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Impact of Seasonal Tree-Cutting Restrictions on Construction Bids

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Impact of Seasonal Tree-Cutting Restrictions on Construction Bids

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**Abstract**
Many of the maintenance and construction projects undertaken by the Kentucky Transportation Cabinet (KYTC) span late spring to early fall (April–October), with this period’s long days, abundant sunshine, and relatively dry conditions being ideal for performing work and minimizing delays from inclement weather. But this compressed timeline for accomplishing work introduces other challenges. Specifically, many of KYTC’s maintenance and construction activities can potentially impact summer habitat of the Indiana bat, which is listed as an endangered species. Removing trees classified as Indiana bat habitat is allowed, however, to do so the Cabinet is required to pay a mitigation fee. The Cabinet frequently mitigates for the loss of bat habitat by paying a mitigation fee into the Imperiled Bat Conservation Fund (IBCF), which since its inception in 2006 has received over $20 million in contributions. Mitigation is not a straightforward activity, however, with the Cabinet navigating six periods of tree-cutting restrictions and a variable mitigation fee schedule. To understand the effects of tree-cutting restrictions on construction bids, Kentucky Transportation Center researchers spoke with several contractors throughout Kentucky to approximate the surcharges they impose based on project award date and period of tree-cutting restrictions. Equipped with this information, researchers established a method that KYTC staff can use to estimate mitigation fees and contractor surcharges under a variety of scenarios. While the scenarios discussed are relatively uncomplicated, the step-by-step method presented can be applied irrespective of the level of complexity associated with a project. Cabinet personnel, using this method, will be able to quickly compare the financial implications of different combinations of tree-cutting restrictions and mitigation fee rates.
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Executive Summary

Most of the Kentucky Transportation Cabinet’s (KYTC) maintenance and construction projects occur from late spring to early fall (April–October), as the long days, sunshine, and relatively dry conditions minimize delays attributable to inclement weather. Attempting to do a great deal of work in this compressed timeline, however, presents challenges. Specifically, many of the Cabinet’s maintenance and construction activities can impact summer habitat of the Indiana bat, which is listed as an endangered species. Removing trees classified as Indiana bat habitat is permissible, however, KYTC must pay a mitigation fee to do so. Mitigation fees vary based on the type of habitat impacted and when the tree removal occurs. The Cabinet also must navigate tree-cutting restrictions during the summer months, when Indiana bats occupy summer or swarming habitats. These restrictions can prove challenging for contractors and KYTC. Contractors may add a surcharge to delay tree removal until after restrictions have been lifted — this increases costs for KYTC and may be consequential for individual projects and programmatic activities. While it is recognized that seasonal tree-cutting restrictions impact maintenance and construction operations, to date there have been no studies of their impacts on the bids of construction contractors.

Before discussing how tree-cutting impact construction bids, the report summarizes information on Indiana bat habitat as well as the species’ winter and summer ranges. It also briefly reviews the Endangered Species Act; conservation and permitting; a programmatic conservation memorandum of agreement entered into by the United States Fish and Wildlife Service (Kentucky Field Office), Federal Highway Administration, and by extension the Cabinet, which is intended to streamline or eliminate the consultation process that has traditionally been required on a project-by-project basis; and mitigation fees paid to the Imperiled Bat Conservation Fund when KYTC maintenance or construction projects impinge upon or harm Indiana bat habitat.

Discussions with several contractors throughout Kentucky revealed that tree-cutting restrictions can affect the entire schedule of a project. Where large-scale excavations are necessary, tree removal can be the controlling item. All the contractors interviewed with had encountered delays on projects where tree cutting restrictions were in place. Delays are problematic because they drive up costs and negatively impact contractors and the travelling public. The project award date and period of tree-cutting restrictions dictate the surcharges levied by contractors — these range from 0 percent of the base cost of tree removal up to 30 percent. Contractors agreed that late summer or early fall is the optimal letting period for projects where tree-cutting restrictions come into play. Using information collected during contractor interviews and an analysis of mitigation fee schedules, a method is proposed that KYTC staff can use to estimate mitigation fees and contractor surcharges based on tree-cutting restriction periods, and the effects of overtime or multiple crew mobilizations to quickly effect tree removal. While the scenarios discussed are relatively straightforward, the step-by-step method can be applied irrespective of the level of complexity associated with a project. Cabinet personnel using this method can quickly gauge the financial implications of different combinations of tree-cutting restrictions and mitigation fee rates.
1. Introduction and Background

A vibrant network of well-maintained roads is critical for propelling and maintaining economic growth in Kentucky. The Kentucky Transportation Cabinet (KYTC) is responsible for maintaining the state’s roadways and constructing new roads to improve traffic flow and opening new transportation options to its residents. Many of the maintenance and construction projects the Cabinet undertakes occur from late spring to early fall (April–October), as the long days, abundant sunshine, and relatively dry conditions are ideal for performing work without suffering unexpected delays due to inclement weather. But this compressed timeline for accomplishing work introduces other challenges. Specifically, many of KYTC’s maintenance and construction activities can potentially impact summer habitat of the Indiana bat\(^1\), which is listed as an endangered species. Removing trees classified as Indiana bat habitat is allowed, however, in doing so the Cabinet is required to pay a mitigation fee. This fee varies based on type of habitat affected and the time of year tree cutting occurs. As such, KYTC often imposes tree-cutting restrictions during the summer months, when Indiana bats occupy summer or swarming habitats. These restrictions can prove challenging for contractors and the Cabinet. Contractors may add a surcharge to remove trees after restrictions have been lifted; this drives up costs for KYTC and may have consequences for individual projects and programmatic activities. While it is recognized that seasonal tree-cutting restrictions impact maintenance and construction operations, to date there have been no studies of their impacts on the bids of construction contractors.

To understand the nature of these impacts and determine best practices, KYTC asked researchers at the Kentucky Transportation Center (KTC) to study the problem. This brief report summarizes the Center’s key findings. The rest of this chapter discusses the habitat of Indiana bats and its current status under the Endangered Species Act, provides an overview of conservation and permitting options sanctioned by the U.S. Fish and Wildlife Service, and reviews a collaborative memorandum of agreement that has been established among the Federal Highway Administration (FHWA), KYTC, and the Kentucky Field Office of the U.S. Fish and Wildlife Service. This document focuses primarily on consultation occurring with the US Fish and Wildlife Service regarding endangered species under Section 7 of the Endangered Species Act. Section 7 consultation is required as a result of federal involvement, either through funding of projects (FHWA) or the necessity for federal permits (e.g., US Army Corps of Engineers, US Coast Guard) Chapter 2 delves into the impact of tree-cutting restrictions on contractors. To grasp how restrictions influence contractor bids, KTC researchers spoke with contractors throughout the state. Based on the feedback they provided and an analysis of conservation options, researchers developed a methodology KYTC Project Managers can use to determine costs and make project decisions under different tree-cutting restrictions scenarios. Chapter 3 presents this methodology and works through several examples to demonstrate its application.

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\(^1\) This project received funding and was begun prior to the Northern Long-Eared Bat being listed as threatened under the Endangered Species Act. Although this report does not address the life history, habitat requirements, and seasonal range of the Northern Long-Eared Bat, its primary findings related to the impact of tree-cutting restrictions on the Indiana Bat should be generally applicable to it as well.
Overview of Indiana Bats — Habitat and Range
The Indiana bat (Myotis sodalis) is an insectivorous, migratory bat, the center of whose habitat range is near Kentucky. The bats average two inches in length and have a wingspan of 9–11 inches. Their fur is brown or dark brown, while their facial areas are often characterized by a pinkish hue. During the winter, they hibernate in caves or abandoned mines, where temperatures generally remain below 50°F but above the freezing point, and relative humidity is greater than 74 percent but below saturation. They have shown a preference for caves located in karst areas of the east-central United States. The bats’ hibernacula exhibit a wide range of vertical structuration, but typically are large spaces with extensive passage ways. Caves, because of their volume and structural complexity, protect bats against rapid fluctuations in outside temperatures. Male and female bats show markedly different behavioral patterns. During the spring, females can migrate up to several hundred miles before they reach their summer range, whereas males generally remain near the hibernacula or migrate very short distances (Loeb and Winters, 2013). Male bats roost individually or with a small number of other bats, although it is uncommon for them to roost with females. During the summer months, the bats most often prefer the confines of forested and wooded habitats, although they can also occupy some non-forested areas, such as emergent wetlands, the edges of agricultural fields, riparian zones, and old fields and pastures. Reproductive females tend to locate their roost sites under the bark of dead trees that have peeling bark and receive direct sunlight for more than half the day. The exposure to sunlight enables passive warming, which is particularly valuable during pregnancy and lactation. Therefore, most roosts are nestled into canopy gaps or along fence lines and wooded edges. Female roosts have also been found in live trees (optimal tree size is 16 inches in diameter at breast height), riparian settings, bottomland and floodplain habitats, wood wetland, and upland communities. Because they feed on aquatic and terrestrial insect, bats are often attracted to semi-open forested habitats, forest edges, and riparian areas to pursue foraging. It is also critical for Indiana bats to have a reliable source of drinking water.

