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ENVIRONMENTAL ASSESSMENT

# KELSEY ROAD-BYRDSTOWN 161-KILOVOLT TRANSMISSION LINE AND SWITCHING STATION

**Clinton and Wayne Counties, Kentucky, and Pickett County, Tennessee**

**PREPARED BY:**
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# ACRONYMS, ABBREVIATIONS, SYMBOLS, AND GLOSSARY OF TERMS

| | |
|---|---|
| §§ | Sections |
| **acre** | A unit measure of land area equal to 43,560 square feet, i.e., a square area 208.7 feet on a side |
| **APE** | Area of potential effect |
| **BA** | Biological assessment |
| **BMPs** | Best management practices, i.e., accepted construction practices designed to reduce environmental effects |
| **bus** | A solid electrical connector (rather than a flexible cable), often used to connect equipment in substations |
| **CFR** | Code of Federal Regulations |
| **cultural resources** | Archaeological and historic resources |
| **DBH** | Diameter at breast height |
| **easement** | A legal agreement that gives TVA the right to use property for a purpose such as a right-of-way for constructing and operating a transmission line |
| **e.g.** | Abbreviation for the Latin term, *exempli gratia*, meaning “for example” |
| **EKPC** | East Kentucky Power Cooperative |
| **EMF(s)** | Electric and magnetic field(s) |
| **endangered species** | A species in danger of extinction throughout all or a significant part of its range |
| **EO(s)** | Executive order(s) |
| **ESA** | Endangered Species Act |
| **forb** | A herbaceous plant other than a grass or a fern |
| **GIS** | Geographic information system |
| **HP** | Hydroelectric power plant |
| **IBCF** | Indiana Bat Conservation Fund |
| **ibid** | Abbreviation for the Latin term *ibidem*, meaning “in the same place”; refers to the immediately preceding work cited |
| **i.e.** | Abbreviation for the Latin term, *id est*, meaning “that is” |
| **IF** | Isolated find |
| **KDFWR** | Kentucky Department of Fish and Wildlife Resources |
| **KDW** | Kentucky Division of Water |
| **kV** | kilovolt |
| **load** | That portion of the entire power in a network consumed within a given area; also synonymous with “demand” in a given area |
| **MOA** | Memorandum of agreement |
| **n.d.** | Indicates “no date,” or date that Web site was accessed is unknown |
| **NEPA** | National Environmental Policy Act |

| | |
|---|---|
| **NERC** | North American Electric Reliability Corporation |
| **NESC** | National Electrical Safety Code |
| **NHPA** | National Historic Preservation Act |
| **NPS** | National Park Service |
| **NRHP** | National Register of Historic Places |
| **NRI** | Nationwide Rivers Inventory |
| **outage** | An interruption of the electric power supply to a user |
| **PI** | Point of intersection |
| **riparian** | Related to or located on the banks of a river or stream |
| **ROC** | Regional Operations Center |
| **ROW** | Right-of-way, a corridor containing a transmission line |
| **runoff** | That portion of total rainfall that eventually enters a stream or river |
| **SHPO** | State Historic Preservation Officer |
| **SMZ(s)** | Streamside management zone (s) |
| **SOC** | System Operations Center |
| **SR** | State route |
| **structure** | A pole or tower that supports a transmission line |
| **substation** | A facility connected to a transmission line used to reduce voltage so that electric power may be delivered to a local power distributor or user |
| **switching station vs. tap point** | A switching station usually contains only breakers and switches to change line connections or sectionalize lines. A tap point is a connection point between a tap line and an existing transmission line. A switching station is fenced and usually has a gravel surface. |
| **tap line** | An electric power line that connects an existing transmission line to a substation |
| **TDEC** | Tennessee Department of Environment and Conservation |
| **TL(s)** | Transmission line(s), a series of electrical conductors (“wires”) and their supporting structures used to transmit electric power |
| **TVA** | Tennessee Valley Authority |
| **TVARAM** | TVA Rapid Assessment Method, a version of the Ohio Rapid Assessment Method designed specifically for the TVA region |
| **US** | United States Highway |
| **USACE** | United States Army Corps of Engineers |
| **USEPA** | United States Environmental Protection Agency |
| **USFWS** | United States Fish and Wildlife Service |
| **USFS** | United States Forest Service |
| **VEC** | Volunteer Electric Cooperative |
| **wetland** | A marsh, swamp, or other area of land where the soil near the surface is saturated or covered with water, especially one that forms a habitat for wildlife |
| **WHO** | World Health Organization |

# CHAPTER 1

## 1.0 PURPOSE OF AND NEED FOR ACTION

### 1.1 Proposed Action – Improve Power Supply

Volunteer Electric Cooperative (VEC) is planning to upgrade its existing Byrdstown 69-kilovolt (kV) Substation to a new 161-kV substation to improve power reliability in the Byrdstown area. Tennessee Valley Authority (TVA) proposes to supply electric power to VEC's substation by constructing and operating approximately 15 miles of new 161-kV transmission line (TL) and a new 161-kV switching station. The proposed 100-foot-wide right-of-way (ROW) would cross portions of Clinton and Wayne counties, Kentucky, and Pickett County, Tennessee, and occupy approximately 182 acres (see Figure 1-1).

The proposed Kelsey Road-Byrdstown 161-kV TL would originate at TVA's proposed new 161-kV Kelsey Road Switching Station in Wayne County, Kentucky, then run generally south-southwest through Clinton County, Kentucky, and into Pickett County, Tennessee. It would end on the south side of State Route (SR) 325, southeast of Byrdstown, and connect to VEC's new 161-kV substation in Pickett County, Tennessee (see Figure 1-1). The proposed TVA switching station would occupy approximately 5.5 acres and would connect to TVA's existing Wolf Creek Hydroelectric Power Plant (HP)-Huntsville 161-kV TL. In order to facilitate the operation of the new TL and switching station, TVA would also provide two manual switches and metering equipment at VEC's planned substation. Any TVA equipment at the existing Byrdstown 69-kV Substation and one structure within the Wolf Creek HP-Huntsville 161-kV TL would be retired. The TVA system's mapboard at the System Operations Center (SOC) and Regional Operations Center (ROC) in Chattanooga would be modified to include the names and numbers of the new transmission lines and switching station.

Construction of the proposed TL would involve removing vegetation within the proposed 100-foot-wide ROW. Project implementation would also entail the establishment of permanent and temporary access roads, installation of culverts and other drainage devices, installation of fences and gates as necessary, and site grading. Following vegetation clearing and construction, the ROW vegetation would be reestablished with low-growing noninvasive plant species.

TVA is planning to complete construction and begin operation of the proposed 161-kV TL and switching station by December 2011.

### 1.2 Need for the Proposed Action

TVA plans its transmission system according to industrywide standards provided by the North American Electric Reliability Corporation (NERC) and the National Electrical Safety Code (NESC). The standards state that the power supply system must be able to serve customer loads with adequate voltage and no equipment damage while maintaining adequate line clearances.

VEC's Byrdstown 69-kV Substation is the worst performing delivery point on the TVA power system. Power is presently supplied to the substation by a 17.8-mile, single source 69-kV TL from the Livingston 161-kV Substation, which is jointly owned by TVA and Upper

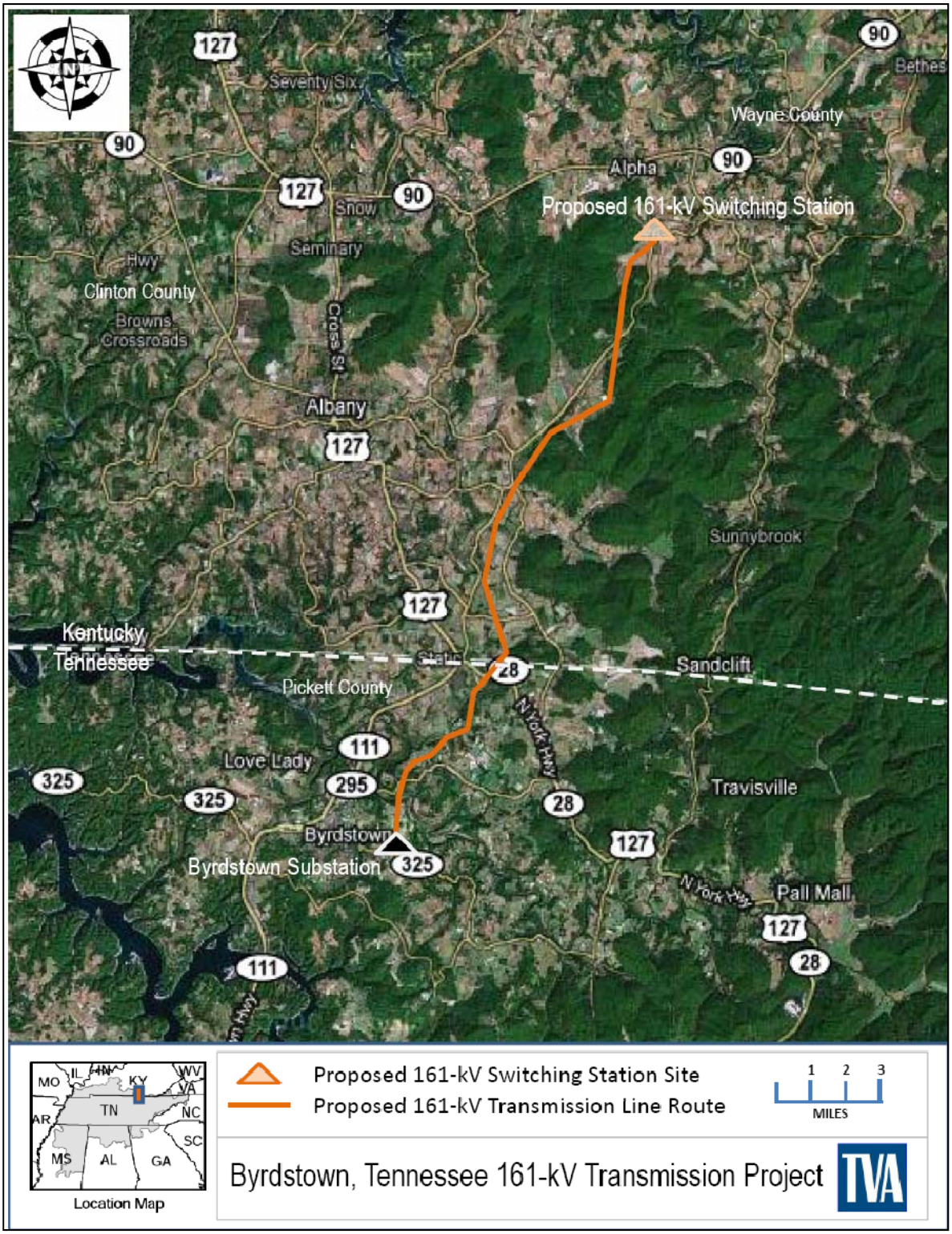


**Figure 1-1. Proposed Byrdstown 161-kV Transmission Line Project Area**

Cumberland Electric Membership Corporation. Due to the long length and age of this TL, the voltage at the Byrdstown Substation falls below acceptable TVA criteria during the summer months when the power demand (or "load") is at its peak.

In addition, the reliability for the Byrdstown 69-kV Substation has been poor, with an average of 10 interruptions per year over the last five years. Lightning continues to be a major contributor to the poor reliability in spite of a lightning mitigation project completed in 2003. The Byrdstown Substation and the Livingston-Byrdstown 69-kV TL serving it were constructed in 1959. Consequently, the substation will need to be rebuilt in the near future due to age and poor condition, and the condition of the TL has diminished substantially over recent years. Several structures have been replaced, and more replacements are planned for the future.

To ensure that the Byrdstown area has continuous, reliable service, TVA needs to provide additional electric service to the area. The construction of a TL and switching station would meet this need by addressing the voltage problems and improving reliability in VEC's Byrdstown service area, thereby allowing TVA to meet NERC reliability criteria. Additionally, the proposed project would allow TVA to provide the area with a reliable, affordable source of power for continued economic health and growth.

## 1.3 Decisions

The primary decision before TVA is whether to provide additional electric power to VEC's Byrdstown service area by constructing a new 161-kV TL and switching station. If the proposed TL and switching station were built, other secondary decisions would be involved, including the following considerations:

- The timing of improvements
- The most suitable route for the TL
- The most suitable site for the switching station
- Determining any necessary mitigation and/or monitoring measures to implement in order to meet TVA standards and minimize the potential for damage to environmental resources

A detailed description of the alternatives is provided in Section 2.1.

## 1.4 Other Pertinent Environmental Reviews or Documentation

In 1995, TVA completed *Energy Vision 2020: An Integrated Resource Plan and Final Programmatic Environmental Impact Statement* (TVA 1995). This study addressed short- and long-term strategies that would allow TVA to meet its customers' needs for electricity through the year 2020 and included a description of TVA's transmission system.

In 2008, TVA completed an environmental review, *Monroe, Tennessee – Provide 161-kV Delivery Point* (TVA 2008). This assessment addressed the need to provide a more reliable power supply to the Monroe, Tennessee, community. TVA proposed to construct and operate a new 161-kV TL to supply a planned new substation near Monroe by Upper Cumberland Electric Membership Corporation. The proposed TL would be 5.5 miles long and would connect the new substation to TVA's existing Huntsville-Livingston 161-kV TL. Approximately 3.3 miles of new TL would be built on new 100-foot-wide ROW, and 2.2

miles of the TL would be built parallel to TVA's existing Livingston-Byrdstown 69-kV TL on new 87.5-foot-wide ROW. TVA would also upgrade communications facilities at its Huntsville, Tennessee, 161-kV Substation. TVA completed the proposed TL in summer 2009.

## 1.5 The Scoping Process and Public Involvement

TVA contacted the following federal and state officials, as well as federally recognized Native American tribes, concerning the proposed power improvement project. TVA also conducted an internal environmental review by a network of designated environmental specialists.

- Absentee Shawnee Tribe of Oklahoma
- Alabama-Quassarte Tribal Town
- Cherokee Nation
- Eastern Band of Cherokee Indians in Oklahoma
- Eastern Shawnee Tribe of Oklahoma
- Kentucky State Nature Preserves Commission
- Kialegee Tribal Town
- Muscogee (Creek) Nation of Oklahoma
- Thlopthlocco Tribal Town
- Seminole Tribe of Florida
- Shawnee Tribe
- United Keetoowah Band of Cherokee Indians in Oklahoma
- National Park Service (NPS)
- Tennessee Department of Archives and History
- Tennessee Natural Heritage Program
- United States Fish and Wildlife Service (USFWS)

TVA's assessment of the environmental impacts of its proposed action included reviewing compliance with Executive Orders (EOs) and applicable laws, including EO 11988, Floodplain Management, EO 11990, Protection of Wetlands, the Farmland Protection Policy Act, the National Historic Preservation Act (NHPA), the Endangered Species Act (ESA), Section 404 of the Clean Water Act, and EO 12372, Intergovernmental Review. TVA coordinated its review of issues covered by these EOs and regulations with many of the parties identified above. Correspondence received related to this coordination is contained in Appendix A.

During the scoping process, TVA developed a public communication plan that included a Web site, http://www.tva.com/power/projects/byrdstown_tn/index.htm, with information about the project, a map of the alternative TL routes, and feedback mechanisms. Property owners that would potentially be affected by any of the TL route alternatives, along with 18 public officials, were invited to a project scoping public meeting (open house). TVA

contacted local news outlets and placed notices in local newspapers to notify other interested members of the public of the open house. TVA held the open house on July 16, 2009, at Clinton County Middle School in Albany, Kentucky, and 172 people attended.

TVA presented a network of eight alternative TL routes comprised of 13 different TL segments and four tap point/switching station sites (see Figure 1-2) to the public for comment. These TL segments and switching station sites are described in Section 2.3.5.

The public's primary concern was the potential impacts to residential development and farmland in the area. Attendees also voiced concerns relative to health issues, property value, and impacts of the proposed TL on visual quality, along with natural, historical, and archaeological resources.

TVA accepted public comments on the alternative TL routes, tap point/switching station locations, and other issues during a 30-day public scoping comment period following the open house. A toll-free phone number and facsimile number were made available to facilitate comments. No new issues were raised by the conclusion of the comment period. TVA personnel made minor adjustments to the TL segments based on the public comments received.

The proposal to build a new switching station adjacent to, rather than tapping the existing Wolf Creek HP-Huntsville 161-kV TL, was influenced by TVA's planning engineers' determination that a new switching station would not only strengthen the power supply to the new Byrdstown Substation, but would also accommodate future needs in the Byrdstown area. The siting requirements used for a tap point are similar to requirements used for switching stations of this size. Each alternative tap point presented at the open house was located in an area that could accommodate a future switching station. The term "switching station" will be used in the remainder of the document instead of "tap point."

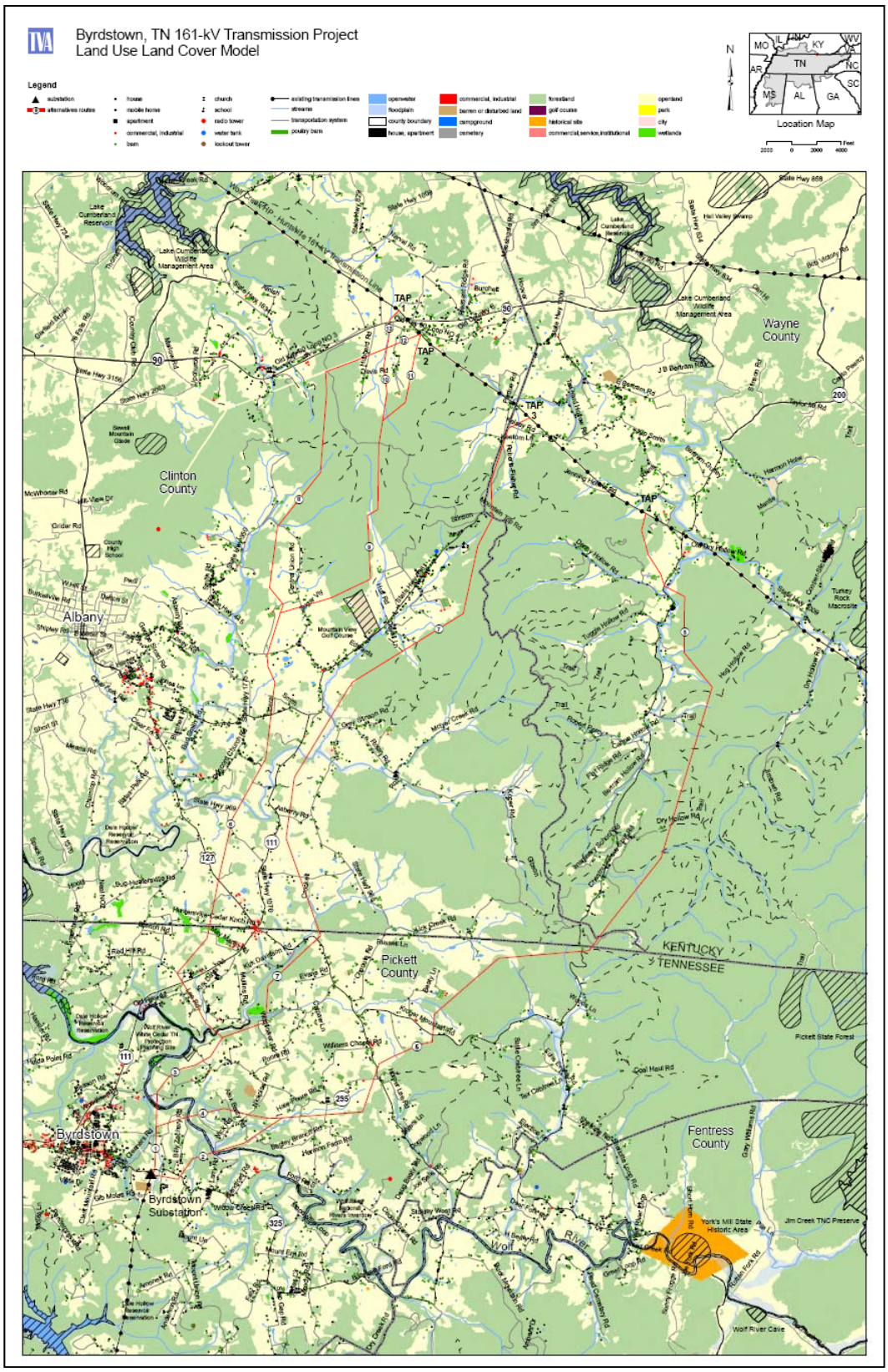


**Figure 1-2. Byrdstown, Tennessee, Transmission Line Route Alternatives**

## 1.6 Issues to be Addressed

TVA identified resources that would potentially be affected by the proposed TL route, access road, and/or switching station construction, operation, and maintenance through a preliminary, internal scoping process. A list of resources potentially affected by the proposed project has been developed with the consideration of public comments received during the public scoping process. Potential affected resource issues addressed in this environmental assessment include the following:

- Vegetation and wildlife
- Aquatic ecology
- Endangered and threatened species and their critical habitats
- Surface water
- Groundwater and geology
- Floodplains
- Wetlands
- Archaeological and historic resources
- Visual resources
- Recreation, managed areas, and ecologically significant sites
- Socioeconomics and environmental justice

Potential effects related to land use, prime farmland, natural areas, air quality, hazardous and nonhazardous wastes, noise, and health and safety were also considered. These effects were found to be minor, and these resources do not require further evaluation.

## 1.7 Necessary Permits and Approvals

Permits would be required from the Tennessee Department of Environment and Conservation (TDEC) and the Kentucky Division of Water (KDW) for discharge of storm water associated with the construction of the TL; a separate permit would be required from the KDW for construction of the switching station. TVA would prepare the required erosion and sedimentation control plans and coordinate them with the TDEC, KDW, and local authorities.

A permit, if required, for burning trees and other combustible materials removed during TL construction would be obtained.

A Section 404 Nationwide Permit would be required from the United States Army Corps of Engineers (USACE) if construction activities would result in the discharge of dredge or fill materials into waters of the United States.

Permits or other approvals would be required from the Tennessee Department of Transportation and the Kentucky Department of Transportation for crossing state highways during TL construction.

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# CHAPTER 2

## 2.0 ALTERNATIVES INCLUDING THE PROPOSED ACTION

As described in Chapter 1, TVA proposes to connect VEC's planned Byrdstown 161-kV Substation to a new 161-kV switching station adjacent to TVA's Wolf Creek HP-Huntsville 161-kV TL. The connection would be accomplished by constructing and operating approximately 15 miles of new 161-kV TL and a new 161-kV switching station. TVA would then retire any TVA equipment in VEC's existing Byrdstown 69-kV Substation.

This chapter contains the following five major sections:

- Description of Alternatives
- Description of Construction, Operation, and Maintenance of the Proposed TLs and Switching Station
- Siting Process
- Comparison of the Alternative TL Routes and Switching Station Sites
- Identification of the Preferred Alternative

This chapter describes all of the alternatives explored and provides additional background information about the switching station and TL construction, operation, and maintenance.

