)** 65° F

See photos 10 & 11 in photolog

	Opening #1	Opening #2	Opening #3	Opening #4
Opening Type (e.g., cave, portal, shaft)	sinkhole			
Opening vertical or horizontal	horizontal			
Opening Size: Height x Width (or Diameter)	8"x8"			
Internal Dimensions: Height x Width	8"x8"			
Slope (up or down from entrance)	down			
Entrance Stable?	no			
Direction of Airflow (In or out?)	none			
Amount of Airflow (e.g., none, slight, heavy)	none			
Internal air warmer or cooler than outside temp.?	60°f			
Evidence of collapse?	Yes			
Ceiling Condition	unstable			
Amount of water in opening	none			
Evidence of past flooding?	yes			
Observed length of internal passage	12"			
Distance to nearest water source	1000 feet			
% Canopy Cover at entrance	0%			
Foraging Signs? (e.g., moth wings)	none			

Are any portals suspected or known to be connected? Which ones? No.

Any observable side passages? No sidepassages.

Additional comments: The sinkhole is located on edge of Project Maximum Disturbance Limits. Based on observed vegetation on sunken soil it appears to be "newer" and getting bigger. There is a focus area for draining that is about 8"x8" and goes back approx. 1 ft.

Entry of abandoned mine portals, quarries, or caves can be extremely dangerous because of the potential for ceiling collapse and presence of toxic gases. Safety or health problems may occur as a result of entering abandoned mines. The FWS does not authorize or require anyone to enter any potential hibernaculum that is or could be unsafe while implementing surveys. These guidelines do not require any applicant or applicant employee, consultant, lessee, or other such designee to enter any cave, quarry, or mine portal.

This sinkhole is receiving rainwater that is collecting at the throat and permeating into the groundwater. The location sits on top of a hill in an active agriculture field with approximately 4 other sinkholes well outside the MDL and not assessed. These features likely all contribute to groundwater charging that moves downslope out of project

[81] Provide coordinates for each opening.

Phase I Habitat Assessment Sample Data Sheet

Location Sinkhole #2 → Not bat habitat

Observers (include permit numbers) Jeff Brown (TE 74592A-1) Josh Adams (TE 91733B-0)

Latitude 37.9838 **Longitude**[81] -85.5841

Date 4-25-2023 **Time** 15:50h **Temp (outside)** 66°F

see photos 12 & 13 in photolog

	Opening #1	Opening #2	Opening #3	Opening #4
Opening Type (e.g., cave, portal, shaft)	sinkhole			
Opening vertical or horizontal	horizontal			
Opening Size: Height x Width (or Diameter)	6"x6"			
Internal Dimensions: Height x Width	6"x6"			
Slope (up or down from entrance)	down			
Entrance Stable?	no			
Direction of Airflow (In or out?)	none			
Amount of Airflow (e.g., none, slight, heavy)	none			
Internal air warmer or cooler than outside temp.?	60° F			
Evidence of collapse?	Yes			
Ceiling Condition	unstable			
Amount of water in opening	none			
Evidence of past flooding?	yes			
Observed length of internal passage	6"			
Distance to nearest water source	860 FT			
% Canopy Cover at entrance	0%			
Foraging Signs? (e.g., moth wings)	none			

Are any portals suspected or known to be connected? Which ones? No.

Any observable side passages? No.

Additional comments: Sinkhole #2 is located on the edge of the maximum disturbance limits. The sides of the sinkhole were heavily vegetated and obscured the throat of the sinkhole. There was debris purposefully thrown into the sinkhole opening. There were 2 other sinkholes located outside the max. dist. limits and not assessed fully. Debris and trash were placed in them and no obvious throat was observed.

Entry of abandoned mine portals, quarries, or caves can be extremely dangerous because of the potential for ceiling collapse and presence of toxic gases. Safety or health problems may occur as a result of entering abandoned mines. The FWS does not authorize or require anyone to enter any potential hibernaculum that is or could be unsafe while implementing surveys. These guidelines do not require any applicant or applicant employee, consultant, lessee, or other such designee to enter any cave, quarry, or mine portal.