Figure 1 is a map of Kentucky, produced by the United States Fish and Wildlife Service (USFWS) that indicates known Indiana bat habitat. Some explanation of key terms is needed to understand the map and the conservation plans discussed below. Hibernacula are classified based on priority, which is related to how important a specific location is for protecting the species. Originally, the classification Priority 1 was reserved for hibernacula sites with populations ≥ 30,000 Indiana bats. This definition was revised in 2005 (USFWS, 2016). The protection of Priority 1 hibernacula is critical for the recovery and long-term conservation of Indiana bats. These hibernacula have two distinguishing features: 1) a current and/or historically observed winter population ≥ 10,000 bats, and 2) possess suitable and stable microclimates. Priority 1 is divided into two subcategories, A and B, which are defined based on population trends. Priority 1A hibernacula include locations that have housed at least 5,000 Indiana bats during one or more winter surveys conducted during the past 10 years. Conversely, Priority 1B hibernacula have contained ≥ 10,000 bats at some point in their history, but have consistently housed < 5,000 bats over the past 10 years. Priority 2 hibernacula contribute to the recovery and long-term conservation of Indiana bats and are defined as having a current or observed historic population of ≥ 1,000 but less than 10,000 and a microclimate that supports hibernation. The USFWS has identified five Priority 1 and 16 Priority 2 hibernacula in Kentucky (over 100 caves throughout the state have, historically, sheltered Indiana bats, and 96 caves are currently home to winter
populations) (USFWS, 2016). Three of the Priority 1 hibernacula are in the Mammoth Cave System while the other two are situated in the Eastern Coalfields.

Figure 1 Location of Indiana Bat Habitat in Kentucky

Places classified as *summer habitat* can be used by any Indiana bat during the summer months irrespective of reproductive status. Specifically, *Summer 1 habitat* refers to known Indiana bat maternity habitat, while *Summer 2 habitat* encompasses areas of non-maternity summer habitat. Maternity colonies have been identified throughout Kentucky, and are generally located near extensive patches of forest and large streams. Broadly, *swarming habitat* is defined as areas that are suitable for roosting, foraging, or traveling within a specified distance of known hibernaculum. Swarming habitat is characterized by “large numbers of bats [flying] in and out of cave entrances from dusk to day, while relatively few roost in caves during the day” (Cope and Humphrey, 1977). *Swarming 1 habitat* refer to Priority 1 and Priority 2 swarming habitats, while *Swarming 2 habitat* encompasses Priority 3 and Priority 4 swarming habitats. Since Indiana bats are considered to be present statewide, removal of habitat at any time of year, anywhere within the Commonwealth, is considered to represent a potential adverse effect to the species. Before any habitat is removed for a federally funded project or project requiring a federal approval, Section 7 ESA consultation with the USFWS Kentucky Field Office is required.

Interest in the habitat and conservation of Indiana bats has increased nationwide since the mid-2000s. Although Indiana bats have been listed as an endangered species since the 1960s (see below), significant population declines have occurred over the last decade because of white-nose syndrome. Outbreaks of this disease, impacts of which are not exclusive to Indiana bats, initially
occurred in the northeastern United States, however, they have quickly spread westward and southward into the central portion of the country. White-nose syndrome is caused by a white fungus (*Pseudogymnoascus destructans*) found in caves that infects skin on the muzzle, ears, and wings of hibernating bats. Estimates have placed total mortality at approximately six million bats (USFWS, 2016). Since the emergence of white-nose syndrome, Indiana bats across their entire range have suffered from annual population declines of 10 percent and many local populations have suffered extinction (Pauli et al., 2015). The first documented instances of white-nose syndrome in Kentucky occurred in Trigg County in 2011. By April 2016, the disease had been confirmed present in 94 hibernacula in 24 counties in the state (USFWS, 2016). Officials at USFWS believe white-nose syndrome occurs throughout Kentucky and expect it will spread to more sites in the coming years. Mortality from white-nose syndrome is most often attributable to afflicted bats emerging from hibernation more frequently or for longer periods than is usual, which can prematurely deplete the fat reserves they rely on to make it through the winter months. Direct mortality can also be the direct product of wings being infected with fungus (Foley et al., 2011)

One strategy of counteracting population declines attributable to white-nose syndrome is to protect and manage summer habitats, making it imperative to understand the fine-grained ecological characteristics of roosting habitat. Recent studies have clarified the roosting habits of Indiana bats. For example, Carter and Feldhammer (2005) in an Illinois-based study of locations previously impacted by flooding, concluded that Indiana bats generally roost on the edge of forests where there is minimal vegetation obstruction or clutter, and almost exclusively under the exfoliating bark of bottomland snags. Based on data collected in central and southern Indiana, Pauli et al. (2015) did a comprehensive modeling study to determine the landscape-level predictors of roost occupancy for Indiana bats and northern long-eared bats. For Indiana bats, their models predicted that roosting females are most likely to inhabit areas with the following characteristics — 1) high density of local forest cover (> 80 percent) but lower proportion of forest cover (< 40 percent) within 0.62 mile (1 km) of a site; 2) within 0.62 mile (1 km) of a perennial stream, and 3) poor foraging habitat. With respect to the latter, somewhat counterintuitive finding, the researchers offered two potential explanations: one, that residents of Indiana bat maternity colonies could be central-place foragers, meaning that roost selection is privileged over the selection of foraging habitat; or two, their model did not accurately capture the behavioral tendencies of the bats. Although a great deal is known about the current range and habitats of Indiana bats, emerging evidence suggests that changes in the climate of the eastern third of the United States could impact their distribution and habitat selection (Loeb and Winters, 2013). Loeb and Winters (2013) modeled the range of Indiana bat maternity colonies under a variety of climate change scenarios. Using 1971–1999 as a climatic baseline, they found that 27 percent of the eastern United States are suitable for Indiana bat maternity colonies. However, over the next 50 years this area is likely to decline and populations are anticipated to concentrate in the northeastern United States and along the Appalachian Mountains. The most significant changes in habitat availability will be on the western portion of the range, which includes Missouri, Iowa, Kentucky, Indiana, and Ohio. Higher average maximum temperatures (above 82º F) would likely be the main drivers of changes in distributions, with bats seeking refugia characterized by cooler temperatures. As Loeb and Winters cautioned, their study omitted land use and land cover changes, which also affect habitat selection. There is also a significant degree of uncertainty associated with species distribution modeling. Nonetheless, shifts in the range of
Indiana bats over the long-term could potentially introduce issues related to tree-cutting restrictions as some portions of Kentucky become less suitable for maternal colonies, and populations flock to more hospitable environments.

**The Endangered Species Act and Status of the Indiana Bat**

The Endangered Species Act (ESA) became law in 1973. Preceded by two previous laws having roughly the same purpose — the Endangered Species Preservation Act of 1966 and the Endangered Species Act of 1969 — its aim is to protect endangered and threatened species and the ecosystems they rely upon\(^2\). The Department of the Interior and Department of Commerce are responsible for administering the law. Under the ESA, species may be designated as either threatened or endangered. *Threatened species* are those “which [are] likely to become an endangered species within the foreseeable future throughout all or a significant portion of [their] range,” while *endangered species* are those that are “in danger of extinction throughout all or a significant portion of [their] range.” Section 7 of the ESA requires federal agencies to consult with USFWS regarding potential project impacts to endangered species. If an agency’s activity will result in the *take* of a threatened species, it must consult with USFWS and seek a Biological Opinion that the action will not threaten the extinction of the species. To *take* is “to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect or attempt to engage in any such conduct.” *Harm* means to engage in an act that “actually kills or injures wildlife. Such an act may include significant habitat modification or degradation where it actually kills or injures wildlife by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering.” The ESA authorizes two types of permits if an activity will result in the *take* of a protected species: 1) permits for scientific research that will “enhance the propagation or survival of the affected species,” and 2) exemption for taking species “if such taking is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity” (i.e., Incidental Take Permits). In this context, *incidental* means the take is *not* the purpose of the sanctioned activity. In 1967, the Indiana bat was listed as endangered pursuant to the Endangered Species Preservation Act of 1966, and its status has remained unchanged since. To comply with the ESA, entities such as KYTC must obtain USFWS authorization before undertaking construction-related activities (e.g., tree cutting) that may harm Indiana bats (or other endangered species).

**Conservation and Permitting**

Under Section 7 of the ESA, the Kentucky Field Office (KFO) of the USFWS is responsible for review of federal actions in the state that may potentially negatively impact Indiana bats, other listed forest-dwelling bats, and their habitat. In 2016, the office updated its conservation strategy, citing two goals: 1) to provide guidance to project proponents whose actions have the potential to adversely affect forest-dwelling bats, and 2) outline appropriate mitigation strategies for adverse effects to forest-dwelling bats and their habitats (USFWS, 2016, p. 10). Under the conservation strategy, project proponents have several options for complying with the ESA. These are summarized in Table 1. The second strategy excluded from the Table is formal consultation, which is only available to federal action agencies and partners (which the Cabinet is not).