### 2.1 Alternatives

Preliminary internal scoping by TVA determined that from the standpoint of the National Environmental Policy Act (NEPA) environmental review, there were five alternatives available to TVA. However, three of the alternatives have been eliminated from consideration because they do not meet the project purpose and/or they would result in greater environmental and economic impacts than the Action Alternative. This environmental assessment analyzes the No Action Alternative – No Build, and the Action Alternative, Construct and Operate a New 161-kV Transmission Line and Switching Station.

#### *2.1.1 Alternative 1 – Do Not Construct a Transmission Line or Switching Station (No Action Alternative)*

Under the No Action Alternative, TVA would not construct the proposed TL or switching station to serve VEC's planned substation, and the TVA power system in the Byrdstown area would continue operating under the current conditions. With the continued use of existing, aging facilities to supply power to the area, potential for power outages would continue due to the failure of overloaded equipment. To provide reliable power to the area, VEC could decide to build a new TL to serve its new substation.

#### *2.1.2 Alternative 2 – Construct and Operate a New 161-kV Transmission Line and Switching Station (Action Alternative)*

Under the Action Alternative, TVA would connect VEC's planned Byrdstown 161-kV Substation to a new 161-kV Kelsey Road Switching Station adjacent to the Wolf Creek HP-Huntsville 161-kV TL. The connection would be accomplished by constructing, operating, and maintaining approximately 15 miles of new 161-kV TL and a new 161-kV switching station. TVA would then retire any TVA equipment in VEC's existing Byrdstown 69-kV Substation along with one structure in its Wolf Creek HP-Huntsville 161-kV Transmission

Line. The TVA system's mapboard at the SOC and ROC in Chattanooga would be modified to include the names and numbers of the new transmission lines and switching station. Permanent and temporary access roads would be required for construction and maintenance of the proposed TL. TVA would also remove two barns and two small sheds that are currently located on the proposed ROW.

Additional information describing implementation of the Action Alternative and how the most suitable TL route and switching station site were determined is provided in the following sections:

- Section 2.2. Construction, Operation, and Management of the Proposed TL and Switching Station
- Section 2.3. Siting Process
- Section 2.4. Comparison of Alternative Routes and Switching Station Sites

Implementation of this alternative would provide another source of power to ensure a reliable power supply is available to serve the electric power needs in the Byrdstown area for now and in the immediate future.

### *2.1.3 Other Alternatives Considered But Not Selected*

During the development of this proposal, other alternatives were considered involving upgrading existing facilities as well as the construction of new TLs in nearby areas. These other alternatives would result in high costs for construction and maintenance, and would have their own respective environmental impacts. The other alternatives do not meet project needs as well as the Action Alternative, and are described below.

#### 2.1.3.1 Upgrade Existing Byrdstown 69-kV Substation

Under this alternative, VEC would replace all of the major equipment in its Byrdstown 69-kV Substation. TVA would install 69-kV capacitor banks at this substation and would continue to refurbish or rebuild the old 69-kV TL that serves Byrdstown. Although adoption of this alternative would improve the voltage problems at the Byrdstown Substation identified in Section 1.2, this option would not address the reliability problems caused by the single-source feed Livingston-Byrdstown 69-kV TL. Furthermore, this alternative does not address current and future load growth in the area. As a result, an upgrade of the Byrdstown Substation would require substantial TL investment to accommodate the new load distribution. For these reasons, this alternative has been eliminated from further consideration.

#### 2.1.3.2 Construct and Operate a New Transmission Line

Under this alternative, VEC would convert the Byrdstown 69-kV Substation to 161-kV operation. TVA would serve VEC's new substation by constructing a new 12-mile, 161-kV TL connection to TVA's existing Monroe 161-kV Substation. In addition, TVA would install a new 161-kV breaker at the Livingston 161-kV Substation. Finally, TVA would rebuild the 2-mile section of its existing Livingston-Huntsville 161-kV TL between the Monroe Tap Point and the Livingston Substation.

While this alternative addresses immediate power supply issues in the Byrdstown area, it does not address future power supply plans for the area as well as the Action Alternative. In fact, if this alternative were selected, the Action Alternative would likely be necessary

within the next several years, increasing the environmental and economic impacts in relation to the Action Alternative. For this reason, this alternative was eliminated from further consideration.

#### 2.1.3.3 Underground Utility Lines

A frequent objection to the construction of new TLs is the perception of adverse visual effects and a frequently suggested alternative is the installation of buried TLs.

Power lines can be buried; however, buried lines tend to be low-voltage distribution lines, i.e., lines that are 13-kV or less. Low-voltage lines can be buried without the need for special conduits; however, higher voltage TLs require armor casings for safety reasons. Burying higher-voltage TLs in the 69-kV, 161-kV, and 500-kV ranges would require extensive excavation, and these TLs must be encased in special conduits or tunnels. Additionally, measures to ensure proper cooling and to provide adequate access are required. Usually, a road along or within the ROW of buried TLs must be constructed and maintained for routine inspection and maintenance of the TLs.

Although buried lines are much less susceptible to catastrophic storm damage, especially wind damage, they tend to be very expensive to install and maintain. Conduit systems require ventilation systems to provide adequate cooling for the conductors (the cables that carry the electrical current). Similarly, they must be protected from flooding, which could cause an outage. Repairs of buried lines may require excavation, and the precise location of problems can be difficult to determine. Burying the proposed 161-kV line would not be practicable for these reasons, and this alternative would be cost prohibitive. Furthermore, the potential adverse environmental effects of constructing and operating a buried high-voltage TL would likely be greater than a traditional aboveground TL. For these reasons, this alternative was considered infeasible and was eliminated from further consideration.

## 2.2 Construction, Operation, and Management of the Proposed Transmission Lines and Switching Station

### *2.2.1 Transmission Line Construction*

#### 2.2.1.1 Right-of-Way Acquisition and Clearing

The proposed TL would be constructed on new 100-foot-wide ROW. TVA would purchase easements from landowners for the new ROW. These easements would give TVA the right to construct, operate, and maintain the TL, as well as remove danger trees. Danger trees include any trees that are located off the cleared ROW, but that are tall enough to pass within 5 feet of a conductor or strike a structure should it fall toward the TL. The fee simple ownership of the land within the ROW would remain with the landowner, and many activities and land uses could occur on the property. However, the terms of the easement agreement prohibit certain activities such as construction of buildings and any other activities within the ROW interfering with operation and maintenance of the TL or that could create a hazardous situation.

In order to maintain adequate clearance between tall vegetation and TL conductors, as well as to provide access for construction equipment, most trees and shrubs would initially be removed from the entire ROW. Equipment used during ROW clearing would include chain saws, skidders, bulldozers, tractors, and/or low ground-pressure feller-bunchers. Marketable timber would be salvaged where feasible; otherwise, woody debris and other vegetation would be piled and burned, chipped, or taken off site. In some instances,

vegetation may be windrowed along the edge of the ROW to serve as sediment barriers. Vegetation removal in streamside management zones (SMZs) and wetlands would remain with the exception of trees tall enough, or with the potential soon to grow tall enough, to interfere with conductors. Clearing in SMZs would be accomplished using hand-held equipment or remote-handling equipment, such as a feller-buncher, in order to limit ground disturbance. TVA *Right-of-Way Clearing Specifications, Environmental Quality Protection Specifications for Transmission Line, Substation, or Communications Construction, Transmission Construction Guidelines Near Streams* (Appendices B, C, D), and Muncy 1999 would be followed in clearing and construction activities.

Subsequent to clearing and construction, vegetative cover on the ROW would be restored as much as possible to its state prior to construction. Pasture areas would be reseeded with suitable grasses. Wooded areas would be restored using native grasses and other low-growing noninvasive species. Erosion controls would remain in place until the plant communities become fully established. Streamside areas would be revegetated as described in Appendices B, C, D, and Muncy (1999).

#### 2.2.1.2 Access Roads

Permanent or temporary access roads would be constructed to allow vehicular access to each TL structure and other points along the ROW. Typically, new permanent or temporary access roads used for TLs are located within the ROW wherever possible and designed to avoid severe slope conditions and minimize stream crossings. Access roads are typically about 20 feet wide and surfaced with dirt or gravel.

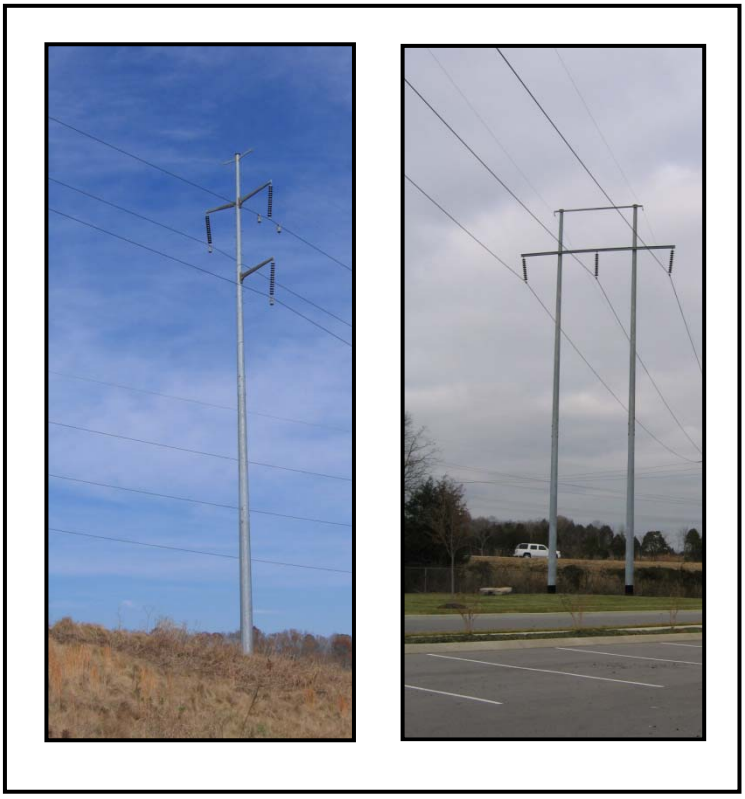
Culverts and other drainage devices, fences, and gates would be installed as necessary. Temporary culverts installed in any permanent streams would be removed following construction. However, in wet-weather conveyances (i.e., streams that run only following a rainfall), they would be left or removed, depending on the wishes of the landowner or on any permit conditions that might apply. If desired by the property owner, TVA would restore new temporary access roads to conditions prior to construction disturbance. Additional applicable ROW clearing and environmental quality protection specifications are described in Appendices B and C.

#### 2.2.1.3 Construction Assembly Areas

A construction assembly area (laydown area) would be required for worker assembly, vehicle parking, and material storage. This area may be on existing substation property or may be leased from a private landowner for the duration of the construction period about one month before construction begins. Selection criteria used for locating potential laydown areas include an area typically 5 acres in size; relatively flat; well drained; previously cleared; if possible, graveled and fenced; preferably with wide access points with appropriate culverts; sufficiently distant from streams, wetlands, or sensitive environmental features; and located adjacent to an existing paved road near the TL. TVA would initially attempt to use or lease properties that require little or no site preparation, such as existing parking lots because site preparation is minimal. Otherwise, the property selected for a laydown area may require some minor grading, and the installation of drainage structures such as culverts may be required. Likewise, the area may require graveling and fencing. Trailers used for material storage and office space would be parked on the site. Following completion of construction activities, all trailers, unused materials, and construction debris would be removed from the site. Removal of fencing installed by TVA and site restoration would be at the discretion of the landowner.

#### 2.2.1.4 Structures and Conductors

The proposed 161-kV TL would utilize single and double pole transmission structures (Figure 2-1). Structure type would depend on terrain and the resulting distance between structures. Structure heights would vary according to the terrain and would range between 80 and 120 feet.



(a) Single Steel-Pole Structure (b) Double Steel-Pole Structure

**Figure 2-1. Examples of Single and Double Steel-Pole 161-kV Transmission Structures**

Three conductors are required to make up a circuit in alternating-current TLs. For 161-kV TLs, each single-cable conductor is attached to fiberglass or ceramic insulators suspended from the structure cross arms. A smaller overhead ground wire or wires are attached to the top of the structures. This ground wire may contain fiber optic communication cables.

Poles at angles (i.e., angle points) in the TL may require supporting guys. Some structures for larger angles could require two or three poles. Most poles would be imbedded directly in holes augured into the ground to a depth equal to 10 percent of the pole's length ( e.g., 8 to 12 feet) plus an additional 2 feet. Normally, the holes would be backfilled with the excavated material, but in some cases, gravel or a cement-and-gravel mixture would be used if necessary. Screw-and-rock-anchored guys would be installed for angle structures. Equipment used during the construction phase would include trucks, truck-mounted augers, and drills, as well as tracked cranes and bulldozers.

#### 2.2.1.5 Conductor and Ground Wire Installation

Reels of conductor and ground wire would be delivered to various staging areas along the ROW, and temporary clearance poles would be installed at road crossings to reduce interference with traffic. A small rope would be pulled from structure to structure. It would be connected to the conductor and ground wire and used to pull them down the line through pulleys suspended from the insulators. A bulldozer and specialized tensioning equipment would be used to pull conductors and ground wires to the proper tension. Crews would then clamp the wires to the insulators and remove the pulleys.

### *2.2.2 Switching Station Construction*

The Kelsey Road Switching Station would be located on a 5.5-acre site near the intersection of Kelsey Road and SR 696 in Monticello, Kentucky. TVA would obtain the fee simple ownership of the land within the site. There would initially be three TL terminations at the Kelsey Road Switching Station, the new Kelsey Road-Byrdstown 161-kV TL and both connections of the Wolf Creek HP-Huntsville 161-kV TL. Space would be provided for three future line connections as well as future capacitor bank installation.

Cut and fill material would be required for construction of the switching station. This includes approximately 5,300 cubic yards of topsoil that would be spread on site or within the TL ROW or that would be handled according to TVA's standard environmental protection procedures, if taken off site. The remaining cut would be placed within the property by flattening the slope. Thus, all of the earthwork would be on site. A spoil area would be located on the western side of the property. Silt fences would be installed, and approximately 2.8 acres of the site would be graded in accordance with TVA's *Site Clearing and Grading Specifications* (Appendix E). Total disturbance, including grading and spoil material, would be approximately 3 acres. Site drainage structures would be installed. The switching station yard would be covered with crushed stone and fenced with chain link fencing 8 feet tall (including 12 inches of barbed wire). A new access road would be constructed to the southern corner of the graded area from Kelsey Road. The length of the access road would be approximately 70 feet. There would be no fill to raise the elevation of the road. Stone would be added to support truck wheel loads, as necessary. The amount of stone would not exceed existing ground or road elevation. An area that is not graveled at the switching station site would be restored as practicable to its state prior to construction.

The major equipment in the switching station would consist of six 161-kV disconnect switches, one station service voltage transformer, 16 161-kV bus supports, two breaker bays, and four 161-kV pull-off structures. The equipment would be interconnected with aluminum pipe and copper strand conductors. The conductors and some equipment would be supported on steel structures. As described in TVA's *Substation Lighting Guidelines* (Appendix F), all lights at the switching station would be fully shielded or would have internal low-glare optics, such that no light is emitted from the fixture at angles above the horizontal plane. TVA's *Environmental Quality Protection Specifications for Transmission Substation or Communications Construction* (Appendix C) would be used during construction of the switching station.

### *2.2.3 Operation and Maintenance*

#### 2.2.3.1 Inspection

Periodic inspections of 161-kV TLs are performed from the ground and by helicopter aerial surveillance, occurring on approximately five-year cycles after operation begins. The inspections would be conducted in order to locate damaged conductors, insulators, or

structures, and to discover any abnormal conditions that might hamper the normal operation of the TL or adversely affect the surrounding area. During these inspections, the condition of vegetation within the ROW, as well as immediately adjoining the ROW, is noted. These observations would then be used to plan corrective maintenance and routine vegetation management.

Certified TVA personnel perform periodic inspections of the switching stations. These inspections would be conducted to identify equipment issues or anything else that may cause equipment problems. Any concerns identified would be fixed immediately (e.g., hornet nest removal), if possible, or recorded and prioritized to be included in the maintenance program.

#### 2.2.3.2 Vegetation Management

Management of vegetation along the ROW would be necessary to ensure access to structures and to maintain an adequate distance between TL conductors and vegetation. For a 161-kV TL, NESC standards require a minimum vegetation clearance of 24 feet. Vegetation management along the ROW would consist of two different activities: felling of danger trees adjacent to the cleared ROW, as previously described in Section 2.2.1.1., and vegetation control within the cleared ROW.

Management of vegetation within the cleared ROW would use an integrated vegetation management approach designed to encourage low-growing plant species and discourage tall-growing plant species. A vegetation reclearing plan would be developed for each TL segment based on the results of the periodic inspections described above. The two principal management techniques are mechanical mowing (using tractor-mounted rotary mowers) and herbicide application. Herbicides would normally be applied in areas where heavy growth of woody vegetation is occurring on the ROW and mechanical mowing would not be practical. Herbicides would be applied selectively by helicopter or from the ground with backpack sprayers or vehicle-mounted sprayers.

Any herbicides used would be applied in accordance with applicable state and federal laws and regulations. Only herbicides registered with the United States Environmental Protection Agency (USEPA) would be used. A list of the herbicides currently used by TVA in ROW management is presented in Appendix G, *TVA Environmental Protection Procedures Right-of-Way Vegetation Management Guidelines*. This list may change over time as new herbicides are developed or new information on presently approved herbicides becomes available.

#### 2.2.3.3 Structure Replacement

Other than vegetation management, little other maintenance work would generally be required. The TL structures and other components typically last several decades. In the event that a structure would need to be replaced, the structure would normally be lifted out of the ground by cranelike equipment, and the replacement structure would be inserted into the same hole or an immediately adjacent hole. Access to the structures would be on existing roads where possible. Replacement of structures may require leveling the area surrounding the replaced structures, but there would be little additional area disturbance when compared to the initial installation of the structure.

## 2.3 Siting Process

The process of siting the proposed TL has followed the basic steps used by TVA to determine a TL route. These include the following:

- Determine potential existing power sources to supply the TL
- Define the study area
- Collect data to minimize potential impacts to cultural and natural features
- Develop general route options and potential routes
- Develop potential tap points (which later become switching stations)
- Gather public input
- Incorporate public input into the final identification of the TL route and switching station site

### *2.3.1 Definition of Project Study Area*

The first task in defining the TL siting study area was to identify the power sources that could supply the identified need. TVA's existing Wolf Creek HP-Huntsville 161-kV TL was the most practical source. It is the closest 161-kV TL and would serve as the most reliable power source to the newly upgraded substation.

The study area boundaries were chosen to allow for the establishment of two or more corridors that would eventually yield a preferred TL route on which to construct the TL. The study area is shown in Figure 1-2. Information for the counties within the siting study area are shown in Table 2-1.

**Table 2-1. Study Area County Statistics**

| County Name | State Name | Population | County Seat | Other Primary Towns |
|---|---|---|---|---|
| Clinton | Kentucky | 9,634 | Albany | Alpha |
| Wayne | Kentucky | 19,923 | Monticello | Parmleysville |
| Fentress | Tennessee | 16,646 | Jamestown | Allardt |
| Pickett | Tennessee | 4,945 | Byrdstown | Love Lady |

The northern boundary of the study area is about 5.1 miles south of Wolf Creek Dam and is 13.45 miles long. Two tributaries of Lake Cumberland extend south from the lake across the northern boundary of the study area. The east boundary of the study area is 18.8 miles long and crosses the Kentucky/Tennessee state line about 3 miles east of Pall Mall, Tennessee. The south boundary is approximately 6.6 miles south of and parallel to the Kentucky-Tennessee state line. The west boundary is 18.85 miles long and passes west of the towns of Albany and Byrdstown by about 1 mile.

### *2.3.2 Data Collection*

TVA has collected geographic data such as topography, land use, transportation, environmental features, cultural resources, near-term future development, and land conservation information for the study area. Information sources used in the TL siting study included design drawings for area TLs, data collected into a geographic information system (GIS), United States Geological Survey digital line graphs, and tax maps from Clinton, and

Wayne counties, Kentucky, and Pickett County, Tennessee. Various proprietary data maintained by TVA in a corporate georeferenced database, including the TVA Natural Heritage database for sensitive plants and animals, and information on archaeological and historical resources, were researched for information within the study area.

In March 2009, TVA took color aerial photography of the proposed project area. These images were georeferenced and digitized for use in the GIS without distortions. This aerial photography was then interpreted to obtain land use and land cover data.

These data were analyzed both manually and with the GIS. The use of GIS allows substantial flexibility in examining various types of spatially superimposed information. This system allowed the multitude of factors of the study area to be examined simultaneously to develop and evaluate numerous options and scenarios to determine the TL route or routes that would best meet project needs, including avoiding or reducing potential environmental impacts.

Manual calculations from aerial photographs, tax maps, and other sources included the number of road crossings, stream crossings, and property parcels. Finally, the aerial photography, GIS-based map, and other maps and drawings were supplemented by reconnaissance throughout the study area by a TVA siting engineer and an environmental engineer.

### *2.3.3 Description of the Project Study Area*

#### 2.3.3.1 Natural Features

The greatest portion of the study area lies in Clinton and Picket counties. The study area is situated on the Central Highland area immediately west of the Cumberland Plateau. In Kentucky, this area is referred to as the Pennyroyal (or Pennyrile) and in Tennessee as the Highland Rim. The Pennyroyal is largely farmland where the bedrock is limestone. In some areas, the limestone is capped with soft sandstone. This kind of karst geology enables the formation of extensive cave systems. Some of the most intensely cave-forming limestones of the world are found here. Where the capping sandstone is intact, the land surface is usually forested with rugged hills as seen in the eastern half of the project study area.

Ridges and valleys with a few steep hills characterize the region inside the study area boundary. The elevations in the study area range from 750 feet to 1,600 feet above mean sea level. The region is well watered with many perennial streams and occasional waterfalls. There are very few known wetland locations in the study area due to the well-drained topography. The few known wetland areas are in the reservoir and/or creek floodplains.

Geologically, the study area is within the Appalachian Basin, and on the southeastern edge of the Cumberland Saddle, a low structure between the Lexington and Nashville domes. Regional dip is to the east-southeast at 20 to 40 feet per mile. No major surface faults are present in the area. The nearest major surface fault zones are located 40 miles to the east in the Ridge and Valley areas of East Tennessee. Rocks exposed at the surface here range from Pennsylvanian to Mississippian in age and are sedimentary. The subsurface sedimentary rock column is thought to exist to a depth of 6,000 feet or more.