Like Sinkhole #1, this sinkhole captures rain water and run off that permeats through the soil into groundwater. IT was observed that some areas were former sinkholes that had been filled over.

[81] Provide coordinates for each opening.

Phase I Habitat Assessment Sample Data Sheet

Location Sinkhole #3 → Not bat habitat

Observers (include permit numbers) Jeff Brown (TE 74598A-1) Josh Adams (TE 91733B-0)

Latitude 37.9828 **Longitude**[81] -85.5823

Date 4-25-2023 **Time** 16:25h **Temp (outside)** 66°F

See photos 14 & 15 in photolog

	Opening #1	Opening #2	Opening #3	Opening #4
Opening Type (e.g., cave, portal, shaft)	Sinkhole			
Opening vertical or horizontal	vertical			
Opening Size: Height x Width (or Diameter)	2" x 2"			
Internal Dimensions: Height x Width	2"x2"			
Slope (up or down from entrance)	down			
Entrance Stable?	no			
Direction of Airflow (In or out?)	none			
Amount of Airflow (e.g., none, slight, heavy)	none			
Internal air warmer or cooler than outside temp.?	NA			
Evidence of collapse?	Yes			
Ceiling Condition	unstable			
Amount of water in opening	none			
Evidence of past flooding?	yes			
Observed length of internal passage	2 inches			
Distance to nearest water source	650 ft			
% Canopy Cover at entrance	0%			
Foraging Signs? (e.g., moth wings)	no			

Are any portals suspected or known to be connected? Which ones? No.

Any observable side passages? No.

Additional comments: This sinkhole is located at the end of a wet weather conveyance. Water pools at this location and filters down through the soil. This feature is located on the edge of the max. dist. limits.

Entry of abandoned mine portals, quarries, or caves can be extremely dangerous because of the potential for ceiling collapse and presence of toxic gases. Safety or health problems may occur as a result of entering abandoned mines. The FWS does not authorize or require anyone to enter any potential hibernaculum that is or could be unsafe while implementing surveys. These guidelines do not require any applicant or applicant employee, consultant, lessee, or other such designee to enter any cave, quarry, or mine portal.

[81] Provide coordinates for each opening.

From: Armstrong, Mike
To: Brown, Jeff; Garland, Jennifer
Cc: Beckman, Nate; Beatty, Stephen; Adams, Joshua
Subject: Re: [EXTERNAL] LG&E Bullitt Co. Project Winter Bat Habitat Assessment of MDL...
Date: Wednesday, July 12, 2023 5:50:42 PM

Afternoon Jeff.

I have reviewed the subject memo pertaining to the LG&E Bullitt County Transmission Pipeline Project: Bat Winter Habitat Assessment. Based on the information provided in the memo, I find it to be in compliance with Phase 1 of Appendix H (Potential Hibernaculum Survey Guidance) of the Range-wide Indiana and Northern long-eared bat Survey Guidance and agree with it's findings that no suitable winter habitat was present for Indiana, northern long-eared, and tricolored bats within the maximum disturbance limits of the proposed project footprint. 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. Additional coordination with our office may be necessary. Please contact your project manager (Jennifer Garland) if you have additional questions.

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
[redacted]

**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: Brown, Jeff [redacted]
Sent: Wednesday, July 12, 2023 10:30 AM
To: Armstrong, Mike <mike_armstrong@fws.gov>; Garland, Jennifer <jennifer_garland@fws.gov>
Cc: Beckman, Nate [redacted]; Beatty, Stephen [redacted]; Adams, Joshua [redacted]; Brown, Jeff [redacted]
Subject: [EXTERNAL] LG&E Bullitt Co. Project Winter Bat Habitat Assessment of MDL...

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

Mike and Jenni,
Please find attached the memo-report regarding the 2023 field effort to assess the Bullitt County pipeline project's maximum disturbance limits (MDL) for winter bat habitat. The memo-report provides the methods and results of the assessment and provides photos and data sheets as attachments to support the conclusions. The assessment concluded that no winter habitat for Indiana bats and northern long-eared bats were found within the MDL. Additionally, we note that no winter habitat is present for the tricolored bat within the MDL as well.