<table>
<thead>
<tr>
<th>Table 1 ESA Compliance Options for Indiana Bats</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Option</strong></td>
</tr>
</tbody>
</table>

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\(^2\) The Endangered Species Act of 1973 has been amended several times, most recently in 2003.
### Avoidance

- If possible, project proponents should avoid impacts to bat habitat. If avoidance is not possible, proponents must select another option.

### Surveys

- The presence or absence of Indiana bats can be demonstrated following the surveying guidelines put out by the USFWS.
- For federal projects, if a survey does not indicate the presence of bats, project proponents can coordinate survey results with the USFWS and seek concurrence with a not likely to adversely affect determination.
- If a survey results in the capture of bats, project proponents must perform additional work and coordinate with the USFWS to ensure compliance, which may require the issuance of a Biological Opinion by the USFWS.

### Conservation Memorandum of Agreement

- Provides a streamlined option for federal and non-federal project proponents to comply with the ESA.
- Process is supported by a programmatic intra-USFWS biological opinion, which offers non-jeopardy determinations and exempts incidental take of Indiana bats.
- Provides a number of benefits to project proponents and KFO.

### FHWA Rangewide Programmatic Consultation

- Allows KYTC to clear trees from October 15-March 31 without having to pay a CMOA.
- All trees must be within 100 feet of existing pavement and project must be at least 0.5 miles away from any known hibernacula and/or 0.25 miles away from any known roost tree.
- Only Federally funded projects are eligible.

The conservation strategy adopted by KFO is more holistic than previous efforts and focuses on conservation and recovery in both winter and summer habitat. The strategy includes the following recovery actions (along with those outlined in the Recovery Plan):

- Conserve and manage hibernacula and their winter populations
- Lease or purchase privately owned Priority 1 and Priority 2 habitat to reduce threats
- Conserve and manage areas near hibernacula
- Lease or purchase privately owned Priority 1 and Priority 2 habitat that lack adequate buffers
- Restore and create hibernacula
- Conserve and manage summer habitat to maximize survival and fecundity
- Monitor and manage known maternity colonies
- Minimize adverse impacts on Indiana bats and their habitat during compliance reviews (with ESA, the National Environmental Policy Act, Fish and Wildlife Coordination Act, and Section 404 of the Clean Water Act)

As Table 1 notes, project proponents should first attempt to avoid impacting known Indiana bat habitat. If this is not possible, they must first minimize damages and then compensate for any remaining damages (pursuant to the mitigation sequence approved by the USFWS\(^3\)). There are several compensatory mitigation strategies available. The first is to protect known and previously unprotected Indiana bat habitat with demonstrated significance to the species. This may take the form of acquiring (through purchase or some other mechanism) one or more parcels, or securing perpetual conservation easements and associated land management agreements for one or more parcels, with the goal of achieving the aims of KFO’s conservation strategy in those locations. Another option is to contribute to the Imperiled Bat Conservation Fund (see below). On a case-by-case basis, KFO may evaluate and approve other mitigation activities that will tangibly benefit the conservation of forest-dwelling bats.

Along with the recovery actions outlined above, KFO also describes Tier 1 and Tier 2 mitigation goals (Table 2). Tier 1 goals are prioritized over Tier 2 goals.

**Table 2 Mitigation Goals for Forest-Dwelling Bats in Kentucky**

<table>
<thead>
<tr>
<th>Tier</th>
<th>Goals</th>
</tr>
</thead>
</table>
| **Tier 1** | - Protect and manage priority hibernacula  
- Protect and manage existing forest habitat  
- Protect and manage conservation lands for forest-dwelling bats  
  o Emphasize habitat contiguous with or within the boundaries of existing public and private conservation land  
- Restore and/or enhance winter habitat in degraded caves and mines |
| **Tier 2** | - Protect and manage lower priority hibernacula  
- Protect and manage conservation lands that have potential habitat  
- Fund priority research and monitoring in support of the strategies listed in Table 1 |

\(^3\) The mitigation sequence is avoid–minimize–compensate.
KFO has identified several Recovery and Mitigation Focus Areas (RMFA) for forest-dwelling bats in Kentucky. These areas: 1) contain public or protected lands known to support forest-dwelling bat populations; 2) currently support bat populations and will likely support their long-term recovery; 3) contain adequate habitat to support recovery efforts; 4) accommodate the future growth of colonies; and 5) have environmental conditions that support the persistence of bat populations and their habitat now and in the future (USFWS, 2016). KFO has determined these are areas in which most compensatory mitigation efforts focused on forest-dwelling bats will be pursued. However, KFO has stated that in some cases it will sanction mitigation efforts outside of the RMFAs. Whether a non-RMFA site is appropriate depends on its location, the type and quality of conservation opportunities available, and new information that justifies conservation actions. The following locations are approved RMFAs in the state of Kentucky: Tygarts Creek — Carter Caves; Daniel Boone National Forest; Pine Mountain; Mammoth Cave National Park; Big Rivers (encompasses Christian, Livingston, Lyon, Marshall and Trigg Counties); Lower Ohio River; and Mississippi River.

**Conservation Memorandum of Agreement Among FHWA, USFWS and KYTC**

In 2012, KFO entered into a programmatic conservation memorandum of agreement (PCMOA) with FHWA and, by extension KYTC, that streamlines or eliminates the consultation process that has traditionally been required on a project-by-project basis. The goal of the agreement is to reduce costs and promote the recovery and conservation of Indiana bats and their habitats. In some cases, it may eliminate the need for presence/absence surveys, however, it does not remove them entirely. More specifically, the stated purpose of the PCMOA is to “[provide] recovery based conservation benefits for the Indiana bat in the form of habitat protection and/or voluntary contributions to the IBCF which in turn will fund habitat protection, conservation, restoration, and/or priority monitoring and research projects for the Indiana bat.” The foundation of the PCMOA is a 2012 USFWS intra-service Biological Opinion that addresses the loss of summer roosting habitat as a result of highway projects throughout the state of Kentucky. The processes for evaluating habitat and determining project effects remain in effect today. The 2016 USFWS Conservation Strategy, and supporting Biological Opinion, superseded the 2012 Programmatic Biological Opinion issued specifically to KYTC for Indiana bat and expanded the use of the new Imperiled Bat Conservation Fund (formerly the Indiana Bat Conservation Fund) to also mitigate for impacts to the newly listed northern long-eared bat. Despite the 2012 Programmatic Biological Opinion being supplanted by the new Conservation Strategy, KYTC continues to use the reporting process for take outlined in it. Use of the IBCF by KYTC is now governed under this updated Biological Opinion.
The PCMOA adopts a two-tiered programmatic process (Figure 2 illustrates Tier 1; Figure 3 depicts Tier 2). The Tier 1 process is used to determine — using the KYTC Habitat Assessment Manual (HAM) — whether Indiana bat summer and/or wintering habitat is present near a project and, if so, whether the project is likely to adversely affect listed bats. Determining effects can be accomplished by either surveying for the presence/absence of a species or by assuming presence and mitigating for the loss of habitat by contributing to the IBCF. The IBCF may not be used if a project affects more than 100 acres of forested habitat. In these cases, project effects are addressed through a project-specific Biological Opinion.
The Imperiled Bat Conservation Fund
The means most frequently used by KYTC to provide compensatory mitigation for bat habitat loss is through a contribution to the Imperiled Bat Conservation Fund (IBCF). Since its inception in 2006, the IBCF has received over $20 million in contributions and helped forge agreements to protect over 15,000 acres. Funds received by the program are administered for USFWS by the Kentucky Natural Lands Trust (KNLT). Proponents of projects, such as the KYTC, finance the IBCF by making voluntary contributions if they are “permanently or semi-permanently [removing] forested habitat in Kentucky” (KNLT, 2016). KFO’s 2015 report on its conservation memorandum of agreement, which applies to the state of Kentucky as well as portions of adjacent states within 20 miles of the Kentucky border, authorizes payments to the IBCF as an acceptable form of mitigation. Initially, the fund sought to provide recovery-focused conservation specifically for the Indiana bat. However, its ambit has gradually expanded, and it now participates in landscape-scale efforts that will benefit all forest-dwelling bats, including Indiana bat and the northern long-eared bat, which was listed as a threatened species in 2015. Currently the fund’s goals are to continue acquiring and protecting forested bat habitats, managing and improving those habitats, and conducting focused research and monitoring of these areas (see KNLT, 2016 for a full description of project selection criteria).
### Figure 4 Methods for Calculating IBCF Contributions

