Document Type: EA-Administrative Record
Index Field: **Final** Environmental Assessment
Project Name: Selmer-W. Adamsville 161-kV Transmission Line
Project Number: 2012-37

SELMER–WEST ADAMSVILLE 161-KV TRANSMISSION LINE AND SWITCHING STATION

ENVIRONMENTAL ASSESSMENT

McNairy County, Tennessee

Prepared by:
TENNESSEE VALLEY AUTHORITY
Chattanooga, Tennessee

January 2015

Direct Comments to:
Anita E. Masters
NEPA Program and Valley Projects
Tennessee Valley Authority
1101 Market Street
Chattanooga, Tennessee 37402
Phone: 423-751-8697
E-mail: aemasters@tva.gov

This page intentionally left blank

TABLE OF CONTENTS

LIST OF APPENDICES

LIST OF TABLES

LIST OF FIGURES

ACRONYMS, ABBREVIATIONS, AND GLOSSARY OF TERMS USED

Acre	A unit measure of land area equal to 43,560 square feet
Access road	A dirt, gravel, or paved road that is either temporary or permanent, and is used to access the right-of-way and transmission line structures for construction, maintenance, or decommissioning activities
APE	Area of potential effect
BMP	Best management practice or accepted construction practice designed to reduce environmental effects
conductors	Cables that carry electrical current
danger tree	A tree located outside the right-of-way that could pose a threat of grounding a line if allowed to fall near a transmission line or a structure
EA	Environmental Assessment
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
EMF	Electromagnetic field
endangered species	A species in danger of extinction throughout all or a significant part of its range
EO	Executive Order
OPGW	An optical fiber composite overhead ground wire installed between transmission line structures to protect the line from lightning strikes
ESA	Endangered Species Act
feller-buncher	A piece of heavy equipment that grasps a tree while cutting it, which can then lift the tree and place it in a suitable location for disposal; this equipment is used to prevent trees from falling into sensitive areas, such as a wetland
GIS	Geographic Information System
groundwater	Water located beneath the ground surface in the soil pore spaces or in the pores and crevices of rock formations
guy	A cable connecting a structure to an anchor that helps support the structure
hydric soil	A soil that formed under conditions of saturation, flooding, or ponding long enough during the growing season to develop conditions of having no free oxygen available in the upper part.
hydrophytic vegetation	Aquatic and wetland plants that have developed physiological adaptations allowing a greater tolerance to saturated soil conditions including with limited or absence of oxygen.
kV	Symbol for kilovolt (1 kV equals 1,000 volts)
load	That portion of the entire electric power in a network consumed within a given area; also synonymous with “demand” in a given area
MOA	Memorandum of Agreement
NEPA	National Environmental Policy Act
NERC	North American Electric Reliability Corporation

NHPA	National Historic Preservation Act
NRCS	Natural Resources Conservation Service
NRHP	National Register of Historic Places
outage	An interruption of the electric power supply to a user
riparian	Related to or located on the banks of a river or stream
ROW	Right-of-way, a corridor containing a transmission line
runoff	That portion of total precipitation that eventually enters a stream or river
SHPO	State Historic Preservation Officer
SMZ	Streamside management zone
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
surface water	Water collecting on the ground or in a stream, river, lake, or wetland; it is naturally lost through evaporation and seepage into the groundwater
switch	A device used to complete or break an electrical connection
TDEC	Tennessee Department of Environment and Conservation
threatened species	A species likely to become endangered within the foreseeable future
TVA	Tennessee Valley Authority
TVARAM	TVA Rapid Assessment Method, a version of the Ohio Rapid Assessment Method for categorizing wetlands, designed specifically for the TVA region
US	United States Highway
USACE	United States Army Corps of Engineers
USDA	United States Department of Agriculture
USEPA	United States Environmental Protection Agency
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
USNPS	United States National Park Service
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

CHAPTER 1

1.0 PURPOSE OF AND NEED FOR ACTION

1.1 Proposed Action – Improve Power Supply

The Tennessee Valley Authority (TVA) proposes to improve reliability of the existing power supply system within McNairy County, Tennessee by constructing and operating a new 161-kilovolt (kV) transmission line and switching station (Figure 1-1). The proposed transmission line and switching station would occupy approximately 189 acres.

The proposed Selmer-West Adamsville 161-kV Transmission Line, which would be approximately 15 miles long, would originate at TVA's existing Selmer 161-kV Substation south of Selmer, Tennessee and parallel existing ROW for almost one half mile. The transmission line then would run generally east-northeast, crossing US Highway (US) 64 towards Adamsville, Tennessee, terminating at the proposed West Adamsville 161-kV Switching Station (Figure 1-1). The proposed switching station would occupy approximately 3 acres and would connect to TVA's existing Pickwick Hydro Plant-Henderson 161-kV Transmission Line. The proposed transmission line and switching station would be completed by July 2016 or as soon as possible after that date.

Additionally, to facilitate the operation of the new transmission line and switching station, TVA would also undertake the following actions:

- Modify existing communications equipment and add an additional electrical equipment at the existing Selmer 161-kV Substation;
- Install fiber optic ground wire along TVA's existing Pickwick Hydro Plant-Henderson 161-kV Transmission Line from the proposed West Adamsville 161-kV Switching Station to the existing North Adamsville 161-kV Substation;
- Install fiber optic ground wire from structures 129 to144 along the de-energized Pickwick Hydro Plant-S. Jackson No. 2 161-kV Transmission Line;
- Install telecommunications connections at the Henderson and the South Jackson, Tennessee 161-kV substations and at the Pickwick Hydro Plant 161-kV Switchyard; and
- Modify the TVA system map boards to include the names and numbers of the new transmission line and switching station.

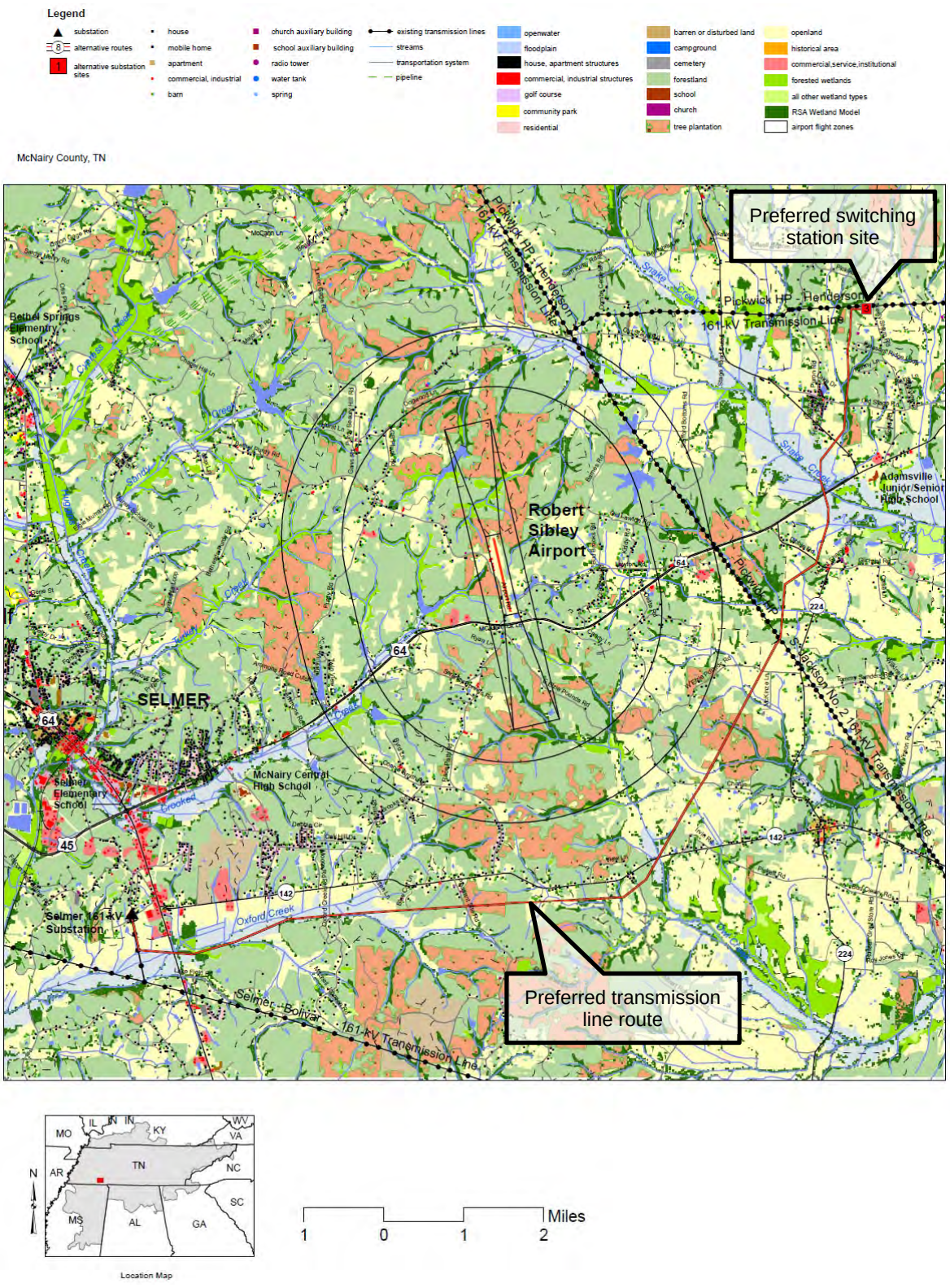

Figure 1-1. Proposed Transmission Line Route and Switching Station Site

1.2 Need for the Proposed Action

TVA plans its transmission system according to industry-wide standards provided by the North American Electric Reliability Corporation (NERC). The standards state that the TVA transmission system must be able to survive single-failure events while continuing to serve customer loads with adequate voltage and no overloaded facilities while maintaining adequate line clearances as required by the National Electric Safety Code (NESC).

The existing transmission line system between the Hickory Valley 161-kV Substation and the Colbert Fossil Plant is over 80 miles long and provides power to six delivery points (i.e., substations). Only two sources of power feed this segment of the TVA transmission system. At the western end, power to the line is supplied from the Cordova 500-kV Substation through the Hickory Valley 161-kV Substation. Power is supplied from the Colbert Fossil Plant via the Colbert Fossil Switchyard at the eastern end of the transmission line. After reviewing single-source contingencies[1], TVA found that if the power source from the Hickory Valley Substation experienced an interruption or loss of power, the entire load[2] would be served from the Colbert Fossil Plant. Due to the length of the transmission line and amount of load related to the number of substations served, the transmission line would likely experience low voltage issues. Additionally, five of the six substations mentioned above could experience voltage violations under such circumstances.

To ensure that the Selmer and West Adamsville area has a continuous, reliable source of electric power, TVA needs to provide additional electric service to the area. The construction of a new transmission line and switching station would meet this need by providing an additional electrical source for the above-mentioned delivery points, alleviate any low voltage issues, and improve reliability, thereby allowing TVA to meet NESC and NERC reliability criteria, as well as providing a source of power for continued economic health and residential and commercial growth in the area.

1.3 The Decision

The primary decision before TVA is whether to provide additional electric service to the Selmer and West Adamsville area of McNairy County, Tennessee area by constructing a new 161-kV transmission line and switching station. If the proposed assets are to be built, other secondary decisions are involved. These include the following considerations and determinations:

- Timing of the proposed improvements;
- Most suitable location for the proposed switching station;
- Most suitable route for the proposed transmission line; and
- Determination of any necessary mitigation and/or monitoring to meet TVA standards and to minimize the potential for damage to environmental resources.

[1] A single-source contingency is a situation where power is supplied from only one source due to loss of connection to the transmission system elsewhere.
[2] "Load" is defined as that portion of the entire electric power in a network that is consumed within a given area. The term is synonymous with "demand" in a given area.

1.4 Other Pertinent Environmental Reviews or Documentation

In 2011, TVA completed the *Integrated Resource Plan: TVA's Environmental & Energy Future* (TVA 2011a). This plan determines how TVA will meet the electric power demands of its customers over the next 20 years while fulfilling TVA's mission of providing low-cost, reliable power, environmental stewardship, and economic development. TVA released the accompanying Environmental Impact Statement for *TVA's Integrated Resource Plan: TVA's Environmental & Energy Future* in March 2011 (TVA 2011b).

1.5 Scoping Process and Public Involvement

TVA contacted the following federal and state agencies and officials, as well as federally recognized Native American tribes, concerning the proposed project.

- Absentee Shawnee Tribe of Oklahoma
- Alabama-Quassarte Tribal Town
- Cherokee Nation
- Chickasaw Nation
- Eastern Band of Cherokee Indians
- Eastern Shawnee Tribe of Oklahoma
- Kialegee Tribal Town
- The Muscogee (Creek) Nation
- Shawnee Tribe
- Tennessee Department of Transportation (TDOT)
- Tennessee State Historic Preservation Officer (SHPO)
- Thlopthlocco Tribal Town
- United Keetoowah Band of Cherokee Indians in Oklahoma
- United States Army Corps of Engineers (USACE)
- United States Fish and Wildlife Service (USFWS)

This proposal was reviewed to ensure conformity with Executive Order (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). Correspondence received from agencies related to this review and coordination is included in Appendix A.

TVA developed a public communication plan that included a website (http://www.tva.com/power/projects/selmer_tn/index.htm) with information about the project, a map of the alternative routes, and feedback mechanisms. The 433 property owners who could potentially be affected by any of the route/switching station alternatives, along with eight public officials, were asked for comments and invited to a project open house. TVA used local news outlets and notices placed in the local newspapers to notify other interested members of the public of the open house. TVA held the open house, which was attended by 107 people, on July 19, 2012, at the Selmer Community Center Gymnasium in Selmer, Tennessee.

At the open house, TVA presented a network of 17 alternative transmission line routes, comprised of 21 different line segments and three alternative switching station sites, to the public for comment (see Figure 1-2).

The alternative transmission line routes are described in Section 2.5.1. The primary concerns expressed by the public were the effects of the proposed line to property values, future residential development, and farmland in the area. Owners also voiced concerns relative to the potential retirement of units at Colbert Fossil Plant, health issues, and impacts of the proposed line on visual quality, natural, historical, and cultural resources.

A 30-day public review and comment period was held following the open house where TVA accepted public comments on the alternative transmission line routes and switching station locations. A toll-free phone number and facsimile number were made available to facilitate comments. During the comment period, several landowners contacted TVA to express their concerns similar to those voiced at the open house.

At the conclusion of the comment period, TVA considered additional information and developed a preferred route and switching station location. TVA announced the preferred route and switching station site to the public in October 2012 (Figure 1-1). Letters were sent to affected property owners, and information was provided to the public through TVA's website.

1.6 Issues to be Addressed

TVA identified resources that could potentially be affected by the construction, operation, and maintenance of the proposed project through an early internal scoping process (see Section 2.3). Potential impacts to the following environmental resources are addressed in this environmental assessment (EA).

- Water quality (surface waters and groundwater)
- Aquatic ecology
- Vegetation
- Wildlife
- Endangered and threatened species and their critical habitats
- Floodplains
- Wetlands
- Aesthetic resources (including visual, noise, and odors)
- Archaeological and historic resources
- Land use and prime farmland
- Recreation, parks, and managed areas
- Socioeconomics and environmental justice

Potential effects related to air quality and global climate change, solid and hazardous waste, and health and safety were considered. Because of the nature of the action, any potential effects to these resources would be minor and insignificant. Thus, potential effects to these resources are not analyzed in detail for the Proposed Action.

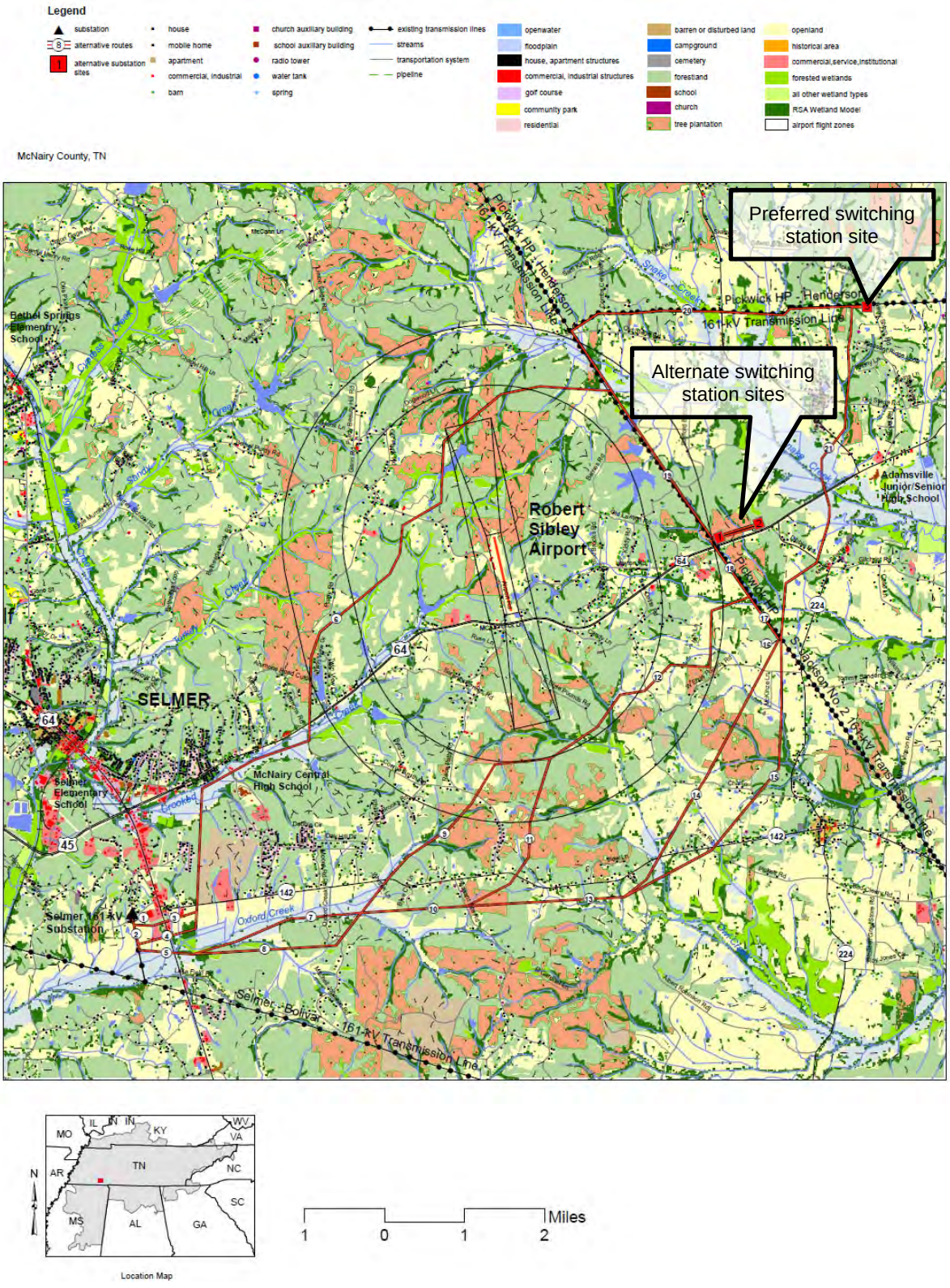

Figure 1-2. Alternative Route Segments and Switching Station Sites

1.7 Necessary Federal Permits and Licenses

A permit would be required from the state of Tennessee and/or local municipality for the discharge of construction site stormwater associated with the construction of the transmission line and switching station. TVA would prepare the required erosion and sedimentation control plans and coordinate them with the appropriate state and local authorities. Aquatic Resource Alteration Permits (ARAP) would be obtained for any stream alterations located within the proposed ROW that may be necessary. A permit may also be required for burning trees and other combustible materials removed during transmission line construction. A permit would be obtained from TDOT for crossing state highways during transmission line construction. A permit would be required from McNairy County for the installation of a septic system at the switching station.

This page intentionally left blank

CHAPTER 2

2.0 ALTERNATIVES INCLUDING THE PROPOSED ACTION

As described in Chapter 1, TVA proposes to construct and operate approximately 15 miles of new 161-kV transmission line and a new 161-kV switching station. The proposed transmission line and switching station would connect to an additional power source, thereby improving the reliability of the power supply system in McNairy County, Tennessee. Other upgrades to the local transmission system would also be made. A description of the proposed actions is provided below in Section 2.1.2.

This chapter contains eight major sections that provide the following information:

1. A description of alternatives;
2. A description of the construction, operation, and maintenance of the proposed transmission line and switching station;
3. An explanation of the transmission line and switching station siting process;
4. A description of the development of the transmission line routes and switching station sites;
5. A comparison of the alternative transmission line routes and switching station sites;
6. A comparison of anticipated environmental effects by alternative;
7. Identification of mitigation measures; and
8. Identification of the Preferred Alternative.

2.1 Alternatives

Two alternatives (the No Action Alternative and the Action Alternative) are addressed in this EA. Under the No Action Alternative, TVA would not implement the proposed action. The Action Alternative involves the construction, operation, and maintenance of the proposed transmission assets.

2.1.1 No Action Alternative – Do Not Construct, Operate, and Maintain a 161-kV Transmission Line and Switching Station

Under the No Action Alternative, TVA would not construct the proposed transmission line and switching station, or complete any actions to upgrade the system reliability in the project area. As a result, the TVA power system in the project area would continue to operate under the current conditions, increasing the risk for substation and transmission line overloading, loss of service, and occurrence of violations of NERC reliability criteria. TVA's ability to provide a strong, reliable source of power for continued economic health and residential and commercial growth in the area would be jeopardized.

Considering TVA's obligation to serve this area and the need to continue to provide reliable electric service, the No Action Alternative is not a reasonable alternative. However, the potential environmental effects of adopting the No Action Alternative were considered in the EA to provide a baseline for comparison with respect to the potential effects of implementing the proposed action.

2.1.2 Action Alternative – Construct, Operate, and Maintain a 161-kV Transmission Line and Switching Station

Under the Action Alternative, TVA would construct, operate, and maintain a new transmission line and switching station, and upgrade various transmission assets. The proposed transmission line, to be called the Selmer-West Adamsville 161-kV Transmission Line, would be approximately 15 miles long and would be constructed utilizing single-steel pole structures on a 100-foot-wide ROW. The new line would be equipped with a fiber optic overhead ground wire, known as "OPGW." The ROW would require the purchase of approximately 186 acres of easement. The new West Adamsville 161-kV Switching Station facility would utilize about 3 acres of a 15-acre site. Access roads would be required for construction and maintenance of the proposed transmission line.

To protect the local transmission system from lightning strikes, thereby improving its reliability, and to facilitate communication, TVA would install OPGW along two existing transmission lines in Hardin and McNairy counties. The conductive part of the OPGW cable shields the high-voltage conductors from lightning strikes, while the optical fibers within the cable can be used for data transmission. TVA proposes to upgrade the existing Selmer 161-kV Switching Station, along with upgrading the Henderson and South Jackson 161-kV substations and the Pickwick Hydro Plant 161-kV Switchyard. The proposed work would be done on existing cleared ROW within each of these transmission lines using existing access roads.

To facilitate the operation of the proposed switching station and transmission line connections, TVA would also undertake the following additional activities:

- Modify existing communications equipment and add expand the yard at the existing Selmer 161-kV Substation to accept additional electrical equipment;
- Install fiber optic ground wire along TVA's existing Pickwick Hydro Plant-Henderson 161-kV Transmission Line from the proposed West Adamsville 161-kV Switching Station to the existing North Adamsville 161-kV Substation and replace structures as needed;
- Install fiber optic ground wire from structures 129 to144 along the de-energized Pickwick Hydro Plant-S. Jackson No. 2 161-kV Transmission Line and replace structures as needed;
- Install telecommunications connections at the Henderson and the South Jackson, Tennessee 161-kV substations and at the Pickwick Hydro Plant 161-kV Switchyard; and
- Modify the TVA system map boards to include the names and numbers of the new transmission line and switching station.

The construction of a new transmission line and switching station would provide an additional power source for the associated delivery points and alleviate any low voltage issues in the Selmer and West Adamsville areas of McNairy County, Tennessee. Selection of the Action Alternative aligns well with TVA's future bulk transmission plans as well as the future plans of the local power company.

Additional information describing implementation of the Action Alternative and how the most suitable transmission line route and switching station site were determined is provided below in Sections 2.2 through 2.4.

2.1.3 Other Alternatives Considered but not Selected

During the development of this proposal, other alternatives were considered that involved upgrading existing facilities as well as constructing new transmission lines in nearby areas. These other alternatives would result in higher costs for construction and maintenance, and would have their own respective environmental impacts. Additionally, these other alternatives do not meet the project needs as well as the Action Alternative. These Alternatives are described below.

2.1.3.1 Loop the Colbert-Hickory Valley 161-kV Transmission Line into Pickwick Hydro and Install Capacitors at the Selmer 161-kV Substation

Under this alternative, TVA would loop the existing Colbert Fossil Plant-Hickory Valley 161-kV Transmission Line into the Pickwick Hydro Plant 161-kV Switchyard in Hardin County, Tennessee. This would require expansions of the Pickwick Hydro Plant and the Selmer 161-kV Substation.

Although implementing this alternative would improve the voltage issues in the Selmer and West Adamsville areas, it would have the highest system electrical losses among the various options. Furthermore, this plan does not align with future transmission area plans. For these reasons, this alternative was eliminated from further consideration.

2.1.3.2 Construct a Corinth-Selmer 161-kV Transmission Line and Install Capacitors at the Selmer 161-kV Substation

Under this alternative, TVA would construct a new 25-mile 161-kV transmission line on new 100-foot-wide ROW between Corinth, Mississippi and the existing Selmer 161-kV Substation. This alternative would also involve expanding the Selmer 161-kV Substation and the Corinth 161-kV Substation in Mississippi.

Although implementing this alternative would resolve voltage issues in the Selmer and West Adamsville areas and result in minimal system electrical loss, it would require the greatest amount of new ROW. Thus, this plan is expected to have the greatest potential for adverse environmental impacts. Furthermore, this plan is considered to be the most costly in terms of initial capital and future maintenance costs. For this reason, this alternative was eliminated from further consideration.

2.2 Construction, Operation, and Maintenance of the Proposed Transmission Line and Switching Station

2.2.1 Transmission Line Construction

2.2.1.1 Right-of-Way Acquisition and Clearing

A ROW utilizes an easement that would be designated for a transmission line and associated assets. The easement would require maintenance to avoid the risk of fires and other accidents. The ROW provides a safety margin between the high-voltage conductors and surrounding structures and vegetation.

The proposed transmission line would be constructed within a new 100-foot-wide ROW easement. TVA would purchase easements from landowners for the new ROW. These easements would give TVA the right to construct, operate, and maintain the transmission line, as well as remove “danger trees” adjacent to the ROW. Danger trees include any trees that are located beyond 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 transmission line. The fee simple ownership of the land within the ROW would remain with the landowner, and many activities and land uses could continue to 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 that could interfere with the operation and maintenance of the transmission line.

Because of the need to maintain adequate clearance between tall vegetation and transmission line conductors, as well as to provide access for construction equipment, most trees and shrubs would initially be removed from the entire 100-foot width of the new ROW. Equipment used during this 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 be restricted to trees tall enough, or with the potential to soon 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 ROW Clearing Specifications, Environmental Quality Protection Specifications for Transmission Line Construction*, *Transmission Construction Guidelines Near Streams* (Appendices B, C, D), and *Best Management Practices for Tennessee Valley Authority Transmission Construction and Maintenance Activities* (Muncy 2012) would be followed in clearing and construction activities. The emission of criteria pollutants or their precursors would not exceed de minimis levels specified in 40 CFR § 93.153(b). Thus, consistent with Section 176(c) of the Clean Air Act, project activities would be in conformity with the requirements under the State Implementation Plan for attaining air quality standards.

Following clearing and construction, vegetative cover on the ROW would be restored to its condition prior to construction, to the extent practicable, utilizing appropriate seed mixtures as described in Muncy (2012) or working with property owners with crop land to ensure restoration supports or minimizes impacts to production. Erosion controls would remain in place until the plant communities become fully established. Streamside areas would be revegetated as described in Appendices B, C, and D, and in Muncy (2012). Failure to maintain adequate clearance can result in dangerous situations, including ground faults. As such, native vegetation or plants with favorable growth patterns (slow growth and low mature heights) would be maintained within the ROW following construction.

2.2.1.2 Access Roads

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

Culverts and other drainage devices, fences, and gates would be installed as necessary. Culverts installed in any permanent streams would be removed following construction. Other culverts would be left or removed, depending on the wishes of the landowner or applicable permit conditions. If desired by the property owner, TVA would restore new

temporary access roads to previous conditions. Additional applicable ROW clearing and environmental quality protection specifications are listed in Appendices B and C.

2.2.1.3 Construction Assembly/Laydown Area Selection

A construction assembly area (or "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. Properties such as existing parking lots or areas used previously as car lots are ideal laydown areas because site preparation is minimal. Selection criteria used for locating potential laydown areas include an area typically 5 acres in size; relatively flat; well drained; cleared; graveled and fenced; 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 transmission asset. TVA attempts to use or lease properties that require no site preparation. However, at times, the property may require some minor grading and installation of drainage structures such as culverts. 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 TVA-installed fencing and site restoration would be performed by TVA at the discretion of the landowner.

2.2.1.4 Structures and Conductors

Single steel-pole structures, as shown in Figure 2-1, would be used for the proposed transmission line. However, at road crossings or other areas where additional clearance is needed, double steel-pole structures would be used. Structure heights would vary according to the terrain and would typically range between 80 and 120 feet.

Three conductors (the cables that carry the electrical current) are required to make up a single-circuit in alternating-current transmission lines. For a 161-kV transmission line, each single-cable conductor is attached to insulators suspended from the structure. A smaller overhead ground wire (OPGW) or wires are attached to the top of the structures. The OPGW cable is installed along the transmission line, running between the tops of transmission line structures.

Poles at angles (i.e. angle points) in the transmission line may require supporting screw, rock, or log-anchored guys. Some angle structures, as well as structures at road crossings requiring additional clearance, may be self-supporting poles or double steel-pole structures like those shown in Figure 2-1. Most poles would be directly imbedded in holes augured into the ground to a depth equal to 10 percent of the pole's length plus an additional 2 feet. Normally, the holes would be backfilled with the excavated material, but, in some cases, gravel or a concrete-and-gravel mixture would be used.

Equipment used during the construction phase would include trucks, truck-mounted augers, drills, and excavators, as well as tracked cranes and bulldozers. Low ground-pressure-type equipment would be used in specified locations (such as areas with soft ground) to reduce the potential for environmental impacts.

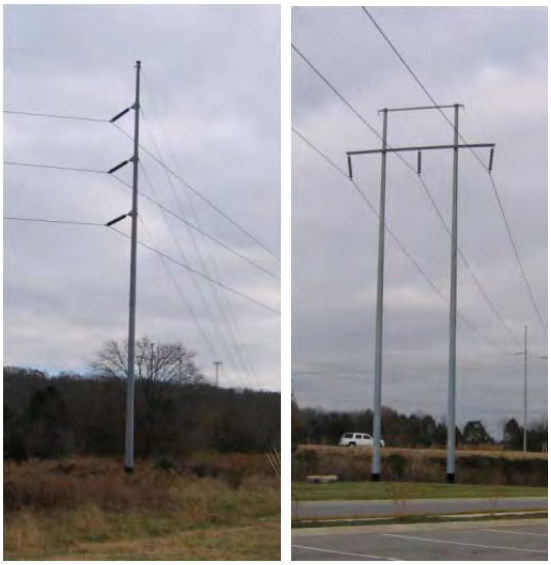

Figure 2-1. Example of Single and Double Steel-Pole 161-kV Transmission Structures

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 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

Property for the proposed West Adamsville 161-kV Switching Station would be located adjacent to Neely Sharpe Road in McNairy County, Tennessee (Figure 2-2). There would be three transmission line terminations at the West Adamsville 161-kV Switching Station, namely, the new Selmer-West Adamsville 161-kV transmission line and both connections of the existing Pickwick Hydro Plant-Henderson 161-kV Transmission Line. The 15 acre site containing the switching station, access road, and associated transmission line connections would be obtained in fee simple ownership from a single landowner.

TVA would clear vegetation on the site, remove the topsoil, and grade the property in accordance with TVA's *Site Clearing and Grading Specifications* (Appendix E). Equipment used during clearing would include chain saws, skidders, bulldozers, tractors, and/or low ground-pressure feller-bunchers. However, because the site is an open pasture, essentially no marketable timber occurs on the parcel. As necessary, any woody debris and other vegetation would likely be piled and burned, chipped, or taken off site. Prior to burning, TVA would obtain any necessary permits. In some instances, vegetation may be windrowed along the edge of the project site to serve as sediment barriers. Implementation of *TVA ROW Clearing Specifications*, *Environmental Quality Protection Specifications for Transmission Line Construction*, *Transmission Construction Guidelines Near Streams* (Appendices B, C, and D), and *Best Management Practices for Tennessee Valley Authority*

Transmission Construction and Maintenance Activities (Muncy 2012) provide further guidance for clearing and construction activities.

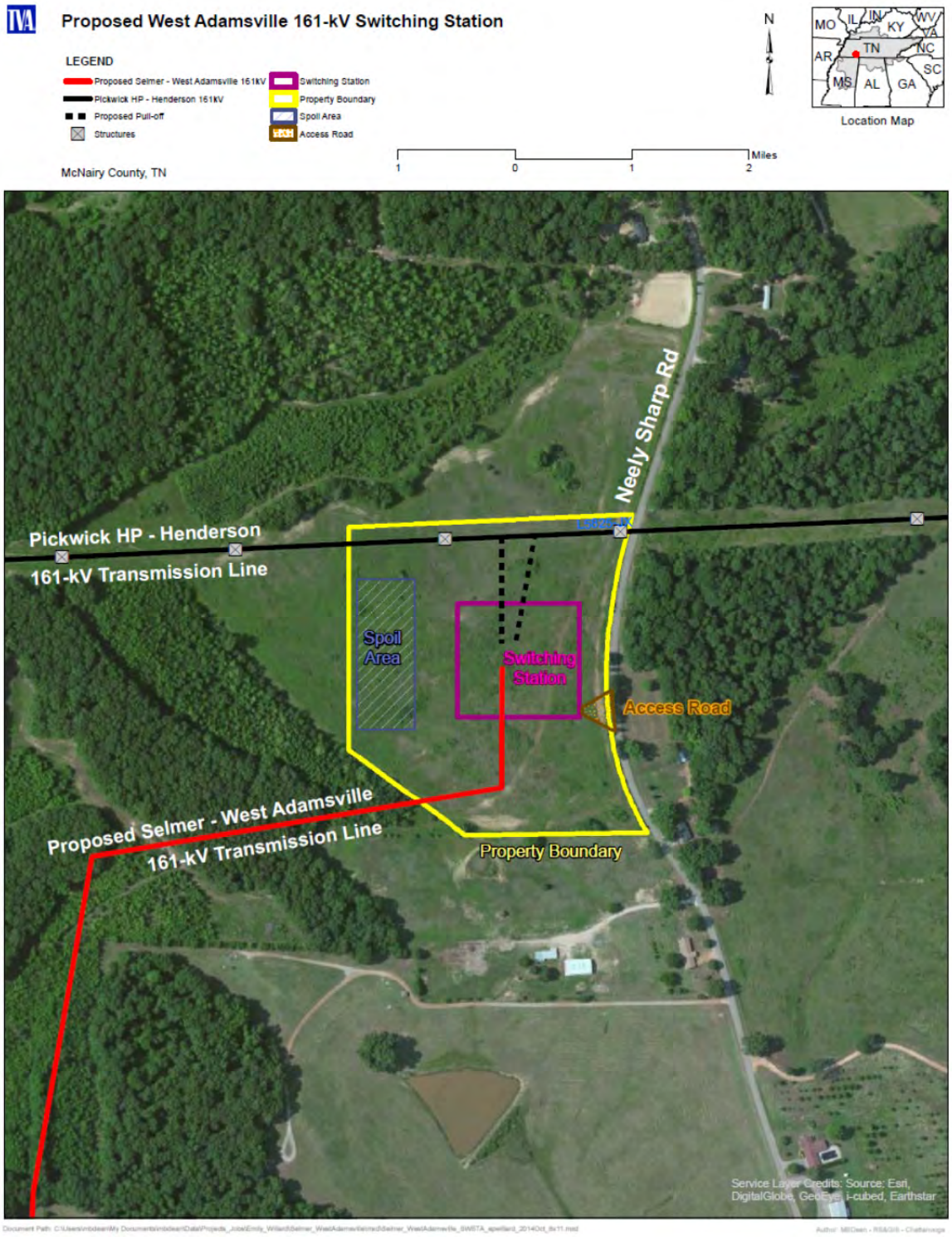

Figure 2-2. West Adamsville 161-kV Switching Station Arrangement

The proposed switching station site is located on a low hill and would be leveled through a cut and fill process to help achieve a design elevation. The areas of the site that are too high (sloped) will be "cut" down to a level elevation, and other areas that are too low require "fill" to raise the elevation. Any additional fill required would be obtained from an approved/permitted borrow area.

Once the switching station site has been graded, excess soil (i.e., "spoil") would be removed in preparation for foundations. Temporary spoil storage is proposed to be located onsite. Silt fences, site drainage structures, and any necessary detention pond(s) would be installed during construction. Total disturbance, including grading, onsite spoil storage, and any necessary detention basins would be approximately 7.5 acres. The switching station yard would be covered with crushed stone and enclosed with chain link fencing. A new gravel access road, approximately 100 feet long, would be constructed from Neely Sharpe Road to the switching station. Once completed, the switching station is expected to occupy approximately 3 acres.