We request your concurrence with the results of our assessment of the MDL. Please call or email if you have any questions regarding the content of this report.

Thank you,
Jeff

R. Jeffrey Brown
Senior Environmental Scientist

[redacted]

Stantec
9200 Shelbyville Road Suite 800
Louisville KY 40222-5136

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Appendix F Geologic Review and Sinkhole Mitigation Plan



Geologic Review and Sinkhole Mitigation Plan

LG&E Bullitt County Transmission Pipeline Project

October 11, 2018

Cardno®

Document Information

Prepared for	EN Engineering, LLC
Project Name	Geologic Review and Sinkhole Mitigation Plan LG&E Bullitt County Transmission Pipeline Project
Project Number	J16X404800
Project Manager	Greg Quartucci
Date	October 11, 2018

Prepared for:

EN Engineering, LLC
28100 Torch Parkway
Warrenville, IL 60555

Prepared by:

Cardno, Inc.
708 Roosevelt Road
Walkerton, IN 46574

OMI, Inc.
5151 Research Drive, NW, Suite A
Huntsville, AL 35805

Table of Contents

1 Introduction 1

2 Geologic Review 2

2.1 Background Geology 2

2.2 Sinkhole Development Potential 2

3 Sinkhole Mitigation 3

3.1 Existing Sinkholes 3

3.2 Action Plan 3

3.3 Repair Plan 3

4 Summary 4

5 References 5

6 Signatures 6

Figures

Figure 1 Site Location Map

Figure 2 Sinkhole Potential Location Map

Figure 3 Geology Map

Figure 4 Potential Sinkholes

Figure 5 Typical Sinkhole Repair

Appendices

Appendix A Site Photographs

Acronyms

LG&E Louisville Gas & Electric

USGS U.S. Geological Survey

1 Introduction

Cardno has prepared this geologic review and sinkhole mitigation plan on behalf of EN Engineering and Louisville Gas & Electric (LG&E) as part of LG&E's Bullitt County Transmission Pipeline Project. This work was performed in conjunction with other environmental review and assessment services performed by Cardno for this project.

LG&E proposes to construct a new natural gas pipeline within Bullitt County, Kentucky in order to meet the growing demand for gas service in the area. The project area and survey area for the proposed project is 11.67 miles long with a survey width of 150 feet. The milepost 0.0 starting point for the survey is located 1.0 mile east of the intersection of Grigsby Lane and Rummage Lane. The survey corridor extends west and south crossing Cedar Grove Road and Deatsville Road terminating just east of Interstate 65 and north of Chapeze Lane.

Several sinkholes were noted within the alignment during the course of Cardno's previous pipeline area review. In addition, the pipeline lies within an area of karst geology, which can be conducive to sinkhole formation. Therefore, the purpose of this work was to a) conduct a review of the pipeline alignment with respect to sinkhole formation potential and b) provide guidance for LG&E to address known and potential sinkholes that may be discovered within the pipeline alignment.

For this work, Cardno worked in conjunction with OMI, Inc., of Huntsville, Alabama to provide geotechnical assistance. OMI is an established geotechnical and construction services firm with experience working in the karst geology regions of north Alabama, Tennessee, and Kentucky.

The location of the proposed alignment is shown on **Figure 1**. The geologic review focuses on the potential for sinkholes to occur along the alignment. In this report Cardno provides the location of known sinkholes along or near the alignment. OMI reviewed the geologic formation and other available maps and resources for outlining the susceptibility of sinkhole development along the alignment during construction. The sinkhole mitigation section provides guidelines for addressing both known and potential future sinkholes encountered during construction.

2 Geologic Review

2.1 Background Geology

According to the U.S. Geological Survey (USGS), the proposed pipeline crosses six geologic formations that include shale, limestone, and sandstone as the parent rock. A geologic reference map, **Figure 2**, is attached to this report. The following are the formations in order of coverage area of Bullitt County from largest to smallest.

