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DRAFT ENVIRONMENTAL ASSESSMENT

POWER SUPPLY UPGRADE - ALGOOD 161-KV TRANSMISSION LINE

Putnam County, Tennessee

TENNESSEE VALLEY AUTHORITY

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ACRONYMS AND GLOSSARY OF TERMS USED

acre	A unit measure of land area equal to 43,560 square feet
APE	Acronym for Area of Potential Effects
BMP	Acronym for Best Management Practice, i.e., accepted construction practice designed to reduce environmental effects
bus	A solid electrical connector (rather than a flexible cable) often used to connect equipment in substations
cultural resources	Archaeological and historic resources
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
easement	A legal agreement that gives TVA the right to use property such as a right-of-way for the purpose of constructing and operating a transmission line
EMF	Acronym for electric and magnetic field
endangered species	A species in danger of extinction throughout all or a significant part of its range
EO	Acronym for Executive Order
firm capability	The amount of electric power an electrical power system is able to deliver reliably
forb	A herbaceous plant other than a grass or a fern
GPS	Acronym for global positioning system
guy	A cable connecting a structure to an anchor that helps support the structure
kV	Symbol for kilovolt (one KV equals 1,000 volts)
line loss	Electrical energy lost due to inherent inefficiencies in an electrical transmission and distribution system under specific conditions
load	That portion of the entire power in a network consumed within a given area; also synonymous with “demand” in a given area
NEPA	Acronym for National Environmental Policy Act
NHPA	Acronym for National Historic Preservation Act
NRHP	Acronym for the National Register of Historic Places
outage	An interruption of the electric power supply to a user

revenue metering equipment	Meters that measure the amount of electric power for which a customer will be billed
right-of-way	A corridor containing a transmission line
riparian	Related to or located on the banks of a river or stream
runoff	That portion of total rainfall that eventually enters a stream or river
SHPO	Acronym for State Historic Preservation Officer
SMZ	Acronym for Streamside Management Zone
SR	Acronym for 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
switch	A device used to complete or break an electrical connection
tap line	An electric power line that connects an existing transmission line to a substation
tap point	A connection point between a tap line and an existing transmission line
TDEC	Acronym for the Tennessee Department of Environment and Conservation
threatened species	A species likely to become endangered within the foreseeable future
transmission line	A series of electrical conductors (“wires” and their supporting structures used to transmit electric power form one location to another
TVA	Acronym for Tennessee Valley Authority
UCEMC	Acronym for Upper Cumberland Electric Membership Corporation
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 Upper Cumberland Electric Membership Corporation (UCEMC) is planning to construct a new substation in Algood, Putnam County, Tennessee. The Tennessee Valley Authority (TVA) is proposing to supply electric power to this new substation by building approximately 5.2 miles of new 161-kilovolt (kV) transmission line (i.e., a "tap line") that would connect the planned substation to TVA's existing West Cookeville-Peavine 161-kV Transmission Line (see Figure 1). TVA would install three switch structures near the tap point between structures 104 and 103 on the West Cookeville-Peavine line. Two of the switch structures would be installed within the West Cookeville-Peavine line, and one would be installed within the new tap line right-of-way. TVA would provide UCEMC revenue metering equipment for installation at the Algood substation. TVA would add Algood substation information to the mapboard display at TVA's System Operations Center. Construction of the proposed line would be completed by June 2008.

At its existing Algood 69-kV substation, UCEMC would remove various equipment belonging to TVA including the capacitor bank, revenue metering equipment, power and voltage transformers, and galvanized buses. TVA would retire this equipment through its Investment Recovery program, which determines if equipment can be reused, recycled, or disposed of according to appropriate procedures.

TVA would also sell UCEMC approximately 1.6 miles of the existing TVA West Cookeville-East Cookeville-Algood 69-kV Transmission Line from the Algood 69-kV substation to structure 48 near Dry Valley Road (see Figure 1). TVA would sell existing structures and conductors to UCEMC but would retain its easement for the right-of-way.

1.2. Need for the Proposed Action

TVA supplies nearly all the electric power for the city of Cookeville and the city of Algood from the same source – TVA's West Cookeville 161-kV substation. The future reliability of electric power in the Algood-Cookeville area is affected by the following three conditions.

- TVA's West Cookeville 161-kV substation transformer bank is projected to be above its calculated capability by summer 2008.
- UCEMC's Algood 69kV substation is projected to be above its firm[1] capability by summer 2008.
- TVA's West Cookeville-East Cookeville-Algood 69-kV transmission line will exceed its capability by summer 2008.

These conditions are described in more detail below.

[1] "Firm" means that if one of the transformers is lost, the others do not have the capability to supply the entire load. Therefore, an overloaded situation exists.