Following clearing and construction, disturbed areas on the property, excluding the switching station, would be restored to the extent practicable to pre-construction conditions, utilizing appropriate seed mixtures as described in Muncy (2012). Erosion controls would remain in place site-wide until the plant communities become fully established.

Major equipment that would be installed at the switching station site includes two breaker bays, three circuit breakers, disconnect switches, two station service voltage transformers, nine voltage transformers and surge arresters, three pull-off structures, and one switch house. The circuit breakers installed would utilize SF-6 as the electrical insulator and would contain no oil. The switch house would be equipped with potable water and septic tank drain field. A water line would be installed along the switching station access road and connected to the local water supply system. A field line system would be installed to treat the generated sewage.

As described in TVA's *Substation Lighting Guidelines* (Appendix F), all lights at the substation would be fully shielded or would have internal low-glare optics, such that no light is emitted from the fixtures at angles above the horizontal plane. TVA's *Environmental Quality Protection Procedures for Transmission Substation or Communications Construction* (Appendix G) would be utilized during the construction of the substation.

2.2.3 Operation and Maintenance

2.2.3.1 Inspection

Periodic inspections of 161-kV transmission lines are performed by helicopter aerial surveillance after operation begins. Foot patrols or climbing inspections are performed to locate damaged conductors, insulators, or structures, and to discover any abnormal conditions that might hamper the normal operation of the line or adversely affect the surrounding area. During these inspections, the condition of vegetation within the ROW, as well as that immediately adjoining the ROW, is noted. These observations are then used to plan corrective maintenance and routine vegetation management.

2.2.3.2 Vegetation Management

Vegetation management along the ROW would be necessary to ensure access to structures and to maintain an adequate distance between transmission line conductors and vegetation. TVA standards for a 161-kV transmission line are based on National Electric

Safety Code requirements and 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 described in Section 2.2.1.1), and vegetation control within the cleared ROW. These activities occur on approximately 3- to 5-year cycles.

Management of vegetation within the cleared ROW would include an integrated vegetation management approach designed to encourage the low-growing plant species and discourage tall-growing plant species. A vegetation re-clearing plan would be developed for each transmission line, 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 are normally applied in areas where heavy growth of woody vegetation is occurring on the ROW and mechanical mowing is not practical. Herbicides would be selectively applied from the ground with backpack sprayers or vehicle-mounted sprayers.

Any herbicides used are applied in accordance with applicable state and federal laws and regulations. Only herbicides registered with the United States Environmental Protection Agency (USEPA) are used. A list of the herbicides currently used by TVA in ROW management is presented in Appendix H. 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 maintenance work is generally required. The transmission line structures and other components typically last several decades. In the event that a structure needs to be replaced, the structure would normally be lifted out of the ground by crane-like equipment, and the replacement structure would be inserted into the same hole or an adjacent hole. Access to the structures would be via existing roads. Replacement of structures may require leveling the area surrounding the replaced structures, but additional area disturbance would be minor compared to the initial installation of the structure.

2.3 Siting Process

The process of siting the proposed transmission assets included the following steps:

- Determine the potential existing power sources to supply the transmission line.
- Define the study area.
- Collect data to minimize potential impacts to cultural and natural features.
- Locate potential tap points (which later become switching station sites).
- Generate general route segments that produce potential routes.
- Gather public input.
- Refine general route segments
- Incorporate public input into the final selection of the transmission line route and switching station location.

2.3.1 Definition of the Study Area

The first task in defining the transmission line siting study was to identify power sources that could supply the power need. TVA's existing Pickwick Hydro Plant-Henderson 161-kV Transmission Line was the most practical source. It is the closest energized 161-kV transmission line and would serve as the most reliable power source to power the upgraded Selmer 161-kV Substation. The study area is located entirely in McNairy County, Tennessee and is shown in Figure 1-1 and Figure 1-2.

The boundaries of the detailed study area were defined by the following:

- The northern boundary was defined primarily by the City of Selmer, Tennessee, as high densities of residential and commercial populations would limit potential transmission line routes.
- The eastern boundary was marked between the existing Pickwick Hydro Plant-Henderson 161-kV Transmission Line and the City of Adamsville.
- The southern boundary was defined by the existing Selmer-Bolivar 161-kV Transmission Line.
- The western boundary was defined by the existing Selmer 161-kV Substation.

2.3.2 Characterization of the Study Area

2.3.2.1 Natural Features

The study area is located within the Northern Hilly Gulf Coastal Plain sub-region of the Southeastern Plains Level IV ecoregion. In Tennessee, this area is underlain by sand and clay substrates. This area has more topographic variation than the Loess Plains to the west and less elevation change compared to the Western Highland Rim to the east. The natural vegetation type in this ecoregion is oak/hickory and oak/hickory/pine forest, but many areas have been converted to agricultural, industrial, and residential land uses.

The study area is characterized by an undulating landscape dominated by agriculture but interspersed with forested uplands and naturalized lowlands between stream and tributary crossings. The Gulf Coastal Plain is noted as the most productive agricultural region of Tennessee. The region is well watered with many perennial streams. Known wetland areas tend to occur within the creek floodplains. The elevations in the study area range from 400 to 600 feet above mean sea level.

Geologically, the study area is within the Coastal Plain Physiographic Province. The Cretaceous aged McNairy-Nacatoch aquifer is a principle aquifer in the region.

2.3.2.2 Cultural Features

There are several small churches and cemeteries scattered within the study area. Selmer Elementary and McNairy Central High School are located in the southeast quadrant of the study area, while Adamsville High School is in the north east quadrant. The towns of Selmer and Stantonville, Tennessee are noted to contain a high concentration of architectural resources that constitute historic districts.

2.3.2.3 Land Use

Land uses in the study area include commercial, industrial, residential, and farming. The most concentrated residential and commercial development is located near the City of

Selmer and along US 64 and State Routes (SR) 142 and 224. Other areas of residential development tend to border local roadways and increase towards the City of Adamsville. Subdivisions are a combination of older established homes and new homes. Several new subdivisions are under construction.

Undeveloped areas contain a mixture of forested area and open land. The forest is a combination of commercial timber (pine plantations) and non-commercial timber (hardwoods). The agricultural farmland is a mix of both commercial farming (corn, soybeans, and cotton) and pasture used for livestock.

2.3.2.4 Transportation

In McNairy County, two U. S. Highways intersect in Selmer. The major north-south transportation route is US 45. The major east-west thoroughfare is US 64. South of Selmer, SR 142 runs in an east-west direction between US 45 and before heading south after reaching the McNairy and Hardin county line. The proposed transmission line would parallel SR 142 (at a distance of about 0.5 mile) for approximately 6 miles. The route of the proposed transmission line would cross US 45 south of Selmer and at SR 142 where it crosses Owl Creek. The proposed route would then cross US 64 and SR 224 southwest of Adamsville. The Robert Sibley Airport serves McNairy County and is located north of US 64 between Selmer and Adamsville (see Figure 1-1).

2.3.3 Data Collection

TVA 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 siting study included design drawings for area transmission lines, data collected into a geographic information system (GIS), United States Geological Survey (USGS) digital line graphs, and tax maps from McNairy County, Tennessee. Various data maintained by TVA in a corporate geo-referenced database, including the TVA Regional Natural Heritage database for sensitive plants and animals, and information on archaeological and historical resources, were identified and incorporated into the study.

In November 2011, TVA took color aerial photography of the proposed project area. These images were geo-referenced and digitized for use in the GIS without distortions. This aerial photography was then interpreted to obtain land use and land cover data.

Data were then analyzed both manually and with GIS. The use of GIS allows substantial flexibility in examining various types of spatially superimposed information. This system allowed the multitude of study area factors to be examined simultaneously for developing and evaluating numerous options and scenarios to determine the transmission line route and switching station site that would best meet project needs, which included avoiding or reducing potential environmental impacts.

Review from aerial photographs, tax maps, and other sources included line length of proposed transmission line alternatives, amount of existing ROW, road/highway crossings, construction access, amount of ROW needed, forest clearing, wetlands, sensitive stream and/or stream crossings, number of parcel/property tracts, development (both commercial and residential), historical areas and structures, archaeological, and recreational areas. The aerial photography, GIS-based map, and other maps and drawings were supplemented by reconnaissance throughout the study area by TVA.

2.3.4 Establishment and Application of Siting Criteria

TVA uses a set of evaluation criteria that represent opportunities and constraints for development of switching station sites and transmission line routes. These criteria include factors such as existing land use, ownership patterns, environmental features, cultural resources, and visual quality. Cost is also an important factor, with engineering and construction considerations, materials, 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 switching station sites and transmission line alternatives involves weighing and balancing these criteria and making adjustments to them as specific conditions dictate.

2.3.4.1 Transmission Line Routing Criteria

Each transmission line 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 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 transmission line. For example, a greater number of streams crossed, a longer transmission line route length, or a greater number of historic resources affected would give a transmission line route option a higher, more unfavorable score.

- **Engineering and Construction Criteria** include considerations such as total length of the transmission route, length of route within Robert Sibley Airport airspace, number of primary and secondary road crossings, and the presence of pipeline and transmission line crossings.

- **Environmental Criteria** include the consideration of the following: total new ROW, the amount of forested and plantation acres within the proposed ROW, open water and floodplain crossings, the presence of slopes greater than 30 percent, visual aesthetics, 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), and the presence of forested wetlands or rare species' habitat.

- **Land Use Compatibility Criteria** consist of the number of individual property tracts required for the project, current land use practice on the tract(s), number of houses, schools, or commercial or industrial structures on or near the site, and the level of visual impact to surrounding area homes and the traveling public.

- **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 route. Next, a normalized ranking of alternative 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 of each alternative route for engineering, environmental, land use, cultural, and

overall total. For each of these categories, a ranking of each alternative transmission line 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. The alternative route options were then rank-ordered by their overall scores.

2.3.4.2 Switching Station Criteria

The switching station criteria used in evaluating the three potential sites included engineering and construction feasibility, environmental effects, land use compatibility, and feasibility of transmission line 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 streams and wetlands or rare species and/or their habitat, including locations outside the property boundary of the site that would be crossed by future transmission line 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, current land use practice of the tract(s), number of houses on or near the site, and the level of visual impact to surrounding area homes and the traveling public.

- **Transmission Line Connections Criteria** involve transmission line 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 transmission lines, while identifying other areas with more compatible land uses, thereby creating lesser impacts.

2.4 Development of General Route Segments and Potential Transmission Line Routes

As described in Section 2.3.3 data were analyzed to develop possible transmission line route segments connecting to the proposed alternative switching station sites. Utilizing aerial photography of the study area, 7.5-minute USGS topographic maps, and other data layers such as property boundaries, digital elevation model results (which were used to identify steepness and terrain characteristics), and transportation (in particular, aviation) a GIS-based constraint map was developed. The constraint map was used to locate

segments (Figure 1-2) that would best meet project needs while avoiding or reducing conflict with constraints and by using identified opportunities.

In the immediate vicinity of the Selmer 161-kV Substation, dense residential and commercial development to the north and northeast, coupled with the opportunity to utilize existing TVA transmission line ROW, resulted in a southern exit from the substation. Once the exit from Selmer 161-kV Substation was defined, the proposed route corridors branched east, with each crossing US Route 45 (Figure 1-2).

The development of potential route segments was limited by the Robert Sibley Airport, which is centrally located within the study area, resulting in routes travelling north and south of the airport to the Pickwick Hydro Plant-S. Jackson No. 2 161-kV Transmission Line. Also, environmental features such as forested wetlands were interspersed within the study area.

Ultimately, 21 separate route segments were developed, and combinations were made to create a network of 17 proposed alternative routes to connect the Selmer 161-kV Substation to the potential 161-kV switching station sites (see Figure 1-2 and Table 2-1).

Table 2-1. Alternate Transmission Line Corridors and Constituent Segments

Alternate Route	Constituent Segments	Switching Station Site
1	1, 3, 6, 20	3
2	1, 3, 6, 19	1 or 2
3	1, 2, 4 ,6, 20	3
4	1, 2, 4, 6, 19	1 or 2
5	1, 2, 5, 7, 9, 12, 18	1 or 2
6	1, 2, 5, 7, 9, 12, 17, 17 ,21	3
7	1, 2, 8, 9, 12, 18	1 or 2
8	1, 2, 5, 8, 9, 12, 17, 16, 21	3
9	1, 2, 5, 8, 10, 11, 12, 18	1 or 2
10	1, 2, 5, 7, 10, 11, 12, 17, 16, 21	3
11	1, 2, 5, 8, 10, 11, 12, 18	1 or 2
12	1, 2, 5, 8, 10, 11, 12, 17, 16, 21	3
13	1, 2, 5, 7, 10, 13, 14, 16, 17, 18	1 or 2
14	1, 2, 5, 7, 10, 13, 14, 16, 21	3
15	1, 2, 5 ,8, 13, 14, 16, 17, 18	1 or 2
16	1, 2, 5, 8, 10, 13, 14, 16, 21	3
17	1, 2, 5, 8, 10, 13, 15, 16, 21	3

The 17 alternative routes were evaluated using criteria as described beginning in Section 2.3.4, and the final rankings were tabulated. As a result of the information gathered at the public open house, environmental field surveys, engineering considerations, and property owner requests, some of these routes were adjusted from routes presented at the open house. These adjustments are described in Section 2.5.2.

2.4.1 Development of Potential Switching Station Sites

Using information gathered during the system studies and data development phases, three potential switching station sites utilizing two separate loop lines were identified (see Figure 1-2). Site 1 and Site 2 are located on the same property parcel adjacent to US 64. Site 1 is adjacent to a de-energized section of the Pickwick Hydro Plant-S. Jackson No. 2 161-kV Transmission Line, and Site 2 is located a few hundred feet to the east. Although both sites would connect to the system via a tap of the Pickwick Hydro Plant- S. Jackson No. 2 161-kV Transmission Line, nearly 3 miles of double circuit line would be required to be rebuilt and energized to facilitate use of these alternative sites.

Site 3 is located northeast of Sites 1 and 2, is adjacent to Neely Sharpe Road, and is located immediately adjacent to TVA's Pickwick Hydro Plant-Henderson 161-kV Transmission Line, thus ensuring no additional transmission ROW would be required for connection to the switching station.

All three of the alternative sites offer the necessary available land and are located outside of the 100-year floodplain. Each site offers good access, but future property values associated with Sites 1 and 2 may escalate as road frontage along US 64 becomes scarcer.

Sites 1 and 2 are within an active commercial pine silviculture operation, while Site 3 is located within a fallow field. Site 3 has the further advantage of being geographically located at a site that would align well with future electrical plans associated with the local power company.

Although all three alternative switching station sites are feasible options, Site 3 is considered most favorable for nearly all criteria. As a result, alternative switching station Sites 1 and 2 were eliminated from further consideration.

2.4.2 Route Identification and Evaluation

Each of the 17 alternative routes offered different opportunities and constraints. Opportunities included utilization of existing transmission line easements, less suitable areas for development, and property line geometry allowing the use of longer segments with some shared easements. The major constraint was the Robert Sibley Airport which is centrally located in the study area. Other constraints included sensitive environmental resources. 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. The relatively flat terrain also reduced the number of engineering inputs. Each of the proposed routes parallels TVA's existing transmission line leaving the Selmer 161-kV Substation and eventually crosses TVA's existing Pickwick Hydro Plant-S. Jackson No.2 161-kV Transmission Line. The Robert Sibley Airport is centrally located within the study area and was a major siting constraint. As such, alternative routes were developed primarily to the south of the airspace. Alternative Routes 14, 16, and 17 had no acres of ROW located within the airspace, while the other alternative routes ranged from approximately 3 to 8 acres. Alternative routes in the airspace would require the transmission line to be designed to meet Federal Aviation Administration regulations. For instance, shorter structures may be required, which would require more structures to meet NESC

requirements. The total length of the alternative routes ranged from approximately 14 to 17 miles, with Alternative Routes 1, 4, and 11 being the shortest and Alternative Route 2 being the longest.

Environmental

Based on the initial review, no threatened or endangered species were identified along any of the alternative routes. However, GIS analysis did identify some sensitive streams and wetlands along the various routes. All of the alternative routes cross several small streams. Forestland acreage impacted by the alternative routes ranged from a minimum of approximately 40 acres for Alternative Route 14 to a high of nearly 91 acres for Alternative Route 2.

Land Use

The study area, defined in Section 2.3, is comprised of concentrated residential and commercial development near the Cities of Selmer and Adamsville and along major roadways and largely undeveloped tracts of forested and open land. Route Segments 1, 2, 17, 18, 19, and 20 were developed to parallel existing TVA transmission lines. The number of affected property parcels along the alternative routes ranges from a low of 46 for Alternative Route 7 to a high of 93 for Alternative Route 1.

Cultural

Cultural resources include features such as archaeological sites, cemeteries, historical sites, historic structures, churches, and recreational areas. The GIS analysis identified few known archaeological or historical sites within any of the alternative routes. None of the alternative routes sites are located within the buffer zones for churches, cemeteries, or recreational areas.

Upon completion of the analysis described in Section 2.3.4, TVA compared the top 5 alternative routes (Table 2-2). Of the top five routes, only Routes 6 and 14 utilized the more favorable potential Switching Station Site 3. Routes 6 and 14 were tied in cultural criteria, but Route 14 scored more favorably in each of the engineering, environmental, and land use criteria.

Table 2-2. Top Five Ranked Alternative Routes

Route Ranking	Alternative Route	Constituent Segments
1	14	1, 2, 5, 7, 10, 13, 14, 16, 21
2	5	1, 2, 5, 7, 9, 12, 18
3	13	1, 2, 5, 7, 10, 13, 14, 16, 17, 18
4	9	1, 2, 5, 8, 10, 11, 12, 18
5	6	1, 2, 5, 7, 9, 12, 17, 17 ,21

2.5 Comparison of Alternate Transmission Line Routes

Based on 21 alternative transmission line segments as shown in Figure 1-2, and three alternative switching station sites, TVA established and considered 17 alternative routes that ranged from approximately 14 to 17 miles in length. This section provides analysis of the route segments and their relation to alternative routes.

2.5.1 Alternative Transmission Line Routes

All of the proposed routes originate from TVA's existing Selmer 161-kV Substation and are primarily oriented in a north-east alignment. The Robert Sibley Airport, centrally located in the study area presented challenges in finding feasible route corridors that did not exceed structure height restrictions within the airspace. As such, all of the proposed routes are oriented to avoid airport airspace structure height restrictions before connecting to the respective alternative switching station locations.

Routes 1 through 4, the northernmost routes, are made up of route Segments 1, 2, 3, 4, 6, 19, and 20 and range from approximately 14 to 17 miles in length. These routes contain the highest amount of forested acreage which, consequently, correlates directly to increased clearing costs. Although the study area terrain is generally flat to undulating in nature, Routes 1 through 4 include the highest percentage of steep slopes within the study area. Approximately 12 acres in each route would exceed 30 percent slope, thus contributing to potential construction and access road difficulties as well as increased erosion risks. Routes 1 through 4 pass closest to the City of Selmer and as a result, have the highest number of houses closest to the proposed ROW. Additionally, these routes all have Segment 6 in common which yields the longest length inside the Robert Sibley Airport flight zone. Finally, Routes 2 and 4 have Segment 19 in common that go to the alternative switching station Sites 1 and 2 which were eliminated from further consideration as per Section 2.4.1 above. The combination of challenges described above led to the removal of Routes 1 through 4 from further consideration.

Routes 5 through 12 consist of Segments 1, 2, 5, 7, 8, 9, 10, 11, 12, 16, 17, 18, 21 and range in length from approximately 14 to 16 miles. While these routes are farther south than routes described above, the land use has a similar mix of forest and tree plantations as well as additional agricultural areas. In general, the topography in this area is not as steep. For example, the maximum acreage exceeding a 30 percent slope for routes 5 through 12 is less than 6 acres as compared to the approximately 12 acres in the northern routes. During the open house, TVA learned that a property owner had just begun construction on a home directly on the centerline of Segment 8. Due to the proximity of other homes, TVA was unable to adjust the segment without involving new property owners. As a result, Routes 7, 8, 9, 11, and 12 were eliminated from further consideration. Consequently, the removal of these routes eliminated any additional acreage within the Robert Sibley Airport flight zone. Following the open house, TVA received more public feedback regarding Segment 11 than any other segment. Concerns ranged from concern of electromagnetic fields (EMF) to effects of the potential transmission line on property values. Due to public sentiment, Segment 11 was eliminated which in turn removed Routes 6 and 10 from further consideration. Finally, the elimination of alternative switching station Sites 1 and 2 eliminated the remaining Route 5 from further consideration.

Routes 13 through 17, the southernmost routes, are made up of Segments 1, 2, 5, 7, 8, 10, 13, 14, 15, 16, 17, 18 and 21 and range in length from approximately 15 to 16 miles. The routes are similar in land use as the routes discussed in the preceding paragraphs. The topography in this area is similar to routes 5 through 12 as the maximum acreage exceeding a slope of 30 percent is approximately 6 acres. An important attribute is that none of these routes go through the Robert Sibley Airport flight zone. As a result, there are no Federal Aviation Administration permit requirements or structure height restrictions associated with routes 13 through 17. Routes 15, 16, 17 have Segment 8 in common, and for the same reason discussed in the preceding paragraph, they were eliminated from

further consideration. The elimination of alternative switching station Sites 1 and 2 resulted in the elimination of Route 13.

2.5.2 Identification of the Preferred Transmission Line Route

Based on the analysis of the potential routes, TVA announced a preferred transmission line route and switching station site for the Action Alternative in October 2012. TVA's preferred switching station location is Site 3 (Figure 1-2). This site, located adjacent to Neely Sharpe Road in McNairy County, Tennessee, is approximately 15 acres in size. Further, based on the analysis, TVA's preferred transmission line route for the proposed Action Alternative is Alternative Route 14 consisting of Segments 2, 5, 7, 10, 13, 14, 16, and 21.

After the preferred transmission line route and switching station site were identified, affected property owners were mailed information showing the location of the preferred route on their property. Additional comments received from property owners were reviewed, and as practical, changes were made to the preferred route selections prior to and during engineering and environmental field surveys. Three minor adjustments were made to the route and are summarized in Table 2-3 below.

Table 2-3. Route Segment Changes Following the Open House

Location	Adjustment	Explanation of Adjustment
Segment 14	Addition of PI* structures	At the request of the property owner, additional PI structures were added in order to move the transmission line further away from a new home and barn.
Segment 10	Addition of PI structures	At the request of the property owner, additional PI structures were added to move the transmission line along wood line to avoid planned pivot irrigation in an agricultural field.
Segment 10	Adjustment of PI structure	When aerial photography of the transmission line was developed, a barn was not visible. At the request of the property owner, a PI structure was moved and the line was adjusted to avoid the barn.

*"PI" structures are those structures that support the transmission line at locations where the line changes direction. As such, their location is important in keeping the alignment of the proposed transmission line within the defined ROW.

2.6 Comparison of Environmental Effects by Alternative

A summary of the anticipated potential effects of implementing the No Action and the Action Alternative is provided in Table 2-4.

Table 2-4. Summary and Comparison of Alternatives by Resource Area

Resource Area	Impacts From Implementing the No Action Alternative	Impacts From Implementing the Action Alternative
Groundwater and Geology	No effects to local groundwater quality or quantity are expected.	Any effects to groundwater quality or quantity are expected to be minor. No cumulative effects to groundwater are expected.
Surface Water	No changes in local surface water quality are anticipated.	Because measures would be taken to avoid adverse effects, any effects to local surface waters would be minor. No cumulative effects to surface water quality are anticipated.
Aquatic Ecology	Aquatic life in local streams would not be affected.	With the implementation of protective measures, effects to aquatic life in local surface waters are expected to be minor.
Vegetation	Local vegetation would not be affected.	ROW clearing would disturb approximately 74 acres of forest. Site preparation and clearing of the switching station site would disturb approximately 7.5 acres of fallow field/brushy areas. Approximately 3 acres of the 15-acre site would be hard-surfaced or graveled. Disturbed/cleared areas would be revegetated with non-invasive species. Thus, the proposed actions would not facilitate the spread of invasive plant species.
Wildlife	Local wildlife would not be affected.	Resident wildlife would be displaced to adjacent local habitats. Those species favoring early successional and edge habitats would likely return. Approximately 74 acres of forest habitat would be converted to early successional habitat.
Endangered and Threatened Species	No effects to endangered or threatened species or any designated critical habitats are anticipated.	No federally listed aquatic animal species occur in the county; thus, no effects to such aquatic animals are anticipated. Implementation of BMPs would ensure no significant adverse effects to state-listed aquatic species. Because no federally listed plant species occur within the project area, there would be no effects to federally listed plants. Mitigative measures would be implemented to ensure the continued existence of Elliot's blueberry, a state-listed plant occurring within the proposed ROW. Approximately 6.4 acres of suitable summer roosting habitat for Indiana and northern long-eared bats would be removed for the proposed ROW.
Floodplains	Local floodplain functions would not be affected.	Portions of the proposed transmission line and access roads would be situated in floodplains but would not affect any floodplains or their functions.

Resource Area	Impacts From Implementing the No Action Alternative	Impacts From Implementing the Action Alternative
Wetlands	No changes in local wetland extent or function are expected.	ROW establishment would convert 0.39 acres of forested wetland to scrub-shrub/emergent wetland.
Aesthetics	Aesthetic character of the area is expected to remain virtually unchanged.	Minor visual discord and noise above ambient levels would be produced during construction. Noises and odors from construction activities would be temporary and minor.
Archaeological and Historic Resources	No effects to archaeological or historic resources are anticipated.	Implementing the proposed action would not affect archaeological or architectural resources listed in or eligible for listing in the National Register of Historic Places.
Recreation, Parks, and Natural Areas	No changes in local recreation opportunities or natural areas are expected.	Because of the intervening distance, no local managed areas would be affected. No loss of local formal or informal recreational opportunities is expected.
Land use and Prime Farmlands	No land use changes would occur. No changes in local prime farmland are expected.	The continued or future use of land within the ROW for agriculture would not be precluded. No prime farmland would be affected from construction of the proposed switching station.
Socioeconomics and Environmental Justice	Over time, the lack of reliable power service could have adverse economic effects to local businesses and residents.	Continued reliability of service would provide long-term indirect economic benefits to the area. No adverse social, economic or environmental justice effects are expected.

2.7 Identification of Mitigation Measures

The following routine measures would be applied during the construction, operation, and maintenance of the proposed switching station, transmission lines, and access roads to reduce the potential for adverse environmental effects.

- To minimize the introduction and spread of invasive species in the ROW, access roads and adjacent areas, consistent with EO 13112 (Invasive Species), TVA would follow standard operating procedures for revegetating with noninvasive plant species as defined in Muncy (2012).

- Wet-weather conveyances that could be affected by the proposed construction would be protected by implementing standard BMPs as identified in Muncy (2012).

- TVA would utilize BMPs, as described by Muncy (2012), to minimize erosion during construction, operation, and maintenance activities.

- In areas requiring chemical treatment, only USEPA-registered herbicides would be used in accordance with BMPs and label directions designed in part to restrict applications near receiving waters and to prevent unacceptable aquatic and groundwater impacts.

- The ROW would be revegetated where natural vegetation would be removed.

To protect and mitigate potential adverse effects to the state-listed Elliot's blueberry, the following measures would be taken.

- TVA has propagated Elliott's blueberry by taking softwood cuttings from the plant in the proposed ROW using the methods of Anderson and Geber (2010). These plants would be grown in a nursery until ready for out planting.
- As part of the post-construction revegetation efforts, at least 10 blueberry plants would be replanted along the northwest facing edge of the ROW, where it would receive partial shade and would be less likely to be impacted by future land management decisions of the property owner.
- If there is an unexpected failure of the propagation efforts, the Elliott's blueberry located in the proposed ROW would be transplanted to the edge of the ROW before clearing begins. If plants generated from cuttings are successfully propagated, the Elliott's blueberry currently on the proposed ROW would not be transplanted.
- The area where the Elliot's blueberry would be planted would be identified on the project engineering plans.
- The Elliot's blueberry would be planted and the location identified using GPS coordinates to define a site polygon. This information would be added to the TVA Sensitive Area Review database so the species would not be inadvertently damaged during future reclearing of the ROW. For at least 5 years post-construction localized treatment using backpack or vehicle-mounted sprayers would be excluded near the plants. Additionally, broadcast herbicide application would be prohibited on the site as long as the blueberries are present.

During this environmental review and based on USFWS's draft guidelines as of April 2013, TVA determined that the proposed action would result in the direct loss of 6.4 acres of potential roosting habitat for the Indiana bat (*Myotis sodalis*), a federally listed endangered species. In accordance with the terms of the ESA, an Indiana Bat Conservation Memorandum of Agreement (MOA) was established between the USFWS and TVA (Appendix I). In accordance with the stipulations of the MOA, TVA contributed $23,040 to the Indiana Bat Conservation Fund to promote the conservation and recovery of the Indiana bat (see Appendix A). Additionally, in accordance with the MOA, TVA would implement the following measure to avoid adversely affecting Indiana bats.

- TVA would selectively remove Indiana bat roosting habitat between the dates of October 15 and March 31 (i.e., when this habitat is unoccupied because the bats are hibernating elsewhere).

2.8 The Preferred Alternative

The Action Alternative, i.e. Construct and Operate a New 161-kV Transmission Line and Switching Station, is TVA's preferred alternative for this proposed project. TVA would build a new 161-kV transmission line from Selmer 161-kV Substation to a new West Adamsville 161-kV Switching Station. TVA's preferred route for the Action Alternative is Alternative Route Option 14. This route is comprised of Alternate Route Segments 2, 5, 7, 10, 13, 14, 16, and 21, and would terminate into switching station Site 3, TVA's preferred switching station site. The transmission line route would be approximately 15 miles in length.

This page intentionally left blank

CHAPTER 3

3.0 AFFECTED ENVIRONMENT

The existing condition of environmental resources that could be affected by the proposed Action Alternative during construction, operation or maintenance is described in this chapter. The descriptions below of the potentially affected environment are based on field surveys conducted between November 2013 and January 2014, and again in September 2014, on published and unpublished reports, and on personal communications with resource experts. This information establishes the baseline conditions against which TVA decision makers and the public can compare the potential effects of implementing the alternatives under consideration.

The analysis of potential effects to endangered and threatened species and their habitats included records of occurrence within a 3-mile radius for terrestrial animals, a 5-mile radius for plants, and a 10-mile radius for aquatic animals. The analysis of potential effects to aquatic resources included the local watershed but was focused on watercourses within or immediately adjacent to the proposed ROW, switching station, and associated access roads. The area of potential effect (APE) for architectural resources included all areas within a 0.5-mile radius from the proposed transmission line route, as well as any areas where the project would alter existing topography or vegetation in view of a historic resource. The APE with respect to archaeological resources included the 15-acre site of the proposed switching station and the 100-foot-wide ROW for the proposed 15-mile transmission line and associated access roads.

Potential effects related to air quality, hazardous and nonhazardous wastes were considered. Potential effects on these resources were found to be minimal or absent because of the nature of the action.

3.1 Groundwater and Geology

The proposed project lies in the Coastal Plain Physiographic Province and is underlain by the lower-most unit of the Mississippi embayment aquifer[3] system. The geologic units of the Coastal Plain include deposits of Late Cretaceous to Holocene sedimentary marine rocks. In the project region, the Cretaceous aged McNairy-Nacatoch aquifer consists of thick layers of the McNairy Sand and the Nacatoch Sand overlain by the Midway confining unit[4]. The McNairy-Nacatoch is a principle aquifer in the region (Lloyd and Lyke 1995) and extends northward from Mississippi and Arkansas into southeastern Missouri, northeastward into western Tennessee, southern Illinois, and southwestern Kentucky. Located within Late Cretaceous age sands, specifically the Nacatoch Sand and the McNairy Sand geologic units, the McNairy-Nacatoch aquifer consists of deltaic deposits of sand, minor gravel, and clay where it extends northward into Tennessee (USGS 1995). Due to the absence of carbonate rock strata, the area is not prone to the development of karst[5] features.

[3] An *aquifer* is an underground layer of material that contains groundwater and is capable of yielding water.
[4] A *confining unit* is a relatively impermeable layer of underground material that tends to isolate or "confine" the aquifer beneath it.
[5] *Karst* refers to a landscape formed over soluble rocks such as limestone, dolomite, and gypsum and characterized by underground drainage systems such as caves and sinkholes.

Recharge for the McNairy-Nacatoch aquifer primarily occurs as precipitation falling directly on surface outcrops of the aquifer units. Predominantly, water flows westward from the topographically higher northern and eastern sides of the aquifer. The discharge zone corresponds with an area subject to large groundwater withdrawals underlying the Mississippi River Valley alluvial aquifer. Portions of the McNairy-Nacatoch discharge zone are confined by the clay and shale of the Midway confining unit. (USGS 1995).

In 1995, fresh groundwater withdrawals from the Mississippi embayment aquifer system were estimated to be 433 million gallons per day. Public supply use accounted for about 52 percent of the total water withdrawn from the aquifer system, or about 224 million gallons per day. Information provided by the Tennessee Department of Environment and Conservation (TDEC) and USEPA indicates groundwater is the primary source of water supply for McNairy County (USEPA 2014a). Information published by the USGS (2000) indicated groundwater withdrawals for McNairy County were approximately 3.42 million gallons per day.

While there are private wells located in the general area, the Selmer Utility Division of Water supplies water to the public in project area. The source for this system is from three wells which withdraw from the McNairy-Nacatoch aquifer. The Selmer Utility Division of Water Quality 2011 Report states that their water supplies meet all of the state and federal requirements for safe drinking water (Selmer Utility Division of Water Quality 2011).

3.2 Surface Water

Precipitation in the general area of the proposed project averages about 57 inches per year. The wettest month is January with an average of 5.9 inches of precipitation, and the driest month is August at 2.8 inches. The median annual air temperature is 59 degrees Fahrenheit and ranges from a monthly average of 38 degrees Fahrenheit in January to 79 degrees Fahrenheit in July. Stream flow varies with rainfall and averages about 22 inches of runoff per year, i.e., approximately 1.6 cubic feet per second per square mile of drainage area.

The portion of McNairy County crossed by the proposed ROW drains westward to tributaries of the Mississippi River (primarily the Hatchie River) and eastward to several tributaries of the Tennessee River. The Tennessee River is located approximately 5 to 6 miles from the easternmost portion of the proposed ROW.

The federal Clean Water Act requires all states to identify all waters where required pollution controls are not sufficient to attain or maintain applicable water quality standards and to establish priorities for the development of limits based on the severity of the pollution and the sensitivity of the established uses of those waters. States are required to submit reports to the USEPA. The term “303(d) list” refers to the list of impaired and threatened streams and water bodies identified by the state. Tables 3-1 and 3-2 provide a listing of local streams, their state (TDEC) designated uses, and their 303(d) impairments.

Table 3-1. Uses for Streams in the Vicinity of the Proposed Transmission Line

Stream	Use Classification[1]							
	DWS	IWS	FAL	REC	LWW	IRR	NAV	HQ
Mississippi River								
Hatchie River	X	X	X	X	X	X		
Tuscumbia River	X		X	X	X	X		
Cypress Creek			X	X	X	X		
Oxford Creek			X	X	X	X		
Bull Branch			X	X	X	X		
South Fork			X	X	X	X		
Tennessee River (Kentucky Reservoir)								
Snake Creek			X	X	X	X		
Owl Creek			X	X	X	X		X
Middle Fork			X	X	X	X		
Tanner Branch			X	X	X	X		
Clear Creek			X	X	X	X		
Graham Creek			X	X	X	X		
Clarey Branch			X	X	X	X		

[1] Codes: DWS=domestic water supply; IWS=industrial water supply; FAL=fish and aquatic life; REC=recreation; LWW=livestock watering and wildlife; IRR=irrigation; NAV=navigation; HQ=Tier 2 high quality

Table 3-2. TDEC 303(d) Listed Streams in the Vicinity of the Proposed Transmission Line

Stream	303 (d) Impaired Stream		
	Use Support	Cause	Source
Mississippi River			
Hatchie River			
Tuscumbia River	Impaired	Loss of biological integrity due to siltation	Sources outside of state
Cypress Creek	Impaired	Loss of biological integrity due to siltation	Non-irrigated crop production, channelization
Oxford Creek	Yes		
Bull Branch	Yes		
South Fork	Yes		
Tennessee River (Kentucky Reservoir)			
Snake Creek	Impaired	Low dissolved oxygen, loss of biological integrity due to siltation	Municipal point source, irrigated crop production
Owl Creek	Yes		
Middle Fork	Yes		
Tanner Branch	Yes		
Clear Creek	Yes		
Graham Creek	Yes		
Clarey Branch	Yes		

3.3 Aquatic Ecology

The proposed project would be located in the Northern Hilly Gulf Coastal Plain, a subdivision of the Southeastern Plains ecoregion (USEPA 2014b). The proposed transmission line ROW would cross the Cypress Creek watershed of the Hatchie River

system and the Snake Creek watershed, which is a direct tributary of the Tennessee River system. Streams encountered during field surveys were low gradient. Sand was the dominant substrate as is typical of the Southeastern Plains ecoregion, but some perennial streams had bedrock present with mixed gravel and sand substrates. Overall, 76 watercourses, including 19 perennial, eight intermittent, and 44 ephemeral streams[6] and five ponds, occur along the proposed transmission line route. Field surveys were also conducted along the proposed access roads associated with the new transmission line, as well as the proposed upgrades to the existing Pickwick Hydro Plant-Henderson 161-kV Transmission Line and the Pickwick Hydro Plant-S. Jackson No. 2 161-kV Transmission Line. Fifteen additional watercourses including two perennial, two intermittent, and 11 ephemeral streams were documented.