- Wildie, Nada, Halls Gap, Holtsclaw Siltstone, Cowbell, Nancy, Kenwood Siltstone, New Providence Shale, Sunbury Shale, Berea Sandstone, and Bedford Shale, undivided; Borden Formation locally includes Renfro Member in eastern Kentucky
    - 60 percent shale (locally silty or carbonaceous), 30 percent siltstone, and 10 percent sandstone
- Louisville Limestone and Waldron Shale, undivided
    - 80 percent limestone, 10 percent dolomite, and 10 percent shale
- New Albany, Chattanooga, and Ohio Shales, Boyle Dolomite (Limestone), and Sellersburg Limestone, undivided
    - 85 percent carbonaceous shale, 10 percent dolomite, and 5 percent limestone
- Laurel Dolomite, Osgood Formation, and Brassfield Dolomite, undivided
    - 10 percent shale and 90 percent dolomite (some cherty)
- Drakes Formation
    - 80 percent dolomite (some of it silty),10 percent limestone, and 10 percent shale
- Ashlock Formation, Grant Lake and Calloway Creek Limestones, and Fairview Formation, undivided
    - 85 percent limestone (much of it nodular), 10 percent shale, and <5 percent siltstone

2.2 Sinkhole Development Potential

Louisville Limestone and Waldron Shale, undivided, and Ashlock Formation, Grant Lake and Calloway Creek Limestones, and Fairview Formation, undivided, are both considered to be geologies with high potential for sinkhole development. Laurel Dolomite, Osgood Formation, and Brassfield Dolomite, undivided, and Drakes Formation are both considered to be geologies with moderate potential for sinkhole development. The remaining geologies present along the pipeline are expected to have limited to no sinkhole development potential.

The area of moderate and high potential for sinkhole development is shown on the attached **Figure 3** with the location of the proposed pipeline. Known and potential sinkholes are also shown on **Figure 4** along with a potential lineament location.

3 Sinkhole Mitigation

3.1 Existing Sinkholes

As noted herein, existing sinkholes have been identified along the pipeline alignment during previous assessment efforts by Cardno. The locations of the known sinkholes are shown on **Figure 4**.

Photographs taken in September 2017 by Cardno of five of the known sinkholes are found in Appendix A. The soil cover appears to be relatively thin, and appeared to be less than 5 feet thick at all locations. Weathered limestone that is often characteristic of a sinkhole's throat is near the surface and is visible in two of the sinkholes. The sinkholes appeared to be relatively small in size, with the largest sinkhole being less than 20 feet in diameter.

Further assessment of all known sinkholes is recommended, as discussed below.

3.2 Action Plan

Based on review of the geologic data and available aerial photography, additional sinkholes are expected to be encountered along the alignment. Where sinkholes are encountered within 15-ft of the centerline of the proposed pipe, Cardno/OMI recommends repairing the sinkhole with an inverted rock filter as shown in **Figure 5** and discussed further herein.

Sinkholes encountered more than 15-ft from the pipeline but within the right-of-way may also be repaired in this manner depending on the Owner's risk aversion. Our team believes these sinkholes to be low risk to the pipeline as long as construction can proceed without being impacted by the location of the sinkhole.

All sinkholes encountered during construction should be inspected by a qualified geotechnical engineer so that detailed repair recommendations can be provided.

3.3 Repair Plan

The standard of practice is to repair sinkholes impacting proposed construction using an inverted rock filter as illustrated in **Figure 5**. This method has been presented in geotechnical engineering publications (Sowers, 1996) and is referenced by the Kentucky Geological Survey as the preferred method in Kentucky.

Inverted rock filters are constructed by excavating the loose soil from the sinkhole to bedrock. Once the throat of the sinkhole is exposed, a layer of rock with a particle diameter at least 25 percent larger than the throat should be placed in the excavation. Then the bottom and sides of the excavation should be covered with a geotextile separation fabric. Successively smaller rock should be placed in layers until ASTM No. 2 stone can be used to fill the remaining excavation. The ASTM No. 2 stone should then be capped with six inches of dense graded base stone and six inches of compacted soil to achieve the proposed pipeline excavation elevation.