Clinton and Pickett counties are a part of a geographic area that has led their respective states in oil production for the past several years. Oil is produced from rocks of Mississippian age and Ordovician age. This high production surpasses the traditional oil production region of the Cumberland Plateau a few miles to the east. Oil in this area can be found in multiple horizons at depths from 200 to 2,200 feet. Initial production rates vary greatly, from one to as much as 2,000 barrels of oil per day. Cumulative oil production from an individual well can exceed 240,000 barrels. In some cases, cavernous areas are created naturally, which can fill with oil or gas. The complexities of these fracture systems and their seemingly random occurrence makes them difficult to find, but the amount of oil they can produce from a small area can be impressive.

A geologic map of Clinton County indicates that the project study area is made up almost entirely of intense karst or karst-prone areas. A karst landscape has sinkholes, sinking streams, caves, and springs. This study area is within some of the most famous karst areas of the world.

The Big South Fork National River Recreation Area is located just southeast of the project study area and straddles the state line between Kentucky and Tennessee. Both states have designated their portions of the Big South Fork River as Outstanding National Resource Waters (USEPA Water Quality Regulation 40 CFR 35.1550). Kentucky has also recognized the section of the Big South Fork from the state line to Blue Heron Mine as a Kentucky Wild River.

#### 2.3.3.2 Cultural Features

There are several small churches in the Clinton and Pickett counties portion of the study area, and cemeteries can be found scattered in the western portion of the project study area. Many of the cemeteries are scattered throughout the rural areas and are likely family plots dating back to the 1800s.

York’s Mill State Historic Area is a noteworthy historic site along the Wolf River in the southeast corner of the study area. It includes the farm and gristmill once owned by decorated World War I hero, Alvin C. York, who lived in the Pall Mall area for most of his life. Along with the millhouse and milldam, the park includes York's two-story house, York's general store and post office, the Wolf River Cemetery (where York and his family are buried), the Wolf River Methodist Church, the York Bible Institute, and various picnic facilities.

Downstream from the York Mill site, the Wolf River flows into the Dale Hollow Reservoir. This section of the river is included on the NPS’s Nationwide Rivers Inventory (NRI) because of its association with a significant event, an important person, or a cultural activity of the past that was rare in the region.

The majority of recreation facilities are located on the Dale Hollow or Lake Cumberland reservations. There are three communication towers in the western portion of the study area.

#### 2.3.3.3 Land Use

The land use in the study area consists of 83 percent forested land (deciduous 63 percent, mixed 15 percent, and evergreen 5 percent), 10 percent pasture/hay, 2 percent row crops, and 4 percent open water. The remaining land use areas include residential, commercial, and other open areas.

The land use/land cover map of the study area indicates that approximately 45 percent of the land is comprised of forestlands, and the remaining area is open/agricultural use. There is a much higher proportion of residential use in the study area due to the small towns of Albany and Byrdstown. In addition, the residential developments near Dale Hollow and Lake Cumberland reservoirs add to the residential land use. There are a few subdivisions developed adjacent to the towns of Albany and Byrdstown.

There is a golf course inside the study area located about 4.5 miles east of Albany. Boat launching ramps exist in a few locations on the shoreline of Dale Hollow Reservoir. The easternmost portions of the Sunset Dock facilities extend into the southwest corner of the study area.

The Lake Cumberland Wildlife Management Area is located in the northeast corner of the study area and along the managed shoreline of Lake Cumberland. A portion of the 19,000-acre Pickett State Forest extends into the southeast corner of the study area. This state forest features a combination of scenic, botanical, and geological features found nowhere else in Tennessee, such as uncommon rock formations, natural bridges, caves, and remains of ancient Native American occupation.

There are three existing TVA TLs in the study area. One is an existing 161-kV TL connecting Wolf Creek HP 161-kV Substation to the Norris HP 161-kV Substation and is located in the extreme northeast corner. The second is an existing 161-kV TL connecting the Wolf Creek HP Substation to the Huntsville 161-kV Substation. This TL is proposed to be the source line for this new project and is located south of the TL that terminates at Norris Dam HP in Tennessee. Finally, a 69-kV line exits the Byrdstown Substation and connects to the Livingston Substation. This aging TL is one of the primary drivers for this project. The only other power lines in the study area are lower-voltage distribution lines belonging to VEC.

The western portion of the study area stretching southward from Albany to Byrdstown is mostly nonforested, rolling terrain, and is the location of much of the residential development and farming activities (pasture and croplands). The portion to the east is a steep, mountainous area that is primarily hardwood forest. This area produces the materials for the many local hardwood flooring sawmill operations.

#### 2.3.3.4 Transportation

Transportation features in the study area are composed of a few primary highways. United States Highway (US) 127 is a heavily used connection from the northwest portion of the study area to the southeast and eventually passes through Jamestown. US 127 also passes through Albany and a rural area east of Byrdstown. Heavily traveled by local residents and vacationers, this highway and other state roads are curvy, and caution is required due to the terrain. Kentucky SR 90 crosses the northern portion of the study area in a west-to-east direction. It connects the areas east and west of Lake Cumberland by passing south of the lake. Kentucky SR 200 follows a north-south path along a valley area between two mountain ridges in the east portion of the study area. It originates at a point on US 127 near Pall Mall and passes through Monticello. Tennessee SR 111 is a major road that originates at the Tennessee and Kentucky state line, passes through Byrdstown, travels south through Livingston, Sparta, Cookeville, Dunlap, and terminates into US 27 north of Chattanooga. The other roads in the area are state or county maintained. There are very few roads of any kind in the east portion of the study area.

There are no active railroad lines or commercial airports in the study area. However, Spring Creek Airport, a paved 3,800-foot private airstrip, is located just outside the study area 3 miles west of Albany.

### *2.3.4 Establish and Apply Siting Criteria*

TVA uses a set of evaluation criteria that represent opportunities and constraints for development of TL routes including factors such as existing land use, ownership patterns, environmental features, cultural resources, and visual quality. Each criterion has a certain value or weight. Cost is also an important factor, with engineering considerations and ROW acquisition costs being the most important elements. Application of these constraints is flexible, and TVA can, and does, deviate from them. Identifying feasible TL routes involves weighing and balancing of these criteria with adjustments to them as specific conditions dictate.

#### 2.3.4.1 Transmission Line Routing Criteria

Each TL route option was evaluated according to criteria related to engineering, environmental, land use, and cultural concerns. Specific criteria are described below. For each feature identified as occurring along a proposed TL route option, specific considerations related to these features were identified and scored. In the evaluation, a higher score means a bigger constraint or obstacle for locating a TL. For example, a greater number of streams crossed, a longer TL route length, or a greater number of historic resources affected would give a TL route option a higher, more unfavorable score.

- **Engineering Criteria** include considerations such as total length of the transmission route, width of new ROW, number of primary and secondary road crossings, the presence of pipeline and TL crossings, and total line cost.

- **Environmental Criteria** include consideration of the following: the presence of slopes greater than 30 percent (steeper slopes have more potential for erosion and potentially greater water quality impacts), visual aesthetics, the amount of forested acres within the proposed ROW, the number of open water crossings, the number of perennial and intermittent stream crossings, presence of sensitive stream crossings (i.e., those supporting endangered or threatened species), presence of wetlands or rare species' habitat, the number of natural area crossings, and proximity to wildlife management areas.

- **Land Use Criteria** include the number of fragmented property parcels and proximity to schools, houses, commercial or industrial buildings, and barns.

- **Cultural Criteria** include the presence of archaeological and historic sites, churches, and cemeteries.

A tally of the number of occurrences for each of the individual criteria was calculated for each potential alternative TL route. Next, a normalized ranking of alternative TL routes was calculated for each individual feature based on each route's value as it related to the other alternative routes. Then, weights reflecting the severity of potential effects (i.e., the relative degree of constraint) were developed for each individual criterion. These criterion-specific weights were multiplied by the individual alternative rankings to create a table of weighted rankings. The weighted rankings for each alternative were then added to develop overall scores by each alternative route for engineering, environmental, land use, cultural, and

overall total. For each of these categories, a ranking of each alternative TL route was calculated based on the relationship of various routes' scores to one another.

These rankings made it possible to recognize which routes would have the lowest and the highest impacts on engineering, environmental, land use, and cultural resources, based on the data available at this stage in the siting process. Finally, the scores from each category were combined into an overall score, and the alternative TL route options were rank-ordered by their overall scores.

#### 2.3.4.2 Switching Station Site Criteria

The switching station siting criteria used in evaluating the four potential locations included engineering and construction feasibility, environmental effects, land use compatibility, and feasibility of TL connections.

- **Engineering and Construction Criteria** take into account the suitability of the size of the site for grading, fencing, and security needs. Evidence that the site is not in a 100-year floodplain is required. These criteria also require that locations be near public roads to minimize construction of a lengthy access road, have the ability to develop a safe driveway connection with good sight distance in each direction, and permit the ease of delivery of extremely large electrical equipment. Good site drainage, soils suitable for grading and foundation construction, minimal tree clearing needs, and availability of off-site electrical service and communications sources are also considered.

- **Environmental Criteria** include the presence of wetlands or rare species and/or their habitat, including locations outside the project boundary of the site that would be crossed by future TL corridors. Other factors include the presence of historic structures or sites on or adjacent to the site; presence or proximity of the site to prime farmland; and aquatic features crossing or adjacent to the site.

- **Land Use Compatibility Criteria** consist of the number of individual property tracts that make up the site; the current land use of the tract(s); the number of houses on or near the site; and the level of visual impact to the surrounding area homes and traveling public.

- **Transmission Line Connections Criteria** involve TL siting criteria including engineering and construction feasibility, environmental effects, and land use compatibility. This involves avoidance of features and areas that are generally incompatible with TLs, while identifying other areas with more compatible land uses, thereby creating lesser impacts.

### *2.3.5 Development of Switching Station Site Options and Potential Transmission Line Routes*

The straight-line distance from the TVA source TL to the planned VEC substation site is about 13 miles. That distance, along with the steep terrain and the sporadic residential and commercial development in the area, limited the number of practicable alternative corridors that could be identified and studied for the project. Using information gathered during the system's studies and data development phases, several potential tap point locations were identified on TVA's Wolf Creek HP-Huntsville 161-kV TL. As explained in Section 1.5., TVA's electric system planning studies indicated that an additional power supply would

likely be needed in the Byrdstown area in the future. Therefore, each alternative tap point selected was in an area that could accommodate a switching station, if necessary. As previously mentioned, TVA announced its preference to build a switching station rather than a tap point several months after the open house.

In order to minimize risk for line exposure for outages, the optimal location for a switching station site would be near the midpoint of the Wolf Creek HP-Huntsville 161-kV TL. Furthermore, it was important for any switching station site to be located within the existing TL ROW so that no additional TL work, namely a loop connection back to the switching station, would be required. As a result, four sites, which also met accessibility and terrain requirements, were evaluated along the midpoint of the existing Wolf Creek HP-Huntsville TL (Figure 1-2). A minimum of 5 acres would be required to allow for the proposed switching station and the associated TL terminations.

The proposed switching station site would require enough space to provide six TL terminations. The initial layout would allow for the termination of three 161-kV TLs—Byrdstown, Wolf Creek HP, and Huntsville. The TL to Byrdstown would improve the reliability in VEC's Byrdstown service area, as described in Section 1.2.

All four of the alternative switching station sites are currently undeveloped (see Figure 1-2). Site 1 is located off Narvel Road, northwest of the intersection of Narvel Road and Kentucky SR 90 between Structures 49 and 50. Site 2 is located south of Kentucky SR 90 off Old Key 90 Loop Number 4 between Structures 51 and 52. Site 3 is located off Kelsey Road, northeast of the intersection of Kelsey Road and Kentucky SR 696 between Structures 63 and 64. Site 4 is located northwest of Kentucky SR 200 between Structures 74 and 75.

Thirteen route segments, as shown in Figure 1-2, were developed using the identified switching station locations, VEC's new substation location, the GIS-based land use/land cover model, property boundaries, digital elevation model results (which were used to identify steepness and terrain characteristics), and transportation. The GIS model was used to locate TL segments that would best meet project needs by avoiding or reducing conflict with constraints (including sensitive environmental resources) and by using identified opportunities.

Segment 1 (see Figure 1-2) begins at the distributor's proposed Byrdstown substation and crosses Tennessee SR 325 before proceeding almost due north over rolling hills. This segment crosses a tributary to the Wolf River before terminating into Segments 3 and 4. Segment 1 is 0.77 mile long.

Segment 2 (see Figure 1-2) travels east from the proposed VEC substation for about 2,500 feet, before turning northeast, and crosses Tennessee SR 325 at a location that avoids existing houses. This segment continues for roughly 2 more miles, crossing rolling hills and rock bluffs, as well as the Wolf River and Begley Branch, to the end of Segment 4 and the beginning of Segment 5. Segment 2 is 2.42 miles long.

Segment 3 (see Figure 1-2) begins at the end of Segment 1, continuing in a north direction over hills and rock bluffs. After crossing the Wolf River, it travels in a northeast direction over steep terrain, crossing Tennessee SR 295 following a path northwest of homes along this road before terminating into Segments 6 and 7. Segment 3 is 1.97 miles long.

Segment 4 (see Figure 1-2) begins at the end of Segment 1 and proceeds in an easterly direction over hilly terrain and rock bluffs, crossing the Wolf River. This segment also crosses several roads and a few tributaries to Wolf River. Segment 4, which is 2.07 miles long, terminates at the end of Segment 2 and the beginning of Segment 5.

Segment 5 (see Figure 1-2) begins at the end of Segments 2 and 4 and proceeds east for about 6,700 feet before turning northeast over hilly terrain, crossing US 127 and Kroger Mountain Road. After crossing Kroger Mountain Road, the terrain becomes mountainous as the segment crosses the Tennessee and Kentucky state line and Kentucky SR 200. The TL segment continues in a northern direction, crossing back over Kentucky SR 200, to tie into the Wolf Creek HP-Huntsville 161-kV TL at Switching Station Site 4. Segment 5 traverses very steep terrain, is heavily wooded, and is 14.2 miles long.

Segment 6 (see Figure 1-2) begins at the end of Segment 3, south of Lick Creek (a major tributary of the Wolf River), and proceeds in a northwest direction, crossing over Tennessee SR 111 in an area that avoids residential buildup. Then, the TL segment continues north, crossing a wetland area just before crossing the state line. Segment 6 continues in a northerly direction, crossing US 127 and Kentucky SRs 696 and 969. This segment travels over rolling, open terrain and crosses over Hays Creek before terminating at Segments 8 and 9. Segment 6 is 7.45 miles long.

Segment 7 (see Figure 1-2) begins at the end of Segment 3, south of Lick Creek, and proceeds northeast, paralleling Lick Creek over rough, mountainous terrain. Then, the TL segment crosses US 127 and the state line before turning northwest for approximately 8,700 feet or 1.6 miles. Segment 7 then turns north for approximately 5,000 feet, crossing Asberry Road over relatively flat terrain. This segment then turns back to the northeast, roughly paralleling the east side of Tennessee SR 111 through rolling terrain. Segment 7 crosses Hays Creek; then, the segment continues across mountainous terrain, crossing the Clinton County line into Wayne County. This segment then crosses Kentucky SR 696 twice before terminating at the Wolf Creek HP-Huntsville 161-kV TL at Switching Station Site 3. Segment 7 is 12.4 miles long.

Segment 8 (see Figure 1-2) begins at the end of Segment 6 and proceeds north, crossing Smith Creek and mountainous terrain. This segment then turns in a northeasterly direction and parallels the south side of an existing East Kentucky Power Cooperative (EKPC) 69-kV TL until the segment ties into the end of Segment 10 and the beginning of Segments 12 and 13. Segment 8 is 5.23 miles long.

Segment 9 (see Figure 1-2) is 4.16 miles long, begins at the end of Segment 6 and proceeds in an easterly direction, crossing Central Union Road on rolling terrain that gradually becomes mountainous. This segment runs northwest of Mountain View Golf Course before turning north and continuing on steep terrain, terminating at Segments 10 and 11.

Segment 10 (see Figure 1-2) is 1.23 miles long, begins at the end of Segment 9, and continues in a north direction, crossing a stream, and running parallel to Davis Road. Then, the TL segment proceeds over hilly terrain that becomes less steep as the segment reaches Segment 12 (just south of an existing EKPC 69-kV TL). A residential area is located to the east of this segment.

Segment 11 (see Figure 1-2) is 1.58 miles long, begins at the end of Segment 9, and proceeds in a northeast direction crossing over first mountainous and then relatively flat terrain before connecting into the Wolf Creek HP- Huntsville 161-kV TL at Switching Station Site 2. Residential areas are located west of this segment.

Segment 12 (see Figure 1-2) is 0.58 mile long, begins at the end of Segments 8 and 10, and parallels the south side of the existing EKPC 69-kV TL. The TL segment crosses Davis Road before connecting into the Wolf Creek HP-Huntsville 161-kV TL at Switching Station Site 2. Residential areas are located north and south of this segment.

Segment 13 (see Figure 1-2) is 0.66 mile long, begins at the end of Segment 10 and continues north, crossing over SR 90 and relatively flat terrain before terminating at the Wolf Creek HP-Huntsville 161-kV TL at Switching Station Site 1.

### *2.3.6 Route Evaluation and Identification*

Each of the eight alternative TL routes offered different opportunities and constraints. Opportunities include characteristics such as open land, areas less suitable for development, and lack of sensitive environmental areas and land use conflicts. The assessment of the opportunities and constraints for these alternative routes are summarized below by engineering, environmental, land use, and cultural criteria.

Engineering

The absence of interstate roads, pipelines, and railroad crossings resulted in fewer engineering constraints along any of the alternative routes. However, the terrain presented a major challenge for route selection because of its potential effect to construction and design. The difficulty is compounded by the requirement that any points where the direction of the route changes (angle points called point of intersection [PI]) must be on a flat or elevated portion of the land and have room for the required structure guys. It is not desirable to route TLs on terrain with a slope greater than 30 percent due to the increased construction difficulty, safety concerns, and the increased potential for erosion on the cleared ROW. Routes 6 and 7 cross Caney Creek Road and cross steeper terrain than the other routes. Routes 1 and 3 cross EKPC's existing 69-kV TL. EKPC's TL presents a challenge from an engineering standpoint because of the need to provide and maintain electrical clearance over the lower-voltage TL and the requirement to coordinate design and construction with a competitive power supply company. All eight of the alternative TL routes would cross the Wolf River. The length of the alternative routes ranged from 15 to 17 miles. Route 6 is the longest.

Environmental

An environmental constraint that is common to all of the alternatives is the Wolf River. The Wolf River has been designated by the NPS as an NRI stream and is noted for its outstanding scenic, historical, and cultural values. Route 5 is the only alternative that does not cross sensitive streams, major streams, or wetlands. Routes 6 and 7 require the most acres of ROW, including the most forestland.

Land Use

Routes 1 and 2 affected more parcels of land than the other alternatives, with Route 5 affecting the fewest number of parcels. No commercial properties would be affected by any of the route alternatives.

Cultural
The absence of known archaeological sites, caves, cemeteries, or historic sites along any of the alternatives resulted in only one cultural constraint, visual impact crossings. The analysis showed that Routes 6 and 7 had the least effect on visual resources because these routes turn east after crossing the Wolf River. The other six route alternatives scored slightly higher (higher scores indicate more potential impacts and lower scores indicate less potential impacts) because they are in closer proximity to the viewshed of the Wolf River.

Eight alternate TL routes consisting of various combinations of the previously described 13 component segments were developed (see Figure 1-2 and Table 2-2) and these routes have been evaluated below.

**Table 2-2. Alternative Route Corridors**

| Alternative Route | Constituent Segments | Switching Station Site |
|---|---|---|
| 1 | 1, 3, 6, 8, 13 | 1 |
| 2 | 1, 3, 6, 8, 12 | 2 |
| 3 | 1, 3, 6, 9, 10, 13 | 1 |
| 4 | 1, 3, 6, 9, 11 | 2 |
| 5 | 1, 3, 7 | 3 |
| 6 | 1, 4, 5 | 4 |
| 7 | 2, 5 | 4 |
| 8 | 1, 3, 6, 9, 10, 12 | 2 |

Upon completion of the analysis described in Section 2.3.3.1, there was a logical spread in the overall scores of the alternative TL routes (see Table 2-3). The numerical scores ranking the alternative routes ranged from 22.36 for Route 5 (ranked lowest amount of potential impacts) to 49.51 for Route 1 (ranked most potential impacts). Routes 1 and 3 scored poorly due to high scores for both engineering and environmental criteria. Similarly, environmental scores were the primary reason that Routes 2, 4, and 8 scored poorly relative to other alternative routes. Route 5 presented the least effects with a better overall score than all the other routes. Routes 6 and 7 scored worse than Route 5 primarily because of constructability concerns. Route 5 has the fewest overall road crossings, crosses fewer parcels of land, affects fewer property owners, and is the shortest route. For these reasons, Route 5 was identified as the Preferred Route.

**Table 2-3. Alternative Route Option Rankings**

| Route Rankings | Total Score Based on Criteria Analysis | Alternative Route | Constituent Segments |
|---|---|---|---|
| 1 | 22.36 | Route 5 | 1, 3, 7 |
| 2 | 33.53 | Route 6 | 1, 4, 5 |
| 3 | 35.09 | Route 7 | 2, 5 |
| 4 | 39.70 | Route 8 | 1, 3, 6, 9, 10, 12 |
| 5 | 39.82 | Route 4 | 1, 3, 6, 9, 11 |
| 6 | 43.49 | Route 2 | 1, 3, 6, 8, 12 |
| 7 | 46.25 | Route 3 | 1, 3, 6, 9, 10, 13 |
| 8 | 49.51 | Route 1 | 1, 3, 6, 8, 13 |

## 2.4 Comparison of Alternative Routes and Switching Station Sites

Based on 13 possible alternative TL segments and four alternative switching station sites, TVA established and considered eight alternative routes ranging between 15 and 17 miles in length for this project. This section provides comparative analysis of the route segments and their relation to route alternatives.

### *2.4.1 Alternative Transmission Line Routes*

To connect VEC's new Byrdstown 161-kV Substation to one of the four alternative switching station sites, the proposed routes are primarily oriented in a north-south alignment. As described in Section 2.3.4., the proposed switching station would be located near the midpoint of the Wolf Creek HP-Huntsville 161-kV TL.

Route 1, which is 16.07 miles long, is the westernmost route and (along with Route 2) follows the greatest amount of open land requiring the least amount of ROW clearing. It also crosses the fewest acres of land with a slope greater than 30 percent. However, this route has a high number of state and local road crossings requiring several clearance pole installations and traffic coordination during construction. Route 1 also parallels and crosses over a 69-kV TL belonging to another utility, which adds to the design and construction complexity for the project. This route crosses the Wolf River (as do all the alternatives), a small wetland area, and one sensitive stream. This route passes near four occupied homes and affects 81 parcels of land. This route also crosses more areas that would result in potential effects to threatened and endangered species than the Preferred Route. These factors resulted in this alternative route ranking eighth (last) in the analysis of possible routes. This alternative, which scored 49.51 in the analysis, terminates at Switching Station Site 1.