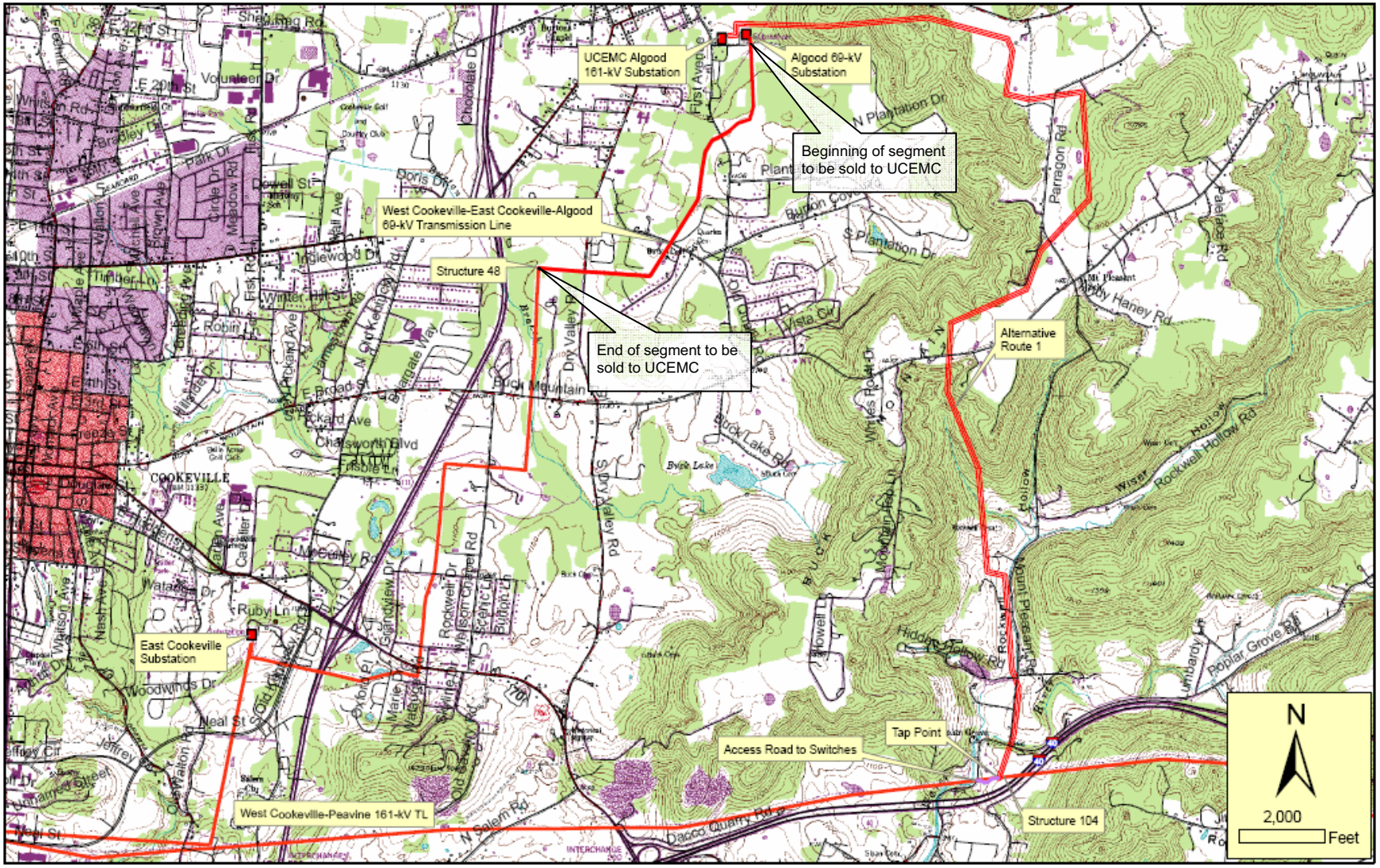

Figure 1. Vicinity Map - Proposed Algood 161-kV Transmission Line and the TVA 69-kV Transmission Line Segment to be Sold to UCEMC

The TVA West Cookeville Substation
TVA's West Cookeville substation is the major source of TVA electric power for the Cookeville area. It provides power to UCEMCs Algood substation and three Cookeville Electric Department substations. These four substations are all 69-kV.

TVA's West Cookeville substation contains four 1-phase 161-69-13-kV transformers with a total calculated capability of 153 megavolt-amperes (MVA)[2]. The projected power demand during the summer of 2008 load is projected to be 155.3 MVA, which is 2.3 MVA above its capability.

Shifting the load from any of the four 69-kV substations to another one does not resolve the problem because all four substations are powered from TVA's West Cookeville Substation transformer bank, which is nearing overload. As the area continues to grow and power demand increases, the equipment will become even more overloaded unless improvements are made to the transmission system.

An additional 8 megawatts of new electrical load is projected for Algood by the summer of 2008. This will increase the load on TVA's West Cookeville transformer bank to 163.1 MVA, which exceeds its capability by 10.1 MVA. The proposed transmission line would provide power to the new Algood Substation from a different source, thereby, relieving the overloaded West Cookeville equipment.

The UCEMC 69-kV Algood Substation
The Algood Substation serves the town of Algood, part of Cookeville, and part of White County. The substation contains two transformers that were built in 1968. They have a firm capability of 18.67 MVA. During the summer of 2006, these transformers were loaded at 19.42 MVA, which is above capability.

The area served by the Algood Substation is experiencing both commercial and residential growth, which is expected to continue due to its proximity to Highway 111 and Interstate 40. Growth in excess of 30 percent over the next 3 to 5 years has been identified. Anticipated commercial and residential growth includes a 400-unit apartment complex, two housing developments (36 homes), a school, a bank, a drug store, and three industries.

With the addition of this new load, the firm capability of the transformers will exceed capability by 7.73 MVA. To meet this and future growth, UCEMC plans to replace the 69-kV Algood Substation with an Algood 161-kV Substation. The firm capability of the new substation will be 33.3 MVA.

The TVA West Cookeville-East Cookeville-Algood Transmission Line
TVA's West Cookeville-East Cookeville-Algood 69-kV transmission line is approximately 8.4 miles long. This line is capable of handling 77.1 MVA during the summer. Summer loading is considered because the capability for equipment is usually lower (more limiting) in the summer due to the high ambient temperature. With the additional 8 megawatts of new load, the projected load on the line is expected to be 84.2 MVA, which exceeds its capability by 7.1 MVA.

[2] Megavolt amperes are a unit of measure of electric power. For practical purposes, 153 MVA is equal to 153,000,000 watts of power, where a watt is that amount of power delivered by 1 volt applied at 1 ampere of current.

The proposed transmission line would provide power to the Algood Substation from a different source, thereby relieving the overloaded West Cookeville Substation equipment.

1.3. Decisions

The primary decision before TVA is whether to provide additional electric power to the Algood area by constructing a new 161-kV transmission line to UCEMC's new Algood 161-kV Substation. A detailed description of the alternatives is provided in Section 2.1.

If the proposed transmission line is built, other secondary decisions are involved. These include the following considerations:

- the timing of improvements;
- the most suitable route for the transmission line; and,
- determining any necessary mitigation and/or monitoring measures to implement in order to meet TVA standards and minimize the potential for damage to environmental resources.

1.4. The Scoping Process and Public Involvement

The following Federal and state agencies and organizations were contacted concerning the project.

- U.S. Fish and Wildlife Service
- National Park Service
- Tennessee Department of Agriculture
- Tennessee Department of Economic and Community Development
- Tennessee Department of Environment and Conservation
- Tennessee Department of Transportation
- Tennessee Historical Commission
- Tennessee Wildlife Resources Agency
- Tennessee Wildlife Federation

This proposal was reviewed in accordance with Executive Order (EO) 11988 (Floodplain Management), EO 11990 (Protection of Wetlands), Farmland Protection Policy Act, National Historic Preservation Act, Endangered Species Act, Section 404 of the Clean Water Act, and EO 12372 (Intergovernmental Review). Correspondence received related to this coordination is contained in Appendix A.