Other methods may be considered on an individual sinkhole basis. These methods include constructing reinforced concrete mats over the sinkhole or placing a concrete plug in the sinkhole. These are much less desirable techniques and may require special permission or may not be allowed by some governing authorities.

4 Summary

The following points summarize the work performed and presented herein:

Several sinkholes were noted within the alignment during the course of Cardno's previous pipeline area review. In addition, the pipeline lies within an area of karst geology, which can be conducive to sinkhole formation.

Louisville Limestone and Waldron Shale, undivided, and Ashlock Formation, Grant Lake and Calloway Creek Limestones, and Fairview Formation, undivided, are both considered to be geologies with high potential for sinkhole development. Laurel Dolomite, Osgood Formation, and Brassfield Dolomite, undivided, and Drakes Formation are both considered to be geologies with moderate potential for sinkhole development. The remaining geologies present along the pipeline are expected to have limited to no sinkhole development potential.

The area of moderate and high potential for sinkhole development is shown on the attached **Figure 3** with the location of the proposed pipeline. These areas appear to underlie the approximate eastern 2/3rd of the pipeline alignment. The western 1/3 of the alignment is indicated to be underlain by formations with relatively low potential for sinkhole development.

At the observed sinkholes, the soil cover appears to be relatively thin, and appeared to be less than 5 feet thick. Weathered limestone that is often characteristic of a sinkhole's throat is near the surface and visible in two of the sinkholes. The sinkholes appeared to be relatively small in size, with the largest sinkhole being less than 20 feet in diameter.

Where sinkholes are encountered within 15-ft of the centerline of the proposed pipe, our team recommends repairing the sinkhole with an inverted rock filter.

Sinkholes encountered more than 15-ft from the pipeline but within the right-of-way may also be repaired in this manner depending on the Owner's risk aversion. We believe these sinkholes to be low risk to the pipeline as long as construction can proceed without being impacted by the location of the sinkhole.

All sinkholes encountered during construction should be inspected by a qualified geotechnical engineer so that detailed repair recommendations can be provided.

The inverted rock filter is the recommended methodology for repairing sinkholes. Other methods may be considered on an individual sinkhole basis. These methods include constructing reinforced concrete mats over the sinkhole or placing a concrete plug in the sinkhole. These are much less desirable techniques and may require special permission or may not be allowed by some governing authorities.

5 References

Kentucky Geological Survey. *Karst Occurrence in Kentucky*. Map. Series XII. Lexington, KY: University of Kentucky. 2001.

Landsat, and Copernicus. *Google Maps*. Google. 2018. http://www.google.com/maps/@37.9589769,-85.6061214,12200m/data=!3m1!1e3.

Sowers, George F. *Building on Sinkholes: Design and Construction of Foundations in Karst Terrain*. ASCE Press, 1996.

United States Geological Survey. *Geologic Map of Kentucky*. Map. Reston, VA: United States Department of Interior. 1988.

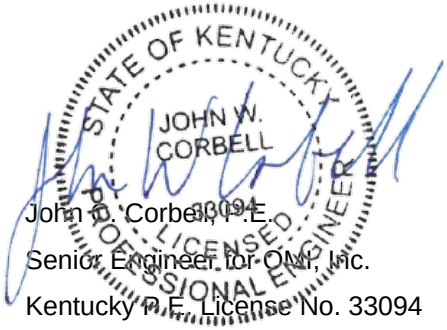
United States Geological Survey. *Samuels Quadrangle*. Map. 7.5- minute series. Reston, VA: United States Department of Interior. 2016.

United States Geological Survey. *Shepherdsville Quadrangle*. Map. 7.5- minute series. Reston, VA: United States Department of Interior. 2016.

6 Signatures

Cardno appreciates the opportunity to provide these services to LG&E. Please direct any questions regarding this report to the undersigned.

Jeremy C. Jess, P.E.
Senior Engineer for OMI, Inc.