Route 2, which is 15.99 miles long, is identical to Route 1 except the final 0.58-mile leg uses Segment 12. It does not require an aerial crossing of the 69-kV TL, has one less state road crossing, and passes near one less occupied house. This route ranked sixth best in the analyses of alternatives. This route, which scored 43.49 in the analysis, terminates at Switching Station Site 2.

Route 3 is 16.18 miles long, and the northern third of its length is slightly east of Routes 1 and 2. This route is slightly longer than Routes 1 and 2 and crosses slightly more land that is greater than 30 percent slope. This route ranked seventh best in the analysis, with a score of 46.25, and terminates at Switching Station Site 1.

Route 4, which is 15.92 miles long, consists of the same segments as Route 3 except for the final north leg, which is Segment 11. This portion of the TL passes through an area south and east of Davis Road and avoids several homes and farm buildings along that road. This route results in one less road crossing, but the route crosses more acres of steep (greater than 30 percent) slope than Route 3. It requires one less minor stream crossing and is near one less occupied home than Routes 1 through 3. This alternative ranked fifth best in the analysis of possible routes, with a score of 39.82, and terminates at Switching Station Site 2.

Route 5, which is 15.15 miles long, is located entirely east of Tennessee SR 111 and Kentucky SR 696. Route 5 consists of Segments 1, 3, and 7. It crosses two state roads and 14 roads/streets (the fewest in both categories). According to the land use/land cover map, this route crosses no wetland areas, one major stream (the Wolf River), and no other TLs. It results in the least amount of new TL ROW easement and affects the fewest parcels of land. This alternative ranked best in the analysis of possible routes, with a score of 22.36, and terminates at Switching Station Site 3.

Route 6 is the easternmost route and is 17.05 miles long. This alternative, along with Route 7, would cross the most acreage of steep terrain. As a result, Routes 6 and 7 scored lowest in terms of constructability. Routes 6 and 7 also affect the largest amount of forested land. Route 6 requires the most acres of new ROW and crosses the largest number of streams. Route 6 ranked second best in the analysis of possible routes, with a score of 33.53. It terminates at Switching Station Site 4.

Route 7, which is 16.63 miles long, differs from Route 6 only in that Segment 2 replaces Segments 1 and 4. The same characteristics for Route 6 hold true for this route; except, (due to the shorter overall length) there are slightly fewer acres of steep slope areas, a slightly lower number of ROW easement acres are required, and slightly less forest acres are impacted. Route 7 would impact more floodplain than Route 6. However, Route 6 crosses two more streams than Route 7. This alternative ranked third best in the analysis of possible routes, with a score of 35.09, and terminates at Switching Station Site 4.

Route 8 is 16.10 miles long and is very similar to Route 4 in that Segments 10 and 12 replace Segment 11. This results in Route 8 being slightly longer than Route 4. Route 8 crosses Davis Road and parallels the existing 69-kV TL. It crosses slightly fewer acres of steep sloped areas and affects slightly fewer forested acres than Route 4. Route 8, which scored 39.70 in the analysis, ranked fourth best of possible routes. This route terminates at Switching Station Site 2.

The evaluation of different routes leading to the identification of Alternative Route 5 for the Preferred Route of the 161-kV TL to the Byrdstown Substation is described in Section 2.3.6., *Route Evaluation and Identification*. Route 5 has the fewest road crossings, contains no TL crossings, is the shortest option in length, has no major stream crossings other than the Wolf River, has no wetlands impacts, has less potential impacts to endangered and threatened species than do most of the alternatives, and impacts the fewest parcels of land.

### *2.4.2 Identification of Preferred Transmission Line Route and Switching Station*

TVA's Preferred TL Route is Route 5 and consists of Alternative Segments 1, 3, and 7, and uses Alternative Switching Station Site 3 (see Figure 1-1). The switching station site is

located northeast of the intersection of Kelsey Road and SR 696 in Monticello, Kentucky, and is approximately 5.5 acres in size.

After the Preferred TL Route was identified, affected property owners were mailed information showing the location of the Preferred Route and/or switching station site on their property. Additional comments received from property owners were reviewed, and where practical, changes were made to the Preferred Route selections prior to and during engineering and environmental field surveys. The Preferred Switching Station Site 3 was moved to the east from between Structures 63 and 64 of the existing Wolf Creek HP-Huntsville 161-kV TL to an area adjacent to Structure 65 in the existing TL. This adjustment was made at the property owner's request to avoid affecting his dairy operation. Four minor adjustments were made to the TL route during field surveys (see Table 2-4). After property owners reviewed the changes, the sections were resurveyed to identify the final route.

**Table 2-4. Individual Segment Adjustments Along the Proposed Route**

| Segment | Adjustment Description | Reason for Adjustment |
|---|---|---|
| 7 | Adjusted PI[1] to the northwest where the transmission line would transition from existing ROW to new ROW | Environmental and Engineering – Avoid spring; also, PI was on very steep terrain |
| 7 | Moved PI south along centerline | Avoid barn in ROW |
| 7 | Moved PI west | Avoid old barn and house and to improve constructability |
| 3 | Moved PI south along centerline | Avoid cemetery in ROW |

[1]PI = Point of intersection or the point at which a survey turns an angle

The TL route segments were adjusted based on public and property owner input and environmental data to lessen overall impacts. For example, the TL follows parcel boundaries to lessen the impact on future uses of the property. Adjustments were also made to the TL route to reduce the proximity to sensitive areas, listed or sensitive species, and cultural/historical features.

As discussed previously, TVA would need to remove four buildings from the proposed ROW, two barns and two sheds. One barn and a shed are located west of Duvall Road near Albany. A second barn is located south of SR 1076 near Albany. Another shed is located north of SR 295 near Byrdstown. Before TVA removes a barn, a survey of the property is performed to identify any environmental hazards. TVA is required to submit an Asbestos Notification to the state for all building demolitions whether or not asbestos-containing materials are present. Surveys of these buildings were completed on November 4 and December 17, 2010, and indicated that no hazardous materials were present. Material from these buildings would be reused, recycled, or disposed of according to TVA's *Environmental Protection Procedures*.

## 2.5 The Preferred Alternative

The Action Alternative is TVA's Preferred Alternative. TVA would build a 161-kV TL from VEC's new Byrdstown Substation to a new Kelsey Road Switching Station. TVA's Preferred TL Route for the Action Alternative is Route 5 consisting of TL Segments 1, 3, and 7. Route 5 would terminate into Switching Station Site 3. The TL route would be approximately 15 miles in length.

# CHAPTER 3

## 3.0 AFFECTED ENVIRONMENT

The scope of the environmental review project area includes portions of Clinton County, Kentucky, and Pickett County, Tennessee, with a small portion of the project area occurring in Wayne County, Kentucky. The project area is comprised of 15 miles of 100-foot-wide ROW, 5.5 acres for the switching station and areas associated with project construction, operation, and maintenance of the TL and switching station, and temporary and permanent access roads.

Potential effects related to land use, prime farmland, natural areas, air quality, hazardous and nonhazardous wastes, noise, and health and safety were also considered and found to be minimal because of the nature of the action. TVA has identified other resources that would be potentially affected by the proposed project construction, operation, and maintenance through preliminary internal scoping. These resources are considered in Chapters 3 and 4.

### 3.1 Vegetation and Wildlife

Habitat assessments for the proposed TL corridor and switching station site were conducted in November 2009 and for access roads in March 2010. The project area occurs in a landscape disturbed and shaped by previous agricultural and development practices (existing roads, residential and industrial buildings). As of 2007, there were at least 1,024,000 acres of forestland in Clinton, Wayne, and Pickett counties, and the adjacent counties in both states (United States Forest Service [USFS] 2010).

The proposed project occurs within both the Eastern Highland Rim and Plateau Escarpment ecoregions (Woods et al. 2002, Griffith et al. 1998). Most of the project area (greater than 75 percent) occurs in the Eastern Highland Rim, located in Pickett County and the western portion of Clinton County. Natural vegetation in this region is an intermediate type between the oak-hickory forests found to the west and the mixed mesophytic forests found further to the east. Parts of the Eastern Highland Rim were formerly dominated by prairielike herbaceous vegetation and have been converted to pasture and cropland or have naturally transitioned to forested communities. The Plateau Escarpment is characterized by steep, forested slopes with mixed oak and chestnut oak on the upper slopes, more mesic forests (beech-tulip-poplar and sugar maple-basswood-ash-buckeye) on the middle and lower slopes, and hemlock along rocky stream banks. In the project area, this ecoregion is in the eastern portion of Clinton County and the southwestern section of Wayne County.

Two main types of vegetation characterize the proposed new TL route and switching station site: herbaceous vegetation (40 percent) and forest (60 percent). Herbaceous vegetation in the proposed TL route occurs in pastures, hayfields, agricultural fields, and fencerows. Herbaceous vegetation is characterized by greater than 75 percent cover of forbs and grasses and less than 25 percent cover of other types of vegetation. The herbaceous vegetation located in the project area is chiefly comprised of grass and forb species typical of heavily disturbed sites. Disturbances observed in the proposed project area include cattle grazing and mowing. Common species in this vegetation type are Johnson grass, Queen Anne's lace, tall fescue, and white clover.

Herbaceous wildlife habitats in the project area include existing TL ROW, cattle pastures, residential lawns, and fields. Pastures and other areas composed primarily of herbaceous vegetation provide habitat for early successional bird species such as Carolina wren, eastern bluebird, American robin, brown thrasher, white-eyed vireo, yellow-breasted chat, prairie warbler, indigo bunting, northern cardinal, blue grosbeak, field sparrow, song sparrow, and orchard oriole. Birds found in early successional habitats with a dominant grass component include dickcissel, grasshopper sparrow, savannah sparrow, northern bobwhite, eastern meadowlark, and white-throated sparrow. Small mammals such as eastern mole, white-footed mouse, and prairie vole, and larger mammals such as eastern cottontail, woodchuck, common raccoon, and white-tailed deer can be abundant in early successional habitats. Predators that hunt small mammals in these areas include red fox, coyote, snakes, and raptors such as American kestrel and red-tailed hawk. Reptiles often found in early successional habitats include black racer, black rat snake, milk snake, and common garter snake. Wetlands and streams occurring within areas dominated by herbaceous vegetation provide habitat for amphibians including American and Fowler's toads, green frog, northern cricket frog, southeastern chorus frog, and red-spotted newt.

Forest vegetation occurring in the project area is comprised of two main subtypes, deciduous and mixed evergreen-deciduous. Deciduous forests are by far the most prevalent forest subtype in the project area and account for greater than 95 percent of total forest cover. Some fragmented forested areas occur in the southern end of the project area, but the majority of forested habitat is located in the northern half of the project area, between US 127 and the northern terminus of the proposed project. Aspects occurring within both habitat types included a variety of karst features, such as sinkholes and rocky outcrops, and aquatic attributes, including an embayment, farm ponds, streams, springs, and wet-weather conveyances.

Deciduous forest is characterized by trees with overlapping crowns where deciduous species account for more than 75 percent of the canopy cover. Forest composition varied slightly with aspect, landscape position, and elevation, but common overstory species were relatively consistent throughout all of the surveyed area. Common overstory tree species included black gum, pignut hickory, shagbark hickory, sugar maple, sweetgum, tulip poplar, white ash, and yellow buckeye. The understory consisted of Carolina buckthorn, pawpaw, redbud, and sassafras. Herbaceous plants observed included Christmas fern, crossvine, Virginia creeper, and wild yam. Young deciduous forest in the project area contained black walnut, sweetgum, and white ash with a dense, yet uniform, herbaceous layer consisting of southern blackberry and trumpet creeper.

Mixed-evergreen forest is characterized by trees with overlapping crowns where evergreen and deciduous species each generally contribute 25 to 75 percent of total canopy cover. Forest composition in these areas was comparable to that found in deciduous forests except that the evergreen species white pine was a common component of the overstory.

Forest structure varied throughout the project area, but forest stands were generally less disturbed in the northern half. Along the northern portion of the proposed TL corridor, average diameter of overstory trees was between 18 and 24 inches diameter at breast height (DBH). The forest structure had relatively low concentrations of nonnative plant species. Along the southern half of the proposed TL route, forest stands were more fragmented and occurred mostly in deep coves where the average overstory trees were between 12 and 24 inches DBH. Approximately 120 acres of mature deciduous forest and

mature mixed hardwoods occur in the project area. No forested areas in the project area have structural characteristics indicative of old-growth forest stands (Leverett 1996).

Forested wildlife habitat in the project area includes deciduous forest and mixed evergreen-deciduous forest. These forested areas provide habitat for wild turkey, downy woodpecker, pileated woodpecker, white-breasted nuthatch, American crow, and Neotropical migrant birds such as wood thrush, red-eyed vireo, ovenbird, hooded warbler, black-and-white warbler, and yellow-rumped warbler. White-tailed deer and eastern gray squirrel are frequently found in deciduous forests, and scattered rock outcrops within these forests provide habitat for woodrats and other small mammals. Eastern zigzag and slimy salamanders and common reptiles including eastern box turtle, ring-necked snake, black rat snake, and copperhead were observed during field surveys. Wetlands and streams within deciduous woodlands provide habitat for amphibians such as American and Fowler's toads, northern cricket frog, spotted salamander, red salamander, and red-spotted newt.

Five caves and two heron colonies are known from within 3 miles of the proposed actions. No other unique habitats have been reported from the project area. During field investigations, unique and important terrestrial habitats were sought. Several small sinkholes were observed near the proposed route, but undocumented caves, heronries, or other unique habitats were not observed during the field surveys.

Invasive plant species are nonnative species that can degrade natural areas and displace native species, generally by outcompeting or hybridizing with native species or by altering ecological communities or ecosystem processes (Morse et al. 2004). EO 13112 for invasive plant species serves to prevent the introduction of invasive species and provides for their control to minimize the economic, ecological, and human health impacts that invasive plant species may cause. Invasive plant species have the potential to spread rapidly, displace native vegetation, and occur in dense stands of numerous individuals. During field surveys, nonnative invasive plant species were observed in forest and herbaceous vegetation types, but areas of herbaceous vegetation generally contained both greater numbers and cover of nonnative, invasive plant species. This likely reflects the frequency and magnitude of disturbance present in areas of herbaceous vegetation. Disturbances associated with mowing and grazing prevent tree species from becoming established but can also encourage invasion and establishment of weedy species. Seven nonnative invasive plant species considered to be a severe threat to native plant communities in Kentucky and Tennessee (Kentucky Exotic Plant Pest Council 2010; Tennessee Exotic Plant Pest Council 2009) were observed in the project area and include Japanese honeysuckle, Japanese stiltgrass, Johnson grass, Kentucky 31 fescue, multiflora rose, princess tree, and tree-of-heaven.

## 3.2 Aquatic Ecology

The proposed Kelsey Road-Byrdstown 161-kV TL occurs within the drainages of Beaver Creek and the Wolf River. A total of 124 watercourses occur along the proposed TL route and access roads, including 14 perennial streams, 13 intermittent streams, one seep, five springs, 89 wet-weather conveyances, and two ponds. The location of each of these watercourses was recorded using a global positioning system. A habitat assessment form was completed for each perennial and intermittent stream during a July 2010 field survey. An August field review of the proposed access roads for the project area documented additional features including two perennial streams, one pond, and five wet-weather

conveyances. A listing of stream crossings, excluding wet-weather conveyances, is provided in Appendix H.

Because TL construction and maintenance activities mainly affect riparian conditions and in-stream habitat, TVA evaluated the condition of both of these at each stream crossing along the proposed TL route. From these habitat assessments, riparian condition was assigned to one of three classes to indicate the current condition of streamside vegetation across the length of the proposed TL (Table 3-1). The assigned classes are as follows:

**Table 3-1. Riparian Condition of Streams Located Within the Project Area**

| Riparian Condition | Number of Perennial Streams | Number of Intermittent Streams | Total |
|---|---|---|---|
| Forested | 6 | 7 | 13 |
| Partially forested | 7 | 6 | 13 |
| Nonforested | 1 | 0 | 1 |
| **Total** | **14** | **13** | **27** |

- Forested - Riparian area is fully vegetated with trees, shrubs, and herbaceous plants. Vegetative disruption from mowing or grazing is minimal or not evident. Riparian width extends more than 60 feet on either side of the stream.

- Partially forested - Sparse trees and/or scrub-shrub vegetation is present within a wider band of riparian vegetation (20 to 60 feet). Disturbance of the riparian zone is apparent.

- Nonforested - Few or no trees are present within the riparian zone. Significant clearing has occurred, usually associated with pasture or cropland.

TVA then assigns appropriate SMZs and best management practices (BMPs) based upon these evaluations and other considerations (such as Tennessee's 303(d) list [TDEC 2008] and presence of endangered or threatened aquatic species). Implementation of these measures minimizes the potential for impacts to water quality and in-stream habitat for aquatic organisms.

## 3.3 Endangered and Threatened Species

Species listed at the federal level as endangered or threatened are protected under the ESA, which is administered by the USFWS. Section 7 of this act requires federal agencies to conserve these species and to consult with USFWS in situations where a federal action may affect these species or their habitats. The states of Kentucky and Tennessee also list species as endangered, threatened, or of other conservation concern.

### *3.3.1 Plants*

A June 2010 review of the TVA Natural Heritage database indicated that one federally listed plant species is known to occur in Pickett County, and no federally listed plants are known from Clinton and Wayne counties. There are six Tennessee state-listed species known from within 5 miles of the project area, and no Kentucky state-listed plant species are reported from within 5 miles of the project area.

No populations of federally or state-listed plant species were observed during field surveys conducted in June 2010. Two small rock houses in forested sections of the proposed ROW contain suitable habitat for the federally listed as endangered Cumberland sandwort, but this species was not observed during field surveys. No designated critical plant habitat is located within the proposed project area.

### *3.3.2 Terrestrial Animals*

Data from the TVA Natural Heritage database (accessed June 2010) and data provided by the Kentucky Natural Heritage Program indicated the federally listed gray bat and Indiana bat are known from Clinton and Wayne counties; there are no federally listed terrestrial animals recorded from Pickett County. Furthermore, three Kentucky state-listed animals and one Tennessee state-listed animal have been recorded from within 3 miles of the project area (Table 3-2).

During field surveys, suitable foraging habitat for both gray and Indiana bat was identified along streams and other water sources within the project area. Potentially suitable summer roosting and foraging habitat for the Indiana bat was identified within forested areas and hillsides and along some of the waterways and riparian zones, particularly on the northern end of the project area. These forests are composed of mature trees, including shaggy bark species suitable for summer roosts, as well as some snags with exfoliating bark.

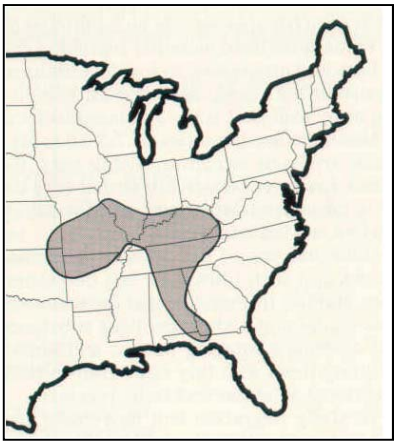
<u>Gray Bat</u>

The gray bat was listed as endangered by the USFWS in 1976. The gray bat feeds on a variety of flying aquatic and terrestrial insects and lives in caves year-round. The species occupies deep, vertical caves or mines in winter during the hibernation season and it roosts in warmer caves scattered along rivers and streams in the summer. Gray bats typically select hibernation sites with multiple entrances and good airflow where temperatures are often 41 to 48 degrees Fahrenheit (ºF). Gray bats primarily forage over open waters of rivers, streams, or reservoirs as far as 20 miles away from occupied caves; maternity colonies are typically 0.5 to 2.5 miles from foraging areas. The species' primary range is concentrated in the cave regions of Alabama, Arkansas, Kentucky, Missouri, and Tennessee (see Figure 3-1), with smaller populations found in adjacent states. Although this species has recovered in many areas, human disturbance of unprotected caves continues to be the primary cause of continued decline in some populations of the gray bat.

**Table 3-2. Federally and State-Listed Species Known From Clinton, Wayne, and Pickett Counties and/or Within a 3-Mile, 5-Mile, or 10-Mile Radius[1] of the Project Area**

| Common Name | Scientific Name | Federal Status | State Status[2] (Rank)[3] | |
|---|---|---|---|---|
| | | | Tennessee | Kentucky |
| **Plants** | | | | |
| Spreading False-Foxglove | *Aureolaria patula* | - | SPCO (S3) | - |
| Schreber Aster | *Eurybia schreberi* | - | SPCO (S1) | - |
| Starflower Solomons-Seal | *Maianthemum stellatum* | - | END (S1) | - |
| Cumberland Sandwort | *Minuartia cumberlandensis* | END | END (S2) | - |
| Grass-of-Parnassas | *Parnassia grandifolia* | - | SPCO (S3) | - |
| Shining Ladies'-Tresses | *Spiranthes lucida* | - | THR (S1S2) | - |
| Northern White Cedar | *Thuja occidentalis* | - | SPCO (S3) | - |
| **Birds** | | | | |
| Sharp-shinned Hawk | *Accipiter striatus* | - | - | SPCO (S3/S4) |
| Bald Eagle | *Haliaeetus leucocephalus* | - | NMGT (S3) | THR (S2) |
| **Mammals** | | | | |
| Rafinesque's Big-eared Bat | *Corynorhinus rafinesquii* | - | - | SPCO (S3) |
| Gray Bat | *Myotis grisescens* | END | END (S2) | THR (S2) |
| Eastern Small-footed Bat | *Myotis leibii* | - | - | THR (S2) |
| Indiana Bat | *Myotis sodalis* | END | END (S1) | END (S1S2) |
| **Fish** | | | | |
| Highfin Carpsucker[4] | *Carpiodes velifer* | - | NMGT (S2S3) | - |
| Ashy Darter | *Etheostoma cinereum* | - | THR (S2S3) | - |
| Pallid Shiner[4] | *Hybopsis amnis* | - | - | END (S1) |
| Blotchside Logperch[4] | *Percina burtoni* | - | NMGT (S2) | - |
| Longhead Darter[4] | *Percina macrocephala* | - | THR (S2) | - |
| Slenderhead Darter[4] | *Percina phoxocephala* | - | NMGT (S3) | - |
| **Mussels** | | | | |
| Ring Pink[5] | *Obovaria retusa* | END | - | END (S1) |
| Orangefoot Pimpleback[5] | *Plethobasus cooperianus* | END | - | END (S1) |
| Tennessee Clubshell | *Pleurobema oviforme* | - | TRKD (S2S3) | END (S1) |
| Fluted kidneyshell | *Ptychobranchus subtentum* | CAND | - | END (S1) |
| **Crustaceans** | | | | |
| Cumberland Cave Crayfish[5] | *Orconectes barri* | - | THR (S2S3) | - |
| **Snails** | | | | |
| Armored Rocksnail[4] | *Lithasia armigera* | - | TRKD (S1S2) | - |
| Helmet Rocksnail[4] | *Lithasia duttoniana* | - | TRKD (S2) | - |
| Ornate Rocksnail[4] | *Lithasia geniculata* | - | TRKD (S3) | - |

[1]Terrestrial animals = 3-mile radius, Plants = 5-mile radius, Aquatic animals = 10-mile radius for species records
[2]**Status Codes:** CAND = Candidate; END = Endangered; NMGT = In need of management; SPCO = Special Concern; THR = Threatened; TRKD = Tracked as sensitive but has no legal status
[3]**State Ranks:** S1 = Critically Imperiled; S2 = Imperiled; S3 = Rare, uncommon, or vulnerable, S#S# – Denotes a range of ranks because the exact rarity of the element is uncertain (e.g., S1S2)
[4]Historical occurrence, this species is considered "possibly extirpated" due to general habitat loss or degradation of the environment in the area.
[5]These species are known from a 10-mile radius but are not known to occur within the subject watersheds.