#### Imperiled Bat Conservation Fund Calculation

**APPENDIX B: Mitigation Multipliers by Habitat Type and Season**

<table>
<thead>
<tr>
<th></th>
<th>Nov 15 - Mar 31 (all habitats unoccupied)</th>
<th>April 1 - Aug 15 (swarming unoccupied*)</th>
<th>Jun 1 - July 31** (non-volant period; swarming unoccupied; potential, summer occupied)</th>
<th>Aug 16 - Oct 14 (swarming &amp; potential occupied; summer unoccupied)</th>
<th>Oct 15 - Nov 14 (swarming occupied; potential, summer unoccupied)</th>
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</thead>
<tbody>
<tr>
<td>Summer 1 + Swarming 1</td>
<td>2.5</td>
<td>3.0 (4.0)*</td>
<td>4.0</td>
<td>3.5</td>
<td>3.5</td>
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<tr>
<td>Summer 1 + Swarming 2</td>
<td>2.0</td>
<td>2.5 (3.5)*</td>
<td>3.5</td>
<td>3.0</td>
<td>3.0</td>
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<tr>
<td>Summer 2 + Swarming 1</td>
<td>2.0</td>
<td>2.5 (3.5)*</td>
<td>3.5</td>
<td>3.0</td>
<td>3.0</td>
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<tr>
<td>Summer 2 + Swarming 2</td>
<td>1.5</td>
<td>2.0 (3.0)*</td>
<td>3.0</td>
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<td>2.5</td>
</tr>
<tr>
<td>Swarming 1</td>
<td>1.5</td>
<td>2.0 (3.0)*</td>
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<td>2.5</td>
</tr>
<tr>
<td>Swarming 2</td>
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<td>1.5 (2.5)*</td>
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<td>2.0</td>
<td>2.0</td>
</tr>
<tr>
<td>Summer 1</td>
<td>1.5</td>
<td>2.0</td>
<td>3.0</td>
<td>1.5</td>
<td>1.5</td>
</tr>
<tr>
<td>Summer 2</td>
<td>1.0</td>
<td>1.5</td>
<td>2.5</td>
<td>1.0</td>
<td>1.0</td>
</tr>
<tr>
<td>Potential</td>
<td>0.5</td>
<td>1.0</td>
<td>2.0</td>
<td>1.0</td>
<td>0.5</td>
</tr>
</tbody>
</table>

*Spring emergence occurs close to the hibernacula entrances in the early spring with females emerging in early to mid-April and males emerging in late April – early May. Swarming habitat within 1 mile of P1 and P2 hibernacula entrances and within ½ mile of P3 and P4 hibernacula entrances will be considered occupied between April 1 and May 14. Projects within these areas require project-specific evaluation by the Service and may require additional mitigation; please see page 19 for more information.

**Projects impacting known or potential Summer 1 habitat and that occur June 1 – July 31 require project-specific evaluation by the Service, please see page 19 for more information. A limited amount of impact under the CMEM process is available for impacts during the November season, however additional mitigation is required to compensate for the increased severity of the impacts. June – July impacts per project may not exceed 20 acres.**
As noted, the terms of the KFO Conservation Strategy specifies that mitigation fees can be paid to compensate for habitat damages and losses. Figure 4 summarizes the IBCF’s fee schedule. Fees are contingent on project location, time of year when habitat will be removed, type of habitat affected, and the project’s overall impact (acres removed). Currently, the per acre base price is $3,420, which is adjusted annually based upon the average value of farm real estate as published by the U.S. Department of Agriculture in the Land Values and Cash Rents document. The required contribution is calculated by multiplying the number of acres impacted by average land cost and a mitigation multiplier. The highest rate multipliers are for known maternity and swarming habitats; the lowest rate multipliers for known non-maternity and potential habitat. Multipliers are highest during the summer and early fall, when swarming and maternity habitat are occupied, and lowest in the winter, when bats occupy hibernacula.
2. Contractor Perspectives on Tree Cutting Restrictions

KTC researchers visited with three contractors in December 2016 to understand the impacts of tree cutting restrictions on road projects and their effects on contractor practices. To ensure geographical representativeness, contractors were selected throughout Kentucky — one in the western part of the state, one in the eastern part, and one in the Bluegrass region. The ensuing discussion preserves their anonymity. During each discussion, KTC researchers posed a series of five questions that focused on contractors’ experience with tree cutting restrictions, mitigation fees, scheduling methods, and waste areas. While organized around these issues, the interviews followed a semi-structured format, and the contractors were free to elaborate on a variety of issues where they saw fit. This chapter summarizes the findings of these interviews and includes a matrix table that can facilitate the determination of mitigation obligations under different letting scenarios. Appendix 1 provides a list of interview questions.

Findings and Contractor Recommendations

Contractors incur costs in several areas when a project requires tree cutting. Indeed, restrictions affect a project’s entire schedule, and where large-scale excavations are needed, removing trees can be the controlling item. This can be especially problematic on projects that involve the use of multiple phasing. Mobilizing work crews so they can remove trees is a key expense. On large or more complex projects, many contractors must pay workers overtime to ensure trees are removed in a timely manner to avoid disrupting the flow of project activities. A general rule of thumb is that one crew can clear one acre per day. If there is a right-of-way fence present contractors are forced to remove trees by hand (as opposed to with an excavator). Removing trees by hand adds cost and increases to the time required to finish tree removal. Another scenario where contractors frequently remove trees by hand is when projects are in locations with high traffic. Projects in heavily trafficked areas can suffer detrimental scheduling impacts due to vehicle volumes, and being unable to close lanes increases the likelihood that trees will need to be cut by hand. All the contractors that researchers spoke with had encountered delays on projects where tree cutting restrictions were in place. Delays are problematic because they increase costs and negatively impact contractors and the travelling public. Another issue related to cost is the erosion problems that result when trees are removed during the winter months to cope with restrictions. On jobs where there are no tree cutting restrictions, contractors typically remove trees on an as-needed basis. One contractor mentioned that having to take out trees during non-clearing periods is challenging because work crews are not as productive, and significant erosion issues often result from removing all trees in a single pass. Excavating all the trees in an area at a project’s outset exposes large quantities of sediment to the effects of flowing water, which necessitates the installation of erosion control devices. Maintaining these devices is costly; thus, if all trees are removed at the beginning of the project, erosion control devices will remain in place for a longer period. Installing and maintaining erosion control averages $500 per acre per season.

All contractors spoke about the importance of letting the job at the correct time. The three firms agreed that late summer or early fall is the optimal letting period for projects where tree cutting restrictions come into play. Letting these projects in the winter months (e.g., January or February) drives up expenses — the premium to remove trees can be upwards of 30 percent. When project awards are delayed, contractors are forced to absorb the additional costs of clearing trees. One contractor remarked that on one delayed project they had to spend 20 percent
more on tree removal. If a project is delayed, one contractor felt the best course of action is to let the project and include a note about the delay in the letting and adjust the completion date accordingly.

Contractors brought up two other topics of concern: waste areas and the challenges utilities present. All the contractors recommended having KYTC identify project waste areas, although, it is also critical that they have the flexibility to select alternative waste areas if necessary. The presence of utilities (e.g., overhead lines) hampers contractors’ abilities to excavate trees. One contractor discussed a project where KYTC’s local district office established an agreement with utility companies, which facilitated tree removal. Contractors agreed on the importance of forging agreements with utility companies that permit tree cutting before utility relocations are complete.

Contractors offered recommendations for improving the letting process, awarding projects, and dealing with tree cutting restrictions. The suggestions presented here were put forward by contractors — and their inclusion does not constitute an endorsement by KTC researchers. One contractor favored the idea of extending the letting time to five weeks because it would afford them the opportunity to perform more in-depth research before submitting a bid, potentially resulting in cost savings. Another contractor said they would benefit from the Cabinet providing cross sections and the Excel file used on projects. Receiving grade quantities that are +/- 10 percent lead to better costing and more effective identification of waste areas. The use of A+B contracts did not strike the interviewees as particularly viable given that most contractors do not understand what they entail, because they are not required to have biologists or environmental specialists on staff to bid on projects. Contractors said they would benefit from having more notes in the plan that explain the full extent of tree-cutting restrictions and issues related to nearby bat habitat. Similarly, more notes that apply to available phasing options would provide clarification on tree-cutting restrictions and permitting. On projects for which there is a utility note, contractors supported establishing procedures that enable contractors to remove trees without invalidating other aspects of the contract. Contractors also proposed alternative contractual arrangements to improve the efficiency of tree removal. Under one arrangement, the Cabinet could retain two contractors, one responsible for clearing trees and utilities while another contractor would perform construction work. A second proposal suggested using a partial contract that would afford contractors the opportunity to enter project sites and clear out trees. Under the final contractual arrangement, a mitigation fee would be established in the bid. Then, if tree excavation occurs during a restricted period, KYTC would pay the mitigation fee and remove that amount from the contract; conversely, if clearing occurred during an unrestricted period, the contractor would receive the fee amount. The final recommendation pertains to waste areas. Contractors stated their preference for KYTC designating waste areas while giving them the option to select a more optimal solution if one presents itself.
3. Estimating Cost Impacts on Construction Bids Due to Tree Cutting Restrictions

KTC researchers spoke with several contractors about the additional costs that are incurred when tree-cutting restrictions are included in the bid item for Clearing and Grubbing. Most contractors use one crew for clearing and grubbing activities. On average, a crew can clear one acre per day. It costs between $1,000 and $5,000 per day for one crew, depending on terrain and accessibility. Table 3 provides geographically specific estimates for the cost of clearing one acre. Contractors try to maintain one clearing crew per job and pace the work to keep clearing ahead of the current construction work. Scheduling work in this manner lets the clearing crew work continually throughout the grading portion of a construction project. Tree-cutting restrictions negatively impact contractor workflows. They not only impact work on the project at hand, but can influence work schedules on other projects. Thus, restrictions on a single project can have more far-reaching programmatic consequences.