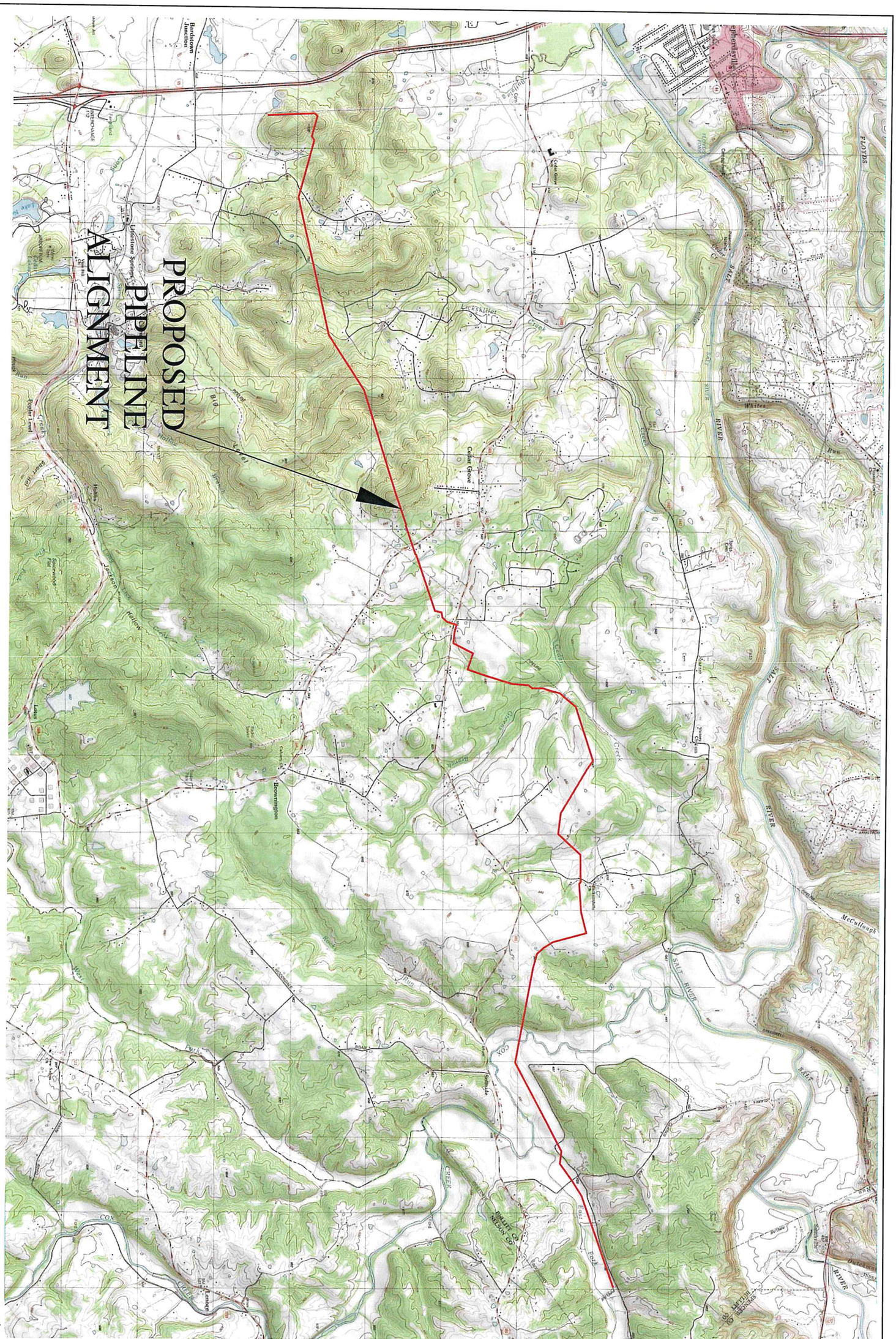


John W. Corbell, P.E.
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Kentucky P.E. License No. 33094

Greg Quartucci
Senior Consultant for Cardno, Inc.