(a) Approximate Gray Bat Range

(b) Gray Bat

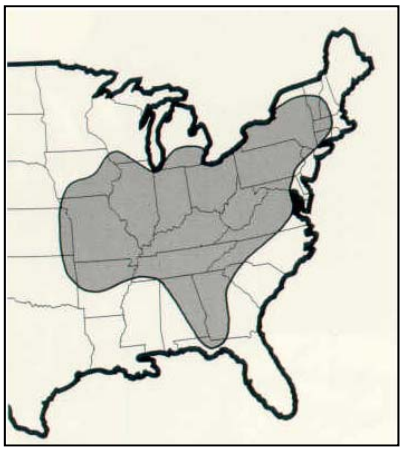
**Figure 3-1. Gray Bat Approximate Range Map and Image**

Indiana Bat

The Indiana bat originally was listed as in danger of extinction in 1966 under the Endangered Species Preservation Act, and is currently listed as endangered under the ESA of 1973, as amended. Its listing was due to large numbers of Indiana bat deaths caused by human disturbance during hibernation (USFWS 2007). A recovery plan was completed and approved in 1983, and in 2007, a new draft revised recovery plan was released reflecting knowledge of 281 hibernacula in 19 states and 269 colonies in 16 states (USFWS 2007). The USFWS completed a five-year review of the status of Indiana bat in 2009 (USFWS 2009). The current recovery priority for the Indiana bat is “Priority 8,” indicating that Indiana bat has a moderate degree of threat and high recovery potential.

The endangered Indiana bat is an insectivorous, migratory bat that hibernates in limestone caves and mines during the winter, and spends summer months living throughout the eastern United States (see Figure 3-2). In the spring, reproductive females migrate to wooded areas where they form maternity colonies. Males and nonreproductive females also migrate and roost in wooded areas but tend to stay closer to hibernacula and not roost in colonies. Summer roosts of both maternity colonies and other adults typically occur behind exfoliating bark of large trees. Maternity colonies tend to occupy dead trees with large pieces of exfoliating bark that receive direct sunlight for more than half the day. Maternity colonies occur in riparian areas, bottomland and floodplain habitats, wooded wetlands, and upland communities. Indiana bats typically forage in semi-open to closed forested habitats, forest edges, and riparian areas. Indiana bats return to hibernacula in late summer or early fall to mate and then enter into hibernation (Kurta and Kennedy 2002, USFWS 2007, USFWS 2008).

Biologically critical needs of Indiana bats include limiting use of fat during hibernation, obligate colonial roosting, high-energy demands of pregnant and nursing females, and development and weaning of young. Threats that may make Indiana bats increasingly vulnerable include significant disruption to roosting areas (both hibernacula and maternity colonies), availability of hibernacula, and connectivity and conservation of roosting, foraging, and migration corridors (USFWS 2007).



(a) Approximate Indiana Bat Range

(b) Indiana Bat

**Figure 3-2. Indiana Bat Approximate Range Map and Image**

A new threat to the gray bat and Indiana bat is white-nose syndrome, a disease affecting hibernating bats that has killed more than a million bats (primarily of other species) from New Hampshire to Tennessee and as far west as Oklahoma since the winter of 2006-2007. The fungus is not species specific, and it is considered a serious threat to gray bats and Indiana bats (USFWS 2010a).

Gray Bat Surveys

One cave occurs within the project area; however, according to a Phase 1 Cave Assessment (see Appendix I) conducted in May 2010, it does not provide suitable habitat for gray bat. Suitable foraging habitat for gray bat is available along streams and other water sources within the project area.

Mist nest bat surveys were conducted between July 13, 2010, and August 12, 2010; 44 gray bats were captured (see Appendix J). Of the 44 gray bats captured, 10 were captured in Pickett County Tennessee, 33 in Clinton County, Kentucky and one in Wayne County, Kentucky. Data provided by the Kentucky Nature Preserves Commission indicated that foraging gray bats have been captured in mist nets over Spring Creek in Clinton County, approximately 2 miles west of the project area.

Indiana Bat Surveys

TVA biologists identified potentially suitable summer roosting and foraging habitat for the Indiana bat within the vicinity of the project area. The habitat area consists of forests composed of mature trees, including species that have shaggy bark suitable for summer roosts, as well as some snags with exfoliating bark. Suitable foraging habitat for Indiana bats is available along streams and other water sources within the project area.

TVA biologists surveyed the proposed ROW in late June 2010, and identified potentially suitable forested habitat for Indiana bat, especially along the northern half of the proposed ROW. TVA communicated with USFWS to discuss next steps and ultimately decided to conduct mist net and acoustical surveys for Indiana bat within the estimated 10 miles of forested habitat within the proposed ROW. One survey site was established for every kilometer (1 kilometer = 0.62 mile) of habitat (USFWS and Kentucky Department of Fish

and Wildlife Resources [KDFWR] 2010), resulting in the need to survey a minimum of 16 sites: 10 sites in Kentucky and six sites in Tennessee.

In July 2010, the Kentucky Field Office of the USFWS provided TVA with a map updated in May 2010, identifying known Indiana bat habitat in Kentucky. The map indicated that four known Indiana bat 'Priority' hibernacula are located within 10 miles of the project area. In addition to the three hibernacula located within Wayne County, a fourth hibernacula is located within Fentress County, Tennessee. Forested habitat within 10 miles of each of these hibernacula is considered known swarming habitat. With the exception of approximately 1 mile of proposed ROW in Pickett County, Tennessee, all of the project area lies within Indiana bat swarming habitat.

Review of data provided by the Kentucky Nature Preserves Commission indicated that Indiana bats had been documented hibernating in caves located in Wayne County approximately 1.5, 5, and 7 miles from the proposed ROW. Indiana bats were not known from Pickett County prior to bat surveys conducted for this project.

Mist net and acoustical Indiana bat surveys were conducted by Third Rock Consultants (Storm 2010) in accordance with Indiana bat survey guidelines in July and August 2010 (USFWS and KDFWR 2010). The mist net survey resulted in the capture of 221 bats representing 10 species (see Appendix J).

Of the 221 bats captured during mist net surveys, three were Indiana bats, including one juvenile male in Pickett County and one juvenile male and one adult male in Wayne County. Ten bat calls were identified as Indiana bat during acoustical surveys (see Appendix J). The telemetry effort was unsuccessful in identifying a roost tree for the juvenile Indiana bat captured in Pickett County, but two roosts each were identified for the juvenile and adult male Indiana bats captured in Wayne County.

Prior to these bat surveys conducted by Third Rock Consultants in 2010, Indiana bats had not been documented in Pickett County, and the closest record in Tennessee was for hibernacula 9 miles southeast of the project area in Fentress County.

Evening emergence counts were conducted at one roost for the adult male and at two roosts for the juvenile male. One bat emerged from each tree at all roosts. The radio receiver was used during the emergence to confirm that the emerging bat was radio tagged.

A roost tree was not identified for the juvenile captured in Pickett County; therefore, the forested habitat within 5 miles of the capture site was identified as maternity colony habitat (USFWS 2010b). Since roost trees were located for the bats in Wayne County, forested habitat within 2.5 miles of the roost trees for the juvenile Indiana bat was identified as maternity colony habitat (USFWS 2010b). Portions of the proposed ROW fall within the 5-mile and 2.5-mile radius of habitat identified as maternity colony habitat.

State-Listed Species

Suitable habitat for eastern small-footed bat and Rafinesque's big-eared bat also occurs in the project area. Two eastern small-footed bats were captured in Clinton and Wayne counties, and one Rafinesque's big-eared bat was captured in Clinton County during bat mist net surveys.

Although a limited amount of marginally suitable habitat for bald eagles may be available along the Wolf River in the vicinity of the project area in Pickett County and suitable habitat is likely available throughout the project area for sharp-shinned hawks (NatureServe 2010), neither species was observed during field surveys conducted in the summer of 2010.

### *3.3.3 Aquatic Animals*

A review of the TVA Natural Heritage database in June 2010 indicated three federally listed aquatic species and 11 state-listed aquatic species are known to occur from Clinton, Wayne, and Pickett counties (Table 3-2) and/or within a 10-mile radius of the project area. The federally listed orangefoot pimpleback and ring pink mussels and the state-listed Cumberland Plateau cave crayfish are not known to occur within the potentially affected watersheds and are not analyzed further. Habitat requirements for these species are described in Etnier and Starnes (1993) for fish; Parmalee and Bogan (1998) for mussels; and NatureServe (2010) for snails and macroinvertebrates.

The fluted kidneyshell is a candidate for federal listing. It is primarily a stream and small river species, inhabiting sand or sand and gravel substrate in riffles with fast current, usually at depths of 2 feet or less (Parmalee and Bogan 1998). Suitable habitat for the fluted kidneyshell was observed within portions of the proposed ROW during field surveys of the project area. Suitable habitat was not observed for any other state-listed or federally listed species.

## 3.4 Surface Water

Precipitation in the project area averages about 57 inches per year, with the wettest month in March at 5.6 inches and the driest month in October at 3.3 inches. The average annual air temperature is 54ºF, ranging from a monthly average of 34ºF in January to 74ºF in July. Stream flow varies with rainfall and averages about 21 inches of runoff per year or approximately 1.5 cubic feet per second per square mile of drainage area.

The project area drains to tributaries of the Cumberland River. These tributaries include Gap Creek of Otter Creek of the Wolf Creek Reservoir; and Hays Creek (and its tributary Duvall Creek) of Spring Creek; Lick Creek (and its tributary South Branch); and Town Branch, all of the Wolf River of the Obey River at Dale Hollow Reservoir. In Kentucky, Otter Creek and Gap Creek are classified by Kentucky Department for Environmental Protection for warm water aquatic habitat, primary contact recreation, secondary contact recreation, and domestic water supply. In Tennessee, the Obey River is classified by TDEC for domestic and industrial water supply, fish and aquatic life, recreation, livestock watering, and irrigation. The Wolf River is classified for industrial water supply (downstream of the Kentucky state line), fish and aquatic life, recreation, livestock watering, irrigation, and trout stream (upstream of the Kentucky state line). Lick Creek, South Branch, and Town Branch are each classified for fish and aquatic life, recreation, livestock watering, and irrigation. Town Branch is listed on the Tennessee 303(d) list of “water quality limited” stream and lakes as impaired (i.e., not fully supporting its designated uses) due to nitrate and nitrite, total phosphorus level, loss of biological integrity due to siltation, and *Escherichia coli* from major municipal point source sludge and undetermined sources.

## 3.5 Groundwater and Geology

The project area is underlain by the Highland Rim aquifer system, which is part of the Interior Low Plateaus Physiographic Province. The Highland Rim aquifer consists of

flat-lying carbonate rocks of Mississippian age. Locally, the formations that make up the Highland Rim aquifer are Monteagle Limestone, Ste. Genevieve Limestone, St. Louis Limestone, Warsaw Limestone, and Fort Payne Formation (Lloyd and Lyke 1995). The bedrock formations weather to form a thick chert regolith, which stores and releases groundwater into fractures and solution openings in the bedrock (TDEC 2002).

Precipitation is the primary source of recharge in the Interior Low Plateaus Province. Most of the precipitation becomes overland runoff to streams, but some percolates downward through soil to the underlying bedrock. In the consolidated rocks, most of the water moves through and is discharged from secondary openings such as joints, fractures, bedding planes, and solution openings. As a result, groundwater discharge from springs is common throughout the Interior Low Plateaus Province.

The carbonate rocks that form the Highland Rim aquifer are typical of karst systems. The term karst refers to carbonate rocks (limestone and dolostone) in which groundwater flows through solution-enlarged channels and bedding planes within the rock. Karst topography is characterized by sinkholes, springs, disappearing streams, and caves, as well as rapid, highly directional groundwater flow in discrete channels or conduits. Because of the connections between surface and underground features, water in karst areas is not distinctly surface water or groundwater.

Karst systems are readily susceptible to contamination as the waters can travel long distances through conduits with no chance for natural filtering processes of soil or bacterial action to diminish the contamination. Mature or well-developed karst is particularly susceptible to contamination, and some karst in the project area is considered mature. In unconfined or poorly confined conditions, karst aquifers have very high flow and contaminant transport rates under rapid recharge conditions such as storm events (ibid). Consequently, the groundwater sources in karst aquifers considered most vulnerable to contamination are those that are under the direct influence of surface water.

The hydraulic characteristics of the Mississippian aquifers are present in much of the project area and can vary greatly over short distances. These large differences are reflected in the yield and specific capacity of wells completed in the limestone aquifers and the discharges of springs that issue from these aquifers. The yields of wells completed in the Mississippian aquifers commonly range from 5 to 50 gallons per minute, and maximum yields range from a few hundred to, rarely, several thousands of gallons per minute. However, such openings constitute only a small part of the rock and might be difficult to locate (Lloyd and Lyke 1995).

The groundwater in the Mississippian aquifers generally contains concentrations of dissolved solids and iron less than secondary maximum contaminant levels for drinking water established by the USEPA. The water is either a calcium-magnesium-bicarbonate type or a calcium-bicarbonate type and generally of adequate quality or can be treated and made adequate for most uses (ibid).

The majority of public drinking water for Pickett, Clinton, and Wayne counties is supplied by surface water (USEPA 2010) with a small population in Clinton and Wayne counties supplied by groundwater wells (Carey and Stickney 2004). No karst features were found within the areas of the proposed access roads. Neither the proposed TL nor the proposed access roads are located within a state-designated source-water protection area.

## 3.6 Floodplains

A floodplain is that relatively level land area along a stream or river that is subject to periodic flooding. The area subject to a 1 percent chance of flooding in any given year is considered the 100-year floodplain. The proposed TL route and several access roads (Access Roads 02, 11A, 12, 17, 23A, and 23B) cross floodplain areas associated with watercourses listed in Section 3.4 and other streams in Wayne, Clinton, and Pickett counties. The existing VEC substation is located outside of the 100-year floodplain, and the proposed Kelsey Road 161-kV Switching Station would not be located within the 100-year floodplain.

## 3.7 Wetlands

Wetlands are areas inundated by surface water or groundwater such that vegetation adapted to saturated soil conditions are prevalent. Examples include swamps, marshes, bogs, wet meadows, and lacustrine or palustrine shoreline fringes. Field surveys were conducted in November 2009 to delineate wetland areas within the proposed TL ROW, the associated access roads, and the switching station site.

Wetland determinations were performed according to USACE standards, which require documentation of hydrophytic (i.e., wet-site) vegetation, hydric soil, and wetland hydrology (Environmental Laboratory 1987; Reed 1997; United States Department of Defense and USEPA 2003). Broader definitions of wetlands, such as that used by the USFWS (Cowardin et al. 1979), the Tennessee definition (Tennessee Code 11-14-401), and the TVA Environmental Review Procedures definition (TVA 1983), were also considered in this review. Using a TVA-developed modification of the Ohio Rapid Assessment Method (Mack 2001) specific to the TVA region (Tennessee Valley Authority Rapid Assessment Method [TVARAM]), wetlands were categorized by their functions, sensitivity to disturbance, rarity, and ability to be replaced. The categorization was used to evaluate potential effects to wetlands and to determine the appropriate levels of mitigation for wetland impacts.

According to TVARAM, wetlands may be classified into three categories. Category 1 wetlands are considered “limited quality waters.” They represent degraded aquatic resources having limited potential for restoration and with such low functionality that lower standards for avoidance, minimization, and mitigation can be applied. Category 2 includes wetlands of moderate quality and wetlands that are degraded but that have reasonable potential for restoration. Avoidance and minimization are the preferred mitigation for Category 2 wetlands. Category 3 generally includes wetlands of very high quality or of regional/statewide concern, such as wetlands that provide habitat for threatened or endangered species.

The project area includes a mountainous landscape that is predominantly upland forested and pasture. Portions of the TLs cross cropland, residential areas, creeks, and drainage ways. Two wetlands, totaling 0.28 acre, were identified within the proposed TL ROW and one was identified adjacent to an access road (see Table 3-3).

**Table 3-3. Wetlands Delineated Within the Proposed Project Area**

| Wetland Identifier | Type[1] | Wetland Acreage in Proposed Right-of-Way | Estimated Forested Wetland Acreage in Proposed Right-of-Way | TVARAM Category (score) |
|---|---|---|---|---|
| W001 | PEM1E/PUBH | 0.26 | -- | 2 (30) |
| W002 | PEM1E | 0.02 | -- | 1 (18) |
| W003 | PEM/PSS/PFO/PUBH | 0 | 0 | NA |
| **Total Acres** | | **0.28** | **0** | |

[1]Classification codes as defined in Cowardin et al. (1979): PEM1 = Palustrine emergent, persistent vegetation; PUB = Palustrine, unconsolidated bottom; E = Seasonally flooded/saturated; H = Permanently flooded; PSS = Palustrine, scrub-shrub; PFO = Palustrine, forested

Wetland W001 is a small emergent wetland that resulted from a former farm pond. A component of this wetland is still open water. W001 totals 0.26 acre in size and is entirely located on the ROW. W001 exhibits hydric soils but only an ephemeral (temporary) hydrologic connection to any other waterway. W001 is dominated by hydrophytic vegetation that includes rice cut grass and spikerush.

Wetland W002 is a small emergent wetland located within a pasture at the base of an ephemeral drainage channel. This wetland totals an estimated 0.02 acre in size and is almost entirely located within the ROW. W002 exhibits hydric soils and drains into an unnamed tributary of Town Creek. W002 is dominated by hydrophytic vegetation that includes Frank's sedge and green bulrush.

Wetland W003 is an open water pond with bordering emergent, scrub-shrub, and forested wetland habitat. This wetland is located adjacent to Access Road 08, a well-maintained dirt road. W003 was once dominated by hydrophytic vegetation and exhibited hydric soil and ponding; however, it no longer shows a surface water connection to a navigable waterway.

## 3.8 Archaeological and Historic Resources

Prehistoric occupation of the region is likely to have occurred continuously since at least 12,000 B.C. Throughout this vast period, various changes in technology, settlement patterns, subsistence practices, population density, social organization, ideology, and other aspects of human behavior have occurred. Human occupation of the area is generally described in five broad cultural periods: Paleo-Indian (12,000 to 8000 B.C.), Archaic (8000 to 1600 B.C.), Woodland (1600 B.C. to A.D. 1000), Mississippian (A.D. 1000 to 1700), and Historic (A.D. 1700 to present). Prehistoric land use and settlement patterns vary during each period, but short- and long-term habitation sites are generally located on floodplains and alluvial terraces along rivers and tributaries. Following the exodus of the major tribes, the Chickasaw to the south claimed western Tennessee for hunting territory, but did not permanently settle in the area. European explorers first made their way into the Cumberland Valley beginning in the early 18th century.

Clinton County, Kentucky, was established in 1835 from portions of Cumberland and Wayne counties. Its name is in honor of the seventh governor of New York State, DeWitt Clinton. The majority of the Clinton County's economy was historically based on farming, and later on manufacturing clothing (Bryant 1992).

Wayne County, Kentucky, was established in 1800 from sections of Pulaski and Cumberland counties. The county was named in honor of General Anthony Wayne, a Revolutionary War hero. In 1775, Benjamin Price established a camp near Mill Spring, which would become one of Kentucky's first permanent settlements. Agriculture and logging were the primary basis of Wayne County's economy until the mid-1950s (Edwards 1992).

Pickett County, Tennessee, was established in 1879 from sections of Overton and Fentress counties. The county seat, Byrdstown, was incorporated in 1917. Historically, farming was an important industry in Pickett County. The farming industry and population decreased with the creation of the Dale Hollow Reservoir and Dam by the USACE in 1943. The low-cost hydroelectric power produced at the dam contributed to the construction of several clothing factories in later decades. The logging-rafting industry was integral to the Pickett County economy from the 1870s to 1930s. In addition to rafting, steam boating on the Cumberland River allowed towns such as Byrdstown to transport goods to larger markets (Owens 1998).

Archaeological Resources

The archaeological area of potential effect (APE) for the TL project consists of all areas where land-disturbing activities would take place within the project area. TVA contracted with TRC Inc. to conduct the cultural resources survey of the APE.

Prior to the survey, a records search was conducted at the Kentucky Heritage Council in Frankfort, Kentucky, the Kentucky Office of State Archaeology in Lexington, Kentucky, and the Tennessee Department of Archaeology and Tennessee Historical Commission (THC) in Nashville, Tennessee. The records search identified no previously recorded archaeological resources within the archaeological APE in Kentucky. Following the records search, an archaeological survey of the APE was conducted. The archaeological survey identified 14 newly recorded archaeological sites (Sites 15WN92, 15WN93, and 15WN94 and Sites 15CT143-153) and two isolated finds (IF) of cultural material (IF-1 and IF-2) in the APE in Kentucky (Karpynec 2010; McKee and Karpynec 2010; McKee 2010).

TVA found that 12 of the archaeological sites (Sites 15WN92-94, 15CT143, 15CT145, and Sites 15CT147-153) are ineligible for the National Register of Historic Places (NRHP), and Site 15CT144 and a portion of Site 15CT146 are potentially eligible for NRHP listing; these sites produced dense and extensive artifact assemblages and showed evidence of intact deposits (McKee 2010).

Site 15CT144 represents a multicomponent Archaic to Mississippian open-habitation site. Although the site is shallow in depth, excavations identified intact archaeological deposits. Site 15CT146 represents an Early Archaic open-habitation site. Distinct differences within the site in regard to soil deposits and density of cultural material were identified, and the northern portion of the site contains multiple distinct soil layers with cultural material up to 75 centimeters below the surface. Site 15CT144 and a portion of 15CT146 were found potentially eligible for NRHP listing under Criterion D due to the potential to provide important information on the past.