Because transmission line and switching station construction and maintenance activities can affect riparian conditions and in-stream habitat, the condition of both of these at each stream crossing along the proposed route was evaluated. Riparian condition was evaluated during November 2013 and September 2014 field surveys using a TVA habitat assessment form. A listing of stream and pond crossings within the proposed ROW, excluding ephemeral streams is provided in Appendix J. Additional information regarding watercourses in the vicinity of the project can be found in Section 3.2.

The following three classes were used to indicate the current condition of streamside riparian vegetation along the length of the proposed transmission line, as defined below, and listed in Table 3-3.

- 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 - Although not 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 - No or few trees are present within the riparian zone. Significant clearing has occurred, usually associated with pasture or cropland.

Based on these evaluations and other considerations (such as State 303(d) listing and presence of endangered or threatened aquatic species), TVA assigns appropriate streamside management zones (SMZs) and best management practices (BMPs) to reduce the potential for impacts to water quality and in-stream habitat for aquatic organisms.

The Gulf Coastal Plain is the most productive agricultural region of Tennessee, and watershed land use affects stream habitat quality and aquatic communities (Brim Box and Mossa 1999; Wang et al. 2011). Twenty-two species of fishes have been documented in Oxford Creek, and there are over 107 species of fishes known from the Hatchie River system (Keck and Etnier 2005). Index of Biotic Integrity scores in Snake Creek from TVA aquatic community assessment indicated a “Fair” invertebrate and fish community. A total of 31 fish species were collected in the most recent survey in 2005.

[6] Ephemeral streams are those small creeks and streams that typically flow only following rainfall events. They are also known as wet weather conveyances or “WWCs.”

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

Riparian Condition	Perennial Streams Within ROW	Intermittent Streams Within ROW	Total
Forested	0	2	2
Partially forested	9	2	11
Non-forested	10	4	14
Total	**19**	**8**	**27**
	Perennial Streams Along Access Roads	**Intermittent Streams Along Access Roads**	
Forested	0	0	0
Partially forested	2	0	2
Non-forested	0	2	2
Total	**2**	**2**	**4**

3.4 Vegetation

The proposed project would occur in the Southeastern Plains ecoregion (USEPA 2014b). In Tennessee, this area is underlain by Tertiary-age substrates, including sands and clay. This ecoregion has more topographic variation than the Loess Plains to the west and less elevation change compared to the Western Highland Rim to the east. The natural vegetation type in this ecoregion is oak/hickory and oak/hickory/pine forest, but many areas have been converted to agricultural, industrial, and residential land uses.

Vegetation throughout the areas where the proposed transmission line and switching station construction would occur is characterized by two main types: herbaceous (60 percent) and forest (40 percent). No forested areas in the proposed ROW had structural characteristics indicative of old growth forest (Leverett 1996). All plant communities observed, with the exception of the area containing Elliott's blueberry, are common and well represented throughout the region.

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. Cultivated agricultural fields, existing transmission line ROW, heavily manipulated pastures, or disturbed sites in various stages of residential or industrial development account for the vast majority of herbaceous vegetation in the ROW of the proposed transmission line. Most of these areas are dominated by plants indicative of early successional habitats, including many non-native species. Early successional fields with naturalized vegetation contain herbaceous species like broomsedge, crabgrass, dallis grass, greasy grass, gray goldenrod, Johnsongrass, silver plume grass, and tall fescue. However, many areas of herbaceous vegetation are agricultural fields, which are intensively managed for grazing or the production of row crops such as corn, soybeans, and wheat. Some areas of emergent wetlands were present in the proposed ROW. See Section 3.8 for species indicative of those areas.

Deciduous forest, which is characterized by trees with overlapping crowns where deciduous species account for more than 75 percent of the canopy cover, is the most prevalent forest

type and accounts for approximately 20 percent of the total proposed ROW. Upland deciduous forest is comprised of numerous species that can occupy relatively dry sites. Canopy species include black oak, blackjack oak, mockernut hickory, post oak, scarlet oak, southern red oak, and white oak. Few understory species were visible above ground during the late fall survey. However, the herbaceous layer on dry, upland sites like those found in the proposed ROW is typical of those in the area and tends to have relatively few species regardless of survey season. Mesic deciduous forest, which occurs on wetter sites, has different species in the canopy including red maple, northern red oak, river birch, sweetgum, sugar maple, water oak, willow oak, and yellow-poplar. Species observed in the understory of this type of deciduous forest include American beautyberry, Christmas fern, greenbrier, river oats, St. Peterswort, slender woodoats, strawberry bush, and wrinkleleaf goldenrod. The structure of these forest stands varies throughout the proposed ROW, but overstory diameter trees were commonly 18 to 24 inches in diameter at breast height. Forest stands falling into this size class are mature, but have likely been cleared at some point in the past.

Mixed deciduous-evergreen forest, where both evergreen and deciduous species account for more than 25 percent of canopy cover, occurs on both upland and wetter sites. This forest type covers about 15 percent of the proposed ROW and is fairly similar to the previously described upland deciduous forest and mesic deciduous forest but for the greater concentration of loblolly pine and, to a lesser extent, shortleaf pine.

Evergreen forest, which accounts for about five percent of total cover in the proposed ROW, has very low species diversity and is dominated by loblolly pine being grown in a plantation forest setting. Canopy trees in forests stands like these are all approximately the same size, are regularly harvested to produce wood products, and bear little resemblance to native plant communities found in the region.

Executive Order 13112 (Invasive Species) serves to prevent the introduction of invasive species and provides for their control to minimize the economic, ecological, and human health impacts that those species potentially cause. In this context, invasive species are nonnative species that invade natural areas, displace native species, and degrade ecological communities or ecosystem processes (Miller et al. 2010). No federal-noxious weeds were observed, but multiple species designated by the Tennessee Exotic Plant Pest Council as high priority invasive plants were observed in the proposed ROW (Table 3-4). During field surveys, invasive plants were noted to be more prevalent in areas of herbaceous vegetation. This likely reflects the frequency and magnitude of disturbance present in areas of herbaceous vegetation. Disturbances associated with agriculture, grazing, and mowing prevent tree species from becoming established, but can also encourage invasion and establishment of weedy plants.

Table 3-4. High Priority Invasive Plant Species Observed Along the Proposed Transmission Line Route

Common Name	Scientific Name
Tall fescue	*Festuca arundinacea*
Chinese lespedeza	*Lespedeza cuneata*
Japanese honeysuckle	*Lonicera japonica*
Japanese stiltgrass	*Microstegium vimineum*
Johnsongrass	*Sorghum halepense*

3.5 Wildlife

Habitat assessments for terrestrial animal species were conducted in November 2013 and September 2014 for the proposed project area. The proposed ROW would occupy approximately 186 acres, and the switching station would occupy about 3 acres of a 15-acre parcel. The local landscape surrounding the project area is a combination of mixed mesophytic forest, pine forest, wetlands, early successional (pasture and agricultural) fields, roads, residential homes and existing transmission line ROWs. The majority of the proposed transmission line is routed through agricultural fields, pasture, and forest fragments. Forest fragments include evergreen forest, deciduous forest, and mixed deciduous-evergreen forest. Approximately 6.3 acres of wetland, 2 acres of developed areas including road crossings and five farm ponds equivalent to 1 acre combined, would be spanned by the proposed transmission line. Access roads utilize existing roads within these same types of habitats. Each of the varying community types offers suitable habitat for species common to the region both seasonally and year-round.

Deciduous forests and mixed deciduous-evergreen forests provide habitat for a variety of terrestrial animal species. Birds found in this habitat include chuck-will's-widow, downy and hairy woodpecker, eastern screech-owl, eastern wood-pewee, red-tailed hawk, white-breasted nuthatch, wood thrush, and yellow-billed cuckoo (National Geographic Society, 2002). This area also provides foraging and roosting habitat for several species of bats, particularly in areas where the forest understory is more open. Some examples of bat species likely found within this habitat are big and little brown, eastern red, evening, hoary, Rafinesque's big-eared, silver-haired, and tricolored bat. Coyote, eastern chipmunk, eastern woodrat, North American deermouse, and woodland vole are also likely mammalian species present within this habitat (Kays and Wilson 2002). Black rat and midland brown snakes as well as scarlet kingsnakes are all common reptilian residents of this habitat (Conant and Collins 1998). In forests with aquatic features, amphibians likely found in the area include dusky, marbled, mole, and spotted salamanders as well as barking and Cope's gray treefrogs and southern leopard frogs (Conant and Collins 1998, Niemiller and Reynolds 2011).

Evergreen forests encountered during field surveys were typically pine forests. These forests provide habitat for other common terrestrial species. Bachman's sparrow, barred owl, brown creeper, golden-crowned kinglet, hermit thrush, northern parula, pine siskin, pine warbler, red-breasted nuthatch, summer tanager, wild turkey, yellow-rumped and yellow-throated warblers all utilize this habitat (National Geographic Society 2002). Cotton deermouse and white-footed deermouse, eastern fox squirrel, Seminole bat and wild boar are mammalian species that may utilize resources found in pine forests (Kays and Wilson 2002). Coachwhip, eastern hognose, pine, northern red-bellied, red corn, and northern scarlet snakes are found in open pine forests (Conant and Collins 1998). Additionally, eastern narrowmouth toad, eastern spadefoot toad, eastern tiger salamander, and Fowler's toads may all be present in pine forest (Niemiller and Reynolds 2011).

Wetland habitat provides resources for bird species such as blue grosbeak, great horned owl, hooded warbler, northern harrier, red-winged blackbird, song sparrow, swamp sparrow and white-throated sparrow (National Geographic Society 2002). Mammalian species that may utilize this habitat are American beaver, eastern harvest mouse, marsh rice rat, muskrat, nutria, and swamp rabbit (Kays and Wilson 2002). Eastern black kingsnake, eastern ribbon, garter, northern water, Mississippi ring-necked and rat snake are typical wetland reptilian species (Conant and Collins 1998). Eastern red-spotted newt and three-lined salamanders as well as bull frogs, bird-voiced frogs, tree-frogs, green frogs, northern

cricket frog, pickerel frog, and southern cricket frogs are examples of some amphibian species that are likely present (Niemiller and Reynolds 2011).

Pastures and agricultural fields offer habitat to a variety of species such as brown-headed cowbird, brown thrasher, common grackle, common yellowthroat, Bewick's wren, dickcissel, eastern bluebird, eastern kingbird, eastern meadowlark, field sparrow, grasshopper sparrow, house finch, and prairie warbler among others (National Geographic Society 2002). Mammalian species likely present in this habitat include eastern cottontail, eastern harvest mouse, eastern woodrat, hispid cotton rat, red fox, and striped skunk (Kays and Wilson 2002). Farm ponds within agricultural settings provide habitat for common amphibians and reptiles. Amphibious species likely present include pickerel and upland chorus frogs as well as spring peepers and mole salamander (Niemiller and Reynolds 2011). Reptilian species with the potential to occur in the proposed ROW are eastern milk, gray rat, smooth earth and southern black racer snakes, as well as eastern slender glass lizard (Conant and Collins 1998).

Disturbed, developed areas are home to a number of common species. American robin, barred owl, Carolina chickadee, blue jay, European starling, house sparrow, mourning dove, northern cardinal, northern mockingbird, and vultures are all commonly found in transmission line ROWs, as well as near roads and neighborhoods. Urbanized mammals found in this community include the eastern gray squirrel, nine-banded armadillo, northern raccoon, and Virginia opossum (Kays and Wilson 2002). Road-side ditches can be habitat for American toad, upland chorus frog and spring peeper. Common reptiles using these urbanized areas include black rat snakes and gray rat snakes as well as mole kingsnake (Conant and Collins 1998).

No caves are known to occur within 3 miles of the proposed project area. No caves were observed during field surveys. No other unique or important terrestrial habitats exist on the project site.

No aggregations of migratory birds or colonial wading bird colonies are known from proposed project area. The nearest wading bird colony occurs approximately 8.6 miles from the project area. No other unique habitats were identified during field surveys.

3.6 Endangered and Threatened Species

Endangered species are those determined to be in danger of extinction throughout all or a significant portion of their range. Threatened species are those determined to be likely to become endangered within the foreseeable future. Section 7 of the ESA requires federal agencies to consult with the USFWS when their proposed actions may affect endangered or threatened species or their critical habitats.

The ESA provides broad protection for species of fishes, 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 or designated critical habitat. 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.

The State of Tennessee provides protection for species considered threatened, endangered, or deemed in need of management within the state other than those federally

listed under the ESA. The listing is handled by the TDEC; however, the Tennessee Natural Heritage Program and TVA both maintain databases of aquatic animal species that are considered threatened, endangered, special concern, or tracked in Tennessee. A listing of federally and state-listed species that occur near the proposed transmission line ROW is provided as Table 3-5.

Table 3-5. Federally Listed and State-listed Species Known to Occur in the Vicinity of the Proposed Transmission Line Route

Common Name	Scientific Name	Federal Status[1]	State Status[1]	State Rank[2]
Aquatic Insects				
Margaret's River Cruiser	*Macromia margarita*		TRKD	S2S3
Fishes				
Blue Sucker	*Cycleptus elongatus*		THR	S2
Flame Chub	*Hemitremia flammea*		NMGT	S3
Highfin carpsucker	*Carpiodes velifer*		NMGT	S2S3
Southern cavefish	*Typhlichthys subterraneus*		NMGT	S3
Mussels				
Clubshell[3]	*Pleurobema clava*	END	END	SH
Cracking pearlymussel	*Hemistena lata*	END	END	S1
Fanshell	*Cyprogenia stegaria*	END	END	S1
Orange-foot pimpleback	*Plethobasus cooperianus*	END	END	S1
Pink mucket	*Lampsilis abrupta*	END	END	S2
Rabbitsfoot	*Quadrula cylindrica*	THR	TRKD	S3
Ring pink	*Obovaria refusa*	END	END	S1
Rough pigtoe	*Pleuroblema plenum*	END	END	S1
Sheepnose	*Plethobasus cyphyus*	END	TRKD	S2S3
Slabside pearlymussel[3]	*Pleuronaia dolabelloides*	END	TRKD	S2
Spectaclecase	*Cumberlandia mondonta*	END	TRKD	S2S3
White wartyback	*Plethobasus cicatricosus*	END	END	S1
Snails				
Armored rocksnail	*Lithasia armigera*		TRKD	S1S2
Muddy rocksnail	*Lithasia salebrosa*		TRKD	S2
Ornate rocksnail[3]	*Lithasia geniculate*		TRKD	S3
Rugged hornsnail[3]	*Pleurocera alveare*		TRKD	S2
Shortspire Hornsnail[3]	*Pleurocera curta*		TRKD	S2
Crustaceans				
Hatchie burrowing crayfish	*Fallicambarus hortoni*		END	S1
A crayfish	*Orconectes wrighti*		END	S2
Plants				
Plukenet's cyperus	*Cyperus plukenetii*		SPCO	SH
Whorled sunflower[4]	*Helianthus verticillatus*	END	END	S1
Sweetbay magnolia	*Magnolia virginiana*		THR	S2
Maryland milkwort	*Polygala mariana*		SPCO	S1
Chapman's redtop	*Tridens flavis* var. *chapmanii*		SPCO	SH
Elliot's blueberry[5]	*Vaccinium elliotii*		END	S1
Mammals				
Gray bat	*Myotis grisescens*	END	END	S1
Indiana bat[6]	*Myotis sodalis*	END	END	S1
Northern long-eared bat	*Myotis septentrionalis*	PE	NMGT	S4

Source: TVA Regional Natural Heritage Database

[1] Status Codes: END = Endangered; NMGT = In Need of Management; PE = Proposed Endangered; SPCO = Special Concern; THR = Threatened.
[2] State Ranks: S1 = Critically Imperiled; S2 = Imperiled; S4 = Apparently Secure; SH = Historic in Tennessee
[3] Historical record greater than 25 years old.
[4] This species is known to occur within McNairy County, but not necessarily within 5 miles of the proposed actions.
[5] This species was not previously reported from the vicinity, but was identified within the proposed ROW during field surveys.
[6] This species is known to occur within McNairy County, but not within 3 miles of the proposed ROW.

3.6.1 Aquatic Animals

Twelve federally listed mussel species as shown in Table 3-5 are known to occur within streams or watersheds crossed by the proposed ROW (including the site of the proposed switching station) and/or within McNairy County, Tennessee. Of those, 10 mussel species are considered to still be in existence. However, the records of occurrence for two mussels (the clubshell and the slabside pearlymussel) are historical, and the presence of these two species is uncertain (Table 3-5). These species, as well as the 12 additional state-listed species (one aquatic insect, two crayfish, four fish, and five snails) are all either large riverine species (i.e. highfin carpsucker, orange-foot pimpleback, pink mucket, rabbitsfoot) occurring in the mainstem of the Tennessee River or are species with very specific habitats (i.e., flame chub, southern cavefish). Thus, none of the species listed in Table 3-5 would be supported by the aquatic habitat located within the project vicinity.

The Hatchie burrowing crayfish is the only state-listed aquatic species known within the watersheds of the proposed transmission line ROW and/or McNairy County, Tennessee (Table 3-5). As its name implies this species of crayfish burrows in soft mud and is known to occur only within tributaries of the Hatchie River in Tennessee.

3.6.2 Plants

No federally listed plant species are known to occur within a five-mile radius of the proposed transmission line route. However, four state-listed plant species have been previously reported within 5 miles of the proposed ROW (Table 3-5). One federally listed as endangered plant species (i.e., the whorled sunflower) is known from McNairy County. In Tennessee, the whorled sunflower occurs along margins of heavily disturbed agricultural fields and streams and within road and railroad ROWs along with other prairie species (USFWS 2013a). In the field, this habitat can appear nearly identical to weedy areas of naturalized vegetation, which are common throughout the region. For this reason, all sections of the proposed transmission line ROW, associated access roads, and the switching station site containing naturalized herbaceous vegetation were closely examined for individual whorled sunflower plants. Although botanical surveys were conducted in November 2013 after the optimal season for identifying whorled sunflower, the plant would have still been visible above ground, if present. No whorled sunflower plants were observed in the proposed ROW, and no designated critical habitat for plant species occurs in the general project vicinity.

A previously unreported occurrence of the state-endangered Elliott's blueberry was observed at one location along the proposed ROW. The single individual was comprised of several stems and appeared vigorous during the surveys. The plant occurred in the understory of a mixed evergreen deciduous forest with canopy species that included black oak, loblolly pine, red maple, sugar maple, sweetgum, Virginia pine, and yellow-poplar. The average size of overstory trees ranged from 10 to 20 inches in diameter at breast height. To determine if Elliott's blueberry plants also occurred outside the proposed ROW,

additional surveys were conducted across approximately 30 acres of potential habitat adjacent to the proposed transmission line ROW. No additional plants were observed.

3.6.3 Terrestrial Animals

There are no records of state-listed terrestrial animal species occurring in the project area. Additionally, no federally listed or federally protected terrestrial animals are known to occur within 3 miles of the proposed transmission line or switching station or from McNairy County. However, acoustic surveys in 2012 detected the northern long-eared (NLE) bat within 3 miles of the proposed transmission line route. The NLE bat is proposed by the USFWS for federal listing. Additionally, two federally endangered Indiana bat tree roosts were located in 2013 within 10 miles of the proposed project.

No caves are known from within 3 miles of the proposed transmission line ROW, and none were found during field surveys conducted in November 2013 and September 2014. The nearest documented cave occurs slightly over 12 miles away in Hardin County, Tennessee. Suitable summer roosting habitat for both the Indiana bat and the NLE bat is present within six forested sections along the proposed ROW. Suitability was determined by the presence of trees with exfoliating bark and relatively open understory. Individual habitat suitability has been included for the Indiana bat, NLE bat, and gray bat.

Indiana bats hibernate in caves in winter and use areas around them for swarming (mating) in the fall and staging in the spring, prior to migration back to summer habitat. During the summer, Indiana bats roost under the exfoliating bark of dead snags and living trees in mature forests that have an open understory and a nearby source of water (Pruitt and TeWinkel 2007, Kurta et al. 2002). Indiana bats are known to change roost trees frequently throughout the season, yet still maintain site fidelity, returning to the same summer roosting areas in subsequent years (Dickenson 2001). Foraging habitat for this species exists over bodies of water and forested areas, including tree-lined fence rows. Foraging habitat exists throughout the project area over streams, ponds, forest fragments, fence rows and other corridors. Indiana bat summer roosts have been previously recorded in McNairy County in April 2013. Two Indiana bats were tracked to McNairy County during field surveys using radio transmitters. These roosting sites were determined to be maternity colonies occurring less than a mile north of the Tennessee-Mississippi state line and approximately 9.5 miles south the proposed activities.

The NLE bat overwinters predominantly in large hibernacula[7], such as caves, abandoned mines, and cave-like structures that have high humidity and no air flow. During the fall and spring, they utilize entrances of caves and the surrounding forested areas for swarming (mating). In the summer, NLE bats roost singly or in colonies beneath exfoliating bark or in crevices of both live trees and snags. This species is also known to roost in abandoned buildings and under bridges, though their primary summer roosting sites appear to be trees. Roost selection by NLE bats is similar to Indiana bats. However, NLE bats tend to be more opportunistic in their roost site selection. NLE bats emerge at dusk to forage below the canopy of mature forests on hillsides and ridges and occasionally forage over forest clearings and along riparian areas (USFWS 2013b, 2014a). Suitable foraging habitat for NLE bats exists throughout the project area over streams, ponds, forest fragments, fence rows and other corridors. In May 2013, bat surveys conducted for another project in McNairy County resulted in acoustic calls identified as NLE bat from four locations. Three

[7] *Hibernacula* are areas, such as caves, that are used by bats for hibernating during the winter.

individual calls were recorded within 0.5 mile of the proposed actions. Twelve individual calls were recorded within 0.7 mile of the proposed ROW, and an additional 18 individual calls were recorded within 1 mile of the proposed project.

Suitable summer roosting habitat for both Indiana and NLE bats found within the proposed project area (including the new ROW, switching station, access roads, and areas along existing transmission lines needing upgrades) totaled 6.4 acres. Six sections of forest were identified along the proposed route as either moderate or highly suitable roosting habitat due to a high concentration of white oaks, shag bark hickories and/or snags with exfoliating bark in and around the proposed ROW. Suitable summer roosting areas were comprised of mature hardwood stands dominated by a mixture of oaks (black, blackjack, red, and white) and other hardwood species such as hackberry, pignut and shagbark hickories.

Gray bats roost in caves year-round and migrate between summer and winter roosts during spring and fall (Tuttle 1976). They forage over bodies of water. The closest known gray bat hibernaculum is 15.8 miles away. Gray bats were recorded during 2013 acoustic surveys approximately 0.5 mile from the proposed project area. Several streams and farm ponds exist within the project area where gray bats may forage.

3.7 Floodplains

A floodplain is the relatively level land area along a stream or river that is subjected to periodic flooding. The area subject to a one-percent chance of flooding in any given year is normally called the 100-year floodplain.

As shown in Figure 1-1, the proposed 15-mile transmission line route would cross several floodplain areas. These floodplains are associated primarily with Oxford Creek, Owl Creek, and Snake Creek. The site of the proposed switching station is located outside the 100-year floodplain.

3.8 Wetlands

Wetlands are those areas inundated by surface water or groundwater such that vegetation adapted to saturated soil conditions is prevalent. Examples include swamps, marshes, bogs, and wet meadows. Wetland fringe areas also are found along the edges of most watercourses and impounded waters (both natural and man-made). Field surveys were conducted on November 2013 to identify wetland areas within the project area.

Wetland determinations were performed according to the USACE standards, which require documentation of hydrophytic (wet-site) vegetation, hydric soil, and wetland hydrology (USACE 2010; Environmental Laboratory 1987; Lichvar and Kartesz 2009; U.S. Department of Defense and USEPA 2003). Broader definitions of wetlands, such as those used by the USFWS (Cowardin et al. 1979) 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 (i.e., the TVA Rapid Assessment Method or “TVARAM“) was used to categorize wetlands by their functions, sensitivity to disturbance, rarity, and ability to be replaced.

TVARAM scores are used to classify wetlands into three categories. Category 1 wetlands are considered “limited quality waters.” They represent degraded aquatic resources having limited potential for restoration 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 have reasonable potential for restoration. Avoidance and minimization are the preferred mitigation measures 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 proposed Selmer-West Adamsville 161-kV Transmission Line corridor runs southwest-northeast from Selmer to Adamsville, traversing an undulating landscape dominated by agriculture but interspersed with forested uplands and naturalized lowlands between stream and tributary crossings. Sixteen wetland areas, totaling 6.31 acres, were identified within the proposed transmission line ROW (Table 3-6).

Table 3-6. Wetlands in the Proposed Transmission Line ROW

Wetland Identifier	Type[1]	Acreage in ROW	Forested Wetland Acreage in ROW	TVARAM Category (score)
W001	PEM/PFO1E	0.26	0.07	2 (33)
W002	PSS1E	0.37	0	1 (28)
W003	PSS1E	0.09	0	2 (54)
W004	PSS1E	0.23	0	2 (56)
W005	PFO/PEM1E	0.26	0.13	1 (29)
W006	PUBH/PEM/PSS1E	0.65	0	2 (30)
W007	PFO1E	0.12	0.12	2 (37.5)
W008	PEM/PSS1E	0.04	0	1 (25)
W009	PSS1E	0.07	0	1 (27)
W010	PFO1E	0.07	0.07	2 (36)
W011	PEM1E	0.27	0	1 (19)
W012	PEM1E	0.10	0	1 (19)
W013	PEM1E	0.34	0	1 (19)
W014	PSS1E	0.19	0	2 (52)
W015	PEM/PSS1E	0.37	0	1 (19)
W016	PSS1E	2.88	0	2 (39)
	Total Acres	**6.31**	**0.39**	

[1]Classification codes as defined in Cowardin et al. (1979): PEM1 = palustrine emergent, persistent vegetation; PFO1 = palustrine forested, broadleaf deciduous vegetation; PSS1 = palustrine, scrub-shrub, broadleaf deciduous; PUB = palustrine, unconsolidated bottom; suffix “E” = seasonally flooded/saturated; suffix “H” = permanently flooded.

W001 is a headwater wetland system totaling 0.26 acre within the project footprint and located south of the Selmer 161-kV Substation. This wetland is comprised of 0.07 acre of forested wetland within the new ROW but extends into an existing ROW as emergent wetland habitat. W001 extends west of the proposed ROW for an approximated total of 0.5 acre. This wetland exhibited hydric soils, surface hydrology, and hydrologic connectivity to Oxford Creek. The forested portion of W001 was dominated by red maple and sweetgum, both hydrophytic species. The emergent wetland area was also dominated by hydrophytes including late-flowering thoroughwort and panic grasses.

W002 consists of densely growing young saplings within the floodplain of a tributary to Oxford Creek. W002 contains 0.37 acre within the ROW, but extends to roughly twice this

size beyond the ROW boundary. This wetland area contained hydric soils, crayfish burrows, and drainage patterns providing hydrologic connectivity to Oxford Creek. Although the vegetation in W002 was dominated by sweetgum, swamp chestnut oak, and sycamore, all hydrophytic tree species, the current stature of the stand provides scrub-shrub habitat.

W003 and W004 are located in a span of the proposed ROW between two crossings of South Fork Oxford Creek. Both wetland areas contain emergent/scrub-shrub wetland habitat, and area located in the floodplain of the creek. W003 functions as an overflow channel for South Fork Oxford Creek and there is direct connectivity between the wetland and the creek. W004 is a depression within the floodplain connected to the creek via ephemeral drainage channels. W003 contained 0.06 acre within the proposed ROW, and W004 contained 0.22 acre within the ROW. Both extend outside the ROW for a total of approximately 1.0 acre each. W003 and W004 exhibited wetland hydrology indicators, hydric soil, and hydrophytic vegetation. Dominant species included bulrush and panic grass.

W005 is an upper slope depression, likely remaining from historic and adjacent road construction. W005 receives drainage via an overflow culvert from an upstream pond, passing from the pond, below a gravel road, and into the depression at the head of this wetland. This depression drains along the edge of a field through a linear wetland ditch, eventually expanding into a small forested wetland area at the base. This forested wetland area consists of flatwoods habitat sandwiched between two drains. These conveyances join at the southern terminus of W005, forming a more substantial and sloped means for water drainage. W005 contained hydric soils, ponded water in the northern-most depression, and ephemeral hydrologic connectivity to Owl Creek. This wetland totals 0.26 acre, all of which is located entirely within the ROW, and half of which is forested. The forested wetland area was dominated by hydrophytic vegetation including river birch, sugarberry, and sweetgum. The emergent wetland area was dominated by hydrophytic forbs including panic grasses and soft pathrush.

W006 consists of a wide natural headwater drain feeding a man-made pond, just north of W005. This wetland area contained emergent, scrub-shrub, and ponded wetland habitat totaling 0.65 acre within the ROW, extending west of the ROW for a small distance. Within W006, each habitat type is represented about equally. W006 exhibited hydric soils. Standing water was present in the pond, and saturated soils were present at the northern-most extent of the delineated boundary. W006 is ephemerally connected to Owl Creek when pond overflows take place, feeding W005 and associated downstream drains. The ponded area was surrounded by emergent wetland vegetation dominated by meadow beauties, panic grass, and soft pathrush, all hydrophytic vegetation. Upstream from the pond, W006 contained alternating patterns of emergent and scrub-shrub habitat, all of which was dominated by hydrophytes. The emergent portions contained flattop nutsedge and panic grass while the scrub-shrub portions were dominated by black willow, red maple, and sweetgum saplings.

W007 is a forested lowland wetland area bisected by a drainage feeding Tanner Branch. This wetland totals 0.12 acre within the ROW, but doubles in size as it extends slightly north and south of the ROW. W007 contains hydric soils, exhibits drift deposits from flooding events, and demonstrates hydrologic connectivity. Dominant hydrophytic vegetation consisted of American sycamore, red maple, and sweetgum.

W008 is a linear shallow drain that has developed wetland characteristics. The headwater depression of this small drain is bulbous in shape, contains scrub-shrub habitat, and is located outside to northwest of the ROW. W008 consisted of 0.04 acre within the ROW. It conveys water to Futwood Branch, contained flowing surface water at the time of the site visit, and exhibited hydric soils. W008 contained emergent hydrophytic vegetation within the ROW, with giant goldenrod, panic grass, and soft pathrush dominating.

W009 consists of an old failed man-made pond located in the middle of a timber tract with 0.07 acre on the ROW. Although the pond no longer retains water as intended, the depression is inundated for a duration long enough to allow for all three wetland parameters to be present. Surface water was approximately 3 inches deep at the time of the field visit. However, no hydrologic connectivity to downstream waters was evident. Hydric soils were present, and wetland habitat consisted of scrub-shrub vegetation dominated by black willow saplings, a hydrophytic species.

W010 totals 0.07 acre of forested wetland within the ROW. W010 is located between and includes naturally defined drains in a wide valley just north of a pine plantation. W010 exhibits hydrologic connectivity to Futwood Branch, hydric soils, and dominant hydrophytic vegetation, including cherrybark oak, red maple, and sweetgum.

W011 and W0012 are both emergent wetland features located in headwater depressions of wide valleys and surrounded by the same pasture land. These wetlands feed an unnamed tributary of Graham Creek. W011 totaled 0.10 acre, and W012 totaled 0.27 acre within the ROW, extending south of the ROW for less than 1 acre total. These wetlands contained hydric soils, hydrology indicators, and dominant hydrophytic vegetation that included soft pathrush and various species of sedges.

W013 contains 0.11 acre of emergent wetland vegetation within the ROW, feeding a man-made pond directly below the ROW south of Gilchrist Road. Therefore, hydrologic connectivity could only be established via the pond overflow channel. This wetland exhibits wetland hydrology, hydric soils, and dominant hydrophytic vegetation. Dominant species included soft pathrush and various sedge species.

W014 is a scrub-shrub wetland with 0.19 acre located within the ROW. This wetland area exhibited wetland hydrology, hydric soils, ephemeral connectivity to Graham Creek, and dominant hydrophytic vegetation. The dominant scrub-shrub species was black willow saplings. However, bulrush, knotweed, and panic grass were present in abundance in the understory.

W015 consists of a headwater drain dominated by saplings and emergent vegetation to form a scrub-shrub/emergent wetland complex. W015 contains 0.39 acre within the ROW, extending outside the ROW for a total of approximately 1 acre. This wetland exhibits hydrologic connectivity via an unnamed tributary to Snake Creek Drainage Canal. W015 contained hydric soils, wetland hydrology indicators, and dominant hydrophytic vegetation. Water oak was present as the dominant sapling in the scrub-shrub layer, while the groundcover consisted of sedges, soft pathrush, and tall fescue, all considered hydrophytic species.

W016 is a scrub-shrub wetland due to relatively recent clearing in this area, and regrowth of vegetation to sapling size at the time of the field review. W016 contains 2.88 acre of wetland within the ROW, extending east and west for a total of 5 to 10 acres within the

Clarey Creek floodplain. W016 exhibits hydric soils, standing water, saturated soils, and drainage patterns within the wetland. In addition, W016 was dominated by hydrophytic vegetation including loblolly pine, Nepalese browntop, soft pathrush, and sweetgum.

3.9 Aesthetics

3.9.1 Visual Resources

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 affects 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 0.5 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. The impressions of an area's visual character can have a significant influence on how it is appreciated, protected, and used.

The criteria for classifying the quality and value of scenery has been adapted from a scenic management system developed by the U.S. Forest Service (USFS) and integrated with current planning methods used by the TVA. The classification process (i.e., the Scenic Value Criteria for Scenery Inventory and Management) is also based on fundamental methodology and descriptions adapted from USFS (1995).

The proposed transmission line would be approximately 15 miles in length. At its westernmost end, the new line would connect to the existing Selmer 161-kV Substation, which is located on the southeast side of Selmer (see Figure 1-1). From the substation, the line would run through agricultural fields south and east to cross Oxford Creek and US 45. The route would then travel eastward, paralleling SR 142 at a distance of 0.25 to 0.5 mile. This approximately 3.5-mile segment would cross agricultural areas and forest land. The proposed route would the turn northeast to cross SR 142 and Owl Creek. From this point, the route would cross a mixture of forested areas, pastures, and irregularly shaped agricultural fields. The route would cross SR 224 shortly before crossing US 64 and Snake Creek. North of Snake Creek, the route would again cross SR 224 about 1.5 miles south of the proposed site of the switching station.

3.9.2 Noise

There are no single, major sources of noise along the proposed transmission line route. However, some traffic noise is generated along US 45, which is near the westernmost portion of the proposed transmission line route. Likewise, US 64 is a major highway and generates traffic noise. Local residents have become acclimated to this recurring noise.

3.9.3 Odors

There are no known major sources of objectionable odors along the route or in the vicinity of the proposed transmission line or switching station. However, Packaging Corporation of

America operates containerboard mill near Counce, Tennessee. This mill is approximately 18 miles southeast of Selmer.

3.10 Archaeological and Historic Resources

Federal agencies are required by Section 106 of the NHPA and by NEPA to consider the possible effects of their undertakings on historic properties. The term "historic property" includes any historic or prehistoric site, district, building, structure or object included in, or eligible for inclusion in, the National Register of Historic Places (NRHP) maintained by the U.S. National Park Service (USNPS). "Undertaking" means any project, activity, or program that has the potential to have an effect on a historic property and that is under the direct or indirect jurisdiction of a federal agency, or is licensed or assisted by a federal agency. To determine an undertaking's possible effects on historic properties, a four-step review process is conducted. These steps are:

- Initiation (defining the undertaking and the APE and identifying the parties to be consulted in the process);
- Identification of historic properties within the APE;
- Assessment of effects to historic properties; and
- Resolution of adverse effects by avoidance, minimization or mitigation.

During the Section 106 process, the agency must consult with the appropriate SHPO, federally-recognized Native American tribes that have an interest in the undertaking, and any other party with a vested interest in the undertaking. The affected area has the potential to contain archaeological sites from various prehistoric and historic periods. The affected area also has potential for historic architectural resources spanning the historic period.

TVA carried out studies to identify any cultural resources listed on, or eligible for listing, in the APE. Regulations implementing Section 106 of the NHPA (specifically 36 CFR § 800(16)(d)) define APE as "the geographic area or areas within which an undertaking may directly or indirectly cause alterations in the character or use of historic properties, if any such properties exist."

In consultation with Tennessee SHPO and in agreement with Tennessee Historical Commission guidelines regarding architectural surveys, TVA identified the APE for historic architectural resources as the area within a 0.5-mile radius surrounding the proposed switching station and the proposed new transmission line. The remaining proposed actions (e.g., construction of access roads) are not of the type with potential to affect historic architectural properties.

For the proposed undertaking, the APE for archaeological resources for proposed actions included the following:

- The 15-acre site of the proposed new switching station;
- The 100-foot wide ROW for the proposed 15-mile transmission line;
- The 19 access roads (20 feet wide), totaling 15.5 miles in length, to be used during construction and maintenance of the new transmission line; and

- Approximately 5 miles of transmission line ROW within which structure modifications would be performed as part of proposed upgrades on the Pickwick Hydro Plant-Henderson 161-kV Transmission Line and the Pickwick Hydro Plant-S. Jackson No. 2 161-kV Transmission Line, plus the associated access roads.