LG&E Bullitt County Transmission
Pipeline Project

FIGURES



JOB NAME: BULLITT COUNTY PIPELINE SHEPHERDSVILLE, KENTUCKY	**OMI, Inc.** 5151 Research Dr. NW Huntsville, AL 35805 Ph: (256) 837-7664 Fax: (256) 837-7677	SITE LOCATION MAP	JOB NO.: 8404 DATE: 11-27-2018 SCALE: 1" = 4000' DRAWN BY: DAH FIGURE - 1

LEGEND

- HIGH POTENTIAL FOR SINKHOLE DEVELOPMENT
- MODERATE POTENTIAL FOR SINKHOLE DEVELOPMENT
- LOW POTENTIAL FOR SINKHOLE DEVELOPMENT

Shepherdsville

River

BULLITT

Rolling

65

APPROXIMATE LOCATION OF SINKHOLE (PER CARDNO)

APPROXIMATE LOCATION OF SINKHOLE (PER CARDNO)

PROPOSED PIPELINE ALIGNMENT

NELSON

Bardstown

Blu

MAP FROM KENTUCKY GEOLGICAL SURVEY - KARST OCCURRENCE IN KENTUCKY

JOB NO.: 8404
DATE: 11-27-2018
SCALE: 1" = 10000'
DRAWN BY: DAH
FIGURE - 2

SINKHOLE POTENTIAL LOCATION MAP

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JOB NAME:

BULLITT COUNTY PIPELINE
SHEPHERDSVILLE, KENTUCKY

GOLOGIC MAP OF KENTUCKY, SESQUICENTENNIAL EDITION OF THE KENTUCKY GEOLOGICAL SURVEY

GEOLOGY MAP

JOB NO.: 8404
DATE: 11-27-2018
SCALE: 1" = 10000'
DRAWN BY: DAH
FIGURE - 3

OMI, Inc.
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Huntsville, AL 35805
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JOB NAME:

BULLITT COUNTY PIPELINE
SHEPHERDSVILLE, KENTUCKY

APPROXIMATE LOCATION OF SINKHOLE (PER CARDNO)

APPROXIMATE LOCATION OF SINKHOLE (PER CARDNO)

APPROXIMATE LOCATION OF SINKHOLE (PER CARDNO)

PROPOSED PIPELINE ALIGNMENT

N

LEGEND

- POSSIBLE SINKHOLE LOCATIONS
- APPROXIMATE SINKHOLE LOCATION
- POSSIBLE LINEAMENT
- PIPELINE

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS U

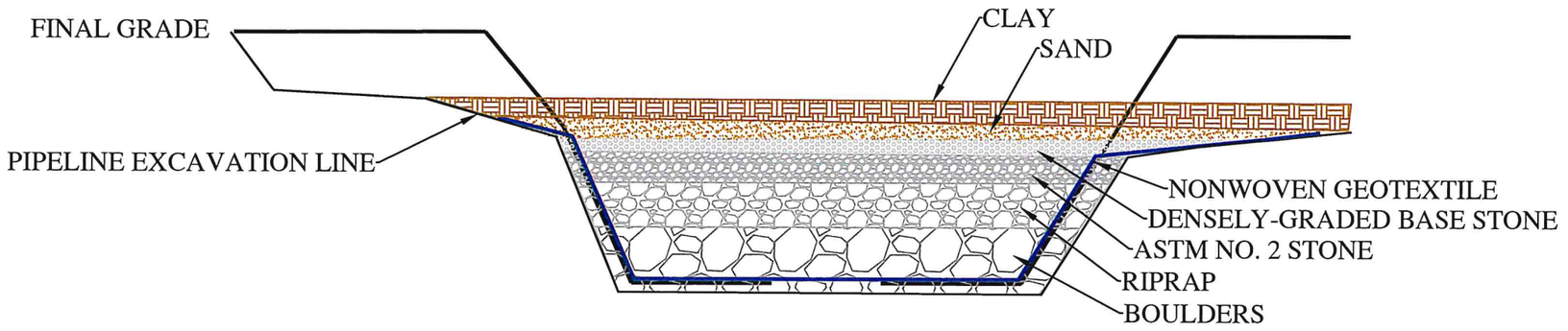
JOB NO.: 8404
DATE: 11-27-2018
SCALE: 1" = 4000'
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FIGURE - 4