A records search at Tennessee Department of Archaeology identified one previously recorded archaeological resource (Site 40PT74) in Tennessee. Following the archival search, an archaeological field survey identified four newly recorded archaeological sites in

the Tennessee portion of the APE (Sites 40PT139, 40PT140, 40PT141, and 40PT142) (Karpynec 2010; McKee and Karpynec 2010; McKee 2010).

TRC Inc. identified no artifacts and no evidence of archaeological deposits within the portion of previously recorded Site 40PT74 in the Tennessee APE (McKee and Karpynec 2010).

Site 40PT139 consists of a prehistoric open habitation marked by a light density lithic and historic artifact scatter and the disturbed remnants of a possible chimney base. Sites 40PT140 and 40PT141 consist of indeterminate prehistoric open-habitation sites, characterized by shallow, disturbed deposits and lithic scatter. TVA found Sites 40PT139, 40PT140, and 40PT141 ineligible for the NRHP due to lack of integrity. Site 40PT142 consists of a Woodland and Mississippian period site. Shovel testing at the site found evidence of intact buried cultural deposits (McKee and Karpynec 2010). Site 40PT142 was found potentially eligible for the NRHP under Criterion D due to its potential to provide important prehistoric research.

Architectural Resources

The architectural APE is a 0.5-mile-wide buffer area centered along the proposed TL ROW. The records search conducted at Tennessee Historical Commission and Kentucky Heritage Council identified one previously recorded architectural resource in Kentucky and 14 previously recorded architectural resources in Tennessee within the architectural APE (Table 3-4).

**Table 3-4. Previously Recorded Architectural Resources in Area of Potential Effect**

| Architectural Resource | Eligibility | Line of Sight | State |
|---|---|---|---|
| CT-3 | Eligible | Sight obscured | Kentucky |
| PT-211 | Not assessed | Destroyed | Tennessee |
| PT-218 | Not assessed | No | Tennessee |
| PT-219 | Not assessed | No | Tennessee |
| PT-223 | Not assessed | Destroyed | Tennessee |
| PT-226 | Not assessed | Destroyed | Tennessee |
| PT-227 | Not assessed | No | Tennessee |
| PT-228 | Not assessed | Destroyed | Tennessee |
| PT-229 | Not assessed | No | Tennessee |
| PT-333 | Not assessed | No | Tennessee |
| PT-335 | Not assessed | Destroyed | Tennessee |
| PT-336 | Not assessed | Destroyed | Tennessee |
| PT-337 | Not assessed | No | Tennessee |
| PT-338 | Not assessed | No | Tennessee |
| PT-340 | Not eligible | Yes | Tennessee |

Of the 15 previously recorded architectural resources, six have been destroyed since their initial recordation, and seven were located outside the visual line-of-sight (see Table 3-4).

Although CT-3 is listed as eligible for the NHRP, TVA found CT-3 ineligible for NRHP listing due to lack of integrity caused by neglect and modifications; furthermore, the historic setting has been altered through the introduction of modern outbuildings. In a letter dated November 3, 2010 (see Appendix A), the Kentucky State Historic Preservation Officer (SHPO) stated that additional documentation would be required to change CT-3's NRHP designation from eligible to ineligible. TVA did not conduct an additional assessment because the Kentucky SHPO indicated the undertaking would have no adverse visual effect to CT-3; therefore, CT-3 remains listed as eligible by the Kentucky SHPO.

TVA found architectural resource PT-340 ineligible for inclusion in the NRHP due to lack of architectural distinction, loss of integrity caused by modern alterations and neglect, as well as the inability to associate the house and/or its original owner(s) with an important historical event or series of events.

Historic architectural surveys of the architectural APE identified four previously unrecorded architectural resources (CT-121, 122, 123, and 124) within the APE in Kentucky and no previously unrecorded architectural resources in Tennessee. TVA found these four properties ineligible for the NRHP due to lack of architectural distinction and loss of integrity caused by modern alterations as well as the inability to associate the house and/or its original owner(s) with an important historical event or series of events.

## 3.9 Visual Resources

The impressions of an area's visual character can have a significant influence on how it is appreciated, protected, and used. The general landscape character of the study area is described in this section.

The physical, biological, and cultural features of an area combine to make the visual landscape character both identifiable and unique. Scenic integrity indicates the degree of unity or wholeness of the visual character. Scenic attractiveness is the evaluation of outstanding or unique natural features, scenic variety, seasonal change, and strategic location. Where and how the landscape is viewed would affect the more subjective perceptions of its aesthetic quality and sense of place. Views of a landscape are described in terms of what is seen in foreground, middleground, and background distances. In the foreground, an area within 0.5 mile of the observer, details of objects are easily distinguished in the landscape. In the middleground, normally between 1 and 4 miles from the observer, objects may be distinguishable, but their details are weak and they tend to merge into larger patterns. Details and colors of objects in the background, the distant part of the landscape, are not normally discernible unless they are especially large and standing alone.

TVA's proposed 161-kV switching station would be located on Kelsey Road east of Kentucky SR 696 and approximately 15 miles northeast of Byrdstown, Tennessee, along the existing Wolf Creek HP-Huntsville 161-kV TL. Kelsey Road is a minor road with little traffic except for local residents. There are several homes in the foreground of the proposed switching station. Scenic attractiveness is common, but the scenic integrity is low.

The proposed TL would be routed over mostly open, gently rolling terrain to the southwest for approximately 0.6 mile and would continue south in the foreground of Kentucky SR 696. This road mainly sees light local traffic and has a mixture of mature hardwood and

evergreen trees outside of the ROW on both sides. The line would cross Kentucky SR 696 just north of Denny Hollow and continue south across steep and heavily vegetated terrain.

Farther south, the proposed TL route would be in the foreground of Kentucky SR 1076 on the east side. This area is sporadically populated, and the line traverses gently sloping terrain and a mixture of open agriculture fields and occasional heavily vegetated areas. Scenic attractiveness is common, and the scenic integrity is moderate.

Continuing south, the proposed TL would cross a number of unimproved roads and the foreground of occasional homes in the area. As previously mentioned, the route would cross a section of the Wolf River that is listed on the NRI to the southwest. The banks of the river are extremely steep on each side and heavily vegetated with mature trees.

The delivery point is at the new 161-kV VEC substation along Tennessee SR 325 just east of Byrdstown. The area is moderately populated, and area residents have foreground views of the existing 69-kV substation. Tennessee SR 325 is a main thoroughfare between Byrdstown and various towns to the east and west. However, traffic along Tennessee SR 325 is moderate, as most of the towns it serves have small populations. The landscape character around the existing substation is mainly rural and unremarkable.

## 3.10 Recreation

The area traversed by the proposed TL is primarily rural countryside. Terrain and general vegetative conditions range from open farmland to rugged forested ridges. These lands likely receive some informal outdoor recreation use such as hunting, nature observation, walking for pleasure and hiking.

As previously mentioned, the proposed TL also crosses a section of the Wolf River that is included in the NRI. The “Outstanding Remarkable Values” listed for the river include Scenery, History, and Cultural values. The Wolf River is a noteworthy recreational resource that is characterized by Class 1 and Class 2 rapids. Canoeing and paddling occur primarily during the winter and spring months when sufficient river flows are generally available.

The proposed TL also passes within about 0.5 mile of the Mountain View Golf Course near Savage, Kentucky.

## 3.11 Socioeconomics and Environmental Justice

<u>Socioeconomics</u>

Pickett, Clinton, and Wayne counties have relatively low population levels. As of 2009 data (United States Census Bureau 2010), the population of Pickett County is estimated to be 4,783; the population of Clinton County is estimated to be 9,403; and Wayne County’s population is estimated at 20,748.

Employment in the area depends on farming and manufacturing more than either the state or the national averages; the Kentucky average was 3.6 percent, the Tennessee average, 2.2 percent, and the national average, 1.5 percent (Bureau of Economic Analysis 2009). In 2008, 18.8 percent of total employment for Pickett County was farming. Clinton and Wayne counties were somewhat less dependent on farming, at about 12 percent in both counties.

In 2008, manufacturing accounted for almost 34 percent of the total employment in Clinton County and almost 23 percent in Wayne County (ibid). These figures were well above the state averages of about 10 percent in both Kentucky and Tennessee. However, in Pickett County, manufacturing accounted for only 5.5 percent of the total employment. The national average for manufacturing was 7.8 percent.

The subject counties have relatively low income levels. In 2008, per capita personal income in Clinton and Wayne counties was 61.2 and 52.7 percent, respectively, of the national average. In Pickett County, the per capita was 62.4 percent of the national average. In comparison, the state of Kentucky had a per capita average of 79.5 percent of the national average, and Tennessee had a per capita average of 86.7 percent.

Environmental Justice

Environmental justice is the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies. In the course of assessments under NEPA, TVA evaluates the impact of its actions on minority and low-income populations.

Minority populations in the project area are low, and poverty levels are relatively high. According to estimates for 2008, Clinton County has a minority population of 3.4 percent, and Wayne County has a minority population of 5.3 percent. The share is even lower in Pickett County with 1.9 percent of the total population. Statewide, minorities constitute 12.2 percent of the total population in Kentucky and 22.9 percent in Tennessee. All of these shares are below the national average of 34.4 percent.

As of the 2000 United States Census of Population (United States Census Bureau 2000), Wayne County had the highest poverty level of the three counties in the project area with 29.4 percent of the total population. However, Block Group 3, Census Tract 9804, which would be impacted by the proposed TLs, had a higher poverty level of 36.0 percent. In Clinton County, the poverty level was 25.8 percent. Block Group 1, Census Tract 9702, which would be impacted by the proposed TL, had a poverty level of 23.8 percent. The poverty level in Pickett County was somewhat lower at 15.6 percent. Block Groups 1 and 4, Census Tract 9851, in Pickett County would be impacted by the proposed TL and had poverty levels of 18.5 percent and 11.1 percent, respectively. Recent estimates for 2008, at the county level, indicate that poverty levels are still relatively high in the area and similar to those poverty levels reported for 2000.

# CHAPTER 4

## 4.0 ENVIRONMENTAL CONSEQUENCES

### Introduction

The potential effects of the No Action Alternative and the Action Alternative on the various resources described in Chapter 3 are provided in this chapter, which is organized similarly to Chapter 3. Under the No Action Alternative, TVA would not construct the proposed TL or switching station to serve VEC's planned substation, and the TVA power system in the Byrdstown area would continue under the current operating conditions. With the continued use of existing, aging facilities to supply power to the area, power outages could result from the failure of overloaded equipment. To provide reliable power to the area, VEC could decide to build a new TL to serve its new substation, which could result in impacts similar to or greater than those described below for the Action Alternative depending on what actions are taken.

### 4.1 Vegetation and Wildlife

#### *4.1.1 No Action Alternative*

Adoption of the No Action Alternative would not result in any project-related direct, indirect, or cumulative impacts to the terrestrial ecology of the region because terrestrial communities would not change. Invasive plant species on site would continue to be present. Terrestrial communities would likely change over time as other factors such as population, land use and development, and recreational patterns change in the area.

#### *4.1.2 Action Alternative*

Adoption of the Action Alternative would not significantly affect the vegetative ecology of the region. Adoption of this alternative would require clearing of approximately 120 acres of forest. Converting forested land to low-growing vegetation for construction and maintenance of the proposed TL would result in a long-term but minor impact. As previously described, there were at least 1,024,000 acres of forestland in Clinton, Wayne, and Pickett counties, and the adjacent counties in both states as of 2007 (USFS 2010). Cumulatively, project-related effects to forest resources would be negligible when considered in the context of the total forestland occurring in the region. In addition, data suggest that regional forest cover is stable and has not changed appreciably between 1987 and 2008 (ibid). Project-related work would temporarily affect herbaceous plant communities, but these areas would likely recover to their preproject condition.

Some areas of mature deciduous forest currently have low concentrations of invasive plants, but much of the project area currently has a large component of invasive terrestrial plants. Adoption of the Action Alternative would not significantly affect the extent or abundance of these species at the county, regional, or state level. Disturbance associated with TL and switching station construction, operation, and maintenance would likely promote increases of invasive plant species in these areas; however, the increases would be minor. TVA's implementation of the standard operating procedure of revegetating with noninvasive species (Muncy 1999) would help minimize the introduction and spread of invasive species in the project area.

Under the Action Alternative, construction of the proposed TL and switching station would result in a change in the composition of wildlife habitats in the project area. Forested habitat and other woody vegetation would be removed from the proposed ROW and associated access roads, and would be converted into early successional and scrub-shrub habitats. The switching station site would be cleared and leveled with regular maintenance to reduce vegetation encroachment into the switchyard. The initial clearing would likely temporarily displace larger animals, such as deer and turkey, from the project area into surrounding areas. Some smaller less mobile animals occupying the project areas, such as mice, shrews, frogs, and salamanders, would be impacted by construction activities. This would change the overall species composition of the area slightly in that there would be more individuals of those species that inhabit early successional habitats, while numbers of forest-dwelling species could decline.

Potential environmental effects resulting from the proposed actions include the loss of approximately 120 acres of forested habitat, increased fragmentation of remaining adjacent forests, and an increase in both early successional and edge habitats within the proposed ROW. The increase in early successional and edge habitats would benefit early successional species and species that tolerate disturbance well. The loss of forested habitats in the proposed ROW and the further fragmentation of adjacent forested areas would negatively affect Neotropical migratory birds and other wildlife that depend on forest-interior habitats. Although the overall increase in the percentage of forest edge would be small, the combination of increased edge and reduced contiguous tract size could result in lower population numbers of some species from some forested tracts. Overall, forest conversion would be regionally insignificant due to the high amount of habitat fragmentation that already exists along the proposed route. Most species that would be affected by these changes are locally and regionally common.

In general, natural habitat in the portion of the project area located in Tennessee has been greatly impacted by agricultural and residential development throughout the last century. The majority of forested areas have been previously cleared, and remaining forest is highly fragmented. Therefore, changes from the proposed project would not be regionally significant. Natural habitat in the form of forest in the Kentucky portion of the project area is less fragmented, and thus this project may contribute to fragmentation to a greater extent than in Tennessee.

With the exception of bluff habitat and Indiana bat habitat (discussed below), no unique terrestrial habitat or habitat important to terrestrial animal species (e.g., caves, clusters of vernal pools, old-growth forests) was observed within the project area during field investigations. Most bluff habitat occurs in steep areas and would be spanned by the proposed TL, thereby minimizing impacts. No heron colonies or other aggregate migratory bird colonies were observed. Therefore, environmental impacts on unique or important terrestrial habitat or bird colonies are not expected to occur.

Although a varied community of terrestrial animals use the mixture of habitats in the project area, the effects on wildlife from the habitat loss would not be significant, as similar habitats occur in abundance within the surrounding landscape. With the exception of Indiana bat habitat, the proposed project is expected to result in insignificant impacts to terrestrial wildlife or their habitats, and cumulative impacts to terrestrial ecology and wildlife are not expected to be significant. Regarding the Indiana bat habitat impacts, as described in Section 4.3.2.2, TVA has identified measures that would compensate for adverse effects to this habitat and has entered into a memorandum of agreement (MOA) with the USFWS to

implement recovery-focused conservation measures to promote the survival and recovery of the Indiana bat. The benefits resulting from the MOA could also provide conservation benefits for other federally listed species and wildlife.

## 4.2 Aquatic Ecology

### *4.2.1 No Action Alternative*

Under the No Action Alternative, the project area's conditions would not change, and no direct, indirect, or cumulative impacts to aquatic communities on or adjacent to the project area would occur. However, changes to aquatic life would likely occur over the long term due to factors such as population growth and land use changes within the area.

### *4.2.2 Action Alternative*

Aquatic life would be insignificantly affected by the proposed action. Impacts would either occur directly by the alteration of habitat conditions within the stream or indirectly due to modification of the riparian zone and storm water runoff resulting from construction and maintenance activities along the TL corridor and construction of the switching station.

Potential construction and maintenance impacts include alteration of stream banks and stream bottoms by heavy equipment and runoff of herbicides into streams. Other potential impacts would occur due to removal of streamside vegetation within the riparian zone such as increased erosion and siltation, loss of in-stream habitat, and increased stream temperatures. Siltation has a detrimental effect on many aquatic animals adapted to riverine environments. Turbidity caused by suspended sediment can negatively impact spawning and feeding success of many fish species (Sutherland et al. 2002).

Watercourses, conveying only surface water during storm events (i.e., wet-weather conveyances), would be affected by the proposed TL construction and maintenance, but these watercourses would be protected by implementation of standard BMPs as identified in Muncy (1999), designed, in part, to minimize disturbance of riparian areas and subsequent erosion and sedimentation that can be carried to streams.

SMZs are areas along the margins of bodies of open water and are typically covered with vegetation on both sides of the stream. The width of the SMZ is determined by the type of watercourse, primary use of the water resource, topography, or other physical barriers (Muncy 1999). Standard BMPs would be used in carrying out construction activities in these zones in order to protect stream banks and water quality (ibid). Because appropriate standard BMPs would be implemented during construction, operation, and maintenance of the proposed TL, access roads, and switching station, any impacts to aquatic life resulting from the proposed action would be insignificant.

## 4.3 Endangered and Threatened Species

The ESA provides broad protection for species of fish, wildlife, and plants that are listed as threatened or endangered in the United States or elsewhere. The act outlines procedures for federal agencies to follow when taking actions that may jeopardize federally listed species. The policy of Congress is that federal agencies must seek to conserve endangered and threatened species and use their authorities in furtherance of the act's purposes.

### *4.3.1 No Action Alternative*

Under the No Action Alternative, TVA would not construct the proposed TL, access roads, or switching station. Thus, any federally or state-listed species and their habitats in the project area would not be directly affected by any TVA project-related actions. The status and conservation of any potentially affected listed species would continue to be determined by the actions of others. Changes to the area would nonetheless occur over time, as factors such as population trends, land use and development, quality of air, water, and soil, recreational patterns, and cultural, ecological, and educational interests change within the area.

### *4.3.2 Action Alternative*

#### 4.3.2.1 Plants

Under the Action Alternative, no impacts are expected to endangered and threatened plant species because none are known to occur within or adjacent to the study area. Although several state-listed species are known from within 5 miles of the project area, habitat to support these species does not occur within the project area. The proposed project would not result in direct, indirect, or cumulative impacts to any federally or state-listed plant species or their habitats.

#### 4.3.2.2 Terrestrial Animals

As previously discussed, mist net surveys resulted in the capture of two federally listed species, gray bat and Indiana bat, and two state-listed species, eastern small-footed bat and Rafinesque's big-eared bat. Of the species captured, there were 44 gray bats, three Indiana bats, two eastern small-footed bats, and one Rafinesque's big-eared bat. No bald eagles or sharp-shinned hawks have been documented nesting within the project area.

Under Section 7 of the ESA, federal agencies, in consultation with the USFWS, must ensure that any action authorized, funded, or carried out by the agency is not likely to jeopardize the continued existence of an endangered or threatened species or result in destruction or adverse modification of the critical habitat of a species. Consultation involves the agency identifying potential for any listed or proposed listed species occurring in the area of the proposed action. If, based on the best scientific and commercial data available, the USFWS determines that such species are present; the agency must conduct a biological assessment (BA) to identify the species likely to be affected. Pursuant to Section 7 of the ESA, TVA prepared a BA as part of the formal consultation process. The USFWS consultation letters are included in Appendix A.

<u>Gray Bat</u>
In the BA, TVA determined that the mist net survey captures indicate that gray bats use the streams and rivers in the project area for foraging habitat and/or travel corridors, but no roost or hibernacula habitat occurs. The BA further states that TVA would implement BMPs for all stream and river crossings to minimize potential impacts to these resources and with this implementation, the proposed project is not likely to adversely affect gray bat. TVA received concurrence on its finding from the USFWS in a letter dated November 17, 2010 (Appendix A).

<u>Indiana Bat</u>
Implementation of the Action Alternative would result in the incidental take of Indiana bats in the form of habitat loss totaling not more than 5.7 acres of known maternity habitat, 62.3 acres of known maternity habitat that overlaps Indiana bat Priority 1 and 2 swarming

habitat, and 52 acres of Indiana bat Priority 1 and 2 swarming habitat within the project area. Proportions of this forest cover fall within known maternity summer habitat, known swarming habitat associated with Priority 1-2 or Priority 3-4 Hibernacula, or a known combination of both maternity and swarming habitat (62.3 acres).

TVA initially scheduled forest-clearing activities to occur from April 1 to August 15, 2011, but this is the season maternity colonies would be present. June 1 to July 31 is the most sensitive period for Indiana bat maternity colonies. TVA is planning for forest-clearing activities to occur between February 14 and March 31, although forest clearing in some areas may need to occur from April 1 to May 31 and after August 1. To minimize this impact, TVA has committed to the following restriction:

- No vegetation clearing would occur between June 1 and July 31, to minimize potential impacts to maternity colonies of the Indiana bat.

Forest clearing after July 31 is not anticipated to result in direct impacts to juveniles because juveniles are assumed able to fly, and thus, it is likely that any bats present in trees being cut would flush the tree during the forest clearing. However, some mortality resulting from clearing after July 31 would be possible.

In the event Indiana bats (maternity colony, roosting adult males, and roosting adult nonreproductive females) are present in a tree during forest-clearing activities, it is possible that adults would be able to escape the tree during the felling process (Belwood 2002). However, since juvenile bats typically are not able to fly until sometime between early July and early August (USFWS 2007; 2008), it is possible that juveniles present in trees felled during April and May could be fatally impacted, although removal of juveniles by adult females from a felled tree (relocation of a maternity colony) has been documented (Belwood 2002). During both spring and summer, removal of any trees inhabited by bats would result in immediate abandonment and displacement of any individuals present.

Noise associated with forest clearing, installation of TL poles, and site grading for the switching station could result in flushing Indiana bats from nearby roosts or avoidance of traditional foraging areas during construction. Potential sources of noise during construction of the ROW include chainsaws, skidders, bulldozers, tractors, and low ground-pressure feller-bunchers. Potential sources of noise during establishment of TL poles include use of trucks, truck-mounted augers, drills, blasting, tracked cranes, and bulldozers. These impacts would be temporary and would terminate with the completion of the construction phase of the project. However, the USFWS has expressed concern regarding potential adverse impacts to Indiana bat that could result from the noise generated from blasting. To minimize this impact, TVA has committed to the following restriction:

- No blasting would occur between November 15 and March 31 to prevent potential impacts to hibernating bats.

Direct impacts also are possible from noise associated with operations and maintenance activities. Helicopter inspections of the TL would be scheduled to occur at five-year intervals and may result in any Indiana bats that are roosting nearby to flush from their roost. However, this impact would be temporary and short-term, and is not expected to have long-term effects on any affected individuals.

Smoke from burning woody debris associated with clearing the ROW also could result in the flushing of Indiana bats from nearby roosts or in the avoidance of traditional foraging areas at or close to locations where burning occurs, a potential direct effect that would end once ROW clearing is complete. This impact would be temporary and short-term, and is not expected to have long-term effects on any affected individuals.