TVA developed a public communication plan that included a website with information about the project, a map of the alternative routes, and feedback mechanisms. Public officials were briefed on the project. Property owners who could be affected by any of the route alternatives were invited to a project open house. Notices were placed in the local newspapers to notify the public of the open house. The open house was held on February

6, 2007, at the Algood United Methodist Church Family Life Center and was attended by 175 people.

A network of 17 alternate routes comprised of 18 different line segments (see Figure 2) was presented to the public for comment. These are described in Section 2.3.3. Concerns associated with project need, alternative route locations, impact of transmission line on residential and commercial land development, health issues, and impacts of the proposed line on natural, historical, and archaeological resources were voiced by those in attendance. Documentation of project need was requested by several individuals. There was some opposition to all the alternative routes.

During the public comment period following the open house, TVA received numerous letters, phone calls, emails, and a report from the Buck Mountain Community Organization regarding the project. Due to interest in the project, the original 30-day public comment period was extended to March 16, 2007. The same concerns voiced at the public meeting were also raised during the public comment period. These concerns were associated with project need, alternative route locations, potential impacts of transmission lines on residential and commercial land development, health issues, and impacts of the proposed line on visual quality, along with natural, historical, and archaeological resources.

1.5. Necessary Federal Permits or Licenses

A Section 404 Nationwide Permit 12, Utility Line Crossing, will be requested from the U.S. Army Corps of Engineers (USACE) for the project. In addition, a permit would be required from the state of Tennessee for discharge of construction site storm water associated with transmission line construction. TVA's Transmission Construction organization would prepare the required erosion and sedimentation control plans and coordinate them with the appropriate state and local authorities. A permit would also be required for burning trees and other combustible materials removed during transmission line construction.

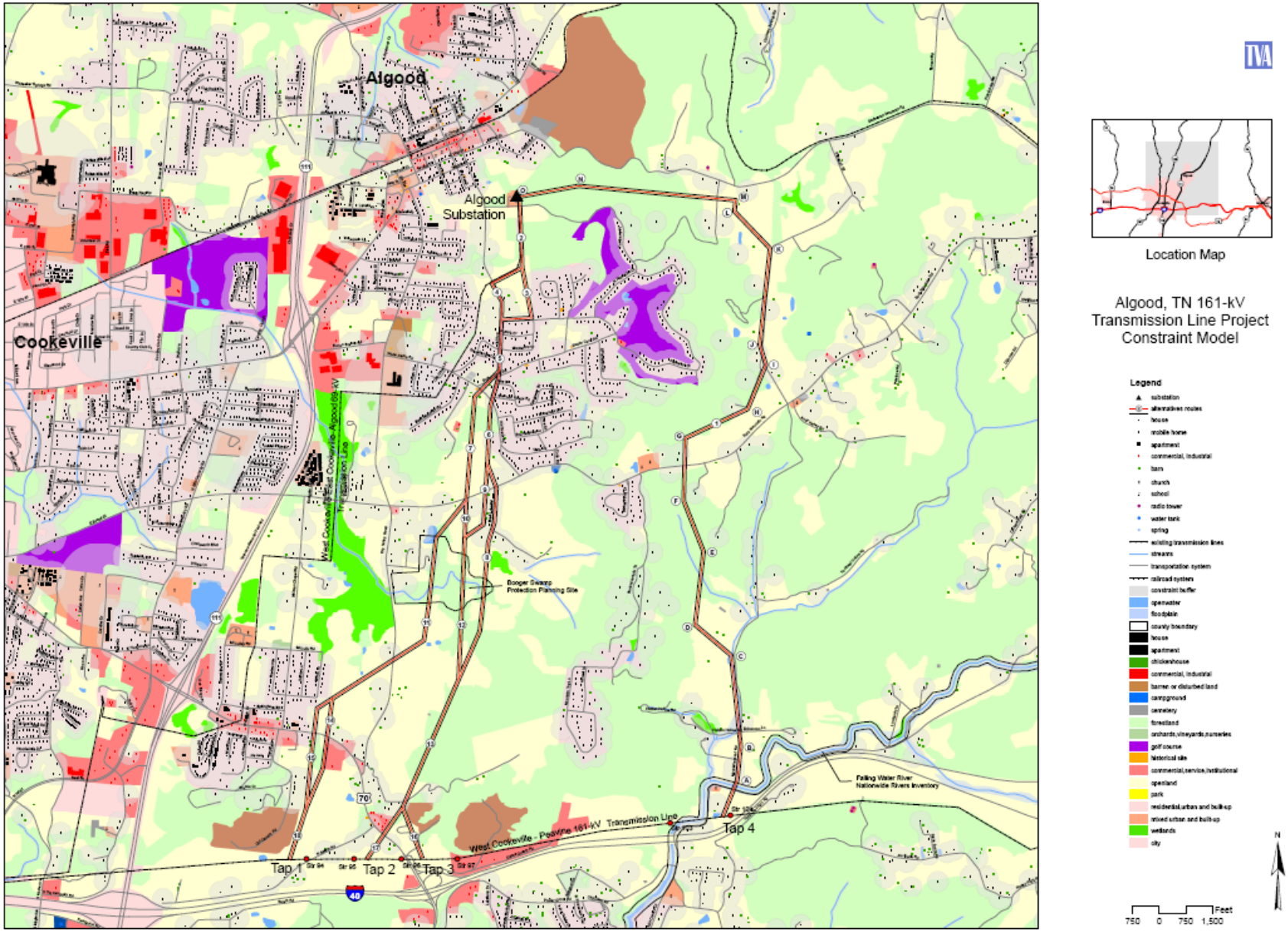

Figure 2. Potential Route Segments for the Proposed Algood 161-kV Transmission Line

CHAPTER 2

2.0 ALTERNATIVES INCLUDING THE PROPOSED ACTION

As described in Chapter 1, TVA is proposing to connect the new UCEMC Algood 161-kV Substation to TVA's existing West Cookeville - Peavine 161-kV Transmission Line. The connection would be accomplished by constructing a new 5.2-mile long 161-kV transmission line. Additional background information about transmission line construction, operation, and maintenance is provided in this chapter.

2.1. Alternatives

Two feasible alternatives were developed. These included the No Action Alternative and the Action Alternative. Under the No Action Alternative, the proposed action would not be undertaken, and the existing transmission system would continue to be used. The Action Alternative involves the construction of the proposed transmission line and the sale of a portion of the TVA West Cookeville-East Cookeville-Algood 69-kV Transmission Line to UCEMC. A third alternative involving the upgrading of the UCEMC Algood 69-kV Substation was developed, but was eliminated from detailed consideration because of high costs and the limited effectiveness of this option. The alternatives are described in further detail below.