### Table 3 Tree Clearing Estimates by Region

<table>
<thead>
<tr>
<th>Region</th>
<th>Terrain</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Western Kentucky</td>
<td>Mostly Flat, Easy Accessibility</td>
<td>$1,500–$2,500 per acre</td>
</tr>
<tr>
<td>Central Kentucky</td>
<td>Moderate Terrain and Accessibility</td>
<td>$2,500–$3,500 per acre</td>
</tr>
<tr>
<td>Eastern Kentucky</td>
<td>Steep Terrain, Difficult Accessibility</td>
<td>$4,000–$5,000 per acre</td>
</tr>
</tbody>
</table>

Tree-cutting restrictions have two critical negative impacts on construction projects. They:

- Delay the start of work in areas impacted by restrictions; and
- Reduce the amount of time available to clear trees, which requires the contractor to employ additional crews and/or utilize overtime.

Estimating delay costs is challenging. The typical response to this situation is extending the completion date, or delaying the start date for Working Days projects. If there are measurable user costs, this impact could be compared to mitigation costs. However, it is difficult, and probably inappropriate, to assign a dollar value to a safety issue. Because many projects attempt to address and resolve known safety issues, if a project is drawn out over a longer period it may expose motorists to additional risk.

It is possible to estimate the additional cost of reducing clearing times. Contractors have several options for employing additional crews and/or using overtime to meet deadlines:

- Utilize overtime with existing crews
  - This typically results in a 15% cost increase. This does not include the potential of multiple mobilizations and the possibility the contractor still does not have adequate workforce to meet the deadlines. Each additional crew that is mobilized increases the cost between 3-5%.
- Hire additional crews
This typically results in a 18-20% cost increase due to additional overhead costs. The most likely outcome is that employees on additional crews will be laid off once the job is finished.

- **Subcontract the tree clearing work**
  - This typically results in cost increase of 15% and is the least desirable option for a contractor. This results in a potential loss of work for the existing workforce and increased overhead.

To develop a method for estimating additional costs associated with tree-cutting restrictions, the yearly calendar was first divided based on KYTC’s three seasonal award dates and their associated letting dates:

- **March 1**
  - Projects typically let in November, December, January, and February
- **July 1**
  - Projects typically let in March, April, May, and June
- **November 1**
  - Project typically let in July, August, September, and October

The USFWS has specified six periods of restriction for tree cutting, depending on the type of habitat being affected (e.g., maternity, swarming). What restricted period is selected is influenced by the willingness to pay higher mitigation fees during times when impacts would be increased, for the project benefit of providing greater scheduling flexibility for the contractor:

- April 1–October 14
- April 1–November 14
- April 1–August 15
- June 1–July 31
- June 1–July 31 and August 16–October 14
- August 16–November 14

Contractor surcharges are influenced by two factors: 1) the project award date, and 2) any restrictions imposed by the Cabinet. Table 4 lists contractor surcharges according to award date and restriction period. For example, if a project award occurs on March 1 and KYTC has imposed the April 1–November 14 restriction period, the contractor will add a 30% surcharge for clearing and grubbing activities. Readers should note that estimated surcharges in Table 4 are based only on additional costs incurred directly from tree-cutting restrictions. Often, contractors must contend with other project-specific factors (e.g., deadlines imposed by school openings, work restrictions, other project work) that could increase the surcharge above the estimates listed. Accordingly, when estimating the cost of imposing tree-cutting restrictions, estimators must account for project-specific contingencies that influence price.
### Table 4 Contractor Surcharge Rates by Award Date and Restriction Period

<table>
<thead>
<tr>
<th>Award Date</th>
<th>Restriction Period</th>
<th>Contractor Surcharge</th>
</tr>
</thead>
<tbody>
<tr>
<td>March 1</td>
<td>April 1–October 14</td>
<td>25%</td>
</tr>
<tr>
<td>Projects Typically Let In:</td>
<td>April 1–November 14</td>
<td>30%</td>
</tr>
<tr>
<td>Nov-Dec-Jan-Feb</td>
<td>April 1–August 15</td>
<td>20%</td>
</tr>
<tr>
<td></td>
<td>June 1–July 31</td>
<td>10%</td>
</tr>
<tr>
<td></td>
<td>June 1–July 31 &amp; August 16–October 14</td>
<td>15%</td>
</tr>
<tr>
<td></td>
<td>August 16–November 14</td>
<td>10%</td>
</tr>
<tr>
<td>July 1</td>
<td>April 1–October 14</td>
<td>10%</td>
</tr>
<tr>
<td>Projects Typically Let In:</td>
<td>April 1–November 14</td>
<td>10%</td>
</tr>
<tr>
<td>Mar-Apr-May-Jun</td>
<td>April 1–August 15</td>
<td>0%</td>
</tr>
<tr>
<td></td>
<td>June 1–July 31</td>
<td>0%</td>
</tr>
<tr>
<td></td>
<td>June 1–July 31 &amp; August 16–October 14</td>
<td>10%</td>
</tr>
<tr>
<td></td>
<td>August 16–November 14</td>
<td>10%</td>
</tr>
<tr>
<td>November 1</td>
<td>April 1–October 14</td>
<td>10%</td>
</tr>
<tr>
<td>Projects Typically Let In:</td>
<td>April 1–November 14</td>
<td>10%</td>
</tr>
<tr>
<td>Jul-Aug-Sep-Oct</td>
<td>April 1–August 15</td>
<td>5%</td>
</tr>
<tr>
<td></td>
<td>June 1–July 31</td>
<td>0%</td>
</tr>
<tr>
<td></td>
<td>June 1–July 31 &amp; August 16–October 14</td>
<td>0%</td>
</tr>
<tr>
<td></td>
<td>August 16–November 14</td>
<td>0%</td>
</tr>
</tbody>
</table>

Estimating tree removal costs on a project is a straightforward process. It can be divided into six steps:

1. Determine how many acres will be impacted by tree-cutting restrictions
2. Estimate the base cost for clearing and grubbing. This does not account for either restrictions or mitigation fees.
3. Calculate mitigation fees based on when clearing and grubbing will occur (see Figure 4)
4. Determine the contractor surcharge that results from restrictions.
5. (If applicable). Estimate the price of mobilizing multiple crews/using overtime work to perform clearing and grubbing operations.
6. Compare estimated costs among different tree-cutting scenarios to select the most economical option.

The following three examples illustrate this methodology. It is imperative to observe that all the examples assume that tree cutting will take place only during the specified windows. For actual projects, once personnel have calculated how much clearing and grubbing costs under different scenarios and decide on a course of action, the KYTC will benefit from preparing special notes which instruct contractors on when they are to remove trees. If contractors do not adhere to the specified dates, it renders the Cabinet’s financial estimates meaningless and could have broader project-level implications.
Example 1 — March 1 Award Date

A road construction project in Central Kentucky is awarded on March 1. The project site includes 15 acres that must be cleared of trees. All 15 acres have been designated Summer 1 + Swarming 2 habitat. The USDA-published average land cost per acre is $3,420. Estimate the cost of clearing and grubbing under Scenarios 1–4 to determine the most cost-effective option:

1. Tree-cutting restrictions are in place from July 1 through July 31. Tree cutting begins immediately and concludes by March 31.
2. Tree-cutting restrictions are in place from April 1 through August 15. Tree cutting begins on or after August 16 and concludes by October 14.
3. Tree-cutting restrictions are in place from April 1 through October 14. Tree cutting begins on or after October 15 and concludes by November 14.
4. Tree-cutting restrictions are in place from April 1 through November 14. Tree cutting begins on or after November 15 and concludes by March 31.
**Scenario 1**

Tree-cutting restrictions are in place from July 1 through July 31. Tree cutting begins immediately and concludes by March 31.

1. Estimate the base cost.

The cost of clearing land in Central Kentucky ranges from $2,500 to $3,500 per acre. For this scenario, we assume a cost of $3,000 per acre (this will vary according to project context).

- The base cost is: $3,000 x 15 = **$45,000**

2. Estimate mitigation fees by applying the correct mitigation multiplier.

Using the Imperiled Bat Conservation Fund Calculation table illustrated in Figure 4, locate the appropriate habitat type (Summer 1 + Swarming 2). Select the correct multiplier. Because tree cutting will occur entirely within the November 15–March 31 window, the correct multiplier is 2.0. The mitigation fee formula is: (Number of Acres) x (Median Land Price) x (IBCF Multiplier).