Two Phase I archaeological surveys were conducted. The initial survey (Greene et al. 2014) evaluated the proposed switching station site and the proposed 15-mile ROW. An additional survey (Hunter and Mocas 2014) included the access roads located outside the proposed transmission line ROW and sections designated for upgrades on the Pickwick Hydro Plant-Henderson 161-kV and Pickwick Hydro Plant-S. Jackson No. 2 161-kV transmission line ROWs. Background research performed prior to the surveys revealed that no previously recorded archaeological sites are known within the APE. Twelve archaeological sites have been identified previously within a one-mile radius of the APE. The initial survey (Green et al. 2014) identified one previously unrecorded archaeological site (40MY151) and two isolated finds within the APE. Based on the results of the investigation, TVA determined that the site and both isolated finds are ineligible for listing in the NRHP based on the low density of artifacts and the lack of artifacts diagnostic of any one time period. The second survey (Hunter and Mocas 2014) identified a scatter of bottle glass (FS-1), which TVA, in consultation with Tennessee SHPO staff, determined to be a modern scatter and not an archaeological site. TVA recommends further that no additional archaeological investigations are necessary within the APE prior to the initiation of the undertaking. TVA and the Tennessee SHPO agree that 40MY151 and the isolated finds are ineligible for listing in the NRHP.

A Phase I architectural survey of the APE was conducted (Karpynec and Sprouse 2014). Background research performed prior to the architectural survey revealed there are 12 previously inventoried architectural resources located within the 0.5-mile radius. However, TVA has determined that ten of these resources are no longer present, one (238BP) is located outside the viewshed of the proposed transmission line, and one (243BP) is ineligible for listing in the NRHP due to poor integrity.

The architectural survey identified an additional 12 previously unrecorded architectural resources (numbered HS-1 through HS-12), consisting of eleven houses (some with associated outbuildings) and one church (Hickory Flats United Methodist Church). Based on the survey results, TVA has determined that each of these 12 newly recorded resources is ineligible for listing in the NRHP due to a lack of unique features of style or workmanship, an inability to associate the structures or their original owners with important historical events, and/or a lack of integrity due to modern additions or alterations. The Tennessee SHPO declined to comment on the undertaking's effects on historic architectural resources within the APE within the 30-day period prescribed the Advisory Council's regulations at 36 CFR Part 800.4(d). Therefore, pursuant to 36 CFR Part 800.4(d)(1)(i), TVA has no further obligation to consider the possible effects of the proposed action on historic architectural properties.

3.11 Recreation, Parks, and Natural Areas

This section describes recreational and natural areas near the proposed project. Natural areas include ecologically significant sites; federal, state, or local park lands; national or state forests; wilderness areas; scenic areas; wildlife management areas; recreational areas; greenways; trails; Nationwide Rivers Inventory streams; and Wild and Scenic Rivers.

Big Hill Pond State Park is a 5,000-acre forested park located in the southwest corner of McNairy County. This state park offers hiking trails, camping, fishing, horseback riding, and mountain biking opportunities. Big Hill Pond State Park is operated by TDEC. The park is more than 8.5 miles from the proposed transmission line route at its closest point.

The Coon Creek Science Center is located approximately 7 miles northwest of Adamsville. The Center has overnight lodging and dining facilities for organized groups and offers visitors a chance to see and dig for a variety of fossils. The facility is operated by the Pink Palace Family of Museums, which is maintained by the City of Memphis and Memphis Museums, Inc. This facility is located approximately 5.5 miles north of the proposed switching station. No natural areas are located within 3 miles of the proposed project.

The Hatchie River is listed on the Nationwide Rivers Index by the USNPS. The Hatchie crosses into the extreme southwest corner of McNairy County, approximately 13 miles from the proposed transmission line route. The Hatchie River is designated as a State Scenic River by TDEC.

Shiloh National Military Park, which is administered by the USNPS, is located along the Tennessee River. This park is approximately 5.8 miles from the proposed transmission line at its closest point.

3.12 Land Use and Prime Farmland

McNairy County is a rural county, and predominant land uses in the county and along the proposed transmission line route include forestry, row crops, and pasture. Selmer and Adamsville are the main population centers. Outside of these two communities, most residences tend to be located mainly along the local road systems.

The proposed ROW would be approximately 15 miles long and would occupy about 186 acres. Within the proposed ROW, the primary land use is agriculture (i.e., row crops and pasture), which occupies about 110 acres. Of the remaining area, about 74 acres are occupied by forest, and about 2 acres are developed areas.

TVA would purchase an approximately 15-acre tract for the proposed switching station. This site is currently agricultural land, primarily pasture. The northern boundary of the tract is formed by the Pickwick Hydro Plant-Henderson 161-kV Transmission Line. A fragmented forested area lies to the west, and pastures lie to the south. Neely Sharp Road forms the eastern boundary of the property. Approximately 7.5 acres of the site would be cleared and graded. The switching station itself would occupy an area of about 3 acres.

Prime farmland is defined by the U.S. Department of Agriculture (USDA) as land that has the best combination of chemical and physical characteristics for producing food, feed, forage, fiber, and oilseed crops. To be considered prime farmland it cannot be urban, built-up or covered by water. Concern regarding the conversion of prime farmland to urban or industrial use prompted the creation of the 1981 Farmland Protection Policy Act. This act requires federal agencies to evaluate impacts to farmland prior to permanently converting the land to non-agricultural use.

Generally, the soils in the area of the proposed transmission line are relatively fertile and are composed primarily of silty loams and sandy loams. Long-term agricultural use has resulted in erosion, especially on hillsides, that has led to localized degradation of soil

productivity. Thus, the better soils, including those considered prime farmlands tend to be located on flatter sites such as broad creek bottoms. An analysis of Natural Resources Conservation Service (NRCS) data (NRCS 2014) indicated that the proposed transmission line would cross several wide creek bottoms containing soils that are considered prime farmlands. These areas include the floodplain areas along Oxford Creek, Owl Creek, and Snake Creek.

According to NRCS (2014) data, the proposed switching station site does not contain any soils considered prime farmlands. However, there is a small area of prime farmlands adjacent to the property on the west.

3.13 Socioeconomics and Environmental Justice

The proposed project is located in McNairy County, Tennessee. The estimated 2012 population of McNairy County is 26,180 (U.S. Census Bureau 2014). Selmer, which is located centrally in the county, is the county seat. As shown in Table 3-7, the percentage of minority black or African American population in the county is less than the state as a whole, while the percent white is higher than that of the state. Economic conditions in McNairy County, as evidenced by per capita income, household income, and the percent of the population living below the poverty level, are less than those of the state.

Table 3-7. Socioeconomic and Demographic Conditions in McNairy County, Tennessee

Demographic Characteristic	McNairy County	Tennessee
Estimated 2012 population	26,180	6,454,914
Black or African American	6.0%	17.0%
Hispanic or Latino	1.7%	4.8%
White (excluding Hispanic or Latino)	90.7%	75.1%
Per capita income (2008-2012)	$17,761	$24,294
Median household income (2008-2012)	$33,066	$44,140
Below poverty level (2008-2012)	23.5%	17.3%

Source: U.S. Census Bureau (2014)

CHAPTER 4

4.0 ENVIRONMENTAL CONSEQUENCES

The potential effects of adopting and implementing the No Action Alternative and the Action Alternative on the various resources described in Chapter 3 were analyzed, and findings are documented in this chapter. The potential effects are presented below by resource in the same order as in Chapter 3.

4.1 No Action Alternative

As stated in Section 2.1.1, under the No Action Alternative, TVA would not construct the proposed transmission line or switching station, and the proposed upgrades to the transmission system would not occur. In the event that TVA chooses not to undertake these proposed actions, the electrical loading on existing portions of TVA's local transmission system would likely increase over time. The transmission system in the project area would continue to deteriorate, leading to equipment and line overloading. This could result in increases in somewhat stronger EMFs being produced along these lines. However, because these increases would be minor, no significant EMF-related effects are anticipated.

No ROW would be cleared to accommodate the proposed line, and no clearing would be done for the proposed switching station. No changes in current land uses along the existing or proposed ROW are anticipated within the foreseeable future under the No Action Alternative. Thus, implementation of this alternative is not expected to directly cause any effects to current land uses or to any prime farmlands along the route of the proposed ROW or at the site of the proposed switching station. Changes to the project area and resources in this area may occur over time, independently of TVA's actions, due to factors such as population increases, changes in land use, and the potential for development to occur in the area. However, these changes are not expected to be the result of implementing the No Action Alternative.

Under the No Action Alternative, no land or property easements for locating the proposed transmission line and switching station would be purchased by TVA, and the proposed transmission facilities would not be built. Over time, the approximately 80-mile long 161-kV transmission line between the Hickory Valley Substation and the Colbert Fossil Plant would likely continue to become more vulnerable to low voltage issues. Six local substations rely on this transmission line segment. A lack of reliability of the local electrical power transmission system could negatively affect local businesses and residents. However, the amount of such economic impact cannot be quantified accurately due to the speculative nature of future conditions.

Because the proposed construction, operation, and maintenance of the proposed new facilities would not occur under the No Action Alternative, no direct effects to those environmental resources listed in Chapter 3 are anticipated.

4.2 Action Alternative

4.2.1 Groundwater and Geology

Contamination of groundwater supplies can potentially occur from the introduction of contaminants into areas that serve as recharge areas for groundwater. Contaminants carried by storm water runoff, include soil sediment, spilled fuel, petroleum products, and chemicals.

Under the Action Alternative, BMPs as described in Muncy (2012) would be used during construction of the proposed switching station and transmission line, including clearing of the ROW, to avoid contamination of groundwater in the vicinity of the project. Thus, the transfer of sediments to groundwater would be avoided by the implementation of appropriate BMPs during construction activities.

The use of petroleum fuels, lubricants, and hydraulic fluids in construction and maintenance vehicles could result in the potential for small on-site spills. However, the use of BMPs to properly maintain vehicles to avoid leaks and spills and procedures to immediately address any spills that did occur would minimize the potential for adverse impacts to groundwater.

During revegetation and maintenance activities, herbicides with groundwater contamination warnings would not be used, and the use of fertilizers and herbicides would be considered with caution before application, and they would be applied according to the manufacturer's label. TVA BMPs as described in by Muncy (2012) would be used to avoid contamination of groundwater. BMPs for herbicide and fertilizer application would be used and would prevent adverse effects to groundwater. BMPs would be used to control sediment infiltration from stormwater runoff. With the use of BMPs, any effects to groundwater quality from the proposed action would be minor. No cumulative impacts to groundwater resources are anticipated. Similarly, no changes in geological characteristics, such as the creation of sinkholes, are anticipated under the Action Alternative.

4.2.2 Surface Water

Soil disturbances associated with ROW clearing and site grading for structures, access roads, and switching station construction can potentially result in adverse water quality impacts. Soil erosion and sedimentation can clog small streams and threaten aquatic life. Removal of the tree canopy along stream crossings can increase water temperatures, algal growth, dissolved oxygen depletion, and cause adverse impacts to aquatic biota. Improper use of herbicides to control vegetation could result in runoff to streams and subsequent aquatic impacts.

TVA routinely includes precautions in the design, construction, and maintenance of its transmission projects to minimize potential adverse effects to surface water. Permanent stream crossings that cannot be avoided would be designed in a manner that would not impede runoff patterns or 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 (2012). ROW maintenance would employ manual and low-impact methods wherever possible. In areas requiring chemical treatment, either along the ROW or at the switching station, only USEPA-registered herbicides would be used in accordance with label directions designed in part to restrict applications near receiving waters and to prevent unacceptable aquatic impacts. Likewise, appropriate construction BMPs would be implemented during clearing and construction of the proposed switching station to prevent erosion and offsite transport

of sediment. Because these control measures would be implemented, effects to surface waters are expected to be minor and temporary. No cumulative impacts are anticipated.

4.2.3 Aquatic Ecology

Aquatic life can be affected either 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 transmission line corridor, at switching station sites, or along access roads.

Potential impacts due to removal of streamside vegetation within the riparian zone include increased erosion and siltation, loss of in-stream habitat, and increased stream temperatures. Other potential effects resulting from transmission system construction and maintenance include alteration of stream banks and stream bottoms by heavy equipment and by herbicide runoff into streams. 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 and mussel species (Brim Box and Mossa 1999; Sutherland et al. 2002).

Watercourses that convey only surface water during storm events (such as ephemeral streams) and that could be affected by the proposed transmission line route would be protected by standard BMPs as identified in Muncy (2012). These BMPs are designed in part to minimize disturbance of riparian areas and subsequent erosion and sedimentation that can be carried to streams. TVA also provides additional categories of protection to watercourses based on the variety of species and habitats that exist in the streams, as well as the state and federal requirements to avoid harming certain species (Appendix D). The width of the streamside management zones (SMZs) is determined by the type of watercourse, primary use of the water resource, topography, or other physical barriers (Muncy 2012).

Applicable permits would be obtained for any stream alterations located within the proposed ROW. The terms and conditions of these permits including any required mitigation from the proposed activities would be implemented. All streams would be protected by Standard Stream Protection (Category A) as defined in Muncy (2012). This standard (basic) level of protection for streams and the habitats around them is to minimize the amount and length of disturbance to the water bodies without causing adverse impacts on the construction work. Appropriate BMPs and SMZs would be implemented during construction, operation, and maintenance of the proposed transmission line, switching station, associated access roads, and the proposed upgrades to the two existing transmission lines. Thus, any direct, indirect, or cumulative impacts to aquatic ecology resulting from undertaking the proposed action would be minor.

4.2.4 Vegetation

Implementing the Action Alternative would involve clearing the ROW and the switching station site as well as the construction of access roads. Such ground-disturbing activities would directly affect the existing plant communities in these areas. Additionally, vegetation management along the ROW is necessary to prevent tall, woody vegetation from becoming established within the ROW. Therefore, the type of vegetative cover that occurs on the ROW is affected.

Adoption of the Action Alternative would have minor effects on the terrestrial life, including vegetation, of the region. The conversion of forested land to a managed transmission line

ROW would constitute a long-term change in vegetative cover. However, the overall effect with respect to local vegetation would be minor. Implementation of this alternative would require clearing approximately 74 acres of forest along the proposed transmission line. All forested land in the project area and in the immediate area has been previously cleared, and the plant communities found along the ROW are common and well represented throughout the region. As of 2012, there were over 759,000 acres of forested land in McNairy and the surrounding Mississippi and Tennessee counties (USFS 2013). Cumulatively, project-related effects to forest resources would be negligible when compared to the total amount of forested land occurring in the region.

Much of the area along the proposed transmission line route currently has a large component of invasive terrestrial plants. Thus, adoption of the Action Alternative is expected to have only minor effects to either the extent or abundance of these species at the county, regional, or state level. A few areas of relatively mature deciduous forest have a smaller component of invasive terrestrial plants. In these areas, the use of TVA standard operating procedures for revegetating with noninvasive species (Muncy 2012) would serve to minimize the potential introduction and spread of invasive species into the ROW.

4.2.5 Wildlife

Adoption of the Action Alternative could directly and indirectly affect local wildlife by altering habitat during construction, operation, and maintenance activities.

In many areas along the proposed ROW, the transmission line would span agricultural and developed areas. The disturbance to local wildlife in these areas would be minimal, except at the locations where the poles would be placed. In addition to running conductors, Ground disturbance would occur in these areas for structure placement, and some disturbance would occur from the installation of conductors. Any wildlife currently using these areas that would be heavily disturbed during construction (primarily common, habituated species) may be temporarily displaced by increased levels of disturbance. These species would likely return to the area upon completion of construction.

As indicated in Section 4.2.4, approximately 74 acres of forested wildlife habitat would be removed to clear the ROW for installation of the structures and conductors for the proposed transmission line. This habitat would be maintained as early successional vegetative habitat via a regular vegetation maintenance program. No additional forested habitat would be removed for the construction of associated access roads or for the upgrades to either of the existing TVA transmission lines. Direct effects of forest removal along the proposed ROW may occur to some wildlife individuals (i.e., juvenile animals and eggs) that may be immobile during construction. This could be the case if construction activities took place during breeding/nesting seasons. However, these actions are unlikely to affect populations of species common to the area, as similar forested habitat exists in the surrounding landscape. The maintenance of early successional habitat along the ROW corridor would provide suitable habitat for several bird, reptile, insect, and small mammal species that may not have previously occupied these areas. Any wildlife species occupying these early successional ROW areas would experience periodic disturbances during ROW operation and maintenance activities.

Construction associated disturbances and habitat removal would force wildlife to move temporarily or permanently into surrounding areas in an attempt to find new food sources, shelter sources and/or to reestablish territories. In the event that the surrounding areas are already overpopulated, further stress to wildlife populations could occur to those species

presently utilizing these areas as well as those attempting to relocate. In much of the general project area existing disturbance is already in occurrence in the form of transmission ROWs, agricultural fields, homes, farm ponds, and roads. Species currently occupying habitat in the project area are unlikely to be negatively affected by the influx of new wildlife residents. Over time, any displaced individuals able to utilize early successional habitat would likely return to the ROW.

In summary, areas of suitable wildlife habitat including wetland, riparian, and mature forested habitat are a vital part in the continued health of wild amphibian, avian, mammalian and reptilian populations in this highly fragmented landscape. The long-term impact of this project would not threaten local populations of common terrestrial animal species, but potential short-term impacts associated with construction exist for individuals in the direct path of the actions. The proposed construction activities would be conducted carefully, following all BMPs to prevent any long-term damage to wetlands and riparian zones in the project area.

4.2.6 Endangered and Threatened Species

4.2.6.1 Aquatic Animals

Adverse effects to water quality could potentially result from the implementation of the proposed project, and these effects could directly or indirectly affect aquatic life within watercourses along the proposed ROW. However, watercourses that could be affected by the proposed project would be protected by implementing standard BMPs and additional protection measures as identified in Muncy (2012). These BMPs are designed in part to minimize disturbance of riparian areas and the subsequent erosion and sedimentation that can be carried to streams. There are no federally listed aquatic species or designated critical habitat within McNairy County. Therefore, no direct, indirect, or cumulative impacts to federally protected aquatic species would occur. Appropriate BMPs and SMZs would be implemented during construction, operation, and maintenance of the proposed transmission line, switching station, associated access roads, and proposed upgrades to existing TVA transmission lines. Thus, no direct, indirect, or cumulative impacts to state protected aquatic species are anticipated to occur under the Action Alternative.

4.2.6.2 Plants

Adoption and implementation of the Action Alternative would not affect federally listed plant species or designated critical habitat because neither occurs in the project area. However, implementing this alternative would affect Elliot's blueberry, a state-listed plant species. A group of Elliott's blueberry plants is situated along the centerline of the proposed new transmission line route and would be impacted adversely during construction. Because of its location near the middle of the ROW, avoiding impacts to the species during construction would be difficult. In addition, Elliott's blueberry currently occurs in the understory of a closed-canopy forest and is shaded throughout the growing season. Even if direct impacts to the species could be avoided during construction, it is uncertain whether the species could compete in conditions found in the interior of an open ROW. Adjusting the alignment of the proposed transmission line ROW to avoid the blueberry is not feasible in this area because of engineering constraints.

Elliott's blueberry has been previously documented from only one additional location in Tennessee, although the species is common in other parts of the southeastern United States (USDA 2014). The other documented location for this species in Tennessee occurs on protected lands in Coffee County on Arnold Engineering and Development Center

property, which is public land managed by the U.S. military. Although the habitat at this location is not likely to be purposefully altered in the foreseeable future, the population is comprised of only a few plants, and no documented observation of this species has been made since the early 1990s (TVA Regional Natural Heritage Database 2014).

Due to the rarity of Elliot's blueberry in Tennessee, there is the potential for significant impacts to this species resulting from construction, operation, and maintenance of the proposed transmission line. To eliminate the potential for such impacts, TVA would implement mitigation measures that would ensure that construction and maintenance of the proposed transmission line would not eliminate the species from the site. Elliott's blueberry would be propagated by taking softwood cuttings from the plant in the proposed ROW using the methods of Anderson and Geber (2010). The efficacy of propagating blueberries by cuttings has been well documented in the horticulture industry. Plants would be grown in a nursery until ready for out planting. Following the clearing and construction of the proposed transmission line, TVA would replant at least ten blueberry plants along the northwest facing edge of the ROW as part of the post-construction revegetation efforts. While Elliott's blueberry may not be able to persist in the middle of a transmission line ROW, it would likely grow along the northwest edge of the ROW. In this area it would receive partial shade and would be less likely to be impacted by future land management decisions of the property owner.

If the propagation efforts are unsuccessful before the beginning of the ROW clearing activities, TVA would transplant Elliott's blueberry to the edge of the ROW. If plants generated from cuttings are successfully propagated, the Elliott's blueberry currently on the proposed ROW would not be transplanted. TVA would ensure that the location of these individual plant specimens are documented on the project engineering plans, Sensitive Area Review database, and the TVA Regional Natural Heritage database to avoid inadvertent damage during future maintenance or reclearing activities along the ROW. Additionally, no applications of broadcast herbicides would be utilized in this location for as long as the blueberry plants are present. Select spray would be excluded from the immediate vicinity of the plants for at least 5 years post-construction.

Mitigation measures to minimize impacts to Elliot's Blueberry include the following:

- Propagate Elliott's blueberry in a greenhouse utilizing softwood cuttings from the plants currently within the proposed ROW.
- Replant a minimum of ten Elliott's blueberry plants along the northwest facing edge of the proposed ROW during the post-construction revegetation efforts (either newly propagated individuals or existing plants from the ROW).
- Identify the area where the Elliot's blueberry would be planted on the project engineering plans.
- Identify the locations along the proposed ROW where Elliot's blueberry was planted following transplantation and enter the information into the Sensitive Area Review data to avoid inadvertent damaged during future maintenance or re-clearing activities along the ROW.
- Limit herbicides to no broadcast herbicide application along the proposed ROW in the vicinity of the blueberries as long as plants are present, and exclude select spray from the immediate vicinity of the plants for at least 5 years post-construction.

4.2.6.3 Terrestrial Animals

No terrestrial animal species of concern are known to occur within 3 miles of the proposed project area. However, occurrences of the federally proposed endangered NLE bat have been recorded less than a mile from where the proposed action would occur. Maternity roosting records of the federally listed Indiana bat also exist within McNairy County, Tennessee approximately 9.5 miles from the project area.

The presence of suitable foraging and summer roosting habitat in the project vicinity indicates that both bat species have the potential to occur within the project area. Additionally, the NLE bat was documented within 0.5 mile of the proposed transmission line ROW. No caves are known from within 3 miles of the project area, and none were identified during field visits. The nearest documented cave occurs just over 12 miles away in Hardin County, Tennessee. Thus, no hibernacula for either of these bat species would be affected by the proposed actions.

Summer roosting habitat surveys were performed in November 2013 and September 2014. Six locations along the proposed ROW were determined to be suitable for summer roosting Indiana bats and NLE bats. However, no such habitat occurred at the proposed switching station site. These areas were chosen due to the high number of snags, large white oaks, shagbark hickories, and the water sources located within the proposed ROW. A total of 6.4 acres of suitable summer roosting habitat would be removed during the construction of the proposed project. Forested areas in the project area also provide foraging habitat for both the Indiana and NLE bat.

Gray bats utilize caves year-round but leave them to forage at night. Because no caves are known from the project area, hibernacula habitat for this species would not be affected by the proposed actions. The proposed project activities would remove tall, woody vegetation in SMZs along streams and around farm ponds along the proposed transmission line ROW. However, BMPs would be used in SMZs; thus, impacts to streams and ponds would be discountable.

Gray bat foraging habitat in the project area would be temporarily affected during project construction, particularly by tree removal at stream crossings. However, these impacts would be temporary, and an abundance of suitable foraging habitat exists in the surrounding area. Thus, TVA determined that the proposed activities may affect but are not likely to adversely affect gray bat.

Because suitable summer roost trees exist within the proposed project area and surrounding area, TVA determined that this area could provide suitable summer roosting habitat for Indiana and NLE bats. TVA would remove trees between November 15 and March 31, when the bats are hibernating elsewhere. This would eliminate the potential for direct adverse effects to Indiana and NLE bat summer roosting habitat. TVA has determined that any indirect or cumulative effects to Indiana bats resulting from these actions would be discountable. TVA also determined that the proposed actions may affect, but would not likely adversely affect the Indiana bat, nor would they jeopardize the existence of the NLE bat.

To compensate for the loss of Indiana bat habitat, TVA established an MOA with USFWS whereby TVA would contribute $23,040 to the Indiana Bat Conservation Fund to promote the conservation and recovery of the Indiana bat.

4.2.7 Floodplains

As a federal agency, TVA is subject to the requirements of EO 11988 (Floodplain Management). The objective of EO 11988 is "…to avoid to the extent possible the long- and short-term adverse impacts associated with the occupancy and modification of floodplains and to avoid direct and indirect support of floodplain development wherever there is a practicable alternative" (U.S. Water Resources Council 1978). 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 the 100-year floodplain unless there is no practicable alternative.

Under the Action Alternative, the proposed 15-mile transmission line and access roads would cross the 100-year floodplains of several streams in McNairy County, Tennessee. Consistent with EO 11988, roads, overhead transmission lines and related support structures are considered to be repetitive actions in the 100-year floodplain. The conductors of the transmission line would be located well above the 100-year floodplain.

The construction of the support structures for the transmission line is not be expected to result in any increase in flood hazard, either as a result of increased flood elevations or changes in flow-carrying capacity of the streams being crossed. To minimize adverse impacts on natural and beneficial floodplain values, the following routine mitigation measures would be implemented:

- The ROW would be revegetated where natural vegetation would be removed.
- BMPs would be used during construction activities.

Based upon a review of McNairy County, Tennessee, Flood Insurance Rate Maps, portions of several access roads would be located within 100-year floodplains. To minimize adverse impacts, any road improvements would be done in such a manner that upstream flood elevations would not be increased.

The proposed switching station would be located outside the 100-year floodplain, which would be consistent with EO 11988. The proposed installation of OPGW would not involve work in any floodplains.

Based upon implementation of the above mitigation measures, the proposed Selmer-West Adamsville 161-kV Switching Station and associated transmission line and access roads would have minor effects on floodplains.

4.2.8 Wetlands

Activities in wetlands are regulated under Section 401 and 404 of the Clean Water Act and are addressed by EO 11990 (Protection of Wetlands). Section 401 requires water quality certification by the state for projects permitted by the federal government (Strand 1997). Activities resulting in the discharge of dredge or fill into waters of the United States require authorization through a Nationwide General Permit or Individual Permit issued by the USACE under Section 404 of the Clean Water Act. EO 11990 requires federal agencies to minimize wetland destruction, loss, or degradation, and preserve and enhance natural and beneficial wetland values, while carrying out agency responsibilities.

Efforts were made during the transmission line siting process to avoid wetlands. However, because of project and topographic constraints, and because of the goal of minimizing

impacts to other environmental resources, no practicable alternative was available that would allow complete avoidance of wetlands.

Wetlands located within the proposed ROW would be spanned by the proposed transmission line, thus allowing wetlands to continue to function as emergent and scrub-shrub wetlands. Approximately 5.92 acres of emergent and scrub-shrub wetlands would continue to function in the same capacity as current conditions. However, as described in Section 2.2.1.1, adequate clearance between tall vegetation and transmission line conductors would require trees within the proposed ROW to be cleared. As a result, implementing the Action Alternative would initially involve the clearing of 0.39 acre of forested wetlands identified within W001, W005, W007, and W010. Subsequently, these forested wetland areas would be converted and maintained as emergent or scrub-shrub wetland habitat (Table 3-6). These actions within these wetlands would fall within the parameters of USACE Nationwide Permit #12 for Utility Line Activities with no pre-construction notification unless triggered by other actions included in this single and complete project or as deemed by the USACE discretionary authority.

Within wetlands where the placement of poles may be required, a minor loss of wetland function is anticipated because only a nominal amount of fill would be required for structure placement and the fact that these wetland areas and their associated wetland functions exhibit moderately low-quality conditions. TVA would use low ground-pressure equipment or mats during clearing and construction activities within the delineated boundaries of all wetlands. With these precautionary measures in place, wetland impacts resulting from the proposed transmission line corridor are anticipated to be minor.

The cumulative impact analysis of wetland effects took into account wetland loss and conversion at a watershed-level scale. Proposed wetland impacts are considered minor on a cumulative basis due to the avoidance and minimization measures in place. Therefore, no cumulative wetland impacts are anticipated as a result of the proposed new transmission line construction project.

Potential indirect wetland impacts would be reduced to a minor level during transmission line construction and ROW maintenance activities through implementation of BMPs (Muncy 2012). As a result of these measures, the proposed project would have no major direct, indirect, and/or cumulative impacts to wetland areas and the associated wetland functions and values provided within the project area and general watershed.

4.2.9 Aesthetics

Visual consequences were examined in terms of visual changes between the existing landscape and proposed actions, sensitivity of viewing points available to the general public, their viewing distances, and visibility of proposed changes.

4.2.9.1 Visual Resources

Transmission structures tend to be most visible element of the electric transmission system. The proposed transmission line would be visible to motorists on US 45 south of Selmer and to motorists on SR 142, US 64, and SR 224 at locations where the line crosses the road. A few local residents would be able to see the line. However, the line was routed to avoid residential areas to the extent possible. Thus, motorists along local roads, area residents, and patrons to commercial districts would notice a minor cumulative change in the landscape due to the presence of new transmission structures and lines. For residents, some views may be as far as middleground distances in both directions. As these

distances increase, details become weak and visually insignificant. For a few residents, the views would be in the foreground. Foreground views of the new transmission line would be presented to motorists mainly at road crossings. Such views would tend to be brief, resulting in minor visual effects.

Operation, construction, and maintenance of the proposed transmission line would cause minor visually effects. There may be some minor cumulative visual discord during the construction period due to an increase in personnel and equipment and the use of laydown and materials storage areas. These minor visual obtrusions would be temporary until the ROW and laydown areas have been restored through the use of TVA standard BMPs (Muncy 2012). Therefore, any visual impacts anticipated as a result of implementing this project would be minor.

4.2.9.2 Noise and Odors

During construction of the proposed transmission line, equipment could generate noise above ambient levels. Because of the short construction period, noise-related effects are expected to be temporary and minor. For similar reasons, noise related to periodic line maintenance is also expected to be insignificant. As described in Section 4.14.1, transmission lines may also produce noise during operation under certain atmospheric conditions. Off the ROW, this noise is below the level that would interfere with speech. Construction and operation of the switching station are not expected to produce any noticeable odors.

4.2.10 Archaeological and Historic Resources

A project may have effects on a historic property (i.e., archaeological resources as well as historic structures) that are not adverse if those effects do not diminish the qualities of the property that identify it as eligible for listing on the NRHP. However, if the agency determines (in consultation) that the undertaking's effect on an historic property within the APE would diminish any of the qualities that make the property eligible for the NRHP, the effect would be considered adverse. Examples of adverse effects include ground disturbing activity in an archaeological site or erecting structures within the viewshed of a historic building in such a way as to diminish the building's historic setting.

Based on field surveys, TVA determined that there are no archaeological resources within the archaeological APE that are eligible for inclusion on the NRHP. The Tennessee SHPO concurred with this determination with respect to the proposed switching station and ROW in a letter of February 12, 2014 (Appendix A). The Tennessee SHPO concurred with TVA's determination that no archaeological resources within the associated access roads are eligible in a letter of November 20, 2014 (Appendix A).

Similarly, TVA determined that no historic structures within the architectural APE are eligible for inclusion on the NRHP. Regarding the undertaking's potential to affect historic architectural properties listed or eligible for listing in the NRHP, the Tennessee SHPO did not comment within the 30-day period prescribed by the Advisory Council's regulations at 36 CFR Part 800.4(d). Therefore, pursuant to 36 CFR Part 800.4(d)(1)(i), TVA's responsibilities under NHPA Section 106 have been fulfilled with respect to historic structures.

TVA finds that there are no historic properties (archaeological or architectural) eligible for listing in the NRHP within the APE. Therefore, the undertaking, i.e., implementing the

Action Alternative, would have no direct, indirect, or cumulative effects on sensitive cultural resources.

4.2.11 Recreation, Parks, and Natural Areas

No formal recreation facilities are located near the proposed transmission line, access roads, or switching station. Therefore, no adverse effects to recreational facilities or parks (including Big Hill Pond State Park and Shiloh National Military Park) are expected from implementing the Action Alternative. Any effects to informal recreation opportunities, such as hunting, bird watching, hiking, etc., along the proposed ROW are expected to be minor and temporary.

4.2.12 Land Use and Prime Farmland

ROW construction for the proposed transmission line would involve clearing of approximately 74 acres of forested land. Approximately 110 acres of the ROW would cross land in open fields (e.g., pasture) or in agricultural production. The remaining approximately 2 acres are other land uses such as developed areas and roads.

As indicated in Section 2.2.1.1, a term of the ROW easement that TVA would purchase from the landowner would prohibit building structures within the ROW. TVA's proposed construction and operation of the transmission line would not preclude the continued use of land within the ROW for agricultural uses, or the conversion of the land used within the ROW to agriculture. Thus, the construction, operation, and maintenance of the proposed 15-mile transmission line is not expected to affect prime farmlands, even though the proposed route crosses some areas containing soils considered prime farmlands.

The 15-acre site TVA proposes to purchase for the proposed 3-acre switching station does not contain any soils considered prime farmland. The site is located on the eastern side of the property fronting Neely Sharp Road (Figure 2-2). Spoil material (i.e., soil) from site preparation would be placed on the property TVA proposes to purchase, immediately to the west of the proposed switching station (see Figure 2-2). Although the 15-acre site would be taken out of agricultural production, the construction and operation of the proposed switching station is not expected to directly or indirectly affect any prime farmlands or prevent their use for agricultural production.

Selmer and West Adamsville are relatively small communities in a predominantly rural county. As such, neither community has recently experienced any major increases in residential or commercial growth. This trend is likely to continue for the foreseeable future. Nevertheless, construction of the proposed transmission line would ensure a reliable supply of power to the local area. Thus, implementing the proposed action could, over time, indirectly facilitate some future urban expansion and the resultant change in land uses of some agricultural areas to commercial and residential uses.

4.2.13 Socioeconomics and Environmental Justice

Under the Action Alternative, the ROW for the proposed transmission line would occupy approximately 186 acres. To construct a proposed transmission line, TVA would normally purchase an easement from private land owners. That easement gives TVA the right to locate, operate, and maintain the transmission line across the property owner's land. In certain cases, TVA may be required to acquire property. In either case, current landowners would be compensated for the value of such rights or properties. Under the Action Alternative, TVA also proposes to purchase approximately 15 acres of agricultural property

for the proposed 3-acre switching station. Nevertheless, the direct local economic effect from the purchase of any additional property or ROW easements would be minor.

Virtually the entire ROW would cross agricultural, pasture, and forested lands; developed areas have been avoided to the extent possible. Therefore, any effects to residential property values are expected to be minor.

Implementing the proposed Action Alternative would introduce additional sources of power to supply the 161-kV line between the Hickory Valley Substation and the Colbert Fossil Plant. This would prevent possible future voltage issues and improve the reliability of the electric system in McNairy County. The upgrades proposed for the Pickwick Hydro Plant-Henderson and the Pickwick Hydro Plant-S. Jackson No. 2 161-kV transmission lines would improve the reliability of these two lines. Therefore, there would be some long-term indirect economic benefits to the area. As shown in Table 3-7, McNairy County is not densely populated and has lower incomes than the state average. Additionally, the county has a lower share of minorities than the state at large. Nevertheless, undertaking the proposed actions, including the construction, operation, and maintenance of the proposed transmission line and switching station, is not expected to disproportionally affect any economically disadvantaged or minority populations.

4.2.14 Postconstruction Effects

4.2.14.1 Electric and Magnetic Fields

Transmission lines, like all other types of electrical wiring, generate both electric and magnetic fields (i.e., EMFs). The voltage on the conductors of a transmission line generates an electric field that occupies the space between the conductors and other conducting objects such as the ground, transmission line 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 transmission line 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 transmission line 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 transmission line 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 transmission line 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.

Under certain weather conditions, high-voltage transmission lines, such as the proposed 161-kV line, may produce an audible low-volume hissing or crackling noise (Appendix K). This noise is generated by the corona resulting from the dissipation of energy and heat as high voltage is applied to a small area. Under normal conditions, corona-generated noise is not audible. The noise may be audible under some wet conditions, but the resulting noise level away from the ROW would be well below the levels that can produce interference with speech. Corona is not associated with any adverse health effects in humans or livestock.

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 readily correctable.

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, 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 objects' 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.

There is some public concern as to the potential for adverse health effects that may be related to long-term exposure to EMF. 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 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 recent 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 transmission 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 are 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; U.S. Department of Energy 1996; National Institute of Environmental Health Sciences 1998).

Although no federal standards exist for maximum EMF field strengths for transmission lines, 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 milligauss at the edge of the ROW for lines of 230 kV and less. The expected magnetic field strengths at the edge of the proposed ROW would fall well within these standards. Consequently, the construction and operation of the proposed transmission line connectors are not anticipated to cause any significant impacts related to EMF.

Under this alternative, EMFs would be produced along the length of the proposed transmission line. The strength of the fields within and near the ROW varies with the electric load on the line and with the terrain. Nevertheless, EMF strength attenuates rapidly with distance from the line and is usually equal to local ambient levels at the edge of the ROW. Thus, public exposure to EMFs would be minimal, and no significant impacts from EMFs are anticipated.