2.1.1. Alternative 1 – The No Action Alternative

Under the No Action Alternative, TVA would not construct the proposed transmission line to serve the new Algood 161-kV Substation. However, UCEMC could decide to build a new transmission line to serve its new substation. UCEMC could possibly use the route identified by TVA, or could select another route. If UCEMC were to construct the transmission line, the potential environmental effects resulting from the implementation of the No Action Alternative likely would be comparable to or greater than those resulting from the adoption of the Action Alternative, depending on the route chosen and the construction methods used by UCEMC.

Absent this, UCEMC's transmission system would continue to operate with a high risk of interruption in certain situations, especially during periods of high electricity use. Because ongoing and future development will result in increased electrical demand, this risk is projected to increase over time. Without a new 161-kV substation and a new 161-kV transmission line, these increasing power loads could cause overloads of TVA's West Cookeville 161-kV substation, the West Cookeville-Algood 69-kV transmission line, and the UCEMC Algood 69-kV substation as early as summer of 2008.

Transformers and other electrical equipment that are overloaded can be damaged or fail completely. The amount of damage depends on how heavily the equipment is overloaded. If a transformer and or transmission line fails, the result is a power outage. Sometimes power can be restored by rerouting it along other transmission lines. However, UCEMC can supply only a small portion of the Algood load from other sources. In addition, this could cause the remaining equipment to become overloaded and be in risk of failure. Overloading of a transmission line can cause heating and cooling of the material, which weakens the transmission line over time. Overloading can also cause a transmission line to

sag in excess of design criteria, resulting in inadequate clearance between the transmission line and the ground.

2.1.2. Alternative 2 – The Action Alternative

Under the Action Alternative, TVA would serve UCEMC's planned Algood 161-kV Substation by building a 5.2-mile long 161-kV transmission line connecting the planned substation to TVA's existing West Cookeville-Peavine 161-kV Transmission Line (see Figure 1). TVA would install three switch structures near the tap point between structures 104 and 103 on the West Cookeville-Peavine line. Two of the switch structures would be installed within the West Cookeville-Peavine line, and one would be installed within the new tap line right-of-way. The switches would be owned by TVA and would be operated manually. The access road to the switches would be located mostly on the existing right-of-way off Poplar Grove. The new transmission line would be located on new right-of-way from the new tap point to the new Algood 161-kV Substation (see Figure 1). TVA would provide UCEMC revenue metering equipment for installation at the Algood 161-kV Substation. TVA would add Algood Substation information to the mapboard display at TVA's System Operations Center. At the existing Algood 69-kV substation, UCEMC would remove the capacitor bank, revenue metering equipment, power and voltage transformers, and galvanized bus, and TVA would retire and dispose of this equipment through TVA's Investment Recovery Department.

TVA would also sell UCEMC approximately 1.6 miles of the existing West Cookeville-east Cookeville-Algood 69-kV Transmission Line from the Algood 69-kV substation to structure 48 near Dry Valley Road (see Figure 1). However, TVA would retain the easement for the right-of-way. A license agreement between TVA and UCEMC would be prepared for UCEMC's access and use of the 69-kV transmission line section proposed for sale. UCEMC would be required to operate and maintain the right-of-way according to TVA specifications, which will be included in the license agreement.

Implementation of this alternative would provide service to UCEMC's planned substation, would help meet the growing electric power needs in the Algood area, and would improve the reliability of the transmission line system.

2.1.3. Alternatives Considered but Eliminated from Detailed Study

<u>Upgrade the Algood 69-kV Substation</u>

UCEMC considered upgrading its Algood 69-kV Substation. Under this alternative, TVA would provide power to the upgraded Algood 69-kV substation. In order to provide additional power to the upgraded substation, TVA would increase capacity at the West Cookeville 161-kV substation by replacing the four transformers and rebuilding the 5-mile 69-kV transmission line between the West Cookeville and the East Cookeville Substations.

Implementing this alternative would resolve the potential overloads at the Algood and West Cookeville substations and on the transmission line between the West Cookeville and East Cookeville substations. However, adoption of this alternative would result in much higher line losses, worse voltage fluctuations, less reliability, and would cost over $5,000,000 more than Alternative 2. For these reasons, UCEMC decided to build a new 161-kV substation, instead of upgrading its 69-kV substation. Consequently, this alternative was eliminated from further consideration.

Load Reduction and Energy Conservation

UCEMC and TVA estimate that the Algood service area system needs will be 8MW above firm capability by the summer of 2008. TVA currently operates energy conservation programs, which TVA and local power distributors cooperatively promote and expand. Energy efficiency initiatives throughout the UCEMC service area have resulted in an approximate reduction of 5MW over the last ten years. This reduction has resulted from energy right® installations throughout the UCEMC service area. The Algood area is a portion of that service area.

Due to the growth in demand for electric power and the planned increases in commercial and residential development requiring approximately 8MW in the Algood area, current conservation efforts will not be sufficient to offset the projected 2008 deficit.

The development and implementation of any additional conservation efforts within a timeframe that would meet the identified system needs are extremely unlikely. This assumption is based on the findings of a study of demand-side management options for the Tennessee Valley (Pacific Energy Associates 2002). This study explored energy efficiency program options that could supply electricity savings within two years. The study indicated that on average over a 2-year period, a 0.9 MW reduction in load could be reached. Likewise, a 1.9-MW peak load reduction could be achieved over that period.

The combination of existing and proposed efficiency programs could result in additional reductions in the UCEMC service area through June 2008. Prorating these conservation efforts to the Algood area using square miles of area served as the basis, the resulting load reduction would be less than 1MW across the residential and commercial sectors. This reduction would not be sufficient to offset the existing overload of the current system, nor would it be sufficient to address the projected growth in the area. Based on this continued deficit, conservation was ruled out as the means to meet the system needs during the required period. Consequently, this alternative was not considered further.

Distributed Generation

Distributed generation has been mentioned as a possible alternative to the construction of new transmission lines. Distributed generation refers to the generation of electric power at or near the site of consumption. For example, hospitals and some industrial or commercial buildings may have backup generators. Likewise, some industries may generate power from waste heat produced by their manufacturing processes. At a smaller scale, homeowners may have solar photovoltaic units or small wind turbines installed on their property to supplement their power supply.