POTENTIAL SINKHOLES

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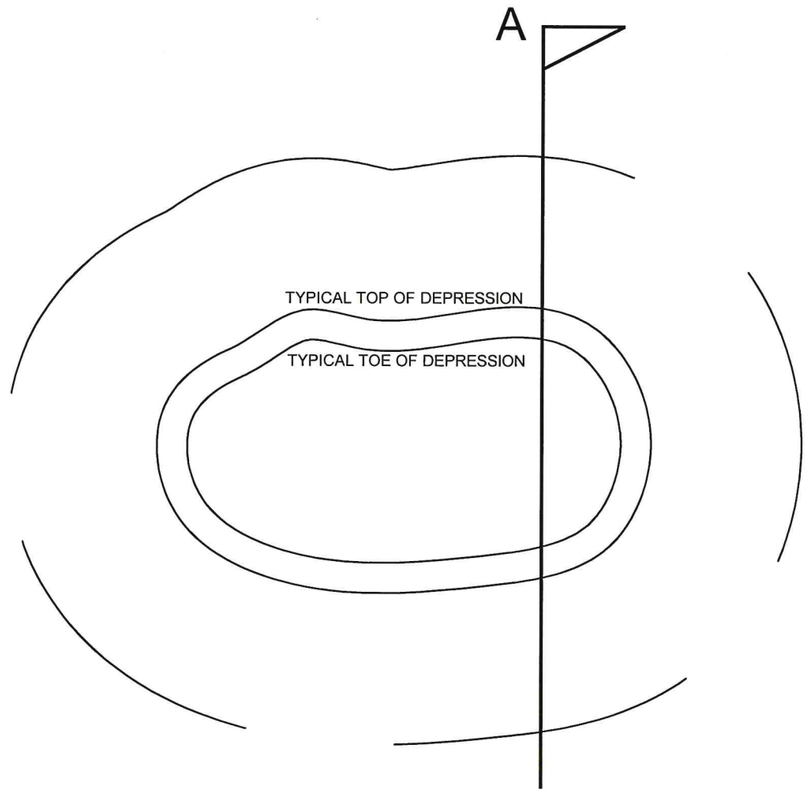
JOB NAME:

BULLITT COUNTY PIPELINE
SHEPHERDSVILLE, KENTUCKY



TYPICAL SECTION A

NOTE: DEPTH OF EACH MATERIAL TO BE DETERMINED
BY ENGINEER IN FIELD AFTER EXCAVATION.



NOTE: DIAGRAM IS NOT TO SCALE, REPRESENTATIVE ONLY

JOB NO.: 8404
DATE: 11-27-2018
SCALE: NTS
DRAWN BY: DAH
FIGURE - 5

TYPICAL SINKHOLE REPAIR

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SHEPHERDSVILLE, KENTUCKY

LG&E Bullitt County Transmission
Pipeline Project

APPENDIX A

SITE PHOTOGRAPHS



Photo 1: Sinkhole Example 1



Photo 2: Sinkhole Example 2



Photo 3: Sinkhole Example 3



Photo 4: Sinkhole Example 4

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Site Photographs
Bullitt County Gas Transmission Pipeline Project
Sinkhole Survey
EN Engineering, LLC
Bullitt County, Kentucky

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About Cardno

Cardno is an ASX-200 professional infrastructure and environmental services company, with expertise in the development and improvement of physical and social infrastructure for communities around the world. Cardno's team includes leading professionals who plan, design, manage, and deliver sustainable projects and community programs. Cardno is an international company listed on the Australian Securities Exchange [ASX:CDD].

Cardno Zero Harm

Cardno ZERO HARM EVERY JOB. EVERY DAY.

At Cardno, our primary concern is to develop and maintain safe and healthy conditions for anyone involved at our project worksites. We require full compliance with our Health and Safety Policy Manual and established work procedures and expect the same protocol from our subcontractors. We are committed to achieving our Zero Harm goal by continually improving our safety systems, education, and vigilance at the workplace and in the field. Safety is a Cardno core value and through strong leadership and active employee participation, we seek to implement and reinforce these leading actions on every job, every day.

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