4.2.14.2 Lightning Strike Hazard

TVA transmission lines 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 National Electrical Safety Code is strictly followed when installing, repairing, or upgrading TVA lines or equipment. Transmission line structures are well grounded, and the conductors are insulated from the structure. Therefore, touching a structure supporting a transmission line poses no inherent shock hazard.

4.2.14.3 Transmission Structure Stability

The structures, similar to those shown in Figure 2-1, that would be used on the proposed 161-kV transmission line are the result of detailed engineering design and have been used by TVA for over 70 years with an exceptional safety record.

The pole structures that would be used on the proposed 161-kV transmission line 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.

4.2.14.4 Other Impacts

No major impacts as air quality and solid waste are expected to result from the relatively short-term activities of construction. Appendices B and C contain procedures for dealing with these issues.

Transmission line structures are well grounded, and the conductors are insulated from the ground. Therefore, touching a structure supporting a transmission line poses no inherent shock hazard. Additionally, TVA transmission lines 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 National Electrical Safety Code is strictly followed when installing, repairing, or upgrading TVA lines or equipment.

4.3 Long-term and Cumulative Impacts

The presence of the transmission line and switching station would present long-term visual effects to the mostly rural character of the local area. However, because of the route of the proposed line would traverse mostly rural areas with few residences and would involve only a few road crossings, the transmission line would not be especially prominent in the local landscape. Likewise, the establishment of easements for the proposed ROW with local landowners would pose a long-term encumbrance on the affected properties. Various agricultural land uses could be practiced within the ROW, but any timber production within the ROW would be foregone for the life of the transmission line. The site of the switching station would also be taken out of agricultural use (i.e., as pasture and hay crops) for the life of the switching station.

The availability of a reliable power supply is one factor in improving the overall infrastructure in the local area, which over time could make the area more attractive to additional commercial and residential development. However, the extent and degree of such development in the Selmer-Adamsville area depends on a variety of factors and cannot be predicted accurately. Thus, residential and commercial growth of this mainly rural area would be a minor, long-term and cumulative consequence of the proposed transmission system improvements.

4.4 Unavoidable Adverse Environmental Impacts

The following unavoidable effects would result from implementing the proposed actions as described under the Action Alternative in Section 2.1.2.

- Clearing associated with construction of the proposed transmission line and switching station could result in a small amount of localized siltation.
- Trees would not be permitted to grow within the transmission line ROW or to a determined height adjacent to the ROW that would endanger the transmission line.

In areas where the ROW would traverse forested areas, this would cause a change in the visual character of the immediate area and would segment some forested areas. Likewise, the proposed switching station would present a localized change in the visual character of the area.

- Clearing and construction would result in the disruption and/or loss of some plant and wildlife, and the permanent loss of about 74 acres of forested habitat.
- Any burning of cleared material would result in some short-term air pollution.
- ROW construction would involve tree clearing and conversion of 0.39 acre of forested wetland to emergent or scrub-shrub wetland habitat.
- The proposed transmission line would result in minor, long-term visual effects on the landscape in the immediate local area.

4.5 Relationship of Local Short-Term Uses and Long-Term Productivity

Land within the ROW of the proposed transmission line and at the proposed switching station site would be committed to use for electrical system needs for the foreseeable future. Approximately 186 acres of land within the proposed ROW and 3 acres of the 15-acre switching station site would be converted from their current use of pasture, agriculture, and as forested land. Agricultural uses of the ROW could and would likely continue. However, periodic clearing of the ROW would preclude forest management within the ROW for the operational life of the transmission line. These losses of long-term productivity with respect to timber production and as wildlife habitat are minor both locally and regionally.

4.6 Irreversible and Irretrievable Commitments of Resources

Irreversible commitments of resources are those uses of resources that cannot be reversed. An example of an irreversible commitment is the mining and use of an ore, which once mined, cannot be replaced. Irretrievable commitments of resources are those that may occur over a period of time but that may be recovered. For example, filling a wetland area for a parking lot would irretrievably commit the property for as long as the parking lot remains.

The materials used for construction of the proposed transmission line would be committed for the life of the line. Some materials, such as ceramic insulators and concrete foundations, may be irrevocably committed, but the metals used in equipment, conductors, and supporting steel structures could be recycled. The useful life of steel-pole transmission structures is expected to be at least 60 years. Thus, recyclable materials would be irretrievably committed until they are eventually recycled.

The ROW used for the transmission line and the 15-acre site of the proposed switching station would constitute an irretrievable commitment of onsite resources, such as wildlife habitat, forest resources, and forested wetlands in that the approximate previous land use and land cover could be returned upon retirement of these facilities. In the interim, compatible uses of the ROW for the transmission line could continue. However, approximately 3 acres of the 15-acre parcel used for the switching station area would be irretrievably committed to be used for a switching station. The balance of the property, would likely be mowed, but may or may not be used for agricultural purposes. At some point in the future, the switching station could be removed, and the entire site could be returned to prior land uses or used for other purposes.

CHAPTER 5

5.0 LIST OF PREPARERS

5.1 NEPA Project Management

Anita E. Masters

Position:	Specialist, NEPA Compliance
Education:	M.S., Biology/Fisheries; B.S., Wildlife Management
Experience:	28 years in Project Management, NEPA Compliance, and Community and Watershed Biological Assessments
Involvement:	Project Coordination, NEPA Compliance, and Document Preparation

James F. Williamson Jr.

Position:	Contract Senior NEPA Specialist
Education:	Ph.D., Fisheries and Wildlife Sciences; M.S., Wildlife Ecology; B.S., General Science/Zoology
Experience:	10 years in Forest Management, Inventory, and Software Development; 23 years in NEPA Compliance
Involvement:	Document Preparation

5.2 Other Contributors

W. Nannette Brodie, CPG

Position	Specialist, Remediation Projects
Education	B.S., Environmental Science; B.S., Geology
Experience	17 years in Environmental Analyses, Surface Water Quality, and Groundwater/Surface Hydrology Evaluations
Involvement:	Groundwater

Kimberly D. Choate

Position	Manager, Transmission Siting
Education	B.S. and M.S. Civil Engineering
Experience	26 years in Civil Engineering, Environmental Engineering, NEPA Preparation, Project Management, and Manager of Siting Engineers
Involvement:	Document Review

Stephen C. Cole

Position:	Contract Archaeologist
Education:	Ph.D., Archaeology; M.A. and B.A., Anthropology
Experience:	11 years in Cultural Resources; 4 years teaching at university level
Involvement:	Cultural Resources Compliance

Adam J. Dattilo

Position:	Biologist, Botany
Education:	M.S. Forestry; B.S. Natural resource Conservation
Experience:	11 years in Ecological Restoration and Plant Ecology; 7 years in Botany
Involvement:	Vegetation; Threatened and Endangered Plants

Patricia Bernard Ezzell

Position:	Specialist, Native American Liaison
Education:	M.A., History with an emphasis in Historic Preservation; B.A., Honors History
Experience:	26 years in History, Historic Preservation, and Cultural Resource Management; 11 years in Tribal Relations
Involvement:	Tribal Liaison

Elizabeth Burton Hamrick

Position:	Biologist, Zoology
Education:	M.S. Wildlife; B.S. Biology
Experience:	3.5 years in Biological Surveys and Environmental Reviews
Involvement:	Wildlife; Threatened and Endangered Terrestrial Animals

Andrew Henderson

Position:	Aquatic Endangered Species Biologist
Education:	M.S. Fisheries; B.S. Fisheries
Experience:	10 years in Imperiled Aquatic Species; 5 years in Aquatic Threatened and Endangered Species
Involvement:	Aquatic Life; Threatened and Endangered Aquatic Animals

John M. Higgins, P.E.

Position:	Water Quality Specialist
Education:	Ph.D., Environmental Engineering; M.S., B.S., Civil Engineering
Experience:	42 years in Environmental Engineering and Water Resources Management
Involvement:	Surface Water

Britta P. Lees

Position:	Biologist, Wetlands
Education:	M.S., Botany-Wetlands Ecology Emphasis; B.A., Biology
Experience:	14 years in Wetlands Assessments, Botanical Surveys, Wetlands Regulations, and/or NEPA Compliance
Involvement:	Wetlands

Carrie C. Mays, P.E., CFM

Position:	Civil Engineer, Flood Risk
Education:	M.S., Civil Engineering; B.S., Civil Engineering
Experience:	10 years in Compliance Monitoring and Reservoir Water Quality; 4 years in River Hydraulics
Involvement:	Floodplains
Involvement:	Document Review

Craig L. Phillips

Position:	Biologist, Aquatic Community Ecology
Education:	M.S. and B.S., Wildlife and Fisheries Science
Experience:	6 years Sampling and Hydrologic Determinations for Streams and Wet-Weather Conveyances; 5 years in Environmental Reviews
Involvement:	Aquatic Ecology; Threatened and Endangered Aquatic Animals

Kim Pilarski-Hall

Position:	Specialist, Wetlands and Natural Areas
Education:	M.S., Geography, Minor Ecology
Experience:	17 years in Wetlands Assessment and Delineation
Involvement:	Wetlands and Natural Areas

Aurora Moldovanyi Pulliam

Position:	Recreation Representative
Education:	M.S., Recreation, Tourism, Park Planning and Management; B.S., Wildlife and Fisheries Biology and Management
Experience:	10 years in NEPA and recreational project planning
Involvement:	Recreational Resources

Amos L. Smith, PG

Position:	Solid Waste Specialist
Education:	B.S. Geology
Experience:	29 years in Environmental Analyses and Groundwater Evaluations
Involvement:	Geology and Groundwater

Emily P. Willard

Position:	Program Manager, Environmental Support
Education:	B.S., Environmental Science
Experience:	8 years in Environmental Compliance; Preparation of Environmental Review Documents
Involvement:	Project Coordination; Purpose of and Need for Action; Alternatives Including the Proposed Action

This page intentionally left blank

CHAPTER 6

6.0 ENVIRONMENTAL ASSESSMENT RECIPIENTS

6.1 Federal Agencies

United States Army Corps of Engineers
Nashville, Tennessee

United States Fish and Wildlife Service
Cookeville, Tennessee

6.2 Federally Recognized Tribes

The following tribes were notified of the availability of the document:

Absentee Shawnee Tribe of Oklahoma
Alabama-Quassarte Tribal Town
Cherokee Nation
Chickasaw Nation
Eastern Band of Cherokee Indians
Eastern Shawnee Tribe of Oklahoma
Kialegee Tribal Town
The Muscogee (Creek) Nation
Shawnee Tribe
Thlopthlocco Tribal Town
United Keetoowah Band of Cherokee Indians in Oklahoma

6.3 State Agencies

Tennessee Department of Transportation
Nashville, Tennessee

Tennessee Historical Commission
Nashville, Tennessee

This page intentionally left blank

CHAPTER 7

7.0 LITERATURE CITED

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

Anderson, J. T. and M. A. Geber. 2010. Demographic source-sink dynamics restrict local adaptation in Elliott's blueberry (*Vaccinium elliottii*). Evolution 64:370-384.

Brim Box, J. and J. Mossa. 1999. Sediment, land use, and freshwater mussels: prospects and problems. Journal of the North American Benthological Society 18(1):99-117.

Conant, R. and J. T. Collins. 1998. *A Field Guide to Reptiles and Amphibians: Eastern and Central North America*. 3rd ed. Houghton Mifflin. Boston, Massachusetts.

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.: U.S. Fish and Wildlife Publication FWS/OBS-79/31.

Dickenson, J. G. 2001. *Wildlife of Southern Forests: Habitat and Management*. Blaine, WA: Hancock House Publishers.

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

Green, J. N., J. A. Hunter, D. E. Breetzke, and S. T. Mocas. 2014. *Phase I Archaeological Survey, West Adamsville Switching Station and Selmer-W. Adamsville Transmission Line, McNairy County, Tennessee*. Report prepared by AMEC Environment & Infrastructure, Lexington, Kentucky. Report prepared for Tennessee Valley Authority, Knoxville, Tennessee.

Hunter, J. A. and S. T. Mocas. 2014. *Phase I Archaeological Survey, Access Roads Associated with West Adamsville Switching Station and Selmer-W. Adamsville Transmission Line, McNairy County, Tennessee*. Report prepared by AMEC Environmental & Infrastructure, Lexington Kentucky. Report prepared for Tennessee Valley Authority, Knoxville, Tennessee.

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

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

Karpynec, T. and D. Sprouse. 2014. *Phase I Architectural Survey for the Proposed 161-kV Selmer-West Adamsville Transmission Line, McNairy County, Tennessee*. Report

prepared by Tennessee Valley Archaeological Research, Nashville, Tennessee. Report prepared for Tennessee Valley Authority, Knoxville, Tennessee.

Kays, R. and D. E. Wilson. 2002. *Mammals of North America*. Princeton University Press, Princeton, New Jersey.

Keck, B. P. and D. A. Etnier. 2005. Distributional Changes of the Fishes of the Hatchie River System in Western Tennessee and Northern Mississippi. Southeastern Naturalist 4(4):597-626.

Kurta, A., S. W. Murray, and D. H. Miller. 2002. Roost selection and movements across the summer landscape. Pages 118-129 *in* A. Kurta and J. Kennedy, editors. The Indiana Bat: Biology and Management of an Endangered Species. Bat Conservation International, Austin, Texas.

Leverett, R. 1996. *Definitions and History in Eastern Old-growth Forests: prospects for rediscovery and recovery*. Edited by Mary Byrd Davis. Island Press, Washington D.C. and Covelo, California.

Lichvar, R. W. and J. T. Kartesz. 2009. *North American Digital Flora: National Wetland Plant List*, version 2.4.0 (*https://wetland_plants.usace.army.mil*). U.S. Army Corps of Engineers, Engineer Research and Development Center, Cold Regions Research and Engineering Laboratory, Hanover, New Hampshire, and BONAP, Chapel Hill, North Carolina. (11-13-2012).

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

Mack, 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.

Miller, J. H., S. T. Manning and S. F. Enloe. 2010. *A Management Guide for Invasive Plants in the Southern Forests*. Gen. Tech. Rep. SRS-131. U.S. Department of Agriculture, Forest Service, Southern Research Station: 1-3.

Muncy, J. A. 2012. *A Guide for Environmental Protection and Best Management Practices for Tennessee Valley Authority Transmission Construction and Maintenance Activities* (revised edition). Edited by A. Bowen, J. Branum, C. Chandler, A. Dattilo, B. Dimick, S. Gaither, C. Henley et al. Norris: Tennessee Valley Authority Technical Note TVA/LR/NRM 92/1. Available online at: <http://www.tva.com/power/projects/bmp_manual_2012.pdf>.

National Geographic Society. 2002. *A Field Guide to the Birds of North America.* 4th ed. Washington, D.C.

National Institute of Environmental Health Sciences. 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/health/materials/electric_and_magnetic_fields_associated_with_the_use_of_electric_power_questions_and_answers_english_508.pdf#search=electric%20and%20magnetic%20fields%20electric%20power>.

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

Natural Resources Conservation Service. 2014. *Web Soil Survey*. Available online at: <http://websoilsurvey.nrcs.usda.gov/app/WebSoilSurvey.aspx>. Accessed February 2014.

Niemiller, M. L. and R. G. Reynolds. 2011. *The Amphibians of Tennessee*. The University of Tennessee Press, Knoxville.

Pruitt, L. and L. TeWinkel, editors. 2007. *Indiana Bat (Myotis sodalis) Draft Recovery Plan*: First Revision. U.S. Fish and Wildlife Service, Fort Snelling, Minnesota. 258 pages.

Selmer Utility Division of Water Quality. 2011. Report for 2013. Available online at: <http://www.townofselmer.com/joomla1/documents/ccr%202013.pdf>. Accessed November 2014

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 Valley Authority. 1983. *Procedures for Compliance with the National Environmental Policy Act: Instruction IX Environmental Review*. Available online at: <http://www.tva.gov/environment/reports/pdf/tvanepa_procedures.pdf>.

_____. 2011a. *Integrated Resource Plan: TVA's Environmental & Energy Future*. Knoxville, Tennessee. Available online at: <http://www.tva.gov/environment/reports/irp/archive/pdf/Final_IRP_complete.pdf>.

_____. 2011b. *Environmental Impact Statement for TVA's Integrated Resource Plan: TVA's Environmental & Energy Future*. Knoxville, Tennessee. Available online at: <http://www.tva.gov/environment/reports/irp/archive/pdf/IRP_FEIS-V1_complete.pdf>.

Tuttle, M. D. 1976. Population ecology of the gray bat (*Myotis grisescens*): philopatry, timing, and patterns of movement, weight loss during migration, and seasonal adaptive strategies. Occasional Papers of the Museum of Natural History, University of Kansas, 54:1-38.

U.S. Army Corps of Engineers. 2010. *Interim Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Eastern Mountains and Piedmont Region.*

J. S. Wakely, R. W. Lichvar, C. V. Noble, and J. F. Berkowitz (eds.). ERDC/EL TR-10-9. Vicksburg, Miss. U.S. Army Engineer Research and Development Center.

U.S. Census Bureau. 2014. *American Fact Finder*. Available online at: <http://quickfacts.census.gov/qfd/states/47/47109.html>. Accessed January 2014.

U.S. Department of Agriculture. 2014. *Plants Database*. Available online at: <http://plants.usda.gov/>. Accessed January 27, 2014.

U.S. Department of Defense and U.S. Environmental Protection Agency. 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.

U.S. 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, National Institute of Environmental Health Sciences, Report No. DOE/GO-10095-218, September 1996.

U.S. Environmental Protection Agency. 2014a. *Local Drinking Water Information*. Available online at: <http://oaspub.epa.gov/enviro/sdw_form_v2.create_page?state_abbr=TN>.

U.S. Environmental Protection Agency. 2014b. *Ecoregions of Tennessee*. Western Ecology Division. Available online at: <http://www.epa.gov/wed/pages/ecoregions/tn_eco.htm>

U.S. Fish and Wildlife Service. 2013a. *Proposed Rule - Endangered status for Physaria globosa (Short's bladderbod), Helianthus verticillatus (whorled sunflower), and Leavenworthia crassa (fleshy-fruit gladescress).* Federal Register 78(149):47109-47134, August 2, 2013.

_____. 2013b. *Listing the Northern Long-Eared Bat as an Endangered Species; 12-month finding.* Federal Register 78(191): 61054-61057.

_____. 2014a. *Northern Long-eared Bat Interim Conference and Planning*. Available online at: <http://www.fws.gov/midwest/endangered/mammals/nlba/pdf/NLEBinterimGuidance6Jan2014.pdf> Accessed 14 January 2014

_____. 2014b. Range-Wide Indiana Bat Summer Survey Guidelines. Available online at: <http://www.fws.gov/midwest/endangered/mammals/inba/surveys/pdf/2014IBatSummerSurveyGuidelines13Jan2014.pdf> Accessed 14 January 2014

U.S. Forest Service. 1995. *Landscape Aesthetics, A Handbook for Scenery Management*. Agriculture Handbook Number 701. U.S. Department of Agriculture.

_____. 2013. *Forest Inventory Data Online (FIDO).* Version 1.5.1.05. Available online at: <http://apps.fs.fed.us/fia/fido/index.html>.

U.S. Geological Survey. 1995. Ground Water Atlas of the United States - Arkansas, Louisiana, Mississippi. HA 730-F, Mississippi Embayment Aquifer System. Available online at: at <http://pubs.usgs.gov/ha/ha730/ch_f/F-text4.html>. Accessed November 14, 2014.

U.S. Geological Survey. 2000. *Ground-Water Use by Public Water-Supply Systems in Tennessee.* Available online at: <http://pubs.usgs.gov/of/2003/ofr0347/htdocs/table1.html>

U.S. Water Resources Council. 1978. *Floodplain Management Guidelines for Implementing E.O. 11988*. Federal Register 43:6030, February 10, 1978.

Wang, L., J. Lyons, P. Kanehl and R. Gatti. 2011. Influences of Watershed Land Use on Habitat Quality and Biotic Integrity in Wisconsin Streams. Fisheries 22(6):6-12.

World Health Organization. 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.

This page intentionally left blank

Appendix A – Correspondence

This page intentionally left blank

Tennessee Valley Authority, 400 West Summit Hill Drive, Knoxville, TN 37902

January 27, 2014

Mr. E. Patrick McIntyre, Jr.
Executive Director
Tennessee Historical Commission
2941 Lebanon Road
Nashville, Tennessee 37243-0442

Dear Mr. McIntyre:

TVA, SELMER-WEST ADAMSVILLE 161-KV TRANSMISSION LINE CONSTRUCTION, PHASE I ARCHAEOLOGICAL SURVEY, MCNAIRY COUNTY, TENNESSEE

TVA proposes to build a new West Adamsville 161-kilovolt (kV) Switching Station near Adamsville, Tennessee, as well as a new 15-mile 161-kV transmission line (TL) to connect this new switching station to the existing Selmer 161-kV Substation. This TL construction project is intended to prevent low voltage issues on the Hickory Valley 161-kV TL, which TVA's studies have shown could occur if power were interrupted, and will also support TVA's Clean Air Initiative. TVA has determined that this proposed TL construction project is an undertaking (as defined at 36 CFR § 800.16(y)) that has the potential to cause effects on historic properties. We are initiating consultation under Section 106 of the National Historic Preservation Act for this undertaking.

TVA identified the area of potential effects (APE) for the undertaking, for archaeological resources, as the 15-acre site of the proposed new switching station and the 100-foot right-of-way (ROW) for the proposed 15-mile TL. TVA contracted with AMEC Environment and Infrastructure (AMEC) to perform a phase I archaeological survey of the APE. Enclosed are two copies of the draft report titled, *Phase I Archaeological Survey, West Adamsville Switching Station and Selmer-W. Adamsville Transmission Line, McNairy County, Tennessee*, along with three CDs containing digital copies of the report.

TVA identified the APE for historic architectural resources as the area within a 0.5-mile radius surrounding the proposed switching station and TL. TVA contracted with Tennessee Valley Archaeological Research (TVAR) to perform a phase I historic architectural survey of the APE. Enclosed are two copies of the draft report titled, *Phase I Architectural Survey for the Proposed 161-kV Selmer-West Adamsville Transmission Line, McNairy County, Tennessee*, along with three CDs containing digital copies of the report.

AMEC's background study, conducted prior to the archaeological investigation, indicated there are no previously recorded archaeological sites in the APE. The survey identified one previously unrecorded archaeological site (40MY151) and two isolated finds in the APE. AMEC recommends that the site and isolated finds are ineligible for listing in the National Register of Historic Places (NRHP). AMEC recommends further that no additional archaeological investigations are necessary within the APE prior to the initiation of the undertaking.

Mr. E. Patrick McIntyre, Jr.
Page Two
January 27, 2014

TVAR's background study, conducted prior to their field study, indicated there are 12 previously recorded inventoried resources in the architectural APE (173BP, 223BP, 224BP, 233BP, 238BP, 239BP, 241BP, 242BP, 243BP, 266BP, 267BP, and 285BP). Of these, 10 are no longer extant and one is located outside the viewshed. TVAR recommended that the remaining previously recorded architectural resource (243BP) is ineligible for listing in the NRHP due to the poor integrity of the building.

TVAR's architectural survey identified 12 previously unrecorded architectural resources in the APE, which they labeled HS-1 through HS-12. These consist of one farm, 10 domestic dwellings, and one church (Hickory Flats United Methodist Church). TVAR recommends that each of these resources is ineligible for listing in the NRHP due to a lack of architectural merit, an inability to associate the properties or their original owners with important historical events, and in some cases, to a loss of historic integrity from modern alterations or neglect.

TVA has reviewed both of the enclosed reports and agrees with the findings and recommendations of the authors. TVA finds that there are no historic properties listed in, or eligible for listing in, the NRHP within the APE.

Pursuant to 36 CFR Part 800.4(d)(1), we are seeking your concurrence with TVA's finding that no historic properties would be affected by the proposed undertaking.

Pursuant to 36 CFR Part 800.3(f)(2), TVA is consulting with federally recognized Indian tribes regarding historic properties within the proposed project's APE that may be of religious and cultural significance and are eligible for the NRHP.

Should you have any questions or comments, please contact Richard Yarnell in Knoxville at wryarnel@tva.gov or (865) 632-3463.

Sincerely,

Clinton E. Jones
Senior Manager
Biological and Cultural Compliance
Environmental Permits and Compliance
WT 11B-K

SCC:CSD
Enclosures
cc (Enclosures):
Ms. Jennifer Barnett
Tennessee Division of Archaeology
1216 Foster Avenue, Cole Bldg. #3
Nashville, Tennessee 37210

PHASE I ARCHITECTURAL SURVEY FOR THE PROPOSED 161-KV SELMER-WEST ADAMSVILLE TRANSMISSION LINE, MCNAIRY COUNTY, TENNESSEE

Tennessee Valley Archaeological Research

Phase I Archaeological Survey,
West Adamsville Switching Station and
Selmer – W. Adamsville Transmission Line,
McNairy County, Tennessee

January 2014

TENNESSEE HISTORICAL COMMISSION
2941 LEBANON ROAD
NASHVILLE, TENNESSEE 37243-0442
OFFICE: (615) 532-1550
www.tnhistoricalcommission.org

February 12, 2014

Mr. Clinton Jones
Tennessee Valley Authority
400 West Summit Hill Drive
WT11D
Knoxville, Tennessee 37902-1499

RE: TVA, ARCHAEOLOGICAL ASSESSMENT, SELMER-WEST ADAMSVILLE 161-KV LINE, UNINCORPORATED, MCNAIRY COUNTY, TN

Dear Mr. Jones:

At your request, our office has reviewed the above-referenced archaeological survey report in accordance with regulations codified at 36 CFR 800 (Federal Register, December 12, 2000, 77698-77739). Based on the information provided, we concur that the project area contains no archaeological resources eligible for listing in the National Register of Historic Places.

If project plans are changed or archaeological remains are discovered during construction, please contact this office to determine what further action, if any, will be necessary to comply with Section 106 of the National Historic Preservation Act.

Your cooperation is appreciated.

Sincerely,

E. Patrick McIntyre, Jr.

E. Patrick McIntyre, Jr.
Executive Director and
State Historic Preservation Officer

EPM/jmb

Tennessee Valley Authority, 400 West Summit Hill Drive, Knoxville, TN 37902

April 14, 2014

Mr. E. Patrick McIntyre, Jr.
Executive Director
Tennessee Historical Commission
2941 Lebanon Road
Nashville, Tennessee 37243-0442

Dear Mr. McIntyre:

TENNESSEE VALLEY AUTHORITY (TVA), SELMER-WEST ADAMSVILLE 161-KV TRANSMISSION LINE CONSTRUCTION, PHASE I CULTURAL RESOURCES SURVEY FINAL REPORTS, MCNAIRY COUNTY, TENNESSEE

Enclosed are two copies of the final archaeological survey report titled, *Phase I Archaeological Survey, West Adamsville Switching Station and Selmer – W. Adamsville Transmission Line, McNairy County, Tennessee*, along with two CDs containing digital copies of the report. Also enclosed are two copies of the final architectural survey report titled, *Phase I Architectural Survey for the Proposed 161-kV Selmer-West Adamsville Transmission Line, McNairy County, Tennessee,* along with two CDs containing digital copies. Your concurrence with our finding of no effects to historic properties is documented in your letter of February 12, 2014.

This fulfills TVA's obligations under section 106 for this undertaking. If project plans are altered or there are inadvertent discoveries during construction, TVA will consult further with your office.

Should you have any questions or comments, please contact Richard Yarnell in Knoxville at wryarnell@tva.gov or (865) 632-3463.

Sincerely,

Clinton E. Jones, Manager
Biological and Cultural Compliance, Environment
WT 11B-K

SCC:CSD
Enclosures
cc (Enclosures):
Ms. Jennifer Barnett
Tennessee Division of Archaeology
1216 Foster Avenue, Cole Bldg. #3
Nashville, Tennessee 37210

Phase I Archaeological Survey, West Adamsville Switching Station and Selmer – W. Adamsville Transmission Line, McNairy County, Tennessee

February 2014

PHASE I ARCHITECTURAL SURVEY FOR THE PROPOSED 161-KV SELMER-WEST ADAMSVILLE TRANSMISSION LINE, MCNAIRY COUNTY, TENNESSEE

Tennessee Valley Archaeological Research

Tennessee Valley Authority, 400 West Summit Hill Drive, Knoxville, TN 37902

October 28, 2014

Ms. Mary Jennings
Field Supervisor
U. S. Fish and Wildlife Service
446 Neal Street
Cookeville, Tennessee 38501

Dear Ms. Jennings:

REQUEST FOR CONCURRENCE: TENNESSEE VALLEY AUTHORITY (TVA), SELMER-WEST ADAMSVILLE 161KV TRANSMISSION LINE, MCNAIRY COUNTY, TENNESSEE

To improve the electric reliability in the areas surrounding Selmer and Adamsville, Tennessee, TVA is proposing to build approximately 15 miles of new transmission line along a new 100 foot-wide right-of-way (ROW) and a new switching station. Access roads and upgrades to existing, adjacent TVA lines would be required to construct and support this new line. In total, approximately 74 acres of forested habitat would be removed and permanently maintained as early successional habitat for this proposed project and connected actions. See attached Technical Report for more detailed project description and figures.

Review of the TVA Regional Natural Heritage database and the U.S. Fish and Wildlife Service ECOS website indicated 16 species listed as endangered, threatened, a candidate for listing, or under review for listing under the Endangered Species Act occur in McNairy County, Tennessee or within 10 miles of the project area. These include twelve mussels (Clubshell, Cracking Pearlymussel, Fanshell, Orangefoot Pimpleback, Pink Mucket, Rabbitsfoot, Ring Pink, Rough Pigtoe, Sheepnose, Slabside Pearlymussel, Spectaclecase, White Wartyback), one plant (Whorled Sunflower), and three mammals (Gray bat, Indiana bat, Northern Long-eared bat) that have the potential to occur within McNairy County based on historic range, proximity to known occurrence records, biological characteristics and/or physiographic characteristics. See accompanying Table 1 for listing of species potentially occurring within the project action area.

Field reviews were conducted in November 2013 and September 2014 to determine whether suitable habitat for federally listed species occurs within the project action area. The proposed transmission line and associated access roads cross 21 perennial streams, 10 intermittent streams, and 55 ephemeral streams. The perennial streams crossed by this project are within the Snake Creek drainage, a western tributary to the mainstem Tennessee River. All of the mussel species occurring in McNairy County, TN are known only from the mainstem Tennessee River. None of these species are reported from the Snake Creek drainage.

Best Management Practices (BMPs) would be utilized in stream management zones (SMZs) found within the project footprint in order to minimize disturbance in riparian areas, erosion and sediment inputs in streams. With proper implementation of these BMPs, no direct impacts to streams in the Snake Creek drainage, or indirect impacts to the Tennessee River mainstem are anticipated.

Proposed project activities would not directly, indirectly, or cumulatively impact any federally listed aquatic species.

No federally listed plant species or their habitats were identified in the project action area during these field surveys. Federally listed plant species would not be impacted by the proposed actions. TVA has determined that the proposed transmission line and access road construction would have no effect on Clubshell, Cracking Pearlymussel, Fanshell, Orangefoot Pimpleback, Pink Mucket, Rabbitsfoot, Ring Pink, Rough Pigtoe, Sheepnose, Slabside Pearlymussel, Spectaclecase, White Wartyback, and Whorled Sunflower.

TVA biologists conducted Phase 1 Habitat Assessments (2014 Range-Wide Indiana Bat Summer Survey Guidelines, January 2014) on November 12th and 13th, 2013 and on September 2nd and 3rd, 2014. Suitable habitat for federally endangered Indiana bat and federally proposed northern long-eared bat (NLEB) was identified in six locations along the proposed ROW. A total of 6.4 acres of potentially suitable habitat would be removed by the proposed actions. Habitat assessments were conducted according to 2014 Range-Wide Indiana Bat Summer Survey Guidelines. All requested information is contained within the accompanying Technical Report (e.g., project description, methods, survey locations, maps, datasheets, summary of results, etc.). No known caves exist within three miles of the project area and none were identified during field visits on November 12th and 13th, 2013, and September 2nd and 3rd, 2014. The nearest documented cave record occurs approximately 12 miles away in Hardin County, Tennessee.

Foraging habitat for gray bat, Indiana bat and NLEB exists throughout the proposed action area over streams, ponds, forest fragments, fence rows and other corridors. Six sections of forest were identified within the proposed right-of-way and along access roads 6, 11 and 19 as suitable summer roosting habitat for Indiana bat and NLEB. These areas were identified due to a high concentration of white oaks, shag bark hickories and/or snags with exfoliating bark. Suitable summer roosting forests were comprised of mature hardwood stands dominated by a mixture of oaks (scarlet, post, southern red and white) and other hardwood species such as walnut, sugar maple, sweet gum, pignut hickory and shagbark hickory.

Records of gray bat, Indiana bat and NLEB exist within ten miles of the project area. In April 2013, Copperhead Environmental Consulting tracked two Indiana bats to McNairy County, Tennessee during their annual radio tracking monitoring. Roosting sites used by maternity colonies were identified approximately 9.5 miles south the proposed Selmer - West Adamsville 161-kV Transmission Line. In May 2013, on behalf of TVA, Architecture, Engineering, Consulting, Operations, and Maintenance (AECOM) contracted Jackson Environmental to perform bat acoustic monitoring surveys on two proposed solar farm project footprints approximately 0.3 miles from western most end of the proposed transmission line. These surveys resulted in no calls identified as Indiana bat, 33 calls identified as northern long-eared bat calls, and 25 calls identified as gray bat calls.

Gray bat foraging habitat in the proposed project area would be temporarily impacted by tree removal at stream crossings during the proposed project activities. However, these impacts are minor and temporary, and there is an abundance of similarly suitable foraging habitat in the surrounding landscape. TVA biologists have determined that the proposed activities may effect,

but are not likely to adversely affect, gray bat. The number of suitable summer roost trees within the proposed project area and surrounding areas has led TVA biologists to determine that this area could present suitable summer roosting habitat for Indiana and northern long-eared bats. TVA proposes removal of these trees between November 15 and March 31 to remove any potential for direct effects to Indiana and northern long-eared bats. Due to the relatively small areas of impact, the isolation of the patches across the landscape, and the abundance of similar habitat in the surrounding area, TVA has determined that any indirect or cumulative effects to Indiana bat resulting from this action would be discountable. TVA has determined that the construction of this transmission line, switching station, associated access roads, and upgrades to adjacent existing TVA transmission lines may effect, but are not likely to adversely affect, Indiana bat nor would the actions jeopardize the continued existence of the northern long-eared bat.

To offset any potential impacts to Indiana bat due to loss of habitat, TVA proposes that a Memorandum of Agreement (MOA) be entered into by TVA and the US Fish and Wildlife Service and a contribution of $24,320 to Tennessee's Indiana Bat Conservation Fund be made to promote the conservation and recovery of Indiana bat. It is our understanding that with a signed MOA, TVA's obligations regarding Endangered Species Act compliance would be fulfilled.

Should you have any questions or wish to discuss the project in more detail, please contact Liz Hamrick at 865-632-4011.

Sincerely,

John T. Baxter, Jr.
Manager
Endangered Species Act Compliance
Environment

EBH:CSD
Enclosures

Tennessee Valley Authority, 400 West Summit Hill Drive, Knoxville, TN 37902

November 17, 2014

Mr. E. Patrick McIntyre, Jr.
Executive Director
Tennessee Historical Commission
2941 Lebanon Road
Nashville, Tennessee 37243-0442

Dear Mr. McIntyre:

TENNESSEE VALLEY AUTHORITY (TVA), ACCESS ROADS ASSOCIATED WITH THE SELMER-WEST ADAMSVILLE 161-KV TRANSMISSION LINE (TL), MCNAIRY COUNTY, TENNESSEE (35° 15.10'N/88° 25.19'W to 35° 8.35'N/88° 34.71W)

Earlier this year, we consulted with your office concerning TVA's Section 106 responsibility in connection with the proposed Selmer-West Adamsville 161-kilovolt (kV) transmission line (letters dated January 27 and February 12, 2014). Our offices agreed that no historic properties are located within the area of potential effects (APE). At that time, TVA had not designed the access for construction equipment in the project area. More recently, TVA has developed designs for the access roads associated with the undertaking. TVA has also proposed modifications to two intersecting TLs (Pickwick Hydro Plant - Henderson 161-kV and Pickwick Hydro Plant - S. Jackson No. 2 161-kV TL) as part of the undertaking. Therefore, we are reopening consultation with your office regarding this undertaking, under Section 106 of the National Historic Preservation Act, in order to address potential effects to historic properties that may be located within these more recently identified portions of the project.

TVA has expanded the area of potential effects (APE) for archaeological resources to include approximately 4.16 miles of access roads associated with proposed construction of the Selmer-West Adamsville 161-kV TL, as well as approximately 5.0 miles (total) of structure modifications and associated access roads on the Pickwick Hydro Plant - Henderson 161-kV and Pickwick Hydro Plant - S. Jackson No. 2 161-kV TLs. Although the combined total length of access roads for the proposed Selmer-West Adamsville TL will be 15.47 miles, the majority are within the proposed new TL ROW, which was included in the Phase I cultural resources survey that we reported to you earlier. The expanded portion of the APE therefore consists of only those access roads located outside the proposed TL right-of-way and the areas on the two intersecting lines that would be affected. TVA does not consider use of the access roads to have potential to affect historic architectural resources. A historic architectural survey of the visual APE associated with the proposed new TL was performed as part of the earlier Phase I cultural resources survey.