Under the existing electric power supply infrastructure, electric utilities such as TVA operate large, centralized generating facilities and transmit power to various distributors, e.g. UCEMC. This is accomplished via high-voltage (usually 500-kV or 161-kV) transmission lines, which deliver power to local distributor substations. Distributors supply power to local residential, commercial, and industrial customers via a network of lower-voltage (usually 69-kV or 13-kV) distribution lines. In small-scale distributed generation systems, power may be generated and consumed onsite by a residential, commercial or industrial user. Typically, these systems are intended to supplement power provided via the local distribution network; however, at times these systems may provide all necessary power. In larger distributed generation systems, in which larger amounts or power are generated, the generation source may be connected to the local distribution network so that multiple consumers may be served. Excess power may be fed into the local distribution system and

sold to the distributor. Thus, such systems are frequently used to supplement utility-provided electric power.

Because of increasing demand for power, i.e., an increasing baseload[3] demand, UCEMC is planning to construct a new 161-kV Algood Substation to replace its existing 69-kV substation. The equipment in the existing substation is near its capability and is expected to become overloaded by the summer of 2008. The new 161-kV substation would be able to deliver more power and would not be overloaded. The proposed 161-kV transmission line would deliver 161-kV power to the new substation.

A distributed generation alternative to the construction of a new 161-kV line is to build a power generation facility to supply the new substation. This facility could be built by TVA or by the local distributor. In either case, the proposal would be expensive (likely too expensive for UCEMC), and the facility could not be brought online by the short term, i.e., by summer 2008. Another distributed generation alternative is to install multiple small generation sources in the Cookeville-Algood area to supplement TVA-generated power. For this approach to offset the anticipated increase in demand for power delivered through the existing Algood 69-kV Substation, numerous generating sources would be required. The capital costs for these generators would be high and most likely would be the responsibility of the individual consumers. These costs would be paid either through increased rates (if UCEMC were to sponsor the generators) or be paid directly by homeowners and businesses (if individual onsite units were installed).

Because of the uncertainty over costs, the lack of control over reliability of the power supply, and other factors, TVA does not consider a distributed power generation alternative to be a viable option and eliminated this option from further consideration in the environmental review.

Underground Utility Lines

A frequent objection to the construction of new transmission lines is the perception of potential adverse visual effects. Thus, a frequently suggested alternative is the installation of buried transmission lines.

Power lines can be buried. However, most buried lines tend to be low-voltage distribution lines, i.e, lines that are 13-kV or less. Although such lines can be laid into trenches and buried without the need for special conduits, some lines require armor casings for safety reasons. Burying larger lines in the 69-kV, 161-kV, and 500-kV range requires extensive excavation, and these lines must be encased in special conduits or tunnels. Additionally, measures to ensure proper cooling and to provide adequate access are required. Usually, a road along the right-of-way must be maintained for routine inspection and maintenance.

Although buried lines are much less susceptible to catastrophic storm damage, especially wind damage, they tend to be very expensive to install and maintain. Conduit systems require ventilation systems to provide adequate cooling for the conductors. Similarly, they must be protected from flooding, which could cause an outage. Repairs of buried lines may require excavation, and the precise location of problems can be difficult to determine.

[3] Baseload is that power that is normally available on an electrical network regardless of the total power demand.

Burying the proposed 161-kV line is unfeasible for several reasons. First, expense would be prohibitive. Because of the karst nature of the area, the extensive excavation necessary to construct the conduit is impractical. The potential adverse environmental effects of constructing and operating a buried high-voltage line in the Algood area would likely be greater than those associated with a traditional aboveground line. For these reasons, this alternative was eliminated from further consideration.

2.2. Construction, Operation, and Management of the Proposed Transmission Line

2.2.1. Transmission Line Construction

Right-of-Way Acquisition and Clearing

The transmission line would be constructed within a new 100-foot wide right-of-way. TVA would purchase easements from landowners for the new right-of-way. These easements would give TVA the right to construct, operate, and maintain the transmission line, as well as remove danger trees off the right-of-way. Danger trees include any trees that are located away from the cleared right-of-way, 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 right-of-way remains with the landowner, and many activities and land uses could occur on the property. However, the terms of the easement agreement prohibit certain activities such as construction of buildings and any other activities within the right-of-way that could interfere with the transmission line or create a hazardous situation.

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 width of the right-of-way. Equipment used during this right-of-way 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 right-of-way 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 soon to grow tall enough, to interfere with conductors. Clearing in SMZs would be accomplished using hand-held equipment or remote-handling equipment, such as a feller-buncher, in order to limit ground disturbance. TVA Right-of-Way Clearing Specifications, Environmental Quality Protection Specifications for Transmission Line Construction, and Transmission Construction Guidelines Near Streams (Appendices B, C, and D) would be followed in clearing and construction activities.

Subsequent to clearing and construction, the right-of-way would be restored as much as is possible to its state prior to construction. Pasture areas would be reseeded with suitable grasses. Wooded areas would be restored using native grass and other low-growing species. Erosion controls would remain in place until the plant communities were established fully. Streamside areas would be revegetated as described in Appendices B, C, and D.

Access Roads

Temporary access roads would be needed to allow vehicle access to each structure and other points along the right-of-way. An access road to the switches would be mostly on the existing right-of-way off Poplar Grove Road. TVA would obtain the necessary rights for these access roads from landowners. Existing roads including privately built, farm and field roads, some of which may need upgrading, would be used where possible. New access roads used for transmission lines are located on the right-of-way wherever possible and 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. Much of the access to the proposed right-of-way would be via existing roads. In other locations, access would be from farm roads or across open land.

Culverts and other drainage devices, fences, and gates would be installed as necessary. Culverts installed in any permanent streams would be removed following construction. However, in wet-weather conveyances, they would be left or removed, depending on the wishes of the landowner or on any permit conditions that might apply. If desired by the property owner, new temporary access roads would be restored to previous conditions. Additional applicable right-of-way clearing and environmental quality protection specifications are listed in Appendices B and C.

Construction Assembly Areas

A construction assembly area (laydown area) would be required for worker assembly, vehicle parking, and material storage. This area may be on an existing substation property or leased from a private landowner for the duration of the construction period. This area is typically 5 acres in size, relatively flat, previously cleared, and located adjacent to an existing paved road near the transmission line. Depending upon site conditions, some minor grading and installation of drainage structures may be required. The area would be graveled and fenced, and 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 the fence and site restoration would be at the discretion of the landowner.