Proposed permanent modification of riparian areas at proposed ROW stream crossings would result in increased daylight reaching the stream corridor. Some of these areas may currently serve as foraging habitat for Indiana bats (USFWS 2007). Modification of such riparian areas could result in avoidance of foraging areas located where these stream crossings occur. Proposed installation and removal of culverts at locations where the ROW intersects streams may occur during the construction phase of the project. Placement and presence of culverts in areas utilized as foraging habitat may result in Indiana bats avoiding these sections of foraging habitat, resulting in temporary, minor impacts.

TVA conducts vegetation maintenance of ROWs approximately every five years as a standard operating practice for transmission line maintenance. Suitable habitat for Indiana bat could potentially be impacted by vegetation management activities. Trees located within a forest block and close to the edge of the ROW receive increased solar exposure, and trees adjacent to the ROW are subject to immediate drift from application of herbicides within the ROW, which may result in premature death of vegetation. The combined effect may result in clumps of snags near the edge of the ROW that may become suitable roosting habitat for Indiana bats. Indiana bats may thus be present in trees identified as danger trees and slated for removal. Removal of danger trees adjacent to the ROW may have potential direct effects to Indiana bat. To minimize this impact, TVA has committed to the following restriction:

- Danger trees identified as potentially suitable habitat for Indiana bat would not be removed between June 1 and July 31.

Indirect effects from the proposed project would primarily include loss of available habitat for use during subsequent summer maternity and swarming seasons. Site fidelity to the degree that a tree or cluster of trees remains suitable for roosting across years, due to the ephemeral nature of snags has been documented in Indiana bats (Gumbert et al. 2002). Any loss of habitat used by adult females for maternity colonies may result in these females (or their female progeny) searching for suitable habitat for a longer period of time at the beginning of the maternity season, thereby expelling more energy than they may have if they were returning to a known maternity roost tree or cluster of roost trees.

Indirect effects also may include impacts to contiguous forested travel corridors used to transition between summer habitat and hibernacula. Fragmentation of the landscape and establishment of the ROW may become a barrier to movement. However, Indiana bats have been documented moving through habitats with patchy, diverse cover types (noncontiguous forest) (Watrous et al. 2006) and have been captured along roads within bisected forest (Kurta and Kennedy 2002). The ROW will likely serve as a corridor along which Indiana bats would travel between roosts and foraging areas.

Due to precise construction methods, boundaries, and use of standard BMPs, little impact from storm water runoff and sedimentation are expected to affect the streams and other aquatic features present in and adjacent to the ROW. Thus, indirect effects to foraging habitat through impacts to water quality are not expected.

Associated nonfederal actions include VEC's plan to upgrade its existing Byrdstown 69-kV Substation to 161-kV operation, potential private land use activity within the proposed ROW that occurs as a result of clearing the ROW (e.g., deer hunting, expansion of livestock pasture, etc.), and potential residential and commercial growth in the area. Residential and commercial growth could lead to future clearing of forest on private land, further fragmenting the forest cover in the action area, affecting Indiana bat. Clearing of forest could result in disruption to Indiana bat roosting areas and to connectivity of roosting-foraging and migration corridors.

In a letter dated October 26, 2010 (see Appendix A), TVA determined that the project could adversely affect Indiana bats. The proposed project would have both direct and indirect effects on the Indiana bat. The primary effect would be direct loss of 120 acres of forest, including the loss of 62.3 acres of known maternity and swarming habitat for Indiana bats in the project area. Other elements that could directly impact Indiana bats include noise associated with construction and maintenance of the TL, timing of forest clearing, and smoke from burning woody debris.

TVA proposes to minimize the adverse effects of forest clearing and likely incidental take of Indiana bats in the form of habitat loss that would occur under the Action Alternative by entering into an Indiana bat conservation MOA with the USFWS, established by the Kentucky Ecological Services Office. The MOA incorporates by reference the USFWS's incidental take statement and June 5, 2008, intra-service biological opinion, and authorizes any incidental take of the Indiana bat. In summary, the MOA provides recovery-based conservation benefits for the Indiana bat in the form of monetary contributions to the Indiana Bat Conservation Fund (IBCF), administered by the Kentucky Natural Lands Trust. The IBCF will fund Indiana bat habitat protection, conservation, restoration, and/or priority monitoring, and research projects for the Indiana bat. TVA's contribution amount of $776,055 is based on the assumption that about half of the tree removal is planned to occur when Indiana bats are not anticipated to be present, between November 15 to March 31, and the remaining tree clearing would occur when Indiana bats are anticipated to be present, from April 1 to November 14. If additional forested areas were to be removed, TVA would coordinate with the USFWS to determine if modifications to the MOA would be necessary. To mitigate for this impact, TVA has committed to the following:

- As described in the MOA, TVA would contribute $776,055 to the Indiana Bat Conservation Fund to compensate for impacts to 5.7 acres of known Indiana bat maternity habitat, 62.3 acres of known maternity habitat that overlaps Indiana bat swarming habitat, and 52 acres of Indiana bat swarming habitat.

Entering into this MOA satisfies TVA's obligation to consult with the USFWS under Section 7 of the ESA, relative to the Indiana bat, in order to ensure that the proposed project does not jeopardize the continued existence of the Indiana bat or result in adverse modification of its critical habitat. ESA consultation for the other species that could occur in the project area was completed on November 17, 2010, when the USFWS concurred with TVA's "no effect" and "not likely to adversely affect" determinations on those species (Appendix A).

<u>Eastern Small-Footed Bat and Rafinesque's Big-Eared Bat</u>
Captures of eastern small-footed bat and Rafinesque's big-eared bat during July-August 2010 bat surveys indicate that these species likely forage along open water, in the form of rivers and streams, both within and adjacent to the project area. Impacts to these species from constructing the TL would be minimal and temporary because of the implementation of

BMPs such as implementing sediment and erosion controls, minimizing the number of stream crossings, and retaining 50 to 75 percent of canopy along streams at all stream and river crossings. However, habitat alteration may result in minor changes to foraging behavior. Suitable roosting habitat for eastern small-footed bats may be available in the form of hollow trees within the project area; however, such habitat is available in abundance adjacent to the project area, and thus the species could easily relocate to nearby habitat. Removal of hollow trees is not expected to adversely impact this species. Caves or bridges serve as suitable summer roosting habitat for eastern small-footed bat and none were observed within the project area during field investigations. Proposed actions are not expected to impact Rafinesque's big-eared bat or its suitable winter hibernating or summer roosting habitat.

#### 4.3.2.3 Aquatic Animals

As described in the BA, TVA has determined that construction of the proposed TL would not affect fluted kidneyshell, orangefoot pimpleback, and ring pink. Habitat for fluted kidneyshell is present in streams that would be affected by the proposed project. However, implementation of standard BMPs would prevent impacts from occurring. Therefore, the proposed project would have no effect to fluted kidneyshell, orangefoot pimpleback, ring pink, and other endangered and threatened aquatic animals. The proposed project is expected to have no direct, indirect, or cumulative impacts on federally and state-listed aquatic animal species.

## 4.4 Surface Water

### *4.4.1 No Action Alternative*

Under the No Action Alternative, there would be no direct, indirect, or cumulative impacts to surface water quality because there would be no change from the current situation. Therefore, no environmental effects to current surface water conditions would occur. However, changes to surface water would likely occur over the long term due to other factors such as population growth and land use changes in the area.

### *4.4.2 Action Alternative*

Under the Action Alternative, the majority of impacts to the switching station project site would result from the placement of fill. Stream and soil disturbances associated with access roads and other construction activities have the potential to result in adverse surface water and water quality impacts. To minimize the potential impacts to surface water, TVA routinely includes precautions in the design, construction, and maintenance of its TL projects. Permanent stream crossings that cannot be avoided would be designed not to impede runoff patterns and the natural movement of aquatic fauna. Temporary stream crossings and other construction and maintenance activities would comply with appropriate state permit requirements and TVA requirements as described in Muncy (1999). Canopies in all SMZs would be left undisturbed unless there were no practicable alternative. ROW maintenance would employ manual and low-impact methods wherever possible. In areas requiring chemical treatment, only USEPA-registered herbicides would be used in accordance with label directions that were/are designed in part to restrict applications in the vicinity of receiving waters and to prevent unacceptable aquatic impacts. Proper implementation of these controls is expected to result in only minor temporary direct and indirect impacts to surface waters. No cumulative impacts are anticipated.

## 4.5 Groundwater and Geology

### *4.5.1 No Action Alternative*

Under the No Action Alternative, there would be no effects to groundwater resources or geological features because the proposed transmission lines and switching station would not be constructed. The TVA power system in the Byrdstown area would continue under the current operating conditions, and periodic and routine maintenance of the ROW would continue. Thus, there would be no additional effects to groundwater or geological resources under the No Action Alternative.

### *4.5.2 Action Alternative*

Under the Action Alternative, standard BMPs (Muncy 1999) would be used to avoid contamination of groundwater and to control sediment infiltration in the project area. The vegetation management guidelines and procedures as described in Appendix G to minimize potential impacts would be followed during periodic vegetation maintenance in the ROW. With the implementation of BMPs and routine precautionary measures, direct, indirect, and cumulative impacts to groundwater from the proposed action would be insignificant.

## 4.6 Floodplains

EO 11988, Floodplain Management, directs all federal agencies to take actions to reduce the risk of flood loss, to minimize the impacts of floods on human safety, and to preserve the natural and beneficial values served by floodplains. The EO is not intended to prohibit floodplain development in all cases, but rather to create a consistent government policy against such development under most circumstances. The EO requires that agencies avoid actions in the 100-year floodplain unless there is no practicable alternative.

### *4.6.1 No Action Alternative*

Under the No Action Alternative, there would be no direct, indirect, or cumulative impacts to floodplains because there would be no physical changes to the current conditions found within the local floodplain. However, changes to floodplains would likely occur over the long term due to factors such as population growth and land use changes within the area.

### *4.6.2 Action Alternative*

The proposed TL route and several access roads cross 100-year floodplain areas in Wayne, Clinton, and Pickett counties. Consistent with EO 11988, an overhead TL and related support structures and access roads are considered repetitive actions that would result in minor impacts to the 100-year floodplain. The proposed switching station site is not located within the 100-year floodplain; therefore, no floodplain impacts at the switching station site are anticipated.

The construction of the support structures for the proposed TL would not be expected to result in any increase in flood hazard from either increased flood elevations or changes in flow-carrying capacity of the streams being crossed. To minimize adverse impacts, any new road construction in the floodplain would be done in such a manner that upstream flood elevations would not be increased. In addition, to minimize impacts to natural and beneficial floodplain values, the ROW would be revegetated where natural vegetation is removed as described in Appendix C. Under the Action Alternative, direct, indirect, or cumulative impacts to floodplains associated with this project would be minor, and the proposed project would comply with the TVA Flood Control Storage Loss Guideline and EO 11988.

## 4.7 Wetlands

Activities in wetlands are regulated under Section 404 and Section 401 of the Clean Water Act and are addressed by EO 11990, Protection of Wetlands. Section 404 requires that certain activities in jurisdictional wetlands be authorized by the USACE through a Nationwide General Permit or Individual Permit. Section 401 requires water quality certification by the state for projects permitted by the federal government (Strand 1997). EO 11990 requires agencies to minimize wetland destruction, loss, or degradation, and preserve and enhance natural and beneficial wetland values, while carrying out agency responsibilities. TVARAM is used as an aid in guiding wetland mitigation decisions consistent with TVA's independent responsibilities under NEPA and EO 11990.

### *4.7.1 No Action Alternative*

Under the No Action Alternative, no disturbance to wetlands within the proposed TL ROW or switching station construction site would occur, and no wetlands would be affected. TVA would continue to maintain vegetation in existing ROWs, and BMPs would be used for all maintenance activities to ensure that wetland impacts are temporary and insignificant. The proposed project would not have direct, indirect, or cumulative impacts on wetlands under the No Action Alternative.

### *4.7.2 Action Alternative*

The TL would span the two emergent wetlands located within the proposed ROW, and no structures would be placed in the wetlands. Because little to no vegetation clearing would occur in the wetlands, they would continue functioning in the same capacity as current conditions. Because the wetlands located within the proposed ROW boundaries would be subject to periodic ROW vegetation management, these areas would continue to be maintained as emergent wetland areas. No wetland impacts are anticipated from the proposed switching station or access roads.

Cumulative impact analysis of wetland effects takes into account wetland loss and conversion at a watershed-level scale. This proposed project would not result in any permanent wetland loss or conversion; therefore, no cumulative wetland impacts are anticipated. Potential indirect wetland impacts would be reduced to an insignificant level during the TL and switching station construction, ROW maintenance, and associated access through implementation of standard BMPs (Muncy 1999). Because of these measures, the proposed project would have no significant direct, indirect, and/or cumulative impacts to wetland areas and the associated wetland functions and values provided within the project area and general watershed.

## 4.8 Archaeological and Historic Resources

Historic and cultural resources, including archaeological resources, are protected under various federal laws, including the Archaeological Resources Protection Act, the Native American Graves Protection and Repatriation Act, and the NHPA. Section 106 of the NHPA requires federal agencies to consult with the respective SHPO when proposed federal actions could affect these resources.

### *4.8.1 No Action Alternative*

Under the No Action Alternative, there would be no direct, indirect, or cumulative impacts to historic or archaeological resources because there would be no changes to the project area. Changes to cultural resources may occur independently over time due to factors

such as population increases, changes in land use, and the potential for development to occur in the area.

### *4.8.2 Action Alternative*

Pursuant to regulations (36 CFR Part 800) implementing Section 106 of the NHPA, TVA consulted with the Kentucky and Tennessee SHPOs to assess potential impacts to historic properties (architectural resources and archaeological resources) in the APE.

TVA found that no architectural resources potentially eligible for the NRHP would be affected, and no further investigations are recommended.

TVA considers archaeological resources Sites 40PT142, 15CT144, and a portion of Site 15CT146 potentially eligible for listing in the NRHP; no other sites are considered eligible for listing in the NRHP. In order to avoid impacts to these sites, TVA proposes the following avoidance measures:

- TVA would not place any TL structures within the boundaries of Sites 40PT142, 15CT144, and the eligible portion of Site 15CT146. Additionally, all work within the boundaries of these sites would be conducted in dry conditions or with low-ground pressure-tired equipment. If these options were not possible, then mats would be used.

With these avoidance measures in place, TVA finds that no archaeological sites eligible for the NRHP would be adversely affected by the proposed undertaking, and no further investigations are recommended. Furthermore, TVA found that no architectural resources potentially eligible for the NRHP would be affected, and no further investigations are recommended.

<u>Archaeological Resources</u>
In a letter dated November 5, 2010 (see Attachment A), TVA sought concurrence from the Kentucky SHPO with its finding that Site 15CT144 and a portion of Site 15CT146 are eligible for listing in the NRHP. Furthermore, TVA sought concurrence for its finding that archaeological Site 15CT144 and the eligible portion of Site 15CT146 would not be affected, with the implementation of previously described avoidance measures. In a response letter dated December 20, 2010 (see Appendix A), the Kentucky SHPO concurred with TVA's finding that Site 15CT144 and a portion of Site 15CT146 are potentially eligible for listing in the NRHP. The Kentucky SHPO also concurred with TVA's finding that the proposed undertaking would have no adverse effect on Sites 15CT144 and 15CT146, provided the sites are avoided in their entirety. Furthermore, the Kentucky SHPO indicated with these conditions met, TVA's responsibility to consult under the Section 106 review process for archaeology is fulfilled.

In a letter dated November 10, 2010 (see Appendix A), TVA sought concurrence from the Tennessee SHPO for its findings that Site 40PT142 is potentially eligible for listing in the NRHP. TVA also determined that the proposed undertaking would have no adverse effect on Site 40PT142, with the implementation of previously described avoidance measures. In a letter dated December 6, 2010 (see Appendix A), the Tennessee SHPO responded, indicating the project site has no archaeological sites eligible for listing in the NRHP. Therefore, the proposed undertaking would have no effect on archaeological resources potentially eligible or currently listed in the NRHP.

Architectural Resources
In a letter dated October 5, 2010 (see Appendix A), TVA sought concurrence from the Kentucky SHPO with TVA's findings and recommendations that no architectural resources in the Kentucky portion of the APE for listing in the NRHP. Furthermore, TVA sought concurrence for its findings that no architectural resources potentially eligible for the NRHP would be affected. The Kentucky SHPO responded in a letter dated November 3, 2010 (see Appendix A), and concurred with TVA's finding that the proposed undertaking would have no adverse visual effect to architectural resources based on pole height, mature vegetation obscuring lines of site to the TL ROW, and modifications to the landscape due to modern construction. As previously discussed, the Kentucky SHPO indicated in the November 3, 2010, letter that additional documentation would be required to change CT-3's NRHP designation from eligible to ineligible. TVA did not conduct an additional assessment because the Kentucky SHPO indicated the undertaking would have no adverse visual effect to CT-3; therefore, CT-3 remains listed as eligible by the Kentucky SHPO.

In a letter dated November 10, 2010 (see Appendix A), TVA sought concurrence from the Tennessee SHPO with TVA's findings and recommendations that the architectural resources in the APE are ineligible for listing in the NRHP or are outside the visual line of site of the proposed project and are therefore not impacted. Pursuant to 36 CFR 800.4(d)(1)(i), the Tennessee SHPO did not object with TVA's findings and recommendations regarding the proposed projects' effects to historic structures. Therefore, the proposed undertaking would have no effect on architectural properties potentially eligible or currently listed in the NRHP.

Tribal Consultation
Pursuant to 36 CFR §§ 800.2 (c)(2)(ii), 800.3 (f)(2), and 800.4 (a)(4)(b), TVA consulted with the appropriate federally recognized tribes in letters dated November 5, 2010, regarding historic properties within the proposed project's APE that may be of religious and cultural significance to tribes and that are eligible for listing in the NRHP (see Appendix A). No issues or objections regarding the proposed project were identified by the tribes contacted.

## 4.9 Visual Resources

Visual consequences were examined in terms of visual changes between the existing landscape and proposed actions, sensitivity of viewing points available to the public, their viewing distances, and visibility of proposed changes. Scenic integrity indicates the degree of intactness or wholeness of the landscape character. These measures help identify changes in visual character based on commonly held perceptions of landscape beauty and the aesthetic sense of place.

### *4.9.1 No Action Alternative*

Under the No Action Alternative, TVA would not construct the proposed transmission line improvements at this time, and there would be no direct, indirect, or cumulative impacts to visual resources. Visual resources would not be affected, but the scenic quality of the area would eventually change over time as other factors such as population growth, land use such as other development, and cultural and ecological interests in the area change.

### *4.9.2 Action Alternative*

The proposed TL would be routed over mostly open, gently rolling terrain to the southwest for approximately 0.6 mile and would continue south in the foreground of Kentucky SRs 696 and 1076 and numerous unimproved roads. Area residents would have foreground views

of the new line and structures that would be similar to myriad service poles and lines currently seen in the landscape. New access roads would be visually similar to other roads that are seen in the area now. Operation, construction, and maintenance of the proposed TL and access roads would be visually insignificant. There may be some minor visual discord during the construction period due to an increase in personnel and equipment and the use of laydown and material storage areas. These visual obtrusions would be temporary until the proposed ROW and laydown areas have been restored using TVA standard BMPs (Muncy 1999). Visual impacts would be minor and insignificant.

To the southwest, the route would cross Wolf Creek. This section of the Wolf River, which is listed on the NRI, is already impacted by the bridge crossing on Tennessee SR 295. Recreation users would likely only have views of the TLs in the foreground from the northwest and southeast. Proposed transmission structures on each bank of the river would likely not be seen due to existing dense vegetation and steep banks that make the angle of repose too severe for adequate views from the creek. Therefore, the TL crossing at Wolf River is expected to have minor and insignificant cumulative impacts.

The delivery point is at the new 161-kV VEC substation along Tennessee SR 325 just east of Byrdstown. The area is moderately populated, and area residents have foreground views of the existing 69-kV substation. The delivery point would add to the number of new structures seen in the landscape. However, these views would be similar to views of the existing substation and associated TLs, and visual impacts would not be significant.

TVA's proposed 161-kV switching station would be located on Kelsey Road east of Kentucky SR 696 and approximately 15 miles northeast of Byrdstown, Tennessee, along the existing Wolf Creek HP- Huntsville 161-kV TL. There are several homes in the foreground of the proposed switching station, and these residents currently have views of the existing TL and associated structures. The new switching station would contribute to the number of discordantly contrasting elements seen in the landscape. However, the new elements would be visually similar to the nearby and adjacent industrial elements seen in the landscape now.

There may be some minor and temporary visual discord during the construction of the switching station due to an increase in personnel and equipment and the use of laydown and material storage areas. These visual obtrusions would be temporary until the proposed ROW and laydown areas have been restored using TVA standard BMPs (Muncy 1999). Waste light from the new switching station would be minimized by implementation of TVA's standard substation lighting guidelines as described in Appendix F. Thus, the visual change for area residents would be minor.

## 4.10 Recreation

### *4.10.1 No Action Alternative*

Under the No Action Alternative, no changes to the project area would occur and no direct, indirect, or cumulative effects to local recreational opportunities or experiences are anticipated. Changes to these features as well as their management objectives would nonetheless occur over time as other factors such as population trends, land use and development, quality of air/water/soil, recreational patterns, and cultural, ecological, and educational interests within the area change.

### *4.10.2 Action Alternative*

Under the Action Alternative, the proposed TL would cross the Wolf River, an NRI water body, about 0.2 mile southeast of the SR 295 bridge. Because the Wolf River is listed on the NRI, TVA contacted the NPS regarding the proposed TL project. In the letter, TVA indicated that land use features near the river crossing include a mix of agricultural lands, residences, and forested slopes. Furthermore, TVA determined that because of the existing development in this area of the river and the intervening forest vegetation, the presence of the proposed TL is not expected to result in a significant impact on the recreational character or recreational use of the river. The NPS did not provide comments to TVA regarding the proposed TL project.

Mountain View Golf Course is located within approximately 0.5 mile of the TL project area. Because of the intervening forest vegetation and the elevation differences between the proposed TL and the golf course, the presence of the proposed TL is not expected to influence the recreational experiences afforded by the golf course to a significant extent.

Construction and maintenance of the TL may result in some minor shifts in the informal recreational use patterns that may currently take place along the project route. However, these impacts would be minor and insignificant.

## 4.11 Socioeconomics and Environmental Justice

### *4.11.1 No Action Alternative*

Under the No Action Alternative, there is likelihood of overloading at the existing VEC substation. This overloading could lead to outages and such outages could be expensive, especially for commercial or industrial consumers. Power supply problems for the Byrdstown area would continue to worsen, creating economic and social problems in the area. A noticeable increase in the risk of an outage could diminish the desirability of property located in the impacted area, which would in turn negatively affect property values and marketability. It could also decrease the attractiveness of the area for location of businesses.