TVA contracted with AMEC Environment and Infrastructure, Inc. (AMEC) to perform a Phase I archaeological survey of the expanded portion of the APE. Enclosed are two copies of the draft

report titled, *Phase I Archaeological Survey, Access Roads Associated with West Adamsville Switching Station and Selmer-W. Adamsville Transmission Line, McNairy County, Tennessee*, along with two CDs containing digital copies of the report.

AMEC's background study, conducted prior to the field study, indicated that no previously recorded archaeological sites, and no properties listed in the National Register of Historic Places (NRHP), are located within the expanded APE. The field study consisted of pedestrian survey and systematic shovel testing. The study identified one small scatter of glass artifacts (designated as NS-1). However, AMEC discussed this with your office and concluded that it does not constitute an archaeological site, but is instead modern trash. No archaeological sites were identified by the survey. AMEC recommends no additional cultural resources studies in connection with the expanded APE for the undertaking. Based on these results, TVA finds that there are no properties listed, or eligible for listing, in the NRHP within the expanded APE.

Pursuant to 36 CFR Part 800.4(d)(1), we are seeking your concurrence with TVA's finding that no historic properties are located within the APE of the proposed undertaking.

Pursuant to 36 CFR Part 800.3(f)(2), TVA is consulting with federally recognized Indian tribes regarding historic properties within the expanded APE that may be of religious and cultural significance and are eligible for the NRHP.

Should you have any questions or comments, please contact Richard Yarnell in Knoxville at wryarnell@tva.gov or (865) 632-3463.

Sincerely,

Clinton E. Jones, Manager
Biological and Cultural Compliance
Environment, WT11B-K

SCC:CSD
Enclosures
cc (Enclosures):
Ms. Jennifer Barnett
Tennessee Division of Archaeology
1216 Foster Avenue, Cole Bldg. #3
Nashville, Tennessee 37210

Phase I Archaeological Survey of Access Roads Associated with TVA's Proposed Selmer – West Adamsville 161-kV Transmission Line and West Adamsville Switching Station, McNairy County, Tennessee

November 2014

TENNESSEE HISTORICAL COMMISSION
STATE HISTORIC PRESERVATION OFFICE
2941 LEBANON ROAD
NASHVILLE, TENNESSEE 37243-0442
OFFICE: (615) 532-1550
www.tnhistoricalcommission.org

Received
12-1-14
CD

November 20, 2014

Mr. Clinton Jones
Tennessee Valley Authority
400 West Summit Hill Drive
Knoxville, Tennessee 37902

RE: TVA, ARCHAEOLOGICAL ASSESSMENT, SELMER-WEST ADAMSVILLE ACCESS RDS, UNINCORPORATED, MCNAIRY COUNTY, TN

Dear Mr. Jones:

At your request, our office has reviewed the above-referenced archaeological survey report in accordance with regulations codified at 36 CFR 800 (Federal Register, December 12, 2000, 77698-77739). Based on the information provided, we concur that the project area contains no archaeological resources eligible for listing in the National Register of Historic Places.

If project plans are changed or archaeological remains are discovered during construction, please contact this office to determine what further action, if any, will be necessary to comply with Section 106 of the National Historic Preservation Act.

Your cooperation is appreciated.

Sincerely,

E. Patrick McIntyre, Jr.

E. Patrick McIntyre, Jr.
Executive Director and
State Historic Preservation Officer

EPM/jmb

Kentucky Natural Lands Trust

January 2, 2015

Tennessee Valley Authority
Forest Wilkinson Rogers, Jr.
1101 Market Street MR 5K-C
Chattanooga, TN 37402-2801

Dear Mr. Rogers:

KNLT received the check for $23,040.00 for the Indiana Bat Conservation Fund as part of the Memorandum of Agreement between the U.S. Fish and Wildlife Service and the Tennessee Valley Authority (Tails #14 CPA 0497). Please call me at (859) 986-0744 if you have any questions.

Sincerely,

Donna Alexander

Donna Alexander
Program Manager

Cc: Lee Andrews
Phil DeGarmo
David Pelren
Mary E. Jennings

Office Location: 213A Short Street • Berea
Mailing Address: 433 Chestnut Street • Berea, Kentucky 40403
Toll-free: 877-367-5658 • Fax: 859-986-1299 • KNLT.org

Appendix B – TVA Right-of-Way Clearing Specifications

This page intentionally left blank

Tennessee Valley Authority Right-of-Way Clearing Specifications

1. General - The clearing contractor shall review the environmental evaluation documents (categorical exclusion checklist, environmental assessment, or environmental impact statement) for the project or proposed activity, along with all clearing and construction appendices, conditions in applicable general and/or site-specific permits, the storm water pollution prevention plan, and any Tennessee Valley Authority (TVA) commitments to property owners. The contractor shall then plan and carry out operations using techniques consistent with good engineering and management practices as outlined in TVA's best management practices (BMPs) manual (Muncy 1992, and revisions thereto). The contractor will protect areas that are to be left unaffected by access or clearing work at and adjacent to all work sites. In sensitive areas and their buffers, the contractor will retain as much native ground cover and other vegetation as possible.

   If the contractor fails to use BMPs or to follow environmental expectations discussed in the prebid or prework meeting or present in contract specifications, TVA will order corrective changes and additional work as deemed necessary in TVA's judgment to meet the intent of environmental laws and regulations or other guidelines. Major violations or continued minor violations will result in work suspension until correction of the situation is achieved or other remedial action is taken at the contractor's expense. Penalty clauses may be invoked as appropriate.

2. Regulations - The clearing contractor shall comply with all applicable federal, state, and local environmental and antipollution laws, regulations, and ordinances including without limitation all air, water, solid and hazardous waste, noise, and nuisance laws, regulations, and ordinances. The contractor shall secure or ensure that TVA has secured all necessary permits or authorizations to conduct work on the acres shown on the drawings and plan and profile for the contract. The contractor's designated project manager will actively seek to prevent, control, monitor, and safely abate all commonly recognized forms of workplace and environmental pollution. Permits or authorizations and any necessary certifications of trained or licensed employees shall be documented with copies submitted to TVA's right-of-way inspector or construction environmental engineer before work begins. The contractor will be responsible for meeting all conditions specified in permits. Permit conditions shall be reviewed in prework discussions.

3. Land and Landscape Preservation - The clearing contractor shall exercise care to preserve the condition of cleared soils by avoiding as much compacting and deep scarring as possible. As soon as possible after initial disturbance of the soil and in accordance with any permit(s) or other state or local environmental regulatory requirements, cover material shall be placed to prevent erosion and sedimentation of water bodies or conveyances to surface water or groundwater. In areas outside the clearing, use, and access areas, the natural vegetation shall be protected from damage. The contractor and his employees must not deviate from delineated access routes or use areas and must enter the site at designated areas that will be marked. Clearing operations shall be conducted to prevent any unnecessary destruction, scarring, or defacing of the remaining natural vegetation and adjacent surroundings in the vicinity of the work. In sensitive public or environmental areas, appropriate buffer zones shall be observed and the methods of clearing or reclearing modified to protect

the buffer and sensitive area. Some areas may require planting native plants or grasses to meet the criteria of regulatory agencies or commitments to special program interests.

4. Streamside Management Zones - The clearing contractor must leave as many rooted ground cover plants as possible in buffer zones along streams and other bodies of water or wet-weather conveyances thereto. In such streamside management zones (SMZ), tall-growing tree species (trees that would interfere with TVA's National Electrical Safety Code clearances) shall be cut, and the stumps may be treated to prevent resprouting. Low-growing trees identified by TVA as marginal electrical clearance problems may be cut, and then stump treated with growth regulators to allow low, slow-growing canopy development and active root growth. Only approved herbicides shall be used, and herbicide application shall be conducted by certified applicators from TVA's Transmission, Operations, and Maintenance (TOM) organization after initial clearing and construction. Cutting of trees within SMZs must be accomplished by using either hand-held equipment or other appropriate clearing equipment, such as a feller-buncher. The method will be selected based on site-specific conditions and topography to minimize soil disturbance and impacts to the SMZ and surrounding area. Disturbed soils in SMZs must be stabilized by appropriate methods immediately after the right-of-way is cleared. Stabilization must occur within the time frame specified in applicable storm water permits or regulations. Stumps within SMZs may be cut close to the ground but must not be removed or uprooted. Trees, limbs, and debris shall be immediately removed from streams, ditches, and wet areas using methods that will minimize dragging or scarring the banks or stream bottom. No debris will be left in the water or watercourse. Equipment will cross streams, ditches, or wet areas only at locations designated by TVA after the application of appropriate erosion control BMPs consistent with permit conditions or regulatory requirements.

5. Wetlands - In forested wetlands, tall trees will be cut near the ground, leaving stumps and roots in place. The cambium may be treated with herbicides applied by certified applicators from the TOM organization to prevent regrowth. Understory trees that must be initially cut and removed may be allowed to grow back or may be treated with tree growth regulators selectively to slow growth and increase the reclearing cycle. The decision will be situationally made based on existing ground cover, wetland type, and tree species since tall tree removal may "release" understory species and allow them to grow quickly to "electrical clearance problem" heights. In many circumstances, herbicides labeled for water and wetland use may be used in reclearing.

6. Sensitive Area Preservation - If prehistoric or historic artifacts or features that might be of archaeological significance are discovered during clearing or reclearing operations, the activity shall immediately cease within a 100-foot radius, and a TVA right-of-way inspector or construction environmental engineer and the Cultural Resources Program manager shall be notified. The site shall be protected and left as found until a determination about the resources, their significance, and site treatment is made by TVA's Cultural Resources Program. Work may continue beyond the finding zone and the 100-foot radius beyond its perimeter.

7. Water Quality Control - The contractor's clearing and disposal activities shall be performed using BMPs that will prevent erosion and entrance of spillage, contaminants, debris, and other pollutants or objectionable materials into drainage

ways, surface water, or groundwater. Special care shall be exercised in refueling equipment to prevent spills. Fueling areas shall be remote from any sinkhole, crevice, stream, or other water body. Open burning debris will be kept away from streams and ditches and shall be incorporated into the soil.

The clearing contractor will erect and (when TVA or contract construction personnel are unable) maintain BMPs such as silt fences on steep slopes and adjacent to any stream, wetland, or other water body. BMPs will be inspected by the TVA field engineer or other designated TVA or contractor personnel routinely and during periods of high runoff, and any necessary repairs will be made as soon as practicable. BMP inspections will be conducted in accordance with permit requirements. Records of all inspections will be maintained on site, and copies of inspection forms will be forwarded to the TVA construction environmental engineer.

8. Turbidity and Blocking of Streams - If temporary clearing activities must interrupt natural drainage, appropriate drainage facilities and erosion/sediment controls shall be provided to avoid erosion and siltation of streams and other water bodies or water conveyances. Turbidity levels in receiving waters or at storm water discharge points shall be monitored, documented, and reported if required by the applicable permit. Erosion and sediment control measures such as silt fences, water bars, and sediment traps shall be installed as soon as practicable after initial access, site, or right-of-way disturbance in accordance with applicable permit or regulatory requirements.

   Mechanized equipment shall not be operated in flowing water except when approved and, then, only to construct necessary stream crossings under direct guidance of TVA. Construction of stream fords or other crossings will only be permitted at approved locations and to current TVA construction access road standards. Material shall not be deposited in watercourses or within stream bank areas where it could be washed away by high stream flows. Any clearing debris that enters streams or other water bodies shall be removed as soon as possible. Appropriate U.S. Army Corps of Engineers and state permits shall be obtained for stream crossings.

9. Air Quality Control - The clearing or reclearing contractor shall take appropriate actions to limit the amount of air emissions created by clearing and disposal operations to well within the limits of clearing or burning permits and/or forestry or local fire department requirements. All operations must be conducted in a manner that prevents nuisance conditions or damage to adjacent land crops, dwellings, highways, or people.

10. Dust and Mud Control - Clearing activities shall be conducted in a manner that minimizes the creation of fugitive dust. This may require limitations as to type of equipment, allowable speeds, and routes utilized. Control measures such as water, gravel, etc., or similar measures may be used subject to TVA approval. On new construction sites and easements, the last 100 feet before an access road approaches a county road or highway shall be graveled to prevent transfer of mud onto the public road.

11. Burning - The contractor shall obtain applicable permits and approvals to conduct controlled burning. The contractor will comply with all provisions of the permit, notification, or authorization including burning site locations, controlled draft, burning hours, and such other conditions as stipulated. If weather conditions such as wind speed or wind direction change rapidly, the contractor's burning operation may be

temporarily stopped by TVA's field engineer. The debris to be burned shall be kept as clean and dry as possible and stacked and burned in a manner that produces the minimum amount of smoke. Residue from burning will be disposed of according to permit stipulations. No fuel starters or enhancements other than kerosene will be allowed.

12. Smoke and Odors - The contractor will properly store and handle combustible and volatile materials that could create objectionable smoke, odor, or fumes. The contractor shall not burn oil or refuse that includes trash, rags, tires, plastics, or other manufactured debris.

13. Vehicle Exhaust Emissions - The contractor shall maintain and operate equipment in a manner that limits vehicle exhaust emissions. Equipment and vehicles will be kept within the manufacturers' recommended limits and tolerances. Excessive exhaust gases will be eliminated, and inefficient operating procedures will be revised or halted until corrective repairs or adjustments are made.

14. Vehicle Servicing - Routine maintenance of personal vehicles will not be performed on the right-of-way. However, if emergency or "have to" situations arise, minimal/temporary maintenance to personal vehicles will occur in order to mobilize the vehicle to an off-site maintenance shop. Heavy equipment will be serviced on the right-of-way, except in designated sensitive areas. The clearing or reclearing contractor will properly maintain these vehicles with approved spill protection controls and countermeasures. If emergency maintenance in a sensitive or questionable area arises, the area environmental coordinator or construction environmental engineer will be consulted. All wastes and used oils will be properly recovered, handled, and disposed/recycled. Equipment shall not be temporarily stored in stream floodplains, whether overnight or on weekends or holidays.

15. Noise Control - The contractor shall take steps to avoid the creation of excessive sound levels for employees, the public, or the site and adjacent property owners. Concentration of individual noisy pieces as well as the hours and locations of operation should be considered.

16. Noise Suppression - All internal combustion engines shall be properly equipped with mufflers. The equipment and mufflers shall be maintained at peak operating efficiency.

17. Sanitation - A designated representative of TVA or the clearing contractor shall contact a sanitary contractor who will provide sanitary chemical toilets convenient to all principal points of operation for every working party. The facilities shall comply with applicable federal, state, or local health laws and regulations. They shall not be located closer than 100 feet to any stream or tributary or to any wetland. The facilities shall be required to have proper servicing and maintenance, and the waste disposal contractor shall verify in writing that the waste disposal will be in state-approved facilities. Employees shall be notified of sanitation regulations and shall be required to use the toilet facilities.

18. Refuse Disposal - The clearing or reclearing contractor shall be responsible for daily cleanup and proper labeling, storage, and disposal of all refuse and debris on the site produced by his operations and employees. Facilities that meet applicable regulations

and guidelines for refuse collection will be required. Only approved transport, storage, and disposal areas shall be used.

19. Brush and Timber Disposal (Reclearing) - The reclearing contractor shall place felled tree boles in neat stacks at the edge of the right-of-way, with crossing breaks at least every 100 feet. Property owner requests shall be reviewed with the project manager or right-of-way specialist before accepting them. Lop and drop activities must be specified in the contract and on plan and profile drawings with verification with the right-of-way specialist before conducting such work. When tree trimming and chipping is necessary, disposal of the chips on the easement or other locations on the property must be with the consent of the property owner and the approval of the right-of-way specialist. No trees, branches, or chips shall remain in a surface water body or be placed at a location where washing into a surface water or groundwater source might occur.

20. Brush and Timber Disposal (Initial Clearing) - For initial clearing, trees are commonly part of the contractor's contract to remove as they wish. Trees may be removed from the site for lumber or pulpwood or they may be chipped or stacked and burned. All such activities must be coordinated with the TVA field engineer, and the open burning permits, notifications, and regulatory requirements must be met. Trees may be cut and left in place only in areas specified by TVA and approved by appropriate regulatory agencies. These areas may include sensitive wetlands or SMZs where tree removal would cause excessive ground disturbance or in very rugged terrain where windrowed trees are used as sediment barriers along the edge of the right-of-way.

21. Restoration of Site - All disturbed areas, with the exception of farmland under cultivation and any other areas as may be designated by TVA's specifications, shall be stabilized in the following manner unless the property owner and TVA's engineer specify a different method:

    A. The subsoil shall be loosened to a minimum depth of 6 inches if possible and worked to remove unnatural ridges and depressions.

    B. If needed, appropriate soil amendments will be added.

    C. All disturbed areas will initially be seeded with a temporary ground cover such as winter wheat, rye, or millet, depending on the season. Perennials may also be planted during initial seeding if proper growing conditions exist. Final restoration and final seeding will be performed as line construction is completed. Final seeding will consist of permanent perennial grasses such as those outlined in TVA's *A Guide for Environmental Protection and Best Management Practices for Tennessee Valley Authority Transmission Construction and Maintenance Activities.* Exceptions would include those areas designated as native grass planting areas. Initial and final restoration will be performed by the clearing contractor.

    D. TVA holds the option, depending upon the time of year and weather condition, to delay or withdraw the requirement of seeding until more favorable planting conditions are certain. In the meantime, other stabilization techniques must be applied.

Revision April 2007

This page intentionally left blank

Appendix C – TVA Environmental Quality Protection Specifications for Transmission Line Construction

This page intentionally left blank

Tennessee Valley Authority Environmental Quality Protection Specifications for Transmission Line Construction

1. General – Tennessee Valley Authority (TVA) and/or the assigned contractor shall plan, coordinate, and conduct operations in a manner that protects the quality of the environment and complies with TVA's environmental expectations discussed in the preconstruction meeting. This specification contains provisions that shall be considered in all TVA and contract construction operations. If the contractor fails to operate within the intent of these requirements, TVA will direct changes to operating procedures. Continued violation will result in a work suspension until correction or remedial action is taken by the contractor. Penalties and contract termination will be used as appropriate. The costs of complying with the Environmental Quality Protection Specifications are incidental to the contract work, and no additional compensation will be allowed. At all structure and conductor pulling sites, protective measures to prevent erosion will be taken immediately upon the end of each step in a construction sequence, and those protective measures will be inspected and maintained throughout the construction and right-of-way rehabilitation period.

2. Regulations - TVA and/or the assigned contractor shall comply with all applicable federal, state, and local environmental and antipollution laws, regulations, and ordinances related to environmental protection and prevention, control, and abatement of all forms of pollution.

3. Use Areas - TVA and/or the assigned contractor's use areas include but are not limited to site office, shop, maintenance, parking, storage, staging, assembly areas, utility services, and access roads to the use areas. The construction contractor shall submit plans and drawings for their location and development to the TVA engineer and project manager for approval. Secondary containment will be provided for fuel and petroleum product storage pursuant to 29CFR1910.106(D)(6)(iii)(OSHA).

4. Equipment - All major equipment and proposed methods of operation shall be subject to the approval of TVA. The use or operation of heavy equipment in areas outside the right-of-way, access routes, or structure, pole, or tower sites will not be permitted without permission of the TVA inspector or field engineer. Heavy equipment use on steep slopes (greater than 20 percent) and in wet areas will be held to the minimum necessary to construct the transmission line. Steps will be taken to limit ground disturbance caused by heavy equipment usage, and erosion and sediment controls will be instituted on disturbed areas in accordance with state requirements.

   No subsurface ground-disturbing equipment or stump-removal equipment will be used by construction forces except on access roads or at the actual structure, pole, or tower sites, where only footing locations and controlled runoff diversions shall be created that disturb the soil. All other areas of ground cover or in-place stumps and roots shall remain in place. (Note: Tracked vehicles disturb surface layer of the ground due to size and function.) Some disking of the right-of-way may occur for proper seedbed preparation.

   Unless ponding previously occurred (i.e., existing low-lying areas), water should not be allowed to pond on the structure sites except around foundation holes; the water must be directed away from the site in as dispersed a manner as possible. At tower or

structure sites, some means of upslope interruption of potential overland flow and diversion around the footings should be provided as the first step in construction-site preparation. If leveling is necessary, it must be implemented by means that provide for continuous gentle, controlled, overland flow or percolation. A good grass cover, straw, gravel, or other protection of the surface must be maintained. Steps taken to prevent increases in the moisture content of the in-situ soils will be beneficial both during construction and over the service life of any structure.

5. Sanitation - A designated TVA or contractor representative shall contact a sanitary contractor who will provide sanitary chemical toilets convenient to all principal points of operation for every working party. The facilities shall comply with applicable federal, state, or local health laws and regulations. They shall not be located closer than 100 feet to any stream or tributary or to any wetland. The facilities shall be required to have proper servicing and maintenance, and the waste disposal contractor shall verify in writing that the waste disposal will be in state-approved facilities. Employees shall be notified of sanitation regulations and shall be required to use the toilet facilities.

6. Refuse Disposal - Designated TVA and/or contractor personnel shall be responsible for daily inspection, cleanup, and proper labeling, storage, and disposal of all refuse and debris produced by his operations and by his employees. Suitable refuse collecting facilities will be required. Only state-approved disposal areas shall be used. Disposal containers such as dumpsters or roll-off containers shall be obtained from a proper waste disposal contractor. Solid, special, construction/demolition, and hazardous wastes as well as scrap are part of the potential refuse generated and must be properly managed with emphasis on reuse, recycle, or possible give away, as appropriate, before they are handled as waste. Contractors must meet similar provisions on any project contracted by TVA.

7. Landscape Preservation - TVA and its contractors shall exercise care to preserve the natural landscape in the entire construction area as well as use areas, in or outside the right-of-way, and on or adjacent to access roads. Construction operations shall be conducted to prevent any unnecessary destruction, scarring, or defacing of the natural vegetation and surroundings in the vicinity of the work.

8. Sensitive Areas Preservation - Certain areas on site and along the right-of-way may be designated by the specifications or the TVA engineer as environmentally sensitive. These areas include but are not limited to areas classified as erodible, geologically sensitive, scenic, historical and archaeological, fish and wildlife refuges, water supply watersheds, and public recreational areas such as parks and monuments. Contractors and TVA construction crews shall take all necessary actions to avoid adverse impacts to these sensitive areas and their adjacent buffer zones. These actions may include suspension of work or change of operations during periods of rain or heavy public use; hours may be restricted or concentrations of noisy equipment may have to be dispersed. If prehistoric or historic artifacts or features are encountered during clearing or construction operations, the operations shall immediately cease for at least 100 feet in each direction, and TVA's right-of-way inspector or construction superintendent and Cultural Resources Program shall be notified. The site shall be left as found until a significance determination is made. Work may continue elsewhere beyond the 100-foot perimeter.

9. Water Quality Control - TVA and contractor construction activities shall be performed by methods that will prevent entrance or accidental spillage of solid matter, contaminants, debris, and other objectionable pollutants and wastes into flowing caves, sinkholes, streams, dry watercourses, lakes, ponds, and underground water sources.

   The clearing contractor will erect and (when TVA or contract construction personnel are unable) maintain best management practices (BMPs) such as silt fences on steep slopes and adjacent to any stream, wetland, or other water body. Additional BMPs may be required for areas of disturbance created by construction activities. BMPs will be inspected by the TVA field engineer or other designated TVA or contractor personnel routinely and during periods of high runoff, and any necessary repairs will be made as soon as practicable. BMP inspections will be conducted in accordance with permit requirements. Records of all inspections will be maintained on site, and copies of inspection forms will be forwarded to the TVA construction environmental engineer.

   Acceptable measures for disposal of waste oil from vehicles and equipment shall be followed. No waste oil shall be disposed of within the right-of-way, on a construction site, or on access roads.

10. Turbidity and Blocking of Streams - Construction activities in or near SMZs or other bodies of water shall be controlled to prevent the water turbidity from exceeding state or local water quality standards for that stream. All conditions of a general storm water permit, aquatic resource alteration permit, or a site-specific permit shall be met including monitoring of turbidity in receiving streams and/or storm water discharges and implementation of appropriate erosion and sediment control measures.

    Appropriate drainage facilities for temporary construction activities interrupting natural site drainage shall be provided to avoid erosion. Watercourses shall not be blocked or diverted unless required by the specifications or the TVA engineer. Diversions shall be made in accordance with TVA's *A Guide for Environmental Protection and Best Management Practices for Tennessee Valley Authority Transmission Construction and Maintenance Activities.*

    Mechanized equipment shall not be operated in flowing water except when approved and, then, only to construct crossings or to perform required construction under direct guidance of TVA. Construction of stream fords or other crossings will only be permitted at approved locations and to current TVA construction access road standards. Material shall not be deposited in watercourses or within stream bank areas where it could be washed away by high stream flows. Appropriate U.S. Army Corps of Engineers and state permits shall be obtained.

    Wastewater from construction or dewatering operations shall be controlled to prevent excessive erosion or turbidity in a stream, wetland, lake, or pond. Any work or placing of equipment within a flowing or dry watercourse requires the prior approval of TVA.

11. Clearing - No construction activities may clear additional site or right-of-way vegetation or disturb remaining retained vegetation, stumps, or regrowth at locations other than the structure sites and conductor setup areas. TVA and the construction contractor(s) must provide appropriate erosion or sediment controls for areas they have disturbed that have previously been restabilized after clearing operations. Control measures shall be

implemented as soon as practicable after disturbance in accordance with applicable federal, state, and/or local storm water regulations.

12. Restoration of Site - All construction disturbed areas, with the exception of farmland under cultivation and any other areas as may be designated by TVA's specifications, shall be stabilized in the following manner unless the property owner and TVA's engineer specify a different method:

    A. The subsoil shall be loosened to a minimum depth of 6 inches if possible and worked to remove unnatural ridges and depressions.

    B. If needed, appropriate soil amendments will be added.

    C. All disturbed areas will initially be seeded with a temporary ground cover such as winter wheat, rye, or millet, depending on the season. Perennials may also be planted during initial seeding if proper growing conditions exist. Final restoration and final seeding will be performed as line construction is completed. Final seeding will consist of permanent perennial grasses such as those outlined in TVA's *A Guide for Environmental Protection and Best Management Practices for Tennessee Valley Authority Transmission Construction and Maintenance Activities.* Exceptions would include those areas designated as native grass planting areas. Initial and final restoration will be performed by the clearing contractor.

    D. TVA holds the option, depending upon the time of year and weather condition, to delay or withdraw the requirement of seeding until more favorable planting conditions are certain. In the meantime, other stabilization techniques must be applied.

13. Air Quality Control - Construction crews shall take appropriate actions to minimize the amount of air pollution created by their construction operations. All operations must be conducted in a manner that avoids creating a nuisance and prevents damage to lands, crops, dwellings, or persons.

14. Burning - Before conducting any open burning operations, the contractor shall obtain permits or provide notifications as required to state forestry offices and/or local fire departments. Burning operations must comply with the requirements of state and local air pollution control and fire authorities and will only be allowed in approved locations and during appropriate hours and weather conditions. If weather conditions such as wind direction or speed change rapidly, the contractor's burning operations may be temporarily stopped by the TVA field engineer. The debris for burning shall be piled and shall be kept as clean and as dry as possible, then burned in such a manner as to reduce smoke. No materials other than dry wood shall be open burned. The ash and debris shall be buried away from streams or other water sources and shall be in areas coordinated with the property owner.

15. Dust and Mud Control - Construction activities shall be conducted to minimize the creation of dust. This may require limitations as to types of equipment, allowable speeds, and routes utilized. Water, straw, wood chips, dust palliative, gravel, combinations of these, or similar control measures may be used subject to TVA's approval. On new construction sites and easements, the last 100 feet before an access

road approaches a county road or highway shall be graveled to prevent transfer of mud onto the public road.

16. Vehicle Exhaust Emissions - TVA and/or the contractors shall maintain and operate equipment to limit vehicle exhaust emissions. Equipment and vehicles that show excessive emissions of exhaust gasses and particulates due to poor engine adjustments or other inefficient operating conditions shall not be operated until corrective repairs or adjustments are made.

17. Vehicle Servicing - Routine maintenance of personal vehicles will not be performed on the right-of-way. However, if emergency or "have to" situations arise, minimal/temporary maintenance to personal vehicles will occur in order to mobilize the vehicle to an off-site maintenance shop. Heavy equipment will be serviced on the right-of-way except in designated sensitive areas. The Heavy Equipment Department within TVA or the construction contractor will properly maintain these vehicles with approved spill prevention controls and countermeasures. If emergency maintenance in a sensitive or questionable area arises, the area environmental coordinator or construction environmental engineer will be consulted. All wastes and used oils will be properly recovered, handled, and disposed/recycled. Equipment shall not be temporarily stored in stream floodplains, whether overnight or on weekends or holidays.

18. Smoke and Odors - TVA and/or the contractors shall properly store and handle combustible material that could create objectionable smoke, odors, or fumes. The contractor shall not burn refuse such as trash, rags, tires, plastics, or other debris.

19. Noise Control - TVA and/or the contractor shall take measures to avoid the creation of noise levels that are considered nuisances, safety, or health hazards. Critical areas including but not limited to residential areas, parks, public use areas, and some ranching operations will require special considerations. TVA's criteria for determining corrective measures shall be determined by comparing the noise level of the construction operation to the background noise levels. In addition, especially noisy equipment such as helicopters, pile drivers, air hammers, chippers, chain saws, or areas for machine shops, staging, assembly, or blasting may require corrective actions when required by TVA.

20. Noise Suppression - All internal combustion engines shall be properly equipped with mufflers as required by the Department of Labor's *Safety and Health Regulations for Construction*. TVA may require spark arresters in addition to mufflers on some engines. Air compressors and other noisy equipment may require sound-reducing enclosures in some circumstances.

21. Damages - The movement of construction crews and equipment shall be conducted in a manner that causes as little intrusion and damage as possible to crops, orchards, woods, wetlands, and other property features and vegetation. The contractor will be responsible for erosion damage caused by his actions and especially for creating conditions that would threaten the stability of the right-of-way or site soil, the structures, or access to either. When property owners prefer the correction of ground cover condition or soil and subsoil problems themselves, the section of the contract dealing with damages will apply.

Revision April 2007

This page intentionally left blank

Appendix D – TVA Transmission Construction Guidelines Near Streams

This page intentionally left blank

Tennessee Valley Authority Transmission Construction Guidelines Near Streams

Even the most carefully designed transmission line project eventually will affect one or more creeks, rivers, or other type of water body. These streams and other water areas are protected by state and federal law, generally support some amount of fishing and recreation, and, occasionally, are homes for important and/or endangered species. These habitats occur in the stream and on strips of land along both sides (the streamside management zone [SMZ]) where disturbance of the water, land, or vegetation could have an adverse effect on the water or stream life. The following guidelines have been prepared to help Tennessee Valley Authority (TVA) Transmission Construction staff and their contractors avoid impacts to streams and stream life as they work in and near SMZs. These guidelines expand on information presented in *A Guide for Environmental Protection and Best Management Practices for Tennessee Valley Authority Construction and Maintenance Activities.*

Three Levels of Protection

During the preconstruction review of a proposed transmission line, the TVA Environmental Biological Compliance staff will have studied each possible stream impact site and will have identified it as falling into one of three categories: (A) standard streamside management protection, (B) protection of important permanent streams, springs, and sinkholes, or (C) protection of unique habitats. These category designations are based on the variety of species and habitats that exist in the stream, as well as federal requirements to avoid harming certain species.

As early as possible after field surveys are completed by the TVA Biological Compliance Staff, any streams that have been designated as either Category B or C will be discussed with the TVA Environmental Energy Delivery staff. The purpose of these discussions will be to minimize the number of crossings and their impact on the important resources in the streams during design and construction. The category designation for each stream site will then be marked on the transmission line plan and profile sheets. Construction crews are required to protect streams and other identified water habitats using the following pertinent set(s) of guidelines:

(A) Standard Stream Protection

This is the standard (basic) level of protection for streams, springs, sinkholes, and the habitats around them. The purpose of the following guidelines is to minimize the amount and length of disturbance to the water bodies without causing adverse impacts on the construction work.

Guidelines:

1. All construction work around streams, springs, and sinkholes will be done using pertinent best management practices (BMPs) such as those described in *A Guide for Environmental Protection and Best Management Practices for Tennessee Valley Authority Construction and Maintenance Activities,* especially Chapter 5, “Structural Controls Standards and Specifications” (Muncy 2012).

2. All equipment crossings of streams and shorelines must comply with appropriate state permitting requirements. Crossings of all drainage channels, intermittent streams, and permanent streams must be done in ways that avoid erosion problems and long-term changes in water flow. Crossings of any permanent streams must allow for natural movement of fish and other aquatic life.

3. Cutting of trees within SMZs must be accomplished by using either hand-held equipment or other appropriate clearing equipment (e.g., a feller-buncher) that would result in minimal soil disturbance and damage to low-lying vegetation. The method will be selected based on site-specific conditions and topography to minimize soil disturbance and impacts to the SMZ and surrounding area. Stumps can be cut close to ground level, but must not be removed or uprooted.

4. Other vegetation near streams must be disturbed as little as possible during construction. Soil displacement as a result of clearing operations by the actions of plowing, disking, blading, or other tillage or grading equipment will be minimized in SMZs. Shorelines that have to be disturbed must be stabilized as soon as feasible.

(B) Protection of Important Permanent Streams, Springs, and Sinkholes

This category will be used when there is one or more specific reason(s) why a permanent (always-flowing) stream, spring, or sinkhole requires protection beyond that provided by standard BMPs. Reasons for requiring this additional protection include high potential for occupancy by federally listed or significant state-listed species, federally designated critical habitat, or areas designated as special use classification (e.g., trout waters). The purpose of the following guidelines is to minimize the disturbance of the banks and water in the flowing stream(s) where this level of protection is required.

Guidelines:

1. Except as modified by Guidelines 2-4 below, all construction work around streams will be done using pertinent BMPs, such as those described in *A Guide for Environmental Protection and Best Management Practices for Tennessee Valley Authority Construction and Maintenance Activities,* especially Chapter 5, “Structural Controls Standards and Specifications” (Muncy 2012).

2. All equipment crossings of streams must comply with appropriate state (and, at times, federal) permitting requirements. Crossings of drainage channels and intermittent streams must be done in ways that avoid erosion problems and long-term changes in water flow. Category B designations will be discussed with the TVA Environmental Energy Delivery staff as early as possible in the process, to allow time to discuss possible avoidance or minimization of impacts with design and construction.

3. Cutting of trees within SMZs must be accomplished by using either hand-held equipment or other appropriate clearing equipment (e.g., a feller-buncher) that would result in minimal soil disturbance and damage to low-lying vegetation. The method will be selected based on site-specific conditions and topography to minimize soil disturbance and impacts to the SMZ and surrounding area. Cutting of trees near permanent streams must be limited to those required to meet National

Electrical Safety Code and danger tree requirements. Stumps can be cut close to ground level, but must not be removed or uprooted.

4. Other vegetation near streams must be disturbed as little as possible during construction. Soil displacement by the actions of plowing, disking, blading, or other tillage or grading equipment will be minimized in SMZs. Shorelines that have to be disturbed must be stabilized as soon as possible and revegetated as soon as feasible.

(C) Protection of Unique Habitats

This category will be used when, for one or more specific reasons, a temporary or permanent aquatic habitat requires special protection. This relatively uncommon level of protection will be appropriate and required when a unique habitat requiring special protection is present (for example, the spawning area of a rare species), the stream is known to be occupied by a federally listed or significant state-listed species, or when required as a special condition resulting from consultation with the U.S. Fish and Wildlife Service to avoid project effects on a listed species or designated critical habitat. The purpose of the following guidelines is to avoid or minimize any disturbance of the unique aquatic habitat.

Guidelines:

1. Except as modified by Guidelines 2-4 below, all construction work around the unique habitat will be done using pertinent BMPs, such as those described in *A Guide for Environmental Protection and Best Management Practices for Tennessee Valley Authority Construction and Maintenance Activities,* especially Chapter 5, “Structural Controls Standards and Specifications” (Muncy 2012).

2. Category C designations would be discussed with the TVA Environmental Energy Delivery staff as early as possible following field surveys to allow time to discuss possible avoidance or minimization of impacts with design and construction. Environmental Energy Delivery staff would discuss construction activities to take place in the SMZ with the Environmental Biological Compliance staff. On-site planning sessions would be conducted as needed. All crossings of streams also must comply with appropriate state (and, at times, federal) permitting requirements.

3. Cutting of trees within SMZs must be accomplished by using either hand-held equipment or other appropriate clearing equipment (e.g., a feller-buncher) that would result in minimal soil disturbance and damage to low-lying vegetation. The method will be selected based on site-specific conditions and topography to minimize soil disturbance and impacts to the SMZ and surrounding area. Cutting of trees near permanent streams should be limited to those required to meet National Electrical Safety Code, Federal Energy Regulatory Commission standards, and danger tree requirements. Stumps can be cut close to ground level, but must not be removed or uprooted.

4. Other vegetation near the unique habitat must be disturbed as little as possible during construction. Soil disturbance by plowing, disking, blading, or grading must be kept at a minimum. Areas that have to be disturbed must be stabilized as soon as possible and revegetated as soon as feasible.

5. Special SMZ requirements will be coordinated with Environmental Biological Compliance staff.

Maintenance

During ongoing operations, SMZs will be inspected frequently; and during inactive periods, occasionally. Damaging or failing situations that may cause unacceptable water quality impacts will be corrected as soon as practical.