Structures and Conductors

The proposed 161-kV transmission line would be constructed using single steel pole structures as shown as Figure 3. Structure heights would vary according to the terrain and would range between 75 and 140 feet. At water or highway crossings, taller poles may be used in order to meet clearance requirements.

Additionally, the tap point would be a three-pole dead end structure located within the existing West Cookeville-Peavine Transmission Line right-of-way near structure number 104. Two switch structures 25 feet tall would be located within the existing West Cookeville-Peavine Transmission Line right-of-way on each side of the tap structure. Another switch structure 35 feet tall would b located near the tap structure on the new right-of-way.

Three conductors (the cables that carry the electrical current) are required to make up a circuit in alternating current transmission lines. For 161-kV transmission lines, each conductor is made up of a single cable. The conductors are attached to fiberglass or ceramic insulators suspended from the structure cross arms. A smaller overhead ground

wire is attached to the top of the structures. This ground wire may contain fiber optic communication cables.

Figure 3. Single Steel Pole 161-kV Transmission Structure

Poles at angles (i.e., angle points) in the transmission line may require supporting guys. Some structures for larger angles could require two or three poles. Most poles would be imbedded directly in holes augured into the ground to a depth equal to 10 percent of the pole's length plus an additional 2 feet. Normally, the holes would be back-filled with the excavated material, but in some cases, gravel or a cement and gravel mixture might be used. Screw and rock anchored guys would be installed for angle structures and tap structure. One of the three switch structures located in the new right-of-way would require concrete foundations. Six-foot diameter holes would be excavated for each leg of the structure. The spoil from the foundation holes would be spread within the right-of-way.

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

Conductor and Ground Wire Installation

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

2.2.2. Operation and Maintenance

Inspection
Periodic inspections of 161-kV transmission lines are performed from the ground and by aerial surveillance from a helicopter. These inspections, which occur on approximately five-year cycles after operation begins, are conducted 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 right-of-way, as well as immediately adjoining the right-of-way, is noted. These observations are then used to plan corrective maintenance and routine vegetation management.

Vegetation Management
Management of vegetation along the right-of-way would be necessary to ensure access to structures and to maintain an adequate distance between transmission line conductors and vegetation. For a 161-kV transmission line, National Electric Safety Code standards require a minimum clearance of 24 feet. Vegetation management along the right-of-way would consist of two different activities: felling of danger trees adjacent to the cleared right-of-way, and the control of vegetation within the cleared right-of-way.

Management of vegetation within the cleared right-of-way would use an integrated vegetation management approach designed to encourage the low-growing plant species and discourage tall-growing plant species. A vegetation-reclearing plan would be developed for each transmission line segment based on the results of the periodic inspections described above and any TVA approved special use agreements with property owners. 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 right-of-way and mechanical mowing is not practical. Herbicides would be selectively applied by aircraft or from the ground with backpack sprayers or vehicle-mounted sprayers.

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

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

2.3. Project and Siting Process

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

- Define the study area;
- Collect data to minimize potential impacts to cultural and natural features;
- Develop general route options and potential routes;
- Gather public input
- Incorporate public input into the final identification of the transmission line route.

2.3.1. Definition of the Study Area

The first task in defining the study area was to identify the power sources that could supply the identified need. TVA's existing West Cookeville-Peavine 161-kV transmission line was the most practical source because it is the closest 161-kV transmission line and it would serve as the most reliable power source to the new substation.

The study area boundaries were chosen to allow for the establishment of two or more corridors that would eventually yield a preferred transmission line route on which to construct the transmission line. The study area is shown in Figure 1. The northern boundary is south of Brotherton Mountain Road and the Louisville and Nashville railroad in the town of Algood. The southern boundary is the West Cookeville-Peavine 161-kV transmission located north of Interstate 40 and east of Highway 111. The western boundary is Highway 111. The eastern boundary is east of Parragon and Mount Pleasant Roads before the next ridge.

A Geographic Information System (GIS) based routing map and color orthophotography were developed. The GIS data were used to generate a "constraint" model that served to guide the routing process by identifying obvious routing conflicts or sensitive areas including, but not limited to, houses, rivers, historical sites, and wetlands (see Figure 2). Following is a brief description of other aspects of the study area.

Natural Features

The study area consists of the Plateau Escarpment and Eastern Highland Rim. The Plateau Escarpment has steep, forested slopes, while the Eastern Highland Rim is characterized by moderately steep slopes and irregular plains. There is more farming on the Eastern Highland Rim than on the Plateau Escarpment. Topography of the study area varies, ranging from 1,000 to 1,700 feet in elevation. Several caves and sinkholes are present within the study area. National Wetlands Inventory Database identified several wetlands within the study area. Most of the wetlands were located east of Highway 111.

Booger Swamp Protection Planning Site is located in the study area. This swamp is a poorly drained upland depression located at the base of Buck Mountain. Surface runoff from several directions, as well as the flow of Benton's Branch, converge and drain into a small sinkhole at the site. The soil in this area has a rather impervious subsurface layer that restricts the movement of water in the subsoil. This creates flooded conditions for this area throughout the year. This swamp is one of the best remnants of swamp forest on the highland rim. This swamp is privately owned and is managed cooperatively with Tennessee Department of Environment and Conservation.

The Falling Water River is located in the southeastern portion of study area. The National Park Service has listed the reach from River Mile 12, above Center Hill Lake, to River Mile 41, at headwaters approximately 5 miles southwest of McCoinsville on the Nationwide

Rivers Inventory. This listing is based on the river's scenic, recreational, fisheries, wildlife and geological values. Burgess Falls is located on the Falling Water River 27 miles downstream of the study area.

Cultural Features
There are various churches and cemeteries in the study area.

Land Use
The western portion of the study area includes Algood and East Cookeville, which are the most concentrated development. Other developments are concentrated along the major roads identified above. Several rock quarries are in the study area with the largest located in the northern part of the study area north of the Algood substation. Golf course and associated development are present within the study area. The central to eastern portion of the study area has less development and consists of pastureland and forestland.

Transportation
There are a number of major transportation features in this study area. Interstate 40 is located near the southern edge of the study area. Highway 111 is located on the western edge of the study area. Highway 70 crosses the study area in a north-south direction. Other roads include Buck Mountain, Parragon, Mount Pleasant, White Plains, Burton Cove, Buck Mountain Trail, and Dry Valley. A railroad track crosses the study area in an east-west direction. The western portion of the study area includes Algood and East Cookeville, which contains the most concentrated development. Other developments are concentrated along the major roads identified above.