- The mitigation fee is: 15 x $3,420 x 2.0 = **$102,600**

3. Based on the award date and the period of restriction clearing and grubbing will occur in, use rates in Table 4 to factor in additional contractor fees for clearing and grubbing.

- The surcharge is: $45,000 x 10% = **$4,500**

4. Estimate total cost.

Total cost is the sum of the numbers calculated in Steps 1–3:

- $45,000 + $102,600 + $4,500 = **$152,100**
Scenario 2

Tree-cutting restrictions are in place from April 1 through August 15. Tree cutting begins on or after August 16 and concludes by October 14.

1. Estimate the base cost.

The cost of clearing land in Central Kentucky ranges from $2,500 to $3,500 per acre. For this scenario, we assume a cost of $3,000 per acre (this will vary according to project context).

- The base cost is: $3,000 x 15 = **$45,000**

2. Estimate mitigation fees by applying the correct mitigation multiplier.

Using the Imperiled Bat Conservation Fund Calculation table illustrated in Figure 4, locate the appropriate habitat type (Summer 1 + Swarming 2). Select the multiplier. Because tree cutting will occur entirely within the August 16–October 14 window, the correct multiplier is 3.0. The mitigation fee formula is: (Number of Acres) x (Median Land Price) x (IBCF Multiplier).

- The mitigation fee is: 15 x $3,420 x 3.0 = **$153,900**

3. Based on the award date and the period of restriction clearing and grubbing will occur in, use rates in Table 4 to factor in additional contractor fees for clearing and grubbing.

- The surcharge is: $45,000 x 20% = **$9,000**

4. Estimate total cost.

The total cost is the sum of the numbers calculated in Steps 1–3:

- $45,000 + $153,900 + $9,000 = **$207,900**
Scenario 3

Tree-cutting restrictions are in place from April 1 through October 14. Tree cutting begins on or after October 15 and concludes by November 14.

1. Estimate the base cost.

The cost of clearing land in Central Kentucky ranges from $2,500 to $3,500 per acre. For this scenario, we assume a cost of $3,000 per acre (this will vary according to project context).

   - The base cost is: $3,000 x 15 = $45,000

2. Estimate mitigation fees by applying the correct mitigation multiplier.

Using the Imperiled Bat Conservation Fund Calculation table illustrated in Figure 4, locate the appropriate habitat type (Summer 1 + Swarming 2). Select the multiplier. Because tree cutting will occur entirely within the October 15–November 14 window, the correct multiplier is 3.0. The mitigation fee formula is: (Number of Acres) x (Median Land Price) x (IBCF Multiplier).

   - The mitigation fee is: 15 x $3,420 x 3.0 = $153,900

3. Based on the award date and the period of restriction clearing and grubbing will occur in, use rates in Table 4 to factor in additional contractor fees for clearing and grubbing.

   - The surcharge is: $45,000 x 25% = $11,250

4. Estimate total cost.

Total cost is the sum of the numbers calculated in Steps 1–3:

   - $45,000 + $153,900 + $11,250 = $210,150
Scenario 4

*Tree-cutting restrictions are in place from April 1 through November 14. Tree cutting begins on or after November 15 and concludes by March 31.*

1. Estimate the base cost.

The cost of clearing land in Central Kentucky ranges from $2,500 to $3,500 per acre. For this scenario, we assume a cost of $3,000 per acre (this will vary according to project context).

- The base cost is: $3,000 x 15 = $45,000

2. Estimate mitigation fees by applying the correct mitigation multiplier.

Using the Imperiled Bat Conservation Fund Calculation table illustrated in Figure 4, locate the appropriate habitat type (Summer 1 + Swarming 2 habitat). Select the multiplier. Because tree cutting will occur entirely within the November 15–March 31 window, the correct multiplier is 2.0. The mitigation fee formula is: (Number of Acres) x (Median Land Price) x (IBCF Multiplier).

- The mitigation fee is: 15 x $3,420 x 2.0 = $102,600

3. Based on the award date and the period of restriction clearing and grubbing will occur in, use rates in Table 4 to factor in additional contractor fees for clearing and grubbing.

- The surcharge is: $45,000 x 30% = $13,500

4. Estimate total cost.

Total cost is the sum of the numbers calculated in Steps 1–3:

- $45,000 + $102,600 + $13,500 = $161,100
Table 5 summarizes the costs for each scenario in this example:

### Table 5 Price Comparisons for Example 1 Tree-Cutting Restrictions

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Restriction Period</th>
<th>Base Cost</th>
<th>Mitigation Fee</th>
<th>Contractor Surcharge</th>
<th>Total Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>June 1–Jul 31</td>
<td>$45,000</td>
<td>$102,600</td>
<td>$4,500</td>
<td>$152,100</td>
</tr>
<tr>
<td>2</td>
<td>April 1–August 15</td>
<td>$45,000</td>
<td>$153,900</td>
<td>$9,000</td>
<td>$207,900</td>
</tr>
<tr>
<td>3</td>
<td>April 1–October 14</td>
<td>$45,000</td>
<td>$153,900</td>
<td>$11,250</td>
<td>$210,150</td>
</tr>
<tr>
<td>4</td>
<td>April 1–November 14</td>
<td>$45,000</td>
<td>$102,600</td>
<td>$13,500</td>
<td>$161,100</td>
</tr>
</tbody>
</table>

Looking only at cost, Scenario 1 is the least expensive option, coming in at $9,000 less than Scenario 4. While on the surface the total cost for Scenarios 1 and 4 are similar, with Scenario 4 tree removal would not commence until November, a full eight months after it is scheduled for completion in Scenario 1. The price difference is attributable to the higher contractor surcharge that results from delaying tree-cutting activities. Scenarios 2 and 3 are priced comparably; both are much costlier than Scenarios 1 and 4. However, project-specific or programmatic contingences — which are not captured in the data presented above — may influence decisions about tree-cutting operations.
Example 2 — July 1 Award Date
A road construction project in Eastern Kentucky is awarded on July 1. The project site includes 15 acres that must be cleared of trees. All 15 acres have been designated Summer 1 + Swarming 1 habitat. The median land cost in the project area is $3,420 per acre. Estimate the cost of clearing and grubbing under the following scenarios to determine the most cost-effective option:

1. Tree-cutting restrictions are in place from June 1 through July 31. Tree cutting begins on or after August 1 and concludes by August 14. All tree cutting occurs between August 1 and August 15, with the contactor using additional crews.
2. Tree-cutting restrictions are in place from June 1 through July 31 and August 16 through October 14. Tree cutting begins on or after October 15 and concludes by November 14.
3. Tree-cutting restrictions are in place from April 1 through October 14. Tree cutting begins on or after October 15 and concludes by November 14.
Scenario 1

Tree-cutting restrictions are in place from June 1 through July 31. Tree cutting begins on or after August 1 and concludes by August 14. All tree cutting occurs between August 1 and August 15, with the contractor using additional crews.

1. Estimate the base cost.

The cost of clearing land in Eastern Kentucky ranges from $4,000 to $5,000 per acre. For this scenario, we assume a cost of $4,500 per acre (this will vary according to project context).

- The base cost is: $4,500 x 15 = $67,500

2. Estimate mitigation fees by applying the correct mitigation multiplier.

Using the Imperiled Bat Conservation Fund Calculation table illustrated in Figure 4, locate the appropriate habitat type (Summer 1 + Swarming 1 habitat). Select the multiplier. Because tree cutting will occur entirely within the April 1–August 14 window, the correct multiplier is 3.0. The mitigation fee formula is: (Number of Acres) x (Median Land Price) x (IBCF Multiplier).

- The mitigation fee is: 15 x $3,420 x 3.0 = $153,900

3. Based on the award date and the period of restriction clearing and grubbing will occur in, use rates in Table 4 to factor in additional contractor fees for clearing and grubbing.

- While there is no surcharge related to tree-cutting restrictions, there is an 18% surcharge for the use of additional crews.
- There is an 18% surcharge for the use of additional crews: $67,500 x 18% = $12,150

4. Estimate total cost.

Total cost is the sum of the numbers calculated in Steps 1–3:

- $67,500 + $153,900 + $12,150 = $233,550
Scenario 2

Tree-cutting restrictions are in place from June 1 through July 31 and August 16 through October 14. Tree cutting begins on or after October 15 and concludes by November 14.

1. Estimate the base cost.

The cost of clearing land in Central Kentucky ranges from $4,000 to $5,000 per acre. For this scenario, we assume a cost of $4,500 per acre (this will vary according to project context).

- The base cost is: $4,500 \times 15 = \$67,500

2. Estimate mitigation fees by applying the correct mitigation multiplier.

Using the Imperiled Bat Conservation Fund Calculation table illustrated in Figure 4, locate the appropriate habitat type (Summer 1 + Swarming 1). Select the multiplier. Because tree cutting will occur entirely within the October 15–November 14 window, the correct multiplier is 3.5. The mitigation fee formula is: (Number of Acres) \times (Median Land Price) \times (IBCF Multiplier).