Revision 2.1 - June 2012

Comparison of Guidelines Under the Three Stream and Water Body Protection Categories[1] (page 1)

Guidelines	A: Standard Stream Protection	B: Important Permanent Streams, Springs, and Sinkholes	C: Protection of Unique Habitats
1. Reference	• All TVA construction work around streams, springs, and sinkholes will be done using pertinent Best Management Practices (BMPs) such as those described in *A Guide for Environmental Protection and Best Management Practices for Tennessee Valley Authority Construction and Maintenance Activities*, especially Chapter 5, "Structural Controls Standards and Specifications."	• Except as modified by Guidelines 2-4, all construction work around streams will be done using pertinent BMPs such as those described in *A Guide for Environmental Protection and Best Management Practices for Tennessee Valley Authority Construction and Maintenance Activities*, especially Chapter 5, "Structural Controls Standards and Specifications."	• Except as modified by Guidelines 2-4, all construction work around the unique habitat will be done using pertinent BMPs such as those described in *A Guide for Environmental Protection and Best Management Practices for Tennessee Valley Authority Construction and Maintenance Activities,* especially Chapter 5, "Structural Controls Standards and Specifications."
2. Equipment Crossings	• All equipment crossings of streams and shorelines must comply with appropriate state permitting requirements. • Crossings of all drainage channels, intermittent streams, and permanent streams must be done in ways that avoid erosion problems and long-term changes in water flow. • Crossings of any permanent streams must allow for natural movement of fish and other aquatic life.	• All equipment crossings of streams also must comply with appropriate state (and at times federal) permitting requirements. • Crossings of drainage channels and intermittent streams must be done in ways that avoid erosion problems and long-term changes in water flow. • All construction activity would be discussed with the TVA Environmental Energy Delivery staff as early as possible in the process to allow time to discuss possible avoidance or minimization of impacts with design and construction.	• All crossings of streams also must comply with appropriate state (and, at times federal) permitting requirements. • All construction activity would be discussed with the TVA Environmental Energy Delivery staff as early as possible following field surveys to allow time to discuss possible avoidance or minimization of impacts with design and construction. • Special SMZ requirements will be coordinated with Environmental Biological Compliance staff.

[1]Source: *A Guide for Environmental Protection and Best Management Practices for Tennessee Valley Authority Construction and Maintenance Activities* (Muncy 2012)

Comparison of Guidelines Under the Three Stream and Water Body Protection Categories[1] (page 2)

Guidelines	A: Standard Stream Protection	B: Important Permanent Streams, Springs, and Sinkholes	C: Protection of Unique Habitats
3. Cutting Trees	• Cutting of trees within streamside management zones (SMZs) must be accomplished by using either hand-held equipment or other appropriate clearing equipment (e.g., a feller-buncher) that would result in minimal soil disturbance and damage to low-lying vegetation. The method will be selected based on site-specific conditions and topography to minimize soil disturbance and impacts to the SMZ and surrounding area. • Stumps can be cut close to ground level, but must not be removed or uprooted.	• Cutting of trees within SMZs must be accomplished by using either hand-held equipment or other appropriate clearing equipment (e.g., a feller-buncher) that would result in minimal soil disturbance and damage to low-lying vegetation. The method will be selected based on site-specific conditions and topography to minimize soil disturbance and impacts to the SMZ and surrounding area. • Cutting of trees near permanent streams must be limited to those meeting National Electrical Safety Code (NESC) and danger tree requirements. • Stumps can be cut close to ground level, but must not be removed or uprooted.	• Cutting of trees within SMZs must be accomplished by using either hand-held equipment or other appropriate clearing equipment (e.g., a feller-buncher) that would result in minimal soil disturbance and damage to low-lying vegetation. The method will be selected based on site-specific conditions and topography to minimize soil disturbance and impacts to the SMZ and surrounding area. • Cutting of trees near permanent streams must be limited to those meeting NESC, Federal Energy Regulatory Commission standards, and danger tree requirements. • Stumps can be cut close to ground level, but must not be removed or uprooted.
4. Other Vegetation	• Other vegetation near streams must be disturbed as little as possible during construction. • Soil displacement as a result of clearing operations by the actions of plowing, disking, blading, or other tillage or grading equipment will be minimized in SMZs. • Shorelines that have to be disturbed must be stabilized as soon as feasible.	• Other vegetation near streams must be disturbed as little as possible during construction. • Soil displacement by the actions of plowing, disking, blading, or other tillage or grading equipment will be minimized in SMZs. • Shorelines that have to be disturbed must be stabilized as soon as possible and revegetated as soon as feasible.	• Other vegetation near the unique habitat must be disturbed as little as possible during construction. • The soil disturbance by plowing, disking, blading, or grading must be kept at a minimum. • Areas that have to be disturbed must be stabilized as soon as possible and revegetated as soon as feasible. Special SMZ requirements will be coordinated with Environmental Biological Compliance staff.

[1]Source: *A Guide for Environmental Protection and Best Management Practices for Tennessee Valley Authority Construction and Maintenance Activities* (Muncy 2012)

Appendix E – TVA Site Clearing and Grading Specifications

This page intentionally left blank

Tennessee Valley Authority Site Clearing and Grading Specifications

1. General - The project manager with the clearing and/or grading contractor(s) shall review the environmental evaluation documents for the project or proposed activity (categorical exclusion checklist, environmental assessment, or environmental impact statement) along with all clearing and construction appendices, conditions in applicable general and/or site-specific permits, the storm water pollution prevention plan, open burning or demolition notification requirements, and any Tennessee Valley Authority (TVA) commitments to property owners. The contractor shall then plan and carry out operations using techniques consistent with good engineering and storm water management practices as outlined in TVA's best management practices (BMPs) manual. The contractor will protect areas that are to be left unaffected by access or clearing work at and adjacent to all work sites. In sensitive areas and their buffers, the contractor will retain as much native ground cover and other vegetation as possible. BMPs shall be installed before general site clearing or grading, with progressive stabilization BMPs applied from the perimeter toward the interior work areas as grading is completed. Any stabilized area that must be disturbed in subsequent steps shall have temporary BMPs installed until work is completed and the area is restabilized.

   If the contractor fails to use BMPs or to follow environmental expectations discussed in the prebid, prework meeting or present in contract specifications, TVA will order corrective changes and additional work, as deemed necessary in TVA's judgment, to meet the intent of environmental laws and regulations or other guidelines. Major violations or continued minor violations will result in work suspension until correction of the situation is achieved or other remedial action is taken at the contractor's expense. Penalty clauses may be invoked as appropriate.

2. Regulations - The clearing contractor shall comply with all applicable federal, state, and local environmental and antipollution laws, regulations, and ordinances, including without limitation, all air, water, solid and hazardous waste, noise, and nuisance laws, regulations, and ordinances. He or she shall secure, or ensure that TVA has **secured, all necessary permits and authorizations and made all appropriate notifications** to conduct work on the acres shown on the drawings and plan and profile for the contract. The contractor's designated project manager will actively seek to prevent, control, monitor, and safely abate all commonly recognized forms of workplace and environmental pollution. Permits or authorizations and **any necessary certifications of trained employees knowledgeable of environmental requirements shall be documented** with copies submitted to TVA's project manager or environmental specialist before work begins. The **contractor and subcontractors will be responsible for meeting all** conditions **specified in permits.** Permit conditions shall be reviewed in prework discussions.

3. Land and Landscape Preservation - The contractor shall exercise care to preserve the condition of cleared soils by avoiding as much compacting and deep scarring as possible in areas not to be developed for buildings, structures, or foundations. As soon as possible after initial disturbance of the soil and in accordance with any permit(s) or other state or local environmental regulatory requirements, cover material shall be placed to prevent erosion and sedimentation of water bodies or conveyances to

surface water or groundwater. The placement of erosion/sediment controls shall begin at the perimeter and work progressively to the interior of the site. Repeated work in an area will require establishment of a ground cover immediately after each disturbance is completed. In areas outside the clearing, borrow, fill, or use and access areas, the natural vegetation shall be protected from damage. The contractor and his or her employees and subcontractors must not deviate from delineated access routes or use areas and must enter the site(s) at designated areas that will be marked. Clearing operations shall be conducted to prevent any unnecessary destruction, scarring, or defacing of the remaining natural vegetation and adjacent surroundings in the vicinity of the work. In sensitive public or environmental areas, appropriate buffer zones shall be observed by modifying the methods of clearing or reclearing, grading, borrow, or fill so that the buffer and sensitive area are protected. Some areas may require planting native low-growing plants or grasses to meet the criteria of regulatory agencies, executive orders, or commitments to special program interests.

4. Streamside Management Zones - The clearing and/or grading contractor(s) must leave as many rooted ground cover plants as possible in buffer zones along streams and other bodies of water or wet-weather conveyances thereto. In such streamside management zones (SMZs), tall-growing tree species (trees that would interfere with TVA's National Electrical Safety Code clearances) shall be cut, and the stumps may be treated to prevent resprouting. Low-growing trees identified by TVA as marginal electrical clearance problems may be cut and then the stump treated with growth regulators to allow low, slow-growing canopy development and active root growth. Only approved herbicides shall be used, and herbicide application shall be conducted by certified applicators from the Transmission Operations and Maintenance (TOM) organization after initial clearing and construction. Cutting of trees within SMZs must be accomplished by using either hand-held equipment or other appropriate clearing equipment, such as a feller-buncher. The method will be selected based on site-specific conditions and topography to minimize soil disturbance and impacts to the SMZ and surrounding area. Disturbed soils in SMZs must be stabilized by appropriate methods immediately after the access or site is cleared. Stabilization must occur within the time frame specified in applicable storm water permits or regulations. Stumps within SMZs may be cut close to the ground but must not be removed or uprooted. Trees, limbs, and debris shall be prevented from falling into water bodies or immediately removed from streams, ditches, ponds, and wet areas using methods that will minimize dragging or scarring the banks or stream bottom. No debris will be left in the water or watercourse. Equipment will cross streams, ditches, or wet areas only at locations designated by TVA after the application of appropriate erosion-control BMPs and consistent with permit conditions or regulatory requirements.

5. Wetlands - In forested wetlands, tall trees will be cut near the ground, leaving stumps and roots in place. The cambium may be treated with herbicides applied by certified applicators from the TOM organization to prevent regrowth. Understory trees that must be initially cut and removed may be allowed to grow back or may be treated with tree growth regulators selectively to slow growth and increase the reclearing cycle. The decision will be situationally made based on existing ground cover, wetland type, and tree species, since tall tree removal may "release" understory species and allow them to quickly grow to "electrical clearance problem" heights. In many circumstances, herbicides labeled for water and wetland use may be used in reclearing.

At substation, switching stations, and communications sites, wetlands are avoided unless there is no feasible alternative.

6. Sensitive Area Preservation - If prehistoric or historic artifacts or features that might be of archaeological or historical significance are discovered during clearing, grading, borrow, or fill operations, the activity shall immediately cease within a 100-foot radius, and a TVA project manager, an environmental specialist, and the TVA Cultural Resources program manager shall be notified. The site shall be protected and left as found until a determination about the resources, their significance, and site treatment is made by TVA's Cultural Resources Program. Work may continue beyond the finding zone and the 100-foot radius beyond its perimeter.

7. Water Quality Control - The contractor's clearing, grading, borrow and fill, and/or disposal activities shall be performed using BMPs that will prevent erosion and entrance of spillage, contaminants, debris, and other pollutants or objectionable materials into drainageways, surface waters, or groundwater. Special care shall be exercised in refueling equipment to prevent spills. Fueling areas shall be remote from any sinkhole, crevice, stream, or other water body. Open burning debris shall be kept away from streams and ditches and shall be incorporated into the soil. Only materials allowed to be burned under an open burning permit may be incorporated into the soil.

   The clearing and grading contractor(s) and subcontractors will erect and (when TVA or contract construction personnel are unable) maintain BMPs, such as silt fences, on steep slopes and adjacent to any steam, wetland, or other water body. BMPs will be inspected by the TVA field engineer or other designated TVA or contractor personnel routinely and at least as frequently as required by the permit or good management practices and during periods of high runoff; any necessary repairs will be made as soon as practicable. BMP runoff sampling will be conducted in accordance with permit requirements. Records of all inspections and sampling will be maintained on site, and copies of inspection forms and sampling results will be forwarded to the TVA environmental specialist.

8. Turbidity and Blocking of Streams - If temporary clearing, grading, borrow, or fill activities must interrupt natural drainage, appropriate drainage facilities and erosion/sediment controls shall be provided to avoid erosion and siltation of streams and other water bodies or water conveyances. In Tennessee, conditions of an Aquatic Resource Alteration Permit shall be met. Turbidity levels in receiving waters or at storm water discharge points shall be monitored, documented, and reported if required by the applicable permit. Erosion and sediment control measures such as silt fences, water bars, and sediment traps shall be installed as soon as practicable after initial access, site, borrow, fill, or right-of-way disturbance and after sequential disturbance of stabilized areas due to stepwise construction requirement in accordance with applicable permit or regulatory requirements.

   On rights-of-way, mechanized equipment shall not be operated in flowing water except when approved and then only to construct necessary stream crossings under direct guidance of TVA.

   Construction of stream fords or other crossings will only be permitted at approved locations and to current TVA design or construction access road standards. At any construction site, material shall not be deposited in watercourses or within stream bank

areas where it could be washed away by high stream flows. Any clearing debris that enters streams or other water bodies shall be removed immediately. Appropriate U.S. Army Corps of Engineers and state permits shall be obtained for stream or wetland crossings.

9. Air Quality Control - The clearing or grading contractor shall take appropriate actions to limit the amount of air emissions created by clearing and disposal operations to be well within the limits of clearing or burning permits and/or forestry or local fire department requirements. All operations must be conducted in a manner that prevents nuisance conditions or damage to adjacent land, crops, dwellings, highways, or people. If building renovation or demolition is involved, the required air quality organization shall be notified the minimum 10 days in advance, and if the start date is delayed, renotified to start the clock again.

10. Dust and Mud Control - Clearing, grading, borrow, fill, or transport activities shall be conducted in a manner that minimizes the creation of fugitive dust. This may require limitations as to type of equipment, allowable speeds, and routes utilized. Control measures such as water, gravel, etc., or similar measures may be used subject to TVA approval. On new construction sites and easements, the last 100 feet before an access road approaches a county road or highway shall be graveled to prevent transfer of mud onto the public road.

11. Burning - The contractor shall obtain applicable permits and approvals to conduct controlled burning. The contractor will comply with all provisions of the permit, notification or authorization including burning site locations, controlled draft, burning hours, and such other conditions as stipulated. If weather conditions such as wind speed or wind direction change rapidly, the contractor's burning operation may be temporarily stopped by TVA's field engineer. The debris to be burned shall be kept as clean and dry as possible and stacked and burned in a manner that produces the minimum amount of smoke. Residue from burning will be disposed of according to permit stipulations. No fuel starters or enhancements other than kerosene will be allowed.

12. Smoke and Odors - The contractor will properly store and handle combustible and volatile materials that could create objectionable smoke, odor, or fumes. The contractor shall not burn oil or refuse that includes trash, rags, tires, plastics, or other manufactured debris.

13. Vehicle Exhaust Emissions - The contractor shall maintain and operate equipment in a manner that limits vehicle exhaust emissions. Equipment and vehicles will be kept within the manufacturer's recommended limits and tolerances. Excessive exhaust gases will be eliminated, and inefficient operating procedures will be revised or halted until corrective repairs or adjustments are made.

14. Vehicle Servicing - Routine maintenance of vehicles will not be performed on the site, right-of-way, or access route. However, if emergency or “have to” situations arise, minimal/temporary maintenance to vehicles will occur in order to mobilize the vehicle to an off-site maintenance shop. Some heavy equipment may have to be serviced on the right-of-way, site, or access route, except in designated sensitive areas. The clearing, grading, borrow, or fill contractor will properly maintain these vehicles with approved spill protection controls and countermeasures. If emergency maintenance in a

sensitive or questionable area arises, the Area Environmental Program Administration or project manager will be consulted. All wastes and used oils will be properly recovered, handled, and disposed/recycled. Equipment shall not be temporarily stored in stream floodplains, whether overnight or on weekends or holidays.

15. Noise Control - The contractor shall take steps to avoid the creation of excessive sound levels for employees, the public, or the site and adjacent property owners. Concentration of individual noisy pieces as well as the hours and locations of operation should be considered.

16. Noise Suppression - All internal combustion engines shall be properly equipped with mufflers. The equipment and mufflers shall be maintained at peak operating efficiency.

17. Sanitation - A designated representative of TVA or the clearing, grading, borrow, fill, or construction contractor shall contract a sanitary contractor who will provide sanitary chemical toilets convenient to all principal points of operation for every working party and at each construction step. The facilities shall comply with applicable federal, state, or local health laws and regulations. They shall not be located closer than 100 feet to any stream or tributary or to any wetland. The facilities shall be required to have proper servicing and maintenance, and the waste disposal contractor shall verify in writing that the waste disposal will be in state-approved facilities. Employees shall be notified of sanitation regulations and shall be required to use the toilet facilities.

18. Refuse Disposal - The clearing, grading, borrow, fill, or construction contractor and subcontractor(s) shall be responsible for daily cleanup and proper labeling, storage, and disposal of all refuse and debris on the site produced by his or her operations and employees. Facilities that meet applicable regulations and guidelines for refuse collection will be required. Only approved transport, storage, and disposal areas shall be used. Records of waste generation shall be maintained for a site and shall be provided to the project manager and environmental specialist assigned to the project.

19. Brush and Timber Disposal (Initial Clearing) - For initial clearing, trees are commonly part of the contractor’s contract to remove as they wish. Trees may be removed from the site for lumber or pulpwood, or they may be chipped or stacked and burned. All such activities must be coordinated with the TVA field engineer and the open burning permits; notifications and regulatory requirements must be met. On rights-of-way, trees may be cut and left in place only in areas specified by TVA and approved by appropriate regulatory agencies. These areas may include sensitive wetlands or SMZs where tree removal would cause excessive ground disturbance or in very rugged terrain where windrowed trees are used as sediment barriers along the edge of the right-of-way, site, or access.

    Trees that have been cut may not be left on a substation, switching station, or communications site.

20. Restoration of Site - All disturbed areas, with the exception of farmland under cultivation and any other areas as may be designated by TVA's specifications, shall be stabilized in the following manner unless the property owner and TVA's engineer specify a different method:

A. The subsoil shall be loosened to a minimum depth of 6 inches if possible and worked to remove unnatural ridges and depressions.

B. If needed, appropriate soil amendments will be added.

C. All disturbed areas will initially be seeded with a temporary ground cover such as winter wheat, rye, or millet, depending on the season. Perennials may also be planted during initial seeding if proper growing conditions exist. Final restoration and final seeding will be performed as line, site, or communications facilities construction is completed. Final seeding will consist of permanent perennial grasses such as those outlined in TVA's *A Guide for Environmental Protection and Best Management Practices for Tennessee Valley Authority Transmission Construction and Maintenance Activities.* Exceptions would include those areas designated as native grass planting areas. Initial and final restoration will be performed by the clearing contractor with emphasis on using landscaping materials provided in guidelines for low maintenance native vegetation use.

D. TVA holds the option, depending upon the time of year and weather condition, to delay or withdraw the requirement of seeding until more favorable planting conditions are certain. In the meantime, other stabilization techniques must be applied.

E. Vegetation designated by the Federal Invasive Species Council must be eliminated at the work site, and equipment being transported from location to location must be inspected to ensure removal and destruction of live material.

Revision January 2008

Appendix F – TVA Substation Lighting Guidelines

This page intentionally left blank

Tennessee Valley Authority Substation Lighting Guidelines

For Greenfield Sites
Permanent substation lighting should be a two-stage design. Stage 1 is operated dusk to dawn for fixtures at higher mounting heights, more than 12 feet above the ground, and Stage 2 is switch-controlled for low mounting heights at 12 feet and below.

Stage 1 will be continuous nighttime lighting turned on with a photocell and designed to meet minimum requirements for safety and security. The general purpose of Stage 1 lighting is to light the ground and general area to the fence. Designing Stage 1 continuous lighting should follow Illuminating Engineering Society of North America (IESNA) RP-33-99 recommended practices for maximum lighting at the fence and past the fence, except where National Electrical Safety Code (NESC) requirements supersede these guidelines for safety reasons or *Federal Register* requirements supersede these guidelines for spill-containment facilities. Stage 1 lighting fixtures mounted at an elevation above 12 feet should be the cutoff or full-cutoff type to reduce off-site glare.

The Stage 2 lighting will be provided for temporary operational needs and will only be turned on when required. Stage 2 lighting is intended to provide visibility of substation structures and devices, to operate switches, and to perform tasks. Design of Stage 2 lighting should follow NESC and IESNA RP-7-01 recommended practices for task lighting.

Substation structures should be utilized for mounting Stage 1 and Stage 2 lighting fixtures wherever feasible. Lighting fixtures should be mounted at the minimum elevation required to provide coverage dictated by the required vertical and horizontal light levels and uniformity. Lights may be mounted above an elevation of 40 feet when required for security reasons, such as cameras, or lighting of objects taller than 40 feet.

For Minor Modifications to Existing Facilities
Additional lighting required for substation modifications will follow the basic existing lighting design. To the degree possible, substation structures should be utilized to mount light fixtures. Lighting fixtures may be mounted at an elevation above 40 feet when required for site coverage, security reasons, such as cameras, or lighting of objects taller than 40 feet. All substation lights mounted at an elevation above 12 feet should be cutoff or full-cutoff type, such that no light is emitted from the fixture at lateral angles above 90 degrees (above the horizontal plane) to reduce off-site glare, unless the light is required for operational needs, such as the operation of a disconnect switch mounted at a higher elevation. To the extent possible, lighting additions should follow *Federal Register*, NESC, IESNA RP-7-01, and IESNA RP-33-99 recommended practices for lighting.

The Stage 1 and Stage 2 lighting approach will not be considered for minor modifications because of the difficulty in rearranging wiring circuits for lighting power supply and control. These changes are more appropriately addressed when major modifications are made.

(For major modifications to existing substations, consideration should be given to implement lighting policies for greenfield sites. This can be determined during site visits and project scoping.)

General Design Issues and Design Principle Definitions

- A Good Neighbor. Most of the design constraints are summed up by this principle. Thoughtful consideration of the neighbors is critical to the success of the design.

- Luminaire Optical Properties. Four designations are used for the light control of outdoor lighting fixtures: Full Cutoff (0 percent, <10 percent), Cutoff (<2.5 percent, <10 percent), Semicutoff (<5 percent, < 20 percent), and Noncutoff. These are in terms of a percentage of the lamp's intensity lateral to the fixture and at an angle 10 degrees below the horizontal plane.

- Light Levels. Light levels are determined for both horizontal and vertical surfaces by the appropriate standards. Principally American National Standards Institute (ANSI)/IESNA RP-7-01, IESNA RP-33-99, IESNA *Lighting Handbook,* 9th Edition, 2000, blue pages Safety/Security-1, IESNA G-1-03, and the NESC, Section 111.A, should be considered.

- Neighboring Property Uses. The lighting design shall consider ways to reduce light trespass in directions where neighbors are known to exist through light fixture placement and control of the fixture light output.

- Design Standards. Design standards are general engineering guides to proper application of lighting equipment to achieve lighting levels consistent with their recommended standards. Primary design standards are listed under the "Light Levels" definition.

- Physical Security Survey. If warranted, specific lighting needs can be determined through the process outlined in IESNA G-1-03, Annex B, with measurements according to Annex C.

- Television Surveillance. If required, television surveillance provides lighting compatible with the needs of camera visibility, which may or may not enhance human visibility.

- Mounting Heights. Mounting height is a key factor in determining the uniformity or evenness of the light level. For substations, mounting heights are defined as Stage 1 or Stage 2 for high and low under "Mounting Locations." Generally, mounting heights provide good uniformity on the ground or structure when lights are spaced a distance two times the mounting height or lateral distance. Aboveground structures will have decreased uniformity by the same ratio unless this design geometry is considered. For example, lights at a 12-foot mounting height typically provide uniform coverage on the ground 24 feet wide. Spacing between fixtures of 48 feet would provide good uniformity on the ground. When lighting vertical structures, the distance to the light affects the uniformity in the same way.

- Mounting Locations. Low mounting heights are defined as 12 feet and below and high mounting heights are above 12 feet.

- Terrain. Nuisance glare and light trespass are also a function of the substation height above or below the average local terrain, including land contours and vegetation height. Terrain can shield fixtures and reduce lighting control requirements.

- Temporary Lighting Systems. Systems designed for outages and limited to portable systems should have no restrictions due to their temporary nature.

- Permanent Lighting Systems. These systems require the most care due to their persistent effect on the neighbors.

- New Construction Greenfield Sites. These sites have a higher level of care due to the clean slate available to accommodate good lighting design.

- Minor Substation Modifications. Small modifications include substation component replacement and expansions of less than 50 percent of the substation capacity. Following the existing lighting design pattern in these cases is acceptable practice to expand the lighting system coverage.

- Extensive Substation Modifications. Extensive modifications involve site voltages or expansions of more than 50 percent capacity. Lighting should be evaluated by design engineers to determine feasibility of using the design approaches of new construction greenfield sites.

- Safety. Wherever unsafe conditions are present, in the judgment of design engineers, additional lighting is warranted.

References

IESNA G-1-03, *Guideline on Security Lighting for People, Property, and Public Spaces*

IESNA *Lighting Handbook,* 9th Edition, 2000, blue pages Safety/Security-1

IESNA RP-7-01, *Recommended Practice for Lighting Industrial Facilities*

IESNA RP-33-99, *Recommended Practice for Lighting for Exterior Environments*

NESC, Institute of Electrical and Electronic Engineers (IEEE), *ANSI/IEEE C2-2007*, 2007 Edition

May 2008 Revision

This page intentionally left blank

Appendix G – TVA Quality Protection Specifications for Transmission, Substation or Communications Construction

This page intentionally left blank

Tennessee Valley Authority Environmental Quality Protection Specifications for Transmission, Substation or Communications Construction

1. General – Tennessee Valley Authority (TVA) and/or the assigned contractor and subcontractors shall plan, coordinate, and conduct his or her operations in a manner that protects the quality of the environment and complies with TVA's environmental expectations discussed in the preconstruction meeting (including clearing and grading or reclearing and removal or dismantling). This specification contains provisions that shall be considered in all TVA and contract construction, dismantling, or forensic operations. If the contractor and his or her subcontractors fail to operate within the intent of these requirements, TVA will direct changes to operating procedures. Continued violation will result in a work suspension until correction or remedial action is taken by the contractor. Penalties and contract termination will be used as appropriate. The costs of complying with the Environmental Quality Protection Specifications are incidental to the contract work, and no additional compensation will be allowed. At all site perimeters, structure, foundation, conduit, grounding, fence, drainage ways, etc., appropriate protective measures to prevent erosion or release of contaminants will be taken immediately upon the end of each step in a construction, dismantling, or forensic sequence, and those protective measures will be inspected and maintained throughout the construction and site stabilization and rehabilitation period.

2. Regulations - TVA and/or the assigned contractor and subcontractor(s) shall comply with all applicable federal, state, and local environmental and antipollution laws, regulations, and ordinances related to environmental protection and prevention, control, and abatement of all forms of pollution.

3. Use Areas - TVA and/or the assigned contractor and/or subcontractor(s) use areas include but are not limited to site office, shop, maintenance, parking, storage, staging, assembly areas, utility services, and access roads to the use areas. The construction contractor and subcontractor(s) shall submit plans and drawings for their location and development to the TVA engineer and project manager for approval. Secondary containment will be provided for fuel and petroleum product storage pursuant to 29CFR1910.106(D)(6)(iii)(OSHA).

4. Equipment - All major equipment and proposed methods of operation shall be subject to the approval of TVA. The use or operation of heavy equipment in areas outside the right-of-way, access routes, site, or structure, pole, or tower sites will not be permitted without permission of the TVA inspector or field engineer. Heavy equipment use on steep slopes (greater than 20 percent) and in wet areas will be held to the minimum necessary to construct the transmission or communication facility. Steps will be taken to limit ground disturbance caused by heavy equipment usage, and erosion and sediment controls will be instituted on disturbed areas in accordance with state requirements and best management practices (BMPs).

   No subsurface ground-disturbing equipment or stump-removal equipment will be used by construction forces except on access roads or at the actual site, structure, pole, or tower sites, where only footing locations and controlled runoff diversions shall be created that disturb the soil. All other areas of ground cover or in-place stumps and

roots shall remain in place. (Note: Tracked vehicles disturb surface layer of the ground due to size and function.) Some disking of the right-of-way, access, and site(s) may occur for proper seedbed preparation.

Unless ponding previously occurred (i.e., existing low-lying areas), water should not be allowed to pond on the site or around structures except around foundation holes; the water must be directed away from the site in as dispersed a manner as possible. At tower or structure sites, some means of upslope interruption of potential overland flow and diversion around the footings should be provided as the first step in construction-site preparation. If leveling is necessary, it must be implemented by means that provide for continuous gentle, controlled, overland flow or percolation. A good grass cover, straw, gravel, or other protection of the surface must be maintained. Steps taken to prevent increases in the moisture content of the in-situ soils will be beneficial both during construction and over the service life of any anchor, foundation, or its structure.

5. Sanitation - A designated TVA or contractor and/or subcontractor(s) representative shall contract a sanitary contractor who will provide sanitary chemical toilets convenient to all principal points of operation for every working party. The facilities shall comply with applicable federal, state, or local health laws and regulations. They shall not be located closer than 100 feet to any stream or tributary or to any wetland. The facilities shall be required to have proper servicing and maintenance, and the waste disposal contractor shall verify in writing that the waste disposal will be in state-approved facilities. Employees shall be notified of sanitation regulations and shall be required to use the toilet facilities.

6. Refuse Disposal - Designated TVA and/or contractor and subcontractor(s) personnel shall be responsible for daily inspection, cleanup, and proper labeling, storage, and disposal of all refuse and debris produced by his or her operations and by his or her employees. Suitable refuse collecting facilities will be required. Only state-approved disposal areas shall be used. Disposal containers such as dumpsters or roll-off containers shall be obtained from a proper waste disposal contractor. Solid, special, construction/demolition, and hazardous wastes as well as scrap are part of the potential refuse generated and must be properly managed with emphasis on reuse, recycle, or possible give away, as appropriate, before they are handled as wastes. Records of the amounts generated shall be provided to the site's or project's designated environmental specialist. Contractor(s) and subcontractor(s) must meet similar provisions on any project contracted by TVA. Final debris, refuse, product, and material removal is the responsibility of the contractor unless special written agreement is made with the ultimate TVA owner of the site.

7. Landscape Preservation - TVA and its contractor(s) and subcontractor(s) shall exercise care to preserve the natural landscape in the entire construction, dismantling, or forensic area as well as use areas, in or outside the right-of-way, and on or adjacent to access roads. Construction operations shall be conducted to prevent any unnecessary destruction, scarring, or defacing of the natural vegetation and surroundings in the vicinity of the work.

8. Sensitive Areas Preservation - Certain areas on site and along the access and/or right-of-way may be designated by the specifications or the TVA engineer as environmentally sensitive. These areas include but are not limited to areas classified as erodible, geologically sensitive, scenic, historical and archaeological, fish and wildlife refuges,

endangered species' habitat, water supply watersheds, and public recreational areas such as parks and monuments. Contractors, their subcontractor(s), and TVA construction crews shall take all necessary actions to avoid adverse impacts to these sensitive areas and their adjacent buffer zones. These actions may include suspension of work or change of operations during periods of rain or heavy public use; hours may be restricted or concentrations of noisy equipment may have to be dispersed. If prehistoric or historic artifacts or features are encountered during clearing, grading, borrow, fill, construction, dismantling, or forensic operations, the operations shall immediately cease for at least 100 feet in each direction, and TVA's construction superintendent, project manager, or area environmental program administrator and TVA Cultural Resources Program shall be notified. The site shall be left as found until a significance determination is made. Work may continue elsewhere beyond the 100-foot perimeter.

9. Water Quality Control - TVA and contractor construction, dismantling, or forensic activities shall be performed by methods that will prevent entrance or accidental spillage of solid matter, contaminants, debris, and other objectionable pollutants and wastes into flowing caves, sinkholes, streams, dry watercourses, lakes, ponds, and underground water sources.

   The clearing contractor erected erosion and/or sedimentation control shall be maintained and (when TVA or contract construction personnel are unable) the construction crew(s) shall maintain BMPs such as silt fences on steep slopes and adjacent to any stream, wetland, or other water body. Additional BMPs may be required for areas of disturbance created by construction activities and at sequential steps of construction at the same location on site. BMPs will be inspected by the TVA field engineer or other designated TVA or contractor and/or subcontractor(s) personnel routinely and during periods of high runoff, and any necessary repairs will be made as soon as practicable. BMP inspections and any required sampling will be conducted in accordance with permit requirements. Records of all inspections and sampling results will be maintained on site, and copies of inspection forms and sampling results will be forwarded to the TVA project manager or supporting environmental specialist. Acceptable measures for disposal of waste oil from vehicles and equipment shall be followed. No waste oil shall be disposed of within the site, access, or right-of-way, on a related construction site or its access roads.
10. Turbidity and Blocking of Streams - Construction, dismantling, or forensic activities in or near streamside management zones or other bodies of water shall be controlled to prevent the water turbidity from exceeding state or local water quality standards for that stream. **All conditions** of a general storm water permit, aquatic resource alteration permit, or a site-specific permit **shall be met** including monitoring of turbidity in receiving streams and/or storm water discharges and implementation of appropriate erosion and sediment control measures.

    Appropriate drainage facilities for temporary construction, dismantling, or forensic activities interrupting natural site drainage shall be provided to avoid erosion. Watercourses shall not be blocked or diverted unless required by the specifications or the TVA engineer. Diversions shall be made in accordance with TVA's *A Guide for Environmental Protection and Best Management Practices for Tennessee Valley Authority Transmission Construction and Maintenance Activities.*
    On rights-of-way, mechanized equipment shall not be operated in flowing or standing water bodies except when approved and, then, only to construct crossings or to perform

required construction under direct guidance of TVA. Construction of stream fords or other crossings will only be permitted at approved locations and to current TVA construction access road standards. Material shall not be deposited in watercourses, their adjacent wetlands, or within stream bank areas where it could be washed away by high stream flows. Appropriate U.S. Army Corps of Engineers' and state permits shall be obtained.

Mechanized equipment shall not be operated in flowing or standing water on substation, switching station, or telecommunication sites.

Wastewater from construction, dismantling, or dewatering operations shall be controlled to prevent excessive erosion or turbidity in a stream, wetland, lake, pond or conveyed to a sinkhole. Any work or placing of equipment within a flowing or dry watercourse requires the prior approval of TVA.

11. Floodplain Evaluation - During the planning and design phase of the substation or communications facility, floodplain information should be obtained to avoid locating flood-damageable facilities in the 100-year floodplain. If the preferred site is located within a floodplain area, alternative sites must be evaluated and documentation prepared to support a determination of "no practicable alternative" to siting in the floodplain. In addition, steps taken to minimize adverse floodplain impacts should also be documented.

12. Clearing - No construction, dismantling, or forensic activities may clear additional site or right-of-way vegetation or disturb remaining retained vegetation, stumps, or regrowth at locations other than the structure, substation, or communication site or access thereto. TVA and the construction, dismantling, or forensic contractor(s) must provide appropriate erosion or sediment controls for areas they have disturbed after each disturbance that have previously been restabilized after clearing operations. Control measures shall be implemented as soon as practicable after disturbance in accordance with applicable federal, state, and/or local storm water regulations.

13. Restoration of Site - All construction, dismantling, or forensic-related disturbed areas with the exception of farmland under cultivation and any other areas as may be designated by TVA's specifications shall be stabilized in the following manner unless the property owner and TVA's engineer specify a different method:

    A. The subsoil shall be loosened to a minimum depth of 6 inches if possible and worked to remove unnatural ridges and depressions.

    B. If needed, appropriate soil amendments will be added.

    C. All disturbed areas will initially be seeded with a temporary ground cover such as winter wheat, rye, or millet, depending on the season. Perennials may also be planted during initial seeding if proper growing conditions exist. Final restoration and final seeding will be performed as line construction is completed. Final seeding will consist of permanent perennial grasses such as those outlined in TVA's *A Guide for Environmental Protection and Best Management Practices for Tennessee Valley Authority Transmission Construction and Maintenance Activities.* Exceptions would include those areas designated as native grass planting areas. Initial and final restoration will be performed by the clearing contractor.

D. Rehabilitation species shall use species designated by federal guidance that are low–maintenance, native species appropriate for the site conditions that prevail at that location.

E. TVA holds the option, depending upon the time of year and weather condition, to delay or withdraw the requirement of seeding until more favorable planting conditions are certain. In the meantime, other stabilization techniques must be applied.

F. The site must be protected from species designated by the federal Invasive Species Council and must not be the source of species that can be transported to other locations via equipment contaminated with viable materials; thus, the equipment must be inspected, and any such species' material found must be removed and destroyed prior to transport to another location.

14. Air Quality Control - Construction, dismantling, and/or forensic crews shall take appropriate actions to minimize the amount of air pollution created by their operations. All operations must be conducted in a manner that avoids creating a nuisance and prevents damage to lands, crops, dwellings, or persons.