2.3.2. Data Collection

Geographic data, such as topography, land use, transportation, environmental features, cultural resources, near-term future development, and land conservation information were collected for the entire study area. Analysis of the data was aided by using the GIS. This system allowed the multitude of factors of the study area to be examined simultaneously to develop a route that would best meet project needs, including avoiding or reducing potential environmental impacts.

Maps were created to show regional opportunities and constraints clearly. Sources included aerial photography, county parcel data/property boundaries, U.S. Geological Survey (USGS) topographic data, digital elevation models, National Wetlands Inventory data, and cultural resource data, among others. Aerial photography was interpreted to obtain land use and land cover data such as forests, agriculture, wetlands, houses, barns, commercial and industrial buildings, churches, and cemeteries. Data were analyzed both manually and with GIS. Manual calculations from aerial photographs, tax maps, and other sources included the number of road crossings, stream crossings, and property parcels.

The siting team used the GIS to analyze multiple factors when defining and comparing alternative routes. The GIS was used to display and analyze multiple layers of information simultaneously using geographically referenced digital information. For this project, the GIS data analysis included engineering, environmental, land use/land cover, and cultural features.

2.3.3. Development of General Route Options and Potential Routes

From the information gathered during the system's studies and data development phases, several potential tap point locations were identified on West Cookeville-Peavine 161-kV Transmission Line. Field reconnaissance was used to reduce the number of tap point locations to four. Seventeen alternate transmission line routes consisting of combinations of eighteen constituent segments (see Figure 2 and Table 1) were evaluated to determine the preferred tap point and transmission line route.

Table 1. Alternate Route Corridors

Alternate Route	Segments	Tap Point
1	1	4
2	2,3,5,6,8,13,16	3
3	2,4,5,6,8,13,16	3
4	2,3,5,6,8,13,17	2
5	2,4,5,6,8,13,17	2
6	2,3,5,6,9,12,13,17	2
7	2,3,5,6,9,12,13,16	3
8	2,4,5,6,9,12,13,16	3
9	2,4,5,6,9,12,13,17	2
10	2,3,5,7,10,12,13,16	3
11	2,3,5,7,10,12,13,17	2
12	2,4,5,7,10,12,13,16	3
13	2,4,5,7,10,12,13,17	2
14	2,3,5,7,11,14,18	1
15	2,3,5,7,11,15,18	1
16	2,4,5,7,11,14,18	1
17	2,4,5,7,11,15,18	1

The straight-line distance from the TVA source transmission line to the planned UCEMC substation site is about three and one-half miles. That distance, along with the dense residential and commercial development in the area limited the number of practicable alternative corridors that could be identified and studied for the project. The TVA planning engineers required 161-kV disconnect switches on each side of the future tap structure in the existing source line and a disconnect switch in the tap line itself near the tap point. This requirement called for a tap point located near a road or similar access point. This resulted in four possible tap point locations. These locations were selected based on the ability to access switches in all weather (or flood) conditions, closeness to existing public roads, and the ability of the location to meet engineering requirements. Tap point one is located north of North Salem Road between structures 94 and 95. Tap point two is located between North Salem Road and Highway 70 between structures 95 and 96. Tap point three is located east of Highway 70 and north of Dacco Quarry Road between structures 96 and 97. Tap point four is located just north of Interstate 40 and just east of Poplar Grove Road west of structure 104.

Segment 1 (see Figure 2) begins at the tap point of the West Cookeville-Peavine 161-kV Transmission Line west of structure 104 in a pasture and heads in a northerly direction for 1,000 feet crossing Mount Pleasant Road and the Falling Water River to Point A. This

section crosses mostly open land and less than 1 acre of forest on level terrain. From Point A to Point B, the section travels north approximately 1,000 feet, paralleling Mount Pleasant Road on the east side over open level land. From Point B to Point C, Segment 1 continues north for 2,600 feet crossing Mount Pleasant and Hidden Hollow Roads, then parallels Mount Pleasant Road traveling on mostly open level land. From Point C to Point D, the section travels northwest 1,400 feet away from Mount Pleasant Road on open land with sloping terrain near Buck Mountain. From Point D to Point E, the section begins at the base of Buck Mountain and travels north 2,100 feet up Buck Mountain. The first portion travels through over 1.5 acres of open land with sloping terrain. The rest of the section crosses through over 3 acres of forest with steep terrain and crosses one stream. From Point E to Point F, the route heads slightly northwest 1,600 feet and continues up Buck Mountain. This section is all forest and steep terrain. From Point F to Point G, the section travels north 1,800 feet over Buck Mountain. This section crosses forest on steep terrain before intersecting Buck Mountain Road. On the north side of Buck Mountain Road, the section travels through open land on relatively level terrain. From Point G to Point H, the route runs northeast around the base of Buck Mountain for 2,000 feet. This section travels through a mixture of forest and open land on sloping terrain. From Point H to Point I, the section continues along the base of Buck Mountain in a northerly direction for 1,300 feet. This section crosses Parragon Road and consists of a mixture of forest and open land on relatively level terrain. From Point I to Point J, the route heads northeast following Parragon Road for 575 feet through mostly open land on relatively level terrain. From Point J to Point K, the route parallels Parragon Road, which runs north and south. All but an acre of the potential right-of-way is open land on level terrain. From Point K to Point L, the section bears northwest on open land with level terrain. From Point L to Point M, the section travels north for 300 feet through level, open land. From Point M to Point N, the section travels west for 4,500 feet across Buck Mountain. Most of the section is forest land on steep terrain. From Point N to Point O, UCEMC substation, the section turns slightly south for 1,700 feet over Buck Mountain. Most of the section is forest land on steep terrain except the last 600 feet before it enters UCEMC substation.

Segment 2 travels south from the UCEMC substation for 2,000 feet, paralleling the existing TVA East Cookeville-Algood 69-kV Transmission Line. This segment crosses relatively flat open and forest land to the beginning of Segments 3 and 4.

Segment 3 travels south 1,400 feet to Plantation Drive, then turns west and parallels Plantation Drive for 800 feet before terminating at Segment 5. The land along this segment is heavily developed.

Segment 4 heads southwest 900 feet, paralleling the East Cookeville-Algood 69-kV Transmission Line, to First Avenue. This segment then turns south and parallels First Avenue for 1,100 feet before terminating at Segment 5. The section paralleling First Avenue is heavily developed.