- The mitigation fee is: 15 \times $3,420 \times 3.5 = \$179,550

3. Based on the award date and the period of restriction clearing and grubbing will occur in, use rates in Table 4 to factor in additional contractor fees for clearing and grubbing.

- The surcharge is: $67,500 \times 10\% = \$6,750

4. Estimate total cost.

Total cost is the sum of the numbers calculated in Steps 1–3:

- $67,500 + $179,550 + $6,750 = \$253,800
Scenario 4

Tree-cutting restrictions are in place from April 1 through October 14. Tree cutting begins on or after October 15 and concludes by November 14.

1. Estimate the base cost.

The cost of clearing land in Central Kentucky ranges from $4,000 to $5,000 per acre. For this scenario, we assume a cost of $4,500 per acre (this will vary according to project context).

- The base cost is: $4,500 x 10 = $67,500

2. Estimate mitigation fees by applying the correct mitigation multiplier.

Using the Imperiled Bat Conservation Fund Calculation table illustrated in Figure 4, locate the appropriate habitat type (Summer 1 + Swarming 1). Select the multiplier. Because tree cutting will occur entirely within the October 15–November 14 window, the correct multiplier is 3.5. The mitigation fee formula is: (Number of Acres) x (Median Land Price) x (IBCF Multiplier).

- The mitigation fee is: 15 x $3,420 x 3.5 = $179,550

3. Based on the award date and the period of restriction clearing and grubbing will occur in, use rates in Table 4 to factor in additional contractor fees for clearing and grubbing.

- The surcharge is: $67,500 x 10% = $6,750

4. Estimate total cost.

Total cost is the sum of the numbers calculated in Steps 1–3:

- $67,500 + $179,550 + $6,750 = $253,800
Table 6 summarizes the costs for each scenario in the foregoing example:

**Table 6 Price Comparisons for Example 2 Tree-Cutting Restrictions**

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Restriction Period</th>
<th>Base Cost</th>
<th>Mitigation Fee</th>
<th>Contractor Surcharge</th>
<th>Total Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>June 1 – July 31</td>
<td>$67,500</td>
<td>$153,900</td>
<td>$12,150</td>
<td>$233,550</td>
</tr>
<tr>
<td>2</td>
<td>June 1 – July 31 &amp; August 16 – October 14</td>
<td>$67,500</td>
<td>$179,550</td>
<td>$6,750</td>
<td>$253,800</td>
</tr>
<tr>
<td>3</td>
<td>April 1 – October 14</td>
<td>$67,500</td>
<td>$179,550</td>
<td>$6,750</td>
<td>$253,800</td>
</tr>
</tbody>
</table>

Accounting for cost alone, Scenario 1 is approximately $20,000 less expensive than Scenarios 2 and 3 even with the surcharge incurred for using additional crews. The reasons for this is the slightly lower mitigation multiplier which is in effect during the August 1–August 15 window (3.0). It is critical to point out that Scenario 2 is relatively straightforward in assuming that all tree cutting occurs after October 14. Some contractors could elect to complete a portion of tree removal during the August 1–August 15 window. If this occurs, a slightly more complex calculation ensues given the disparate mitigation multipliers in effect for August 1–August 15 (3.0) and October 15–November 14 (3.5). While Scenario 1 is the most cost-efficient based on the calculations presented here, other project-specific or programmatic contingencies may influence decisions on when to carry out tree removal operations.
Example 3 — March 1 Award Date
A road construction project in Central Kentucky is awarded on March 1. The project site includes 40 acres that must be cleared of trees. All 40 acres have been designated Summer 1 + Swarming 1 habitat. The median land cost in the project area is $3,420 per acre. Estimate the cost of clearing and grubbing under the following scenarios to determine the most cost-effective option:

1. Tree-cutting restrictions are in place from April 1 through October 14. Tree cutting begins on or after October 15 and concludes by November 14.
2. Tree-cutting restrictions are in place from April 1 through November 14. Tree cutting begins on or after November 15 and concludes by March 31.
3. Tree-cutting restrictions are in place from April 1 through August 15. Tree cutting begins on or after August 16 and concludes by October 14.
4. Tree-cutting restrictions are in place from April 1 through August 15. Tree cutting begins on or after March 1 and concludes by March 31, with the contactor using additional crews.
5. Tree-cutting restrictions are in place from June 1 through July 31. All tree cutting occurs between August 1 and August 15, with the contactor using additional crews.
6. Tree-cutting restrictions are in place from August 16 through November 14. Tree cutting begins on or after August 15 and concludes by March 31.
Scenario 1

Tree-cutting restrictions are in place from April 1 through October 14. Tree cutting begins on or after October 15 and concludes by November 14.

1. Estimate the base cost.

The cost of clearing land in Central Kentucky ranges from $2,500 to $3,500 per acre. For this scenario, we assume a cost of $3,000 per acre (this will vary according to project context).

- The base cost is: $3,000 \times 40 = $120,000

2. Estimate mitigation fees by applying the correct mitigation multiplier.

Using the Imperiled Bat Conservation Fund Calculation table illustrated in Figure 4, locate the appropriate habitat type (Summer 1 + Swarming 1). Select the multiplier. Because tree cutting will occur entirely within the October 15–November 14 window, the correct multiplier is 3.5. The mitigation fee formula is: (Number of Acres) \times (Median Land Price) \times (IBCF Multiplier).

- The mitigation fee is: 40 \times $3,420 \times 3.5 = $478,800

3. Based on the award date and the period of restriction clearing and grubbing will occur in, use rates in Table 4 to factor in additional contractor fees for clearing and grubbing.

- The surcharge is: $120,000 \times 25\% = $30,000

1. Estimate total cost.

Total cost is the sum of the numbers calculated in Steps 1–3:

- $120,000 + $478,800 + $30,000 = $628,800
Scenario 2

Tree-cutting restrictions are in place from April 1 through November 14. Tree cutting begins on or after November 15 and concludes by March 31.

1. Estimate the base cost.

The cost of clearing land in Central Kentucky ranges from $2,500 to $3,500 per acre. For this scenario, we assume a cost of $3,000 per acre (this will vary according to project context).

- The base cost is: $3,000 x 40 = $120,000

2. Estimate mitigation fees by applying the correct mitigation multiplier.

Using the Imperiled Bat Conservation Fund Calculation table illustrated in Figure 4, locate the appropriate habitat type (Summer 1 + Swarming 1). Select the multiplier. Because tree cutting will occur entirely within the November 15–March 31 window, the correct multiplier is 2.5. The mitigation fee formula is: (Number of Acres) x (Median Land Price) x (IBCF Multiplier).

- The mitigation fee is: 40 x $3,420 x 2.5 = $342,000

3. Based on the award date and the period of restriction clearing and grubbing will occur in, use rates in Table 4 to factor in additional contractor fees for clearing and grubbing.

- The surcharge is: $120,000 x 30% = $36,000

4. Estimate total cost.

Total cost is the sum of the numbers calculated in Steps 1–3:

- $120,000 + $342,000 + $36,000 = $498,000
Scenario 3

Tree-cutting restrictions are in place from April 1 through August 15. Tree cutting begins on or after August 16 and concludes by October 14.

1. Estimate the base cost.

The cost of clearing land in Central Kentucky ranges from $2,500 to $3,500 per acre. For this scenario, we assume a cost of $3,000 per acre (this will vary according to project context).

- The base cost is: $3,000 x 40 = $120,000

2. Estimate mitigation fees by applying the correct mitigation multiplier.

Using the Imperiled Bat Conservation Fund Calculation table illustrated in Figure 4, locate the appropriate habitat type (Summer 1 + Swarming 1). Select the multiplier. Because tree cutting will occur entirely within the August 16–October 14 window, the correct multiplier is 3.5. The mitigation fee formula is: (Number of Acres) x (Median Land Price) x (IBCF Multiplier).

- The mitigation fee is: 40 x $3,420 x 3.5 = $478,800

3. Based on the award date and the period of restriction clearing and grubbing will occur in, use rates in Table 4 to factor in additional contractor fees for clearing and grubbing.

- The surcharge is: $120,000 x 20% = $24,000

4. Estimate total cost.

Total cost is the sum of the numbers calculated in Steps 1–3:

- $120,000 + $478,800 + $24,000 = $622,800
Scenario 4

Tree-cutting restrictions are in place from April 1 through August 15. Tree cutting begins on or after March 1 and concludes by March 31, with the contactor using additional crews.

1. Estimate the base cost.

The cost of clearing land in Central Kentucky ranges from $2,500 to $3,500 per acre. For this scenario, we assume a cost of $3,000 per acre (this will vary according to project context).