As discussed in Chapter 3, there are no major concentrations of economically disadvantaged or minority populations in the area. Therefore, adoption of the No Action Alternative would not disproportionately affect any such populations. Most likely, low-income populations would be impacted the most because options such as relocating elsewhere would be less readily available to them.

### *4.11.2 Action Alternative*

Under the Action Alternative, construction of the proposed line would have a minor positive impact on the local economy. Once completed, the project would result in more reliable power delivery, which would likely result in beneficial impacts to the regional economy.

Generally, the project area is sparsely populated and rural in nature. Much of the western portion of the area is used for residential development or farming activities. The portion to the east is primarily hardwood forest. Construction of the proposed TL would have a small impact on these land uses. These impacts would not be significant, especially over the long term.

TVA would purchase easements from property owners in areas that would require the acquisition of new ROW. Property owners would be offered fair market value for these rights. The easement would give TVA the right to construct the TL, including the placement of structures, and operate and maintain the TL and the ROW. Because construction would be short term, and most materials would be brought into the area, the economic effect on the local economy would be minor and insignificant.

In situations where the proposed TL is near homes, some short-term adverse impacts on property value and marketability could occur. However, these impacts would be highly variable and not readily predictable. Long-term adverse effects on property values are unlikely. One recent study (Chalmers and Voorvaart 2009) concluded, "a presumption of material negative effects of high voltage TLs on property values is not warranted." Research results vary, and some early studies found little impact of TLs on property values. Some more recent studies indicate that impacts in the range of 5 to 10 percent are possible for properties adjacent to a TL. The size of the impact appears to be sensitive to distance, with little or no impact to properties that are not adjacent or very close (within 200 feet) to the TL. The degree of effect depends on distance from the TL as well as the appearance of the ROW and how it blends visually with the neighborhood (Hamilton and Schwann 1995; Gregory and von Winderfeldt 1996; Electric Power Research Institute 2003). Another study determined if the TL is at least partially screened from view by trees, landscaping, or topography, negative effects are reduced considerably, and negative impacts due to TL proximity usually diminish entirely in four to 10 years (Pitts and Jackson 2007).

**Environmental Justice**

Under the Action Alternative, minority and low-income populations in the Byrdstown power service area would share in the benefits of reliable power and would not be disproportionately affected by impacts that may occur. There are no significant concentrations of minority or low-income populations near the proposed TL and switching station. For this reason and because of the relatively low minority population and poverty rates in the general area, no disproportionate impacts to disadvantaged groups or minority populations are expected.

## 4.12 Postconstruction Effects

### *4.12.1 Electric and Magnetic Fields*

TLs, like all other types of electrical wiring, generate both electric and magnetic fields (EMFs). The voltage on the conductors of a TL generates an electric field that occupies the space between the conductors and other conducting objects such as the ground, TL structures, or vegetation. A magnetic field is generated by the current (i.e., the movement of electrons) in the conductors. The strength of the magnetic field depends on the current, the design of the line, and the distance from the line.

The fields from a TL are reduced by mutual interference of the electrons that flow around and along the conductors and between the conductors; the result is even greater dissipation of the low energy. Most of this energy is dissipated on the ROW, and the residual very low amount is reduced to background levels near the ROW or energized equipment.

Magnetic fields can induce currents in conducting objects. Electric fields can create static charges in ungrounded, conducting materials. The strength of the induced current or charge under a TL varies with: (1) the strength of the electric or magnetic field, (2) the size

and shape of the conducting object, and (3) whether the conducting object is grounded. Induced currents and charges can cause shocks under certain conditions by making contact with objects in an electric or magnetic field.

The proposed TL, like other TLs, has been designed to minimize the potential for such shocks. This is done, in part, by maintaining sufficient clearance between the conductors and objects on the ground. Stationary conducting objects, such as metal fences, pipelines, and highway guardrails, that are near enough to the TL to develop a charge (typically, these would be objects located within the ROW) would be grounded by TVA to prevent them from being a source of shocks.

Other public interests and concerns have included potential interference with AM radio reception, television reception, satellite television, and implanted medical devices. Interference with radio or television reception is typically due to unusual failures of power line insulators or poor alignment of the radio or television antenna and the signal source. Both conditions are correctable and would be repaired if reported to TVA.

Implanted medical devices historically had a potential for power equipment strong-field interference when they came within the influence of low-frequency, high-energy workplace exposure. However, the older devices and designs (i.e., those beyond five to 10 years old) have been replaced with different designs and different shielding that prevent potential for interference from external field sources up to and including the most powerful magnetic resonance imaging medical scanners. Unlike high-energy radio frequency devices that can still interfere with implanted medical devices, low-frequency and low-energy powered electric or magnetic devices no longer potentially interfere (*Journal of the American Medical Association* 2007).

Research has been done on the effects of EMFs on animal and plant behavior, growth, breeding, development, reproduction, and production. Research has been conducted in the laboratory and under environmental conditions, and no adverse effects or effects on health or the above considerations have been reported for the low-energy power frequency fields (World Health Organization [WHO] 2007a). Effects associated with ungrounded, metallic object's static charge accumulation and discharge in dairy facilities have been found when the connections from a distribution line meter have not been properly installed on the consumer's side of a distribution circuit.

TVA TLs are built with overhead ground wires that would lead a lightning strike into the ground for dissipation. Thus, a safety zone is created under the ground wires at the top of structures and along a line for at least the width of the ROW. The NESC is strictly followed when installing, repairing, or upgrading TVA lines, substations, or equipment.

There is some public concern as to the potential for adverse health effects that may be related to long-term exposure to EMFs. A few studies of this topic have raised questions about cancer and reproductive effects on the basis of biological responses observed in cells or in animals or on associations between surrogate measures of power line fields and certain types of cancer. Research has been ongoing for several decades.

The consensus of scientific panels reviewing this research is that the evidence does not support a cause-and-effect relationship between EMFs and any adverse health outcomes (e.g., American Medical Association 1994; National Research Council 1997; National Institute of Environmental Health Sciences [NIEHS] 2002). Some research continues on

the statistical association between magnetic field exposure and a rare form of childhood leukemia known as acute lymphocytic leukemia. A review of this topic by the WHO (International Association for Research on Cancer 2002) concluded that this association is very weak, and there is inadequate evidence to support any other type of excess cancer risk associated with exposure to EMFs.

TVA follows medical and health research related to EMFs, along with media coverage and reports that may not have been peer reviewed by scientists or medical personnel. No controlled laboratory research has demonstrated a cause-and-effect relationship between low-frequency electric or magnetic fields and health effects or adverse health effects even when using field strengths many times higher than those generated by power lines. Statistical studies of overall populations and increased use of low-frequency electric power have found no associations (WHO 2007b).

Neither medical specialists nor physicists have been able to form a testable concept of how these low-frequency, low-energy power fields could cause health effects in the human body where natural processes produce much higher fields. To date, there is no agreement in the scientific or medical research communities as to what, if any, electric or magnetic field parameters might be associated with a potential health effect in a human or animal. There are no scientifically or medically defined safe or unsafe field strengths for low-frequency, low-energy power substation or line fields.

The current and continuing scientific and medical communities' position regarding the research and any potential for health effects from low-frequency power equipment or line fields is that there is no reproducible or conclusive data demonstrating an effect or an adverse health effect from such fields (WHO 2007c). In the United States, national organizations of scientists and medical personnel have recommended no further research on the potential for adverse health effects from such fields (American Medical Association 1994; United States Department of Energy 1996; NIEHS 1998).

Although no federal standards exist for maximum EMF field strengths for TLs, two states (New York and Florida) do have such regulations. Florida's regulation is the more restrictive of the two, with field levels being limited to 150 milligaus at the edge of the ROW for lines with voltages of 230 kV and less. The expected magnetic field strengths at the edge of the proposed ROW would fall well below these standards. Consequently, the construction and operation of the proposed TL are not anticipated to cause any significant impacts related to EMFs.

### *4.12.2 Lightning Strike Hazard*

TVA TLs are built with overhead ground wires that lead a lightning strike into the ground for dissipation. Thus, a safety zone is created under the ground wires at the top of structures and along the line for at least the width of the ROW. The NESC is strictly followed when installing, repairing, or upgrading TVA lines or equipment. TL structures are well grounded, and the conductors are insulated from the structure. Therefore, touching a structure supporting a TL poses no inherent shock hazard.

### *4.12.3 Transmission Structure Stability*

The pole structures (see Figure 2-1) that would be used on the proposed 161-kV TL have demonstrated a good safety record. They are not prone to rot or crack, like wooden poles, nor are they subject to substantial storm damage due to their low cross-section in the wind.

Additionally, all TVA transmission structures are examined visually at least once a year. Thus, the proposed structures do not pose any significant physical danger. For this reason, TVA does not typically construct barricades or fences around structures.

## 4.13 Summary of TVA Commitments and Proposed Mitigation Measures

TVA would undertake the following nonroutine measures to reduce the potential for adverse environmental effects to Indiana bat and archaeological resources.

Habitat for Indiana bat occurs in the project area. In order to minimize adverse effects to Indiana bat, the following measures would be implemented:

- No vegetation clearing would occur between June 1 and July 31 to minimize potential impacts to maternity colonies of the Indiana bat.
- No blasting would occur between November 15 and March 31 to prevent potential impacts to hibernating bats.
- Danger trees identified as potentially suitable habitat for Indiana bat would not be removed between June 1 and July 31.
- As described in the MOA, TVA would contribute $776,055 to the Indiana Bat Conservation Fund to compensate for impacts to 5.7 acres of known Indiana bat maternity habitat, 62.3 acres of known maternity habitat that overlaps Indiana bat swarming habitat, and 52 acres of Indiana bat swarming habitat.

Three sites along the proposed ROW are eligible for listing in the NRHP. In order to minimize adverse effects to archaeological resources, the following measures would be implemented:

- TVA would not place any TL structures within the boundaries of Sites 40PT142, 15CT144, and the eligible portion of Site 15CT146. Additionally, all work within the boundaries of these sites would be conducted in dry conditions or with low-ground pressure-tired equipment. If these options were not possible, then mats would be used.

# CHAPTER 5

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# CHAPTER 6

## 6.0 LIST OF AGENCIES, ORGANIZATIONS, AND PERSONS TO WHOM COPIES ARE SENT

Absentee Shawnee Tribe of Oklahoma

Alabama-Quassarte Tribal Town

Cherokee Nation

Eastern Band of Cherokee Indians in Oklahoma

Eastern Shawnee Tribe of Oklahoma

Kentucky State Nature Preserves Commission

Kialegee Tribal Town

Muscogee (Creek) Nation of Oklahoma

National Park Service

Seminole Tribe of Florida

Shawnee Tribe

Thlopthlocco Tribal Town

United Keetoowah Band of Cherokee Indians in Oklahoma

Tennessee Department of Archives and History

Tennessee Natural Heritage Program

United States Fish and Wildlife Service

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# CHAPTER 7

## 7.0 LITERATURE CITED

American Medical Association. 1994. *Effects of Electric and Magnetic Fields*. Chicago, Illinois: AMA, Council on Scientific Affairs.

Belwood, J. J. 2002. *Endangered Bats in Suburbia: Observations and Concerns for the Future. The Indiana Bat: Biology and Management of an Endangered Species* (A. Kurta and J. Kennedy, eds.). Austin, Texas: Bat Conservation International.

Bryant, Ron. 1992. Clinton County. *The Kentucky Encyclopedia*, edited by John E. Kleber, pp. 659-660. Lexington: The University Press of Kentucky.

Bureau of Economic Analysis. 2009. *National Economic Accounts.* Retrieved from <www.bea.gov/national/> (accessed October 2010).

Carey, D. I., and J. F. Stickney. 2004. *Groundwater Resources of Clinton County, Kentucky*. County Report 27, Series XII. Kentucky Geologic Survey.

Chalmers, J. A., and F. A. Voorvaart. 2009. "High Voltage Transmission Lines: Proximity, Visibility, and Encumbrance Effects." *The Appraisal Journal*.

Cowardin, L. M., V. Carter, F. C. Golet, and E. T. LaRoe. 1979. *Classification of Wetland and Deepwater Habitats of the United States*. Washington, D.C.: United States Fish and Wildlife Publication FWS/OBS-79/31.

Edwards, Gale. 1992. Wayne County. *The Kentucky Encyclopedia*, edited by John E. Kleber, pp. 659-660. Lexington: The University Press of Kentucky.

Electric Power Research Institute (EPRI). 2003. *Transmission Lines and Property Values: State of the Science.* Palo Alto, California: EPRI Report 1005546.

Environmental Laboratory. 1987. *Corps of Engineers Wetland Delineation Manual.* Vicksburg, Miss.: United States Army Corps of Engineers Waterways Experiment Station, Technical Report Y-87-1.

Etnier, D. A., and W. C. Starnes. 1993. *The Fishes of Tennessee*. Knoxville: University of Tennessee Press.

Gregory, R., and D. von Winderfeldt. 1996. "The Effects of Electromagnetic Fields From Transmission Lines on Public Fears and Property Values." *Journal of Environmental Management*, 48:201-214.

Griffith, G. E, J. M. Omernik, and S. Azevedo. 1998. Ecoregions of Tennessee (color poster with map, descriptive text, summary tables, and photographs): Reston, Virginia: United States Geological Survey (map scale 1:1,250,000).

Gumbert, M. W., J. M. O'Keefe, J. R. MacGregor. 2002. *Roost Site Fidelity in Kentucky. The Indiana Bat: Biology and Management of an Endangered Species* (A. Kurta and J. Kennedy, eds.). Austin, Texas: Bat Conservation International.

Hamilton, S. W., and G. M. Schwann. 1995. "Do High Voltage Transmission Lines Affect Property Value?" *Land Economics* 71(4):436-444.

International Association for Research on Cancer. 2002. *Non-Ionizing Radiation, Part 1; Static and Extremely Low Frequency (ELF) Electric and Magnetic Fields*.

*Journal of the American Medical Association.* 2007. "Implantable Cardioverter-Defibrillators." 297(17), May 2, 2007.

Karpynec, Ted. 2010. *Phase I Architectural Survey of the Proposed TVA Byrdstown 161-kV Transmission Line, Clinton and Wayne Counties, Kentucky.* Report submitted to the Tennessee Valley Authority.

Kentucky Exotic Plant Pest Council. 2010. *Kentucky Exotic Pest Council Severe Threat*. Retrieved from <http://www.se-eppc.org/ky/> (accessed July 2010).

Kurta, A., and J. Kennedy, eds. 2002. *The Indiana Bat: Biology and Management of An Endangered Species.* Austin, Texas: Bat Conservation International.

Leverett, R. 1996. *Definitions and History in Eastern Old-Growth Forests: Prospects for Rediscovery and Recovery*. Edited by Mary Byrd Davis. Washington, D.C., and Covelo, California: Island Press.

Lloyd, Orville B. Jr., and William L. Lyke. 1995. *Ground Water Atlas of the United States, Segment 10.* Reston, Virginia: United States Geological Survey.

Mack, J. J. 2001. *Ohio Rapid Assessment Method for Wetlands*, Version 5.0, User's Manual and Scoring Forms. Columbus: Ohio Environmental Protection Agency, Division of Surface Water, 401/Wetland Ecology Unit, EPA Technical Report WET/2001-1.

McKee, Larry. 2010. *Phase I Cultural Resources Survey, Kentucky Segment of the Byrdstown Transmission Line Project.* Report submitted to the Tennessee Valley Authority.

McKee, Larry, and Ted Karpynec. 2010. *Phase I Cultural Resources Survey of the Proposed TVA Byrdstown 161-kV Transmission Line, Pickett County, Tennessee.* Report submitted to the Tennessee Valley Authority.

Morse, L. E., J. M. Randall, N. Benton, R. Hiebert, and S. Lu. 2004. *An Invasive Species Assessment Protocol: Evaluating Non-Native Plants for Their Impact on Biodiversity.* Version 1. Arlington, Virginia: NatureServe.

Muncy, J. A. 1999. *A Guide for Environmental Protection and Best Management Practices for Tennessee Valley Authority Transmission Construction and Maintenance Activities* (revised edition). Edited by C. Austin, C. Brewster, A. Lewis, K. Smithson, T. Broyles, and T. Wojtalik. Norris: Tennessee Valley Authority Technical Note TVA/LR/NRM 92/1.

National Institute of Environmental Health Sciences (NIEHS). 1998. *Report on Health Effects From Exposure to Power Line Frequency Electric and Magnetic Fields.* Research Triangle Park: NIEHS, Publication No. 99-4493.

———. 2002. *Electric and Magnetic Fields Associated With the Use of Electric Power*. Retrieved from <http://www.niehs.nih.gov/about/visiting/index.cfm> (n.d.).

National Research Council. 1997. *Possible Health Effects of Exposure to Residential Electric and Magnetic Fields*. National Resource Council, Committee on the Possible Effects of Electromagnetic Fields on Biologic Systems. Washington, D.C.: National Academy Press.

NatureServe. 2010. NatureServe Explorer: An Online Encyclopedia of Life, Version 7.1. Arlington, Virginia: NatureServe. Retrieved from <http://www.natureserve.org/explorer> (accessed July 2010).

Owens, Anne-Leslie. 1998. *The Tennessee Encyclopedia of History & Culture: Pickett County.* Nashville, Tennessee: Rutledge Hill Press.

Parmalee, P. W., and A. E. Bogan. 1998. *The Freshwater Mussels of Tennessee*. Knoxville: The University of Tennessee Press.

Pitts, J. M., and T. O. Jackson. 2007. "Power Lines and Property Values Revisited." *The Appraisal Journal.*

Reed, P. B. 1997. *Revised National List of Plant Species That Occur in Wetlands: National Summary*. United States Fish and Wildlife Service Biological Report 88(24).

Storm, R. 2010. *Indiana Bat Survey: Byrdstown Transmission Line, Clinton and Wayne Counties, Kentucky and Pickett County, Tennessee.* Lexington, Kentucky: Third Rock Consultants LLC.

Strand, M. N. 1997. *Wetlands Deskbook*, 2nd Edition. Washington, D.C.: The Environmental Law Reporter, Environmental Law Institute.

Sutherland, A. B., J. L. Meyer, and E. P. Gardiner. 2002. "Effects of Land Cover on Sediment Regime and Fish Assemblage Structure in Four Southern Appalachian Streams." *Freshwater Biology* 47(9):1791-1805.

Tennessee Department of Environment and Conservation (TDEC). 2002. *Tennessee Ground Water 305b Water Quality Report.* Nashville, Tennessee: Division of Water Supply. November 2002.

———. 2008. *Final Version. Year 2008 303(d) List.* Nashville, Tennessee: Division of Water Pollution Control. June 2008.

Tennessee Exotic Plant Pest Council. 2009. *Invasive Exotic Pest Plants in Tennessee*. Retrieved from <http://www.tneppc.org/> (accessed July 2010).

Tennessee Valley Authority. 1983. *Procedures for Compliance With the National Environmental Policy Act: Instruction IX Environmental Review*. Retrieved from <http://www.tva.gov/environment/reports/pdf/tvanepa_procedures.pdf> (n.d.).

———. 1995. *Energy Vision 2020 - Integrated Resource Plan and Final Programmatic Environmental Impact Statement.*

———. 2008. *Monroe, Tennessee - Provide 161-kV Delivery Point, Overton County, Tennessee, Final Environmental Assessment.* Retrieved from <http://www.tva.gov/environment/reports/monroe_tn/environmental_assessment.pdf > (n.d.).

United States Census Bureau. 2000. *Decennial Census of the Population and Housing Units, Data Sets - Census 2000 Summary Files Data*. Retrieved from <http://factfinder.census.gov/servlet/DatasetMainPageServlet?_program=DEC&_submenuId=datasets_1&_lang=en> (accessed July 2010).

———. 2010. *State and County Quick Facts: Clinton and Wayne Counties, Kentucky, Picket County, Tennessee*. Retrieved from <http://quickfacts.census.gov/qfd/states/47/47011.html> (accessed September 2010).

United States Department of Defense and United States Environmental Protection Agency (USEPA). 2003. "Advance Notice of Proposed Rulemaking on the Clean Water Act Regulatory Definition of Waters of the United States." *Federal Register*, Volume 68(10), January 15, 2003.

United States Department of Energy. 1996. "Questions and Answers: EMF in the Workplace." *Electric and Magnetic Fields Associated With the Use of Electric Power.* National Institute for Occupational Safety and Health, NIEHS, Report No. DOE/GO-10095-218.

United States Environmental Protection Agency (USEPA). 2010. *Local Drinking Water Information.* Retrieved from <http://www.epa.gov/safewater/dwinfo/index.html> (n.d.).

United States Fish and Wildlife Service (USFWS). 2007. *Indiana Bat (Myotis sodalis) Draft Recovery Plan*: *First Revision*. Fort Snelling, Minnesota.

———. 2008. *Final Biological Opinion: Proposed Participation in and Approval of Conservation Memoranda of Agreement for the Indiana Bat* (*Myotis sodalis*). Frankfort: Kentucky Field Office.

———. 2009. *Indiana bat (Myotis sodalis) 5-Year Review: Summary and Evaluation.* Bloomington, Indiana: Midwest Region, Bloomington Ecological Services Field Office.

———. 2010a. *White-Nose Syndrome - What Is Killing Our Bats?* October 2010. Retrieved from <http://www.fws.gov/whitenosesyndrome/about.html> (accessed November 2010).

———. 2010b. *Revised Indiana Bat Mitigation Guidance for the Commonwealth of Kentucky*. Frankfort: Kentucky Field Office.

United States Fish and Wildlife Service (USFWS) and Kentucky Department of Fish and Wildlife Resources (KDFWR). 2010. *Indiana Bat Survey Guidance for Kentucky*. Frankfort, Kentucky, USFWS and KDFWR.

United States Forest Service (USFS). 2010. *Forest Inventory Data Online (FIDO).* Retrieved from <http://fiatools.fs.fed.us/fido/index.html> (accessed July 2010).

Watrous, K. S., T. M. Donovan, R. M. Mickey, S. R. Darling, A. C. Hicks, and S. L. Von Oettingen. 2006. "Predicting Minimum Habitat Characteristics for the Indiana Bat in the Champlain Valley." *Journal of Wildlife Management* 70:1228-1237.

Woods, A. J., J. M. Omernik, W. H. Martin, G. J. Pond, W. M. Andrews, S. M. Call, J. A. Comstock, and D. D. Taylor. 2002. Ecoregions of Kentucky. (two-sided color poster with map, descriptive text, summary tables, and photographs); Reston, Virginia: United States Geological Survey (map scale 1:1,000,000).

World Health Organization (WHO). 2007a. *Electromagnetic Fields and Public Health.* WHO EMF Task Force Report, WHO Fact Sheet No. 299.

———. 2007b. *Extremely Low Frequency Fields.* Environmental Health Criteria Monograph No. 238.

———. 2007c. *Electromagnetic Fields and Public Health Exposure to Extremely Low Frequency Fields.* WHO Fact Sheet No. 322.