15. Burning - Before conducting any open burning operations, the contractor and subcontractor(s) shall obtain permits or provide notifications as required to state forestry offices and/or local fire departments. Burning operations must comply with the requirements of state and local air pollution control and fire authorities and will only be allowed in approved locations and during appropriate hours and weather conditions. If weather conditions such as wind direction or speed change rapidly, the contractor's burning operations may be temporarily stopped by the TVA field engineer. The debris for burning shall be piled and shall be kept as clean and as dry as possible, then burned in such a manner as to reduce smoke. No materials other than dry wood shall be open burned. The ash and debris shall be buried away from streams or other water sources and shall be in areas coordinated with the property owner on rights-of-way or project manager for TVA sites.

16. RENOVATION OR DEMOLITION DEBRIS MAY NOT BE BURNED.

17. Dust and Mud Control - Construction, dismantling, or forensic activities shall be conducted to minimize the creation of dust. This may require limitations as to types of equipment, allowable speeds, and routes utilized. Water, straw, wood chips, dust palliative, gravel, combinations of these, or similar control measures may be used subject to TVA's approval. On new construction sites and easements, the last 100 feet before an access road approaches a county road or highway shall be graveled to prevent transfer of mud onto the public road.

18. Vehicle Exhaust Emissions - TVA and/or the contractor(s) and subcontractor(s) shall maintain and operate equipment to limit vehicle exhaust emissions. Equipment and vehicles that show excessive emissions of exhaust gasses and particulates due to poor engine adjustments or other inefficient operating conditions shall not be operated until corrective repairs or adjustments are made.

19. Vehicle Servicing - Routine maintenance of personal vehicles will not be performed on the right-of-way or access route to the site. However, if emergency or "have to"

situations arise, minimal/temporary maintenance to personal vehicles will occur in order to mobilize the vehicle to an off-site maintenance shop. Heavy equipment will be serviced on the site except adjacent to or in designated sensitive areas. The Heavy Equipment Department within TVA or the construction, dismantling, or forensic contractor will properly maintain these vehicles with approved spill protection controls and countermeasures. If emergency maintenance in a sensitive or questionable area arises, the area environmental coordinator or construction environmental engineer will be consulted. All wastes and used oils will be properly recovered, handled, and disposed/recycled. Records of amounts generated shall be provided to TVA. Equipment shall not be temporarily stored in stream floodplains whether overnight or on weekends or holidays.

20. Smoke and Odors - TVA and/or the contractor(s) and subcontractor(s) shall properly store and handle combustible material that could create objectionable smoke, odors, or fumes. The contractor and subcontractor(s) shall not burn refuse such as trash, rags, tires, plastics, or other debris.

21. Noise Control - TVA and/or the contractor and subcontractor(s) shall take measures to avoid the creation of noise levels that are considered nuisances, safety, or health hazards. Critical areas including but not limited to residential areas, parks, public use areas, and some ranching operations will require special considerations. TVA's criteria for determining corrective measures shall be determined by comparing the noise level of the construction, dismantling, or forensic operation to the background noise levels. In addition, especially noisy equipment such as helicopters, pile drivers, air hammers, chippers, chain saws, or areas for machine shops, staging, assembly, or blasting may require corrective actions when required by TVA.

22. Noise Suppression - All internal combustion engines shall be properly equipped with mufflers as required by the Department of Labor's *Safety and Health Regulations for Construction.* TVA may require spark arresters in addition to mufflers on some engines. Air compressors and other noisy equipment may require sound-reducing enclosures in some circumstances.

23. Damages - The movement of construction, dismantling, or forensic crews and equipment shall be conducted in a manner that causes as little intrusion and damage as possible to crops, orchards, woods, wetlands, and other property features and vegetation. The contractor and subcontractor(s) will be responsible for erosion damage caused by his or her actions and employees and, especially, for creating conditions that would threaten the stability of the right-of-way or site soil, the structures, or access to either. When property owners prefer the correction of ground cover condition or soil and subsoil problems themselves, the section of the project to be handled shall be documented with an implementation schedule and a property owner signature obtained.

24. Final Site Cleanup and Inspection - The contractor’s designated person shall ensure that all construction, dismantling, or forensic-related debris, products, materials, and wastes are properly handled, labeled as required, and removed from the site. Upon completion of those activities, that person and a TVA-designated person shall walk down the site and complete an approval inspection.

Revision April 2007

Appendix H – TVA Energy Delivery Environmental Protection Procedures Right-of-Way Vegetation Management Guidelines

This page intentionally left blank

Tennessee Valley Authority Environmental Energy Delivery Environmental Protection Procedures Right of Way Vegetation Management Guidelines

1.0 Overview

A. The Tennessee Valley Authority (TVA) must manage the vegetation on its rights-of-way and easements to ensure emergency maintenance access and routine access to structures, switches, conductors, and communications equipment. In addition, TVA must maintain adequate clearance, as specified by the National Electrical Safety Code, between conductors and tall-growing vegetation and other objects. This requirement applies to vegetation within the right-of-way as well as to trees located off the right-of-way.

B. Each year TVA assesses the conditions of the vegetation on and along its rights-of-way. This is accomplished by aerial inspections, periodic field inspections, aerial photography, and information from TVA personnel, property owners, and the general public. Important information gathered during these assessments includes the coverage by various vegetation types, the mix of plant species, the observed growth, the seasonal growing conditions, and the density of the tall vegetation. TVA also evaluates the proximity, height, and growth rate of trees adjacent to the right-of-way that may be a danger to the line or structures.

C. TVA right-of-way specialists develop a vegetation reclearing plan that is specific to each line segment and is based on terrain conditions, species mix, growth, and density.

2.0 Right-of-Way Management Methods

A. TVA uses an integrated vegetation management approach. In farming areas, TVA encourages property owner management of the right-of-way using low-growing crops. In dissected terrain with rolling hills and interspersed woodlands, TVA uses mechanical mowing to a large extent.

B. When slopes become hazardous to farm tractors and rotary mowers, TVA may use a variety of herbicides specific to the species present with a variety of possible application techniques. When scattered small stands of tall-growing vegetation are present and access along the right-of-way is difficult or the path to such stands is very long, herbicides may be used.

C. In very steep terrain, in sensitive environmental areas, in extensive wetlands, at stream banks, and in sensitive property owner land use areas, hand clearing may be utilized. Hand clearing is recognized as one of the most hazardous occupations documented by the Occupational Safety and Health Administration. For that reason, TVA is actively looking at better control methods, including use of low-volume herbicide applications, occasional single tree injections, and tree growth regulators (TGRs).

Energy Delivery Guideline
Revision 2, April 27, 2012

D. TVA does not encourage tree re-clearing by individual property owners because of the high hazard potential of hand clearing, possible interruptions of the line, and electrical safety considerations for untrained personnel that might do the work. Private property owners may re-clear the right-of-way with trained re-clearing professionals.

E. Mechanical mowers not only cut the tall saplings and seedlings on the right-of-way, they also shatter the stump and the supporting near surface root crown. The tendency of resistant species is to re-sprout from the root crown and shattered stumps can produce a multi-stem dense stand in the immediate area. Repeated use of mowers on short cycle re-clearing with many original stumps re-growing in the above manner can create a single species thicket or monoculture. With the original large root system and multiple stems, the resistant species can produce re-growth at the rate of 5-10 feet in a year. In years with high rainfall, the growth can reach 12-15 feet in a single year. These dense, monoculture stands can become nearly impenetrable for even large tractors. Such stands have low diversity, little wildlife food or nesting potential, and become a property owner's concern. Selective herbicide application may be used to control monoculture stands.

F. TVA encourages property owners to sign an agreement to manage rights-of-way on their land for wildlife under the auspices of "Project Habitat," a joint project by TVA, BASF, and wildlife organizations, e.g., National Wild Turkey Federation, Quail Unlimited, and Buckmasters. The property owner maintains the right-of-way in wildlife food and cover with emphasis on quail, turkey, deer or other wildlife. A variation used in or adjacent to developing suburban areas is to sign agreements with the developer and residents to plant and maintain wildflowers on the right-of-way.

G. TVA places strong emphasis on managing rights-of-way in the above manner. When the property owners do not agree to these opportunities, TVA must maintain the right-of-way in the most environmentally acceptable, cost-effective, and efficient manner possible.

3.0 Herbicide Program

A. TVA has worked with universities (such as Mississippi State University, University of Tennessee, Purdue University, and others), chemical manufacturers, other utilities, U.S. Department of Transportation, U.S. Fish and Wildlife Service (USFWS), and U.S. Forest Service (USFS) personnel to explore options for vegetation control. The results have been strong recommendations to use species-specific, low volume herbicide applications in more situations. Research, demonstrations, and other right-of-way programs show a definite improvement of rights-of-way treated with selective low-volume applications of new herbicides using a variety of application techniques and timing. Table 1 below identifies herbicides currently used on TVA rights-of-way. Table 2 identifies pre-emergent herbicides currently being used on bare ground areas on TVA rights-of-way and in substations. Table 3 identifies TGRs that may be used on tall trees that have special circumstances that require trimming on a regular cycle, e.g., restrictions on complete removal. The rates of application utilized are those listed on the U.S. Environmental Protection Agency (USEPA) approved label and consistent with utility standard practice throughout the Southeast.

Table 1 - Herbicides Currently Used on TVA Rights-of-Way

Trade Name	Active Ingredients	Label Signal
Accord	Glyphosate/Liquid	Caution
Arsenal	Imazapyr/Liquid/Granule	Caution
Chopper	Imazapyr/RTU	Caution
Clearstand	Imazapyr/Metsulfuron/Methyl/Liquid	Caution
Escort	Metsulfuron Methyl/Dry Flowable	Caution
Garlon	Triclopyr/Liquid	Caution
Garlon 3A	Triclopyr/Liquid	Danger
Habitat	Imazapyr/Liquid	Caution
Krenite S	Fosamine Ammonium	Caution
Milestone VM	Aminopyralid/Liquid	Caution
Pathfinder II	Triclopyr/RTU	Caution
Rodeo	Glyphosate/Liquid	Caution
Roundup	Glyphosate/Liquid	Caution
Roundup Pro	Glyphosate	Caution
Streamline	Aminocyclopyrachlor/Metsulfuron/Liquid	Caution
Transline	Clopyralid/Liquid	Caution

Table 2 - Preemergent Herbicides Currently Used for Bare Ground Areas on TVA Rights-of-Way

Trade Name	Active Ingredients	Label Signal Word
Arsenal 5G	Imazapyr/Granule	Caution
Sahara	Diuron/Imazapyr	Caution
SpraKil SK-26	Tebuthiuron/Diuron/Granules	Caution
SpraKil S-5	Tebuthiuron/Granules	Caution
Topsite	Diuron/Imazapyr	Caution

Table 3 - Tree Growth Regulators Currently Used on TVA Rights-of-Way

Trade Name	Active Ingredients	Label Signal Word
Profile 2SC	TGR-paclobutrazol	Caution
TGR	Flurprimidol	Caution

B. The herbicides listed in Tables 1 and 2 and TGRs listed in Table 3 have been evaluated in extensive studies in support of registration applications and label requirements. Many have been reviewed in the USFS vegetation management environmental impact statements (EISs), and those evaluations are incorporated here by reference (USFS 1989a, 1989b, 2002a, and 2002b). Electronic copies can be accessed at http://www.fs.fed.us/r8/planning/documents/vegmgmt/. The result of these reviews has been a consistent finding of limited environmental impact beyond that of control of the target vegetation. All the listed herbicides have been found to be of low environmental toxicity when applied by trained applicators following the label and registration procedures, including prescribed measures, such as buffer zones, to protect threatened and endangered species.

C. Low-volume herbicide applications are recommended since research demonstrates much wider plant diversity after such applications. There is better ground erosion protection and more wildlife food plants and cover plants develop. In most situations there is increased development of wild flowering plants and shrubs. In conjunction with herbicides, the diversity and density of low-growing plants provide control of tall-growing species through competition.

D. Wildlife managers often request the use of herbicides in place of rotary mowing in order to avoid damage to nesting and tunneling wildlife. This method retains ground cover year around with a better mix of food species and associated high-protein insect populations for birds in the right seasons. Most also report less damage to soils (even when compared with rubber-tired equipment).

E. Property owners interested in tree production often request the use of low volume applications rather than hand or mechanical clearing because of the insect and fungus problems in damaged vegetation and debris left on the right-of-way. The insect and fungus invasions, such as pine tip moth, oak leaf blight, sycamore and dogwood blight, etc., are becoming widespread across the nation.

F. Best management practices (BMPs) governing application of herbicides are contained within *A Guide for Environmental Protection and Best Management Practices for Tennessee Valley Authority Transmission Construction and Maintenance Activities* (Muncy 1999) which is incorporated by reference. Herbicides can be liquid, granular, or powder and can be applied aerially or by ground equipment and may be selectively applied or broadcast, depending on the site requirements, species present, and condition of the vegetation. Water quality considerations include measures taken to keep herbicides from reaching streams whether by direct application or through runoff of or flooding by surface water. "Applicators" must be trained, licensed, and follow manufacturers' label instructions, USEPA guidelines, and respective state regulations and laws.

G. When herbicides are used, their potential adverse impacts are considered in selecting the compound, formulation, and application method. Herbicides that are designated "Restricted Use" by USEPA require application by or under the supervision of applicators certified by the respective state control board. Aerial and ground applications are either done by TVA or by contractors in accordance with the following guidelines identified in TVA's BMPs manual (Muncy 1999):

   1. The sites to be treated are selected and application directed by the appropriate TVA official.
   2. A preflight walking or flying inspection is made within 72 hours prior to applying herbicides aerially. This inspection ensures that no land use changes have occurred, that sensitive areas are clearly identified to the pilot, and that buffer zones are maintained.
   3. Aerial application of liquid herbicides will normally not be made when surface wind speeds exceed 5 miles per hour, in areas of fog, or during periods of temperature inversion.
   4. Pellet application will normally not be made when the surface wind speeds exceed 10 miles per hour, or on frozen or water-saturated soils.

5. Liquid application is not performed when the temperature reaches 95 degrees Fahrenheit or above.
6. Application during unstable, unpredictable, or changing weather patterns is avoided.
7. Equipment and techniques are used that are designed to ensure maximum control of the spray swath with minimum drift.
8. Herbicides are not applied to surface water or wetlands unless specifically labeled for aquatic use. Filter and buffer strips will conform at least to federal and state regulations and any label requirements. The use of aerial or broadcast application of herbicides is not allowed within a streamside management zone (SMZs) adjacent to perennial streams, ponds, and other water sources. Hand application of certain herbicides labeled for use within SMZs is used only selectively.
9. Buffers and filter strips (200 feet minimum width) are maintained next to agricultural crops, gardens, farm animals, orchards, apiaries, horticultural crops, and other valuable vegetation.
10. Herbicides are not applied in the following areas or times: (a) in city, state, and national parks or forests or other special areas without written permission and/or required permits (b) off the right-of-way and (c) during rainy periods or during the 48- hour interval prior to rainfall predicted with a 20 percent or greater probability by local forecasters, when soil active herbicides are used.

H. TVA currently uses primarily low-volume applications of foliar and basal applications, e.g., Accord (Glyphosate), Arsenal (Imazapyr), Clearstand (Imazapyr / Metsulfuron Methyl), Milestone VM (Aminopyralid), and Streamline (Aminocyclopyrachlor / Metsulfuron Methyl).

4.0 References

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.

U.S. Forest Service. 1989a. Vegetation Management in the Coastal Plain/Piedmont Final Environmental Impact Statement, Volumes I and II. Southern Region Management Bulletin R8-MB-23, January 1989. Atlanta, Ga.: USDA Forest Service.

———. 1989b. Vegetation Management in the Appalachian Mountains Final Environmental Impact Statement, Volumes I and II. Southern Region Management Bulletin R8-MB-38, July 1989. Atlanta, Ga.: USDA Forest Service.

———. 2002a. Vegetation Management in the Appalachian Mountains Final Environmental Impact Statement Supplement. Southern Region Management Bulletin R8-MB-97A, October 2002. Atlanta, Ga.: USDA Forest Service.

———. 2002b. Vegetation Management in the Coastal Plain/Piedmont Final Environmental Impact Statement Supplement. Southern Region Management Bulletin R8-MB-98A, October 2002. Atlanta, Ga.: USDA Forest Service.

Appendix I – Memorandum of Agreement Between TVA and the U.S. Fish and Wildlife Service

This page intentionally left blank

INDIANA BAT CONSERVATION
MEMORANDUM OF AGREEMENT
BETWEEN THE
U.S. FISH AND WILDLIFE SERVICE
AND
TENNESSEE VALLEY AUTHORITY

This Memorandum of Agreement (MOA) is entered into by the United States Department of the Interior, U.S. Fish and Wildlife Service (Service) and Tennessee Valley Authority (TVA) to promote the survival and recovery of the Indiana bat (*Myotis sodalis*), a federally listed endangered species. Together, the Service and TVA are referred to as "Cooperators."

Section 1: PURPOSE AND OBJECTIVES

The Indiana bat is a federally listed endangered species native to a large portion of the eastern United States and the State of Tennessee. This MOA will implement recovery-focused conservation measures that will be undertaken by the Cooperators and afford a measurable conservation benefit for the Indiana bat as set forth in the Tennessee Field Office of the Service's Interim Indiana Bat Mitigation Guidance for the State of Tennessee, hereby incorporated by reference. These measures will be implemented in association with the proposed project as detailed in section 4 of this MOA. All measures will be implemented according to the terms of this MOA. The Cooperators understand and intend that the benefits resulting from this MOA may also provide conservation benefits for other federal protected species and native fish and wildlife.

Section 2: AUTHORITY

This MOA is hereby entered into under the authorities of the Endangered Species Act (16 U.S.C. 1531 *et seq.*) (ESA), Fish and Wildlife Act of 1956 (16 U.S.C. 742a. *et seq.*), and the Fish and Wildlife Coordination Act (16 U.S.C. 661 *et seq.*). Section 5 of the ESA provides that, "The Secretary…shall establish and implement a program to conserve fish, wildlife, and plants, including those which are listed as endangered species or threatened species..." and "shall utilize land acquisition and other authority under the Fish and Wildlife Act, as amended, and the Migratory Bird Conservation Act, as appropriate". Section 7(a) (1) of the ESA further directs Federal agencies to "utilize their authorities in furtherance of the purposes of this Act [ESA] by carrying out programs for the conservation of endangered species and threatened species." The Fish and Wildlife Act of 1956 provides that the Secretary shall "...take such steps as may be required for the development, advancement, management, conservation, and protection of fish and wildlife resources...." Finally, the Fish and Wildlife Coordination Act states that the Secretary is authorized "to provide assistance to, and cooperate with, Federal, State, and public

or private agencies and organizations in the development, protection, rearing, and stocking of all species of wildlife, resources thereof, and their habitat..."

The authorization for any incidental take of the Indiana bat, as defined in section 9 of the ESA, and resulting from impacts that may be associated with the qualified project, as defined in section 4 of this MOA, is provided through the Service's incidental take statement and November 25, 2014, intra-Service biological opinion, which is incorporated herein by this reference. This biological opinion covers the Service's development of this MOA for the Indiana bat, which is based on implementation of the Interim Indiana Bat Mitigation Guidance and provides incidental take of Indiana bats in the form of potential roosting structures (i.e., trees or snags) on up to 6.4 acres of property.

Section 3: STATEMENT OF MUTUAL INTEREST

The mission of the Service is to work with others to conserve, protect, and enhance fish, wildlife, and plants and their habitats for the continuing benefit of the American people. The Service's major responsibilities are for endangered and threatened species, migratory birds, marine mammals, and freshwater and anadromous fish. The Service recognizes the ability and interest of TVA to contribute to the conservation and recovery of the Indiana bat, and recognizes TVA as a partner in the recovery of the species and conservation of its habitat. TVA recognizes the Service's mission and its interest in developing partnerships to protect, restore, and manage important habitats on private and public lands for federal listed species. The Cooperators understand that the collaboration for this MOA is voluntary.

Section 4: PROJECT DESCRIPTION

Tennessee Valley Authority is proposing to build the Selmer-West Adamsville Transmission line, which will consist of approximately 15 miles of new transmission line along a new 100 foot wide right of way and a new switching station. Upgrades to the existing, adjacent TVA lines and 25 access roads would be required to construct and support this new line. In total, the project is approximately 238 acres, of which approximately 74 acres of forested habitat would be removed and maintained as early successional habitat.

The proposed project would result in the direct loss of potential bat roosting structures within a 6.4-acre area, which involve one Indiana bat habitat type as depicted in Table 1 below.

Table 1

Habitat Type	Forested Acreage Removed
Potential Habitat	6.4 acres

These Indiana bat habitat impacts are the impacts that are covered by this agreement and that were evaluated by the Service to assess the direct, indirect, and cumulative effects of the proposed project on Indiana bats.

Section 5: EFFECTIVE DATE AND TERMS OF AGREEMENT

This MOA is valid for TVA consideration for 90 days from the date of the Service's signature below, shall be deemed effective on the last date signed below, and shall remain in effect until all terms of the agreement have been fulfilled, except as modified in Section 8 hereof. TVA has determined that the removal of all Indiana bat habitat will occur during the timeframe when the Indiana bat is not anticipated to be present (i.e., when habitat is unoccupied), which is between the dates of October 15 and March 31 for this project. The Indiana Bat Conservation Fund contribution amount that is identified in section 6.4 of the MOA is based on the assumption that all removal of suitable roosting trees and snags associated with the project will be conducted during the unoccupied timeframe. Structures that are not suitable for bat roosting may be removed any time of year. If the timeframe or other aspects of the project are to be revised, then TVA must coordinate with the Service to determine if additional modification of this agreement is necessary. If found necessary, TVA will seek such modification.

Section 6: SPECIFIC OBLIGATIONS OF THE COOPERATORS

TVA and the Service agree to fulfill the following conditions to minimize the potential level of take of the Indiana bat, compensate for adverse effects on the Indiana bat that may result from construction of the project, and promote future conservation and recovery of the Indiana bat:

6.1 The Service will take the necessary steps to ensure that the project covered under this MOA meets federal requirements for compliance with the National Environmental Policy Act (NEPA) and ESA. If TVA has NEPA requirements beyond the scope of this MOA, TVA or other Federal action agency are responsible for those additional requirements.

With regard to the ESA, the Biological Opinion authorizes incidental take of Indiana bats associated with forested habitat removal. As such, paragraphs 6.3 and 6.4 are incorporated to ensure compliance with the Reasonable and Prudent Measures and Terms and Conditions of the biological opinion. TVA acknowledges that any divergence from these measures and conditions may result in a violation of section 9 of the ESA.

6.2 TVA will take any necessary steps to ensure that the project covered under this MOA meets federal requirements for compliance with the National Historic Preservation Act (NHPA).

6.3 The project proposed by TVA, as described in Section 4, will result in the incidental take of Indiana bats in the form of habitat loss totaling not more than 6.4 acres of potential Indiana bat roosting structures. TVA may remove this habitat during the unoccupied time as stated in Section 5.

6.4 TVA shall contribute $23,040.00 to the Indiana Bat Conservation Fund (IBCF) administered by the Kentucky Natural Lands Trust (KNLT). This contribution is based on 6.4 acres of potential Indiana bat summer habitat using the process identified in the Tennessee Field Office of the Service's Interim Indiana Bat Mitigation Guidance. Funds shall be provided to KNLT within thirty (30) days of the last signature of this MOA. Within seven (7) business days, TVA shall provide the Service with a copy of the check or transaction receipt of payment that shows the date and amount of the deposit.

In summary, this MOA provides recovery based conservation benefits for the Indiana bat in the form of contributions to the IBCF which, in turn, will fund Indiana bat habitat protection, conservation, restoration and/or priority monitoring and research projects for the Indiana bat.

Section 7: COOPERATION

Representatives of both the Service and TVA acknowledge that it is their desire to facilitate the processes set forth in this MOA by open communication and cooperation. Both parties agree to exercise their rights and obligations under this MOA in good faith. If at any time representatives of TVA have questions regarding this MOA or the guidance, the Service agrees to make itself available for consultation in a timely fashion.

Section 8: MODIFICATION OR TERMINATION

Modifications to this MOA may be proposed by either party in writing and will become effective upon being reduced to a written instrument and being signed by duly authorized representatives of the Cooperators. Failure to fulfill the provisions, as specified, within paragraph 6.4 will result in automatic termination of this MOA.

Section 9: OTHER PROVISIONS

9.1 The Cooperators hereto agree that they shall be liable for the negligent or wrongful acts or omissions of their employees, agents, and assigns only to the extent liable under applicable law. Nothing in this MOA shall be interpreted or construed as constituting a waiver by any party of sovereign immunity or statutory limitation on liability.

9.2 Each provision of this MOA shall be interpreted in such a manner as to be effective and valid under applicable law, but if any provision of the MOA shall be prohibited or invalid under application of law, such provision shall be ineffective to the extent of such prohibition or invalidity, without invalidating the remainder of such provision or the remaining provisions of this MOA.

9.3 No provision of this MOA shall be interpreted as or constitute a commitment or requirement that either party take actions in contravention of applicable laws, either substantive or procedural.

9.4 Nothing in the MOA shall be interpreted as or constitute a commitment or requirement that the Service obligate or pay funds in contravention of the Anti-Deficiency Act, 31 U.S.C. §1341, or any other law or regulation.

9.5 Third Parties Not to Benefit: This MOA does not grant rights or benefits of any nature to any party not named or identified in this MOA.

9.6 Merger: This MOA contains the sole and entire MOA of the parties. No oral representations of any nature form the basis of or may amend this MOA. This MOA may be extended, renewed, or amended only when agreed to in writing by the parties.

9.7 Waiver: Failure to enforce any provision of this agreement by either party shall not constitute waiver of that provision, nor a waiver of a claim for subsequent breach of the same type, nor a waiver of any other term of this agreement. The waiver of any provision must be expressed and evidenced in writing.

9.8 Assignment: No part of this agreement shall be assigned to any other party.

Section 10: NOTICES AND AUTHORIZED REPRESENTATIVES

Notices shall be made in writing to the persons at the addresses listed below and may be given by personal delivery, mail or by telecopy (fax) to the duly authorized representatives listed below. If there are changes in a party's representative, each party shall notify the other party, in writing, within thirty (30) days of the change in their representative/s.

U.S. Fish and Wildlife Service
Mary E. Jennings
Field Office Supervisor
446 Neal Street
Cookeville, Tennessee 38501
931-525-4973 (telephone)
931-528-7075 (fax)

Tennessee Valley Authority
Forest Wilkinson Rogers, Jr.
1101 Market Street MR 5K-C
Chattanooga, Tennessee 37402-2801
423-751-6591 (telephone)
Email: fwrogers@tva.gov

Each party hereby indicates its acceptance of the terms of the MOA as outlined herein by its signature below. The parties hereto have executed this MOA as of the last written date below:

U.S. DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE

BY: Mary E Jennings

TITLE: Field Supervisor, TN ES Field Office

DATE: 12/9/2014

TENNESSEE VALLEY AUTHORITY

BY: Forest W. Rogers

TITLE: Vice President, Transmission, Construction & Maintenance

DATE: 12/10/14

Appendix J – Stream Crossings along the Proposed Transmission Line and Access Roads

This page intentionally left blank

Stream Crossings along the Proposed Transmission Line Route and Switching Station in McNairy County, Tennessee.

Stream ID	Stream Type	Streamside Management Zone Category	Stream Name	Field Notes
1	Intermittent	Category A (50 ft)	Unnamed tributary to Oxford Creek	Intermittent headwater trib. adjacent to US 45
2	Perennial	Category A (50 ft)	Oxford Creek	Crosses US 45 at ROW in ag field
3	Perennial	Category A (50 ft)	Bull Branch	Drains into Oxford Creek just north of ROW
4	Perennial	Category A (50 ft)	Oxford Creek	Agricultural erosion
5	Perennial	Category A (50 ft)	Oxford Creek	Stream channel has been altered to run property line
6	Perennial	Category A (50 ft)	South Fork Oxford Creek	10 feet wide, 15-foot banks, sand substrate, 2 inches deep
7	Perennial	Category A (50 ft)	South Fork Oxford Creek	8 feet wide, gravel substrate, 2 feet deep, 15-foot banks
8	Intermittent	Category A (50 ft)	Unnamed tributary to South Fork Oxford Creek	4 feet wide, water present, gravel substrate
9	Intermittent	Category A (50 ft)	Unnamed tributary to Middle Fork Oxford Creek	3 feet wide, sand substrate, farm pond present
10	Intermittent	Category A (50 ft)	Unnamed tributary to Middle Fork Oxford Creek	3 feet wide, sand substrates, farm pond, scrub shrubs
11	Perennial	Category A (50 ft)	Middle Fork Oxford Creek	10 feet wide, sand substrates, beaver activity, 2 feet deep, 8-foot banks
12	Perennial	Category A (50 ft)	Middle Fork Oxford Creek	10 feet wide, sand substrates, beaver activity, 2 feet deep, 8-foot banks
13	Perennial	Category A (50 ft)	Owl Creek	Crosses highway at ROW
14	Perennial	Category A (50ft)	Todd Branch	Trib. to Owl creek at highway and ROW
15	Intermittent	Category A (50 ft)	Unnamed tributary to Owl Creek	Intermittent headwater adjacent to highway, spring and wetland present

Stream ID	Stream Type	Streamside Management Zone Category	Stream Name	Field Notes
16	Perennial	Category A (50 ft)	Tanner Branch	Severely channelized ditch in ag field
17	Perennial	Category A (50 ft)	Unnamed tributary to Tanner Branch	Spring fed stream in ag field
18	Perennial	Category A (50 ft)	Fulwood Branch	Severe channel incision, sunfishes present
19	Intermittent	Category A (50 ft)	Unnamed tributary to Fulwood Branch	Somewhat forested, aquatic invertebrates present
20	Perennial	Category A (50 ft)	Clear Creek	Bedrock substrate, sunfishes present, edge of soybean field
21	Perennial	Category A (50 ft)	Unnamed tributary to Clear Creek	Severe channel incision, stream has been straightened, in soybean field
22	Perennial	Category A (50 ft)	Graham Creek	10 feet wide, 15-foot banks, sand substrate, 2 inches deep
23	Intermittent	Category A (50 ft)	Snake Creek	10 feet wide, 15-foot banks, sand substrate, 2 inches deep
24	Perennial	Category A (50 ft)	Snake Creek	20 feet wide, sand substrate, 10-foot banks
25	Perennial	Category A (50 ft)	Clarey Branch	Drainage canal
26	Intermittent	Category A (50 ft)	Unnamed tributary to Clarey Branch	Stream runs into Clarey Branch at ROW
27	Intermittent	Category A (50 ft)	Unnamed tributary to Clarey Branch	Channel transitions from ephemeral stream to intermittent stream in ROW

Stream Crossings Located Along the Proposed Access Roads to the Selmer-West Adamsville 161-kV Transmission Line and Upgrades to the Existing Pickwick Hydro Plant-Henderson 161-kV and the Pickwick Hydro Plant- S. Jackson No. 2 161-kV Transmission Lines.

Stream ID	Stream Type	Streamside Management Zone Category	Stream Name	Field Notes
001AR	Perennial	Category A (50 ft)	Oxford Creek	Crosses AR03; 10-12 feet wide (15-foot banks), 2-3 feet deep
002AR	Perennial	Category A (50 ft)	Fulwood Branch	Crosses AR19; 6-8 feet deep, 15-20 feet wide with silt/sand substrate; culvert in place
003AR	Intermittent	Category A (50 ft)	Unnamed Tributary to Stanley Creek	Crosses AR04; unnamed first-order tributary to Stanley Creek
004AR	Intermittent	Category A (50 ft)	Unnamed Tributary to Stanley Creek	Crosses AR04; unnamed first-order tributary to Stanley Creek

This page intentionally left blank

Appendix K – Noise During Transmission Line and Substation Construction and Operation

This page intentionally left blank

Noise During Transmission Line and Substation Construction and Operation

At high levels, noise can cause hearing loss; at moderate levels, noise can interfere with communication, disrupt sleep, and cause stress; and at low levels, noise can cause annoyance. Noise is measured in decibels (dB), a logarithmic unit, so an increase of 3 dB is just noticeable, and an increase of 10 dB is perceived as a doubling of sound level. Because not all noise frequencies are perceptible to the human ear, A-weighted decibels (dBA), which filter out sound in frequencies above and below human hearing, are typically used in noise assessments.

Both the U.S. Environmental Protection Agency (USEPA) and the Department of Housing and Urban Development (HUD) have established noise guidelines. USEPA guidelines are based on an equivalent day/night average sound level (DNL), which is a 24-hour average sound level with 10 dB added to hours between 10 p.m. and 7 a.m., since people are more sensitive to nighttime noise. USEPA recommends a guideline of DNL less than 55 dBA to protect the health and well-being of the public with an adequate margin of safety. HUD guidelines use an upper limit DNL of 65 dBA for acceptable residential development and an upper limit DNL of 75 dBA for acceptable commercial development. TVA generally uses the USEPA guideline of 55 dBA DNL at the nearest residence and 65 dBA at the property line in industrial areas to assess the noise impact of a project. In addition, TVA gives consideration to the Federal Interagency Committee on Noise (FICON) 1992 recommendation that a 3-dB increase indicates possible impact, requiring further analysis when the existing DNL is 65 dBA or less.

Annoyance from noise is highly subjective. The FICON used population surveys to correlate annoyance and noise exposure (FICON 1992). Table 1 gives estimates of the percentage of typical residential populations that would be highly annoyed from a range of background noise and the average community reaction description that would be expected.

Table 1. Estimated Annoyance From Background Noise (FICON 1992)

Day/Night Level (dBA)	Percent Highly Annoyed	Average Community Reaction
75 and above	37	Very severe
70	25	Severe
65	15	Significant
60	9	Moderate
55 and below	4	Slight

For comparative purposes, typical background DNLs for rural areas range from about 40 dBA in undeveloped areas to 48 dBA in mixed residential/agricultural areas (Cowan 1993). Noise levels are typically higher in higher-density residential and urban areas. Background noise levels greater than 65 dBA can interfere with normal conversations, requiring people to speak in a raised voice in order to carry on a normal conversation.

Construction Noise

Construction noise impacts would vary with the number and specific types of equipment on the job, the construction methods, the scheduling of the work, and the distance to sensitive noise receptors such as houses. Typical construction activities for a substation and a transmission line are described in Section 2.2. Maximum noise levels generated by the various pieces of

construction equipment typically range from about 70 to 85 dBA at 50 feet (Bolt et al. 1971). An exception would be the use of track drills for building roads and installing foundations in rocky areas; track drills have a typical maximum noise level of 98 dBA at 50 feet. Use of track drills is not expected to be widespread.

Project-related construction noise levels would likely exceed background noise levels by more than 10 dBA at distances from within 500 feet in developed areas to over 1,000 feet in rural areas with little development. These distances are without the use of track drills; drilling activities could increase the distances by an additional 500 feet. A 10-dBA increase would be perceived as a large increase over the existing noise level and could result in annoyance to adjacent residents. The residential noise level guideline of 55 dBA could also be temporarily exceeded for residences near construction activities.

Construction activities would be limited to daylight hours. Because of the sequence of construction activities, construction noise at a given point along the transmission line connections would be limited to a few periods of a few days each. Construction of the substation would take longer, although it would still be limited in duration. The temporary nature of construction would reduce the duration of noise impacts on nearby residents.

Operational Noise

Transmission lines and substations can produce noise from corona discharge, which is the electrical breakdown of air into charged particles. Corona noise is composed of both broadband noise, characterized as a crackling noise, and pure tones, characterized as a humming noise. Corona noise is greater with increased voltage and is also affected by weather. It occurs during all types of weather when air ionizes near irregularities, such as nicks, scrapes, dirt, and insects on the conductors. During dry weather, the noise level is low and often indistinguishable off the ROW from background noise. In wet conditions, water drops collecting on the conductors can cause louder corona discharges.

For 500-kV transmission lines, this corona noise when present, is usually about 40-55 dBA. The maximum recorded corona noise has been 60-61 dBA (TVA unpublished data). During rain showers, the corona noise would likely not be readily distinguishable from background noise. During very moist, nonrainy conditions, such as heavy fog, the resulting small increase in the background noise levels is not expected to result in annoyance to adjacent residents. The substation would also produce similar levels of noise from corona discharge, although it is not expected to cause annoyance to nearby residents.

Transformers at the substation would generally operate in self-cooled mode; although a few days a year during extreme temperatures, transformers would operate in fan-cooled mode. When fans are used, they would generate approximately 85 dB at 3 feet. This is not expected to be audible over background noise at nearby residences.

The substation would produce a loud impulse noise when a breaker is tripped due to excessive current, high voltage, low voltage, low frequency, or other less common problems. When such problems occur, the circuit breaker opens to disconnect part of the system, and the flow of current is interrupted. The noise from the breaker is expected to last 1/20 of a second and range from 96 to 105 dB at 50 feet. Breaker noise would be quite loud, although it is only expected to occur about 18 times each year. Breaker noise may be audible to nearby residents. However, because of the infrequent occurrence, it would not result in a significant impact.

Periodic maintenance activities, particularly vegetation management, would produce noise comparable to that of some phases of transmission line construction. This noise, particularly from bush-hogging or helicopter operation, would be loud enough to cause some annoyance. It would, however, be of very short duration and very infrequent occurrence.

Literature Cited

Bolt, Beranek, and Newman Inc. 1971. *Noise From Construction Equipment and Operation, Building Equipment, and Home Appliances.* U.S. Environmental Protection Agency Report NTID300.1.

Cowan, J. P. 1993. *Handbook of Environmental Acoustics*. Wiley, New York.

Federal Interagency Committee on Noise (FICON). 1992. *Federal Agency Review of Selected Airport Noise Analysis Issues.* Fort Walton Beach, Fla.: Spectrum Sciences and Software Inc.