- The base cost is: $3,000 \times 40 = $120,000

2. Estimate mitigation fees by applying the correct mitigation multiplier.

Using the Imperiled Bat Conservation Fund Calculation table illustrated in Figure 4, locate the appropriate habitat type (Summer 1 + Swarming 1). Select the multiplier. Because tree cutting will occur entirely within the November 15–March 31, the correct multiplier is 2.5 The mitigation fee formula is: (Number of Acres) \times (Median Land Price) \times (IBCF Multiplier).

- The mitigation fee is: 40 \times $3,420 \times 2.5 = $342,000

3. Based on the award date and the period of restriction clearing and grubbing will occur in, use rates in Table 4 to factor in additional contractor fees for clearing and grubbing.

- While there is no surcharge related to tree-cutting restrictions, there is an 18% surcharge for the use of additional crews.
- There is an 18% surcharge for the use of additional crews: $120,000 \times 18\% = $21,600

4. Estimate total cost.

Total cost is the sum of the numbers calculated in Steps 1–3:

- $120,000 + $342,000 + $21,600 = $483,600
Scenario 5

Tree-cutting restrictions are in place from June 1 through July 31. All tree cutting occurs between August 1 and August 15, with the contractor using additional crews.

1. Estimate the base cost.

The cost of clearing land in Central Kentucky ranges from $2,500 to $3,500 per acre. For this scenario, we assume a cost of $3,000 per acre (this will vary according to project context).

- The base cost is: $3,000 x 40 = $120,000

2. Estimate mitigation fees by applying the correct mitigation multiplier.

Using the Imperiled Bat Conservation Fund Calculation table illustrated in Figure 4, locate the appropriate habitat type (Summer 1 + Swarming 1). Select the correct multiplier. Because tree cutting will occur during the April 1–August 15 window, the correct multiplier is 3.0. The mitigation fee formula is: (Number of Acres) x (Median Land Price) x (IBCF Multiplier).

- Mitigation fees for this scenario is: 40 x $3,420 x 3.0 = $410,000

3. Based on the award date and the period of restriction clearing and grubbing will occur in, use rates in Table 4 to factor in additional contractor fees for clearing and grubbing.

- The surcharge related to tree-cutting restrictions is: $120,000 x 10% = $12,000
- There is an 18% surcharge for the use of additional crews: $120,000 x 18% = $21,600
- The total surcharge is: $12,000 + $21,600 = $33,600

4. Estimate total cost.

Total cost is the sum of the numbers calculated in Steps 1–3:

- $120,000 + $410,400 + $33,600 = $564,000
Scenario 6

Tree-cutting restrictions are in place from August 16 through November 14. Tree cutting begins on or after November 15 and concludes by March 31.

1. Estimate the base cost.

The cost of clearing land in Central Kentucky ranges from $2,500 to $3,500 per acre. For this scenario, we assume a cost of $3,000 per acre (this will vary according to project context).

- The base cost is: $3,000 x 40 = $120,000

2. Estimate mitigation fees by applying the correct mitigation multiplier.

Using the Imperiled Bat Conservation Fund Calculation table illustrated in Figure 4, locate the appropriate habitat type (Summer 1 + Swarming 1). Select the multiplier. Because tree cutting will occur entirely within the November 15–March 31 window, the correct multiplier is 2.5. The mitigation fee formula is: (Number of Acres) x (Median Land Price) x (IBCF Multiplier).

- The mitigation fee is: 40 x $3,420 x 2.5 = $342,000

3. Based on the award date and the period of restriction clearing and grubbing will occur in, use rates in Table 4 to factor in additional contractor fees for clearing and grubbing.

- The surcharge is: $120,000 x 10% = $12,000

4. Estimate total cost.

Total cost is the sum of the numbers calculated in Steps 1–3:

- $120,000 + $342,000 + $12,000 = $474,000
Table 7 summarizes the costs for each scenario in the foregoing example:

**Table 7 Price Comparisons for Example 3 Tree-Cutting Restrictions**

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Restriction Period</th>
<th>Base Cost</th>
<th>Mitigation Fee</th>
<th>Contractor Surcharge</th>
<th>Total Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>April 1 – October 14</td>
<td>$120,000</td>
<td>$478,800</td>
<td>$30,000</td>
<td>$628,800</td>
</tr>
<tr>
<td>2</td>
<td>April 1 – November 14</td>
<td>$120,000</td>
<td>$342,000</td>
<td>$36,000</td>
<td>$498,000</td>
</tr>
<tr>
<td>3</td>
<td>April 1 – August 15</td>
<td>$120,000</td>
<td>$478,800</td>
<td>$24,000</td>
<td>$622,800</td>
</tr>
<tr>
<td>4</td>
<td>April 1 – November 14</td>
<td>$120,000</td>
<td>$342,000</td>
<td>$21,600</td>
<td>$483,600</td>
</tr>
<tr>
<td>5</td>
<td>June 1 – July 31</td>
<td>$120,000</td>
<td>$410,400</td>
<td>$33,600</td>
<td>$564,000</td>
</tr>
<tr>
<td>6</td>
<td>August 16 – November 14</td>
<td>$120,000</td>
<td>$342,000</td>
<td>$12,000</td>
<td>$474,000</td>
</tr>
</tbody>
</table>

While Scenario 6 is the least expensive option at $474,000, it also has the longest waiting period, with tree cutting not getting underway until eight months after the award date. Although Scenario 4 is slightly more expensive and requires the contractor to use supplemental crews to finish tree cutting in the March 1–March 31 window, it has the advantage of wrapping up tree cutting before higher mitigation multipliers go into effect as well as before the onset of peak construction season. Scenario 2 shares the same problems as Scenario 6 — it delays tree cutting until after the height of the construction season, making it unclear how much work could be accomplished on a project if tree clearance were not to occur. Scenarios 1, 3, and 5 carry significant price premiums, although they may be appropriate if there are project-specific circumstances that can be used to justify their selection. As with the other scenarios presented in this chapter, project managers will need to base their decisions about tree cutting on a holistic evaluation of contingencies and choose an option that best suits the needs of the Cabinet and satisfies the project demands.
4. Conclusions and Recommendations

Mitigation fees paid to compensate for habitat losses of forest-dwelling bats represents a significant cost to KYTC. To minimize compensatory mitigation fees, the Cabinet occasionally imposes tree-cutting restrictions on maintenance and construction projects, which limits tree removal to periods when the mitigation fees are lower. This report briefly reviewed issues related to conservation and permitting in areas designated as habitat of the endangered Indiana bat and presented contractor perspectives on tree-cutting restrictions and their impact on scheduling and completing project work. Tree-cutting restrictions may impact only one or two projects a contractor is working on, but the delays can have more programmatic consequences if contractors must rearrange their schedules to accommodate those restrictions. This can impact project workflows and, depending on the timing, prompt contractors to mobilize multiple crews and pay workers overtime to remove trees quickly. As Chapter 3 demonstrated, imposing tree-cutting restrictions leads to contractors charging an additional fee (on top of their base cost) when tree removal is limited to only certain parts of the year. The contractor surcharge varies as a function of project award date and the period of tree-cutting restrictions. Based on these considerations, KTC researchers developed and illustrated a straightforward methodology Cabinet program managers can use to estimate the cost of clearing and grubbing under different tree-cutting-restrictions scenarios. As noted in the write-ups of each example, the methodology only accounts for cost differences attributable to contractor surcharges and mitigation fees. Project-specific contingencies inevitably influence decision making, but the methodology provides a baseline KYTC project managers can work from to determine the best course of action.

Moving forward, KTC researchers suggest refining the methodology by working with the Cabinet to estimate costs associated with tree-cutting restrictions on specific projects. In addition to helping KYTC decide whether imposing tree-cutting restrictions is the most economically efficient option, assisting the Cabinet will give KTC researchers the opportunity to observe and document the influence of project context on decision making. Having a catalogue of project-specific contingencies KYTC project managers should account for before identifying a strategy will improve their analysis and ensure that no hidden factors are overlooked. At the Cabinet’s request KTC researchers can also assist with other aspects of estimating costs associated with tree-cutting restrictions, such as determining whether instituting tree-cutting restrictions will add costs in other areas, such as erosion control.
References


Appendix A — Contractor Interview Questions

1. Tell us about recent experience (last 5 years) you have on KYTC projects dealing with tree cutting restrictions?

2. When Tree Cutting Restrictions are included in a project that limit access to work areas this obviously increases your costs and therefore the project costs. How have you included these costs in past bids? (i.e. increase clearing and grubbing or excavation)?

3. Would you like to have the option to pay applicable mitigation fees to allow cutting during restricted times as an incidental cost based on your operations? The Cabinet would still pay the amount they committed to in preparing the project for bid. Fish and Wildlife allows the process for a contractor at a reduced fee.

4. How have tree-cutting restrictions impacted obtaining waste areas and how has this impacted your costs and bid?

5. Now that you have several years of experience dealing with tree-cutting restrictions, do you have any suggestions for revised bidding procedures to help alleviate contractor risk and reward innovate scheduling methods? For example, a variation of A+B where A is the base bid and B would be a “not to exceed” mitigation cost used for bid evaluation only. Could a bid line item be Bat in-lieu mitigation fees?