Segment 5 runs south 1,500 feet, paralleling First Avenue on the eastern side and crossing two roads before terminating near Burton Cove Road at Segments 6 and 7. This section is heavily developed. Most of this development is on the west side of First Avenue.

Segment 6 travels south 2,600 feet crossing four roads containing residential development on the northern portion. The rest of this segment crosses relatively level land containing almost 2 acres of forested land. The remainder of the segment lies in open land before it terminates at Segments 8 and 9.

Segment 7 runs southeast for 1,000 feet before turning south and traveling 3,000 feet to terminate with Segments 10 and 11. The first 1,000 feet crosses Burton Cove Road and White Plains Road. The last 3,000 feet travels through approximately 2 acres of forest land. The remainder runs through pastureland and crosses Buck Mountain Road.

Segment 8 heads south for 6,250 feet and terminates at Segment 13. The first 2,400 feet crosses Buck Mountain Road and parallels Buck Lake Road, which contains residential development. The rest of the segment travels through about 2 acres of forested wetlands in Booger Swamp, then over 2 acres of forest land. The remainder of the route crosses pastureland. A wetland area identified on the National Wetlands Inventory is located east of this segment.

Segment 9 runs south for 1,650 feet and crosses Buck Mountain Road. It then turns southwest for 650 feet and terminates at Segment 12. Segment 9 is located mostly in an open field. Residential development is located east of the segment.

Segment 10 travels south for 1,000 feet, crosses Buck Mountain Road, and terminates at Segment 12. Segment 10 is located in an open field. A residence is located to the east of this segment.

Segment 11 bears southwest for 1,300 feet, then turns south for 2,900 feet, then turns southwest for 3,000 feet. This segment crosses one road, and terminates with Segments 14 and 15. Segment 11 is located mostly in pastureland, but it contains about one acre of forest and over 4.5 acres of forested wetlands in Booger Swamp.

Segment 12 heads south for 4,000 feet to terminate with Segment 13. Segment 12 is located in some pastureland. However, this segment crosses about two acres of forest in rough terrain at the base of Buck Mountain and nearly 4 acres of forested wetlands in Booger Swamp.

Segment 13 bears southwest for 4,000 feet and terminates with Segments 16 and 17. This segment is located in over seven acres of forest in rough terrain on the side of Buck Mountain.

Segment 14 travels south for 3,200 feet and terminates at Segment 18. Segment 14 is located in mostly open land. Residential and commercial development occurs on the east side of the segment in the area where it crosses Highway 70.

Segment 15 travels southwest for 500 feet then turns south for 2,800 feet. Segment 15 crosses Highway 70 and is located in over 2 acres of forest on level terrain. Residential development occurs along the western side of this segment.

Segment 16 runs southeast for 1,500 feet and intersects the TVA West Cookeville-Peavine 161-kV Transmission Line between structures 96 and 97. Segment 16 is located in over 1 acre of forest on level terrain. A rock quarry is adjacent to this segment on the east side.

Segment 17 bears southwest for 1,800 feet, crossing Highway 70, and then intersects the West Cookeville-Peavine 161-kV line between structures 95 and 96. Segment 17 crosses approximately 1.5 acres of forest; the rest of this segment crosses open land. Residential and commercial development is adjacent to the segment on the west north of Highway 70.

Segment 18 travels south-southwest for about 1,500 feet to intersect the West Cookeville-Peavine 161-kV Transmission Line between structures 94 and 95. Segment 18 is located on mostly open land. A rock quarry is located immediately west of this segment.

2.3.4. Establishment and Application of Siting Criteria

TVA uses a set of evaluation criteria that represent opportunities and constraints for development of transmission line routes. These criteria are oriented toward factors such as existing land use, ownership patterns, environmental features, cultural resources, and visual quality. Cost is also an important factor, with engineering considerations and right-of-way acquisition cost being the most important elements. Application of these constraints is flexible, and TVA can, and does, deviate from them. Identifying feasible transmission line routes involves weighing and balancing of these criteria with adjustments to them as specific conditions dictate. Information gathered and comments made at the public meeting and subsequent comment periods were taken into account while refining criteria to be specific to the study area.

Each of the transmission line alternative routes was evaluated according to these criteria relating to engineering, environmental, land use, and cultural concerns. Specific criteria are described below. For each category described, a higher score indicates a greater constraint. For example, a greater number of streams crossed, a longer transmission line route length, or a greater number of historic resources affected would give an alternative transmission line route a higher (i.e., less desirable) score.

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

- **Environmental Criteria** include the presence of slopes greater than 20 percent (steeper slopes have more potential for erosion and potentially greater water quality impacts), consideration of visual aesthetics, the number of forested acres within the proposed right-of-way, the number of open water crossings, presence of sensitive stream (i.e., those supporting endangered or threatened species) crossings, the number of perennial and intermittent stream crossings, presence of wetlands or rare species habitat, the number of natural area crossings, and proximity to wildlife management areas.

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

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

Scores for each of the alternative routes were calculated by adding individual criterion values for each potential transmission line route. The resulting sum values were evaluated using standard statistical techniques and were assigned a ranking from 1 to 4 for each route in each subcategory (i.e., engineering, environmental, land use, and cultural).

A weighted score was produced for each potential transmission line route in each subcategory. Thus, those routes that would have the lowest and highest impacts on

engineering, environmental, land use, and cultural resources were identified. Finally, to determine total impacts, the scores from each category were combined for an overall score.

2.3.5. Route Evaluation and Selection of the Preferred Route Alternative

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

Engineering

Evaluation the alternative routes for the number of road crossings and existing transmission lines affected resulted in no major constraints along any of the alternative routes. The existence of underground utilities in segment 5, which is common to Alternative Routes 2 through 17, makes these routes less desirable than Alternative Route 1. This is due to potential conflicts between pole locations and underground utilities, constraints to line location, and proximity of the line to nearby homes. The length of the alternative routes ranged from 3.8 to 4.9 miles, with Alternative Route 1 being the longest. Alternative Route 1 crosses steeper terrain than the other routes.

Environmental

Based on the initial environmental review, no threatened or endangered species were identified along any of the alternative routes. The major environmental constraint identified for Alternative Routes 2 through 17 was wetlands. Booger Swamp is a wetland managed cooperatively by the property owners and Tennessee Department of Environment and Conservation. Booger Swamp may qualify as an Exceptional Tennessee Water. In general, these characteristics are streams with good water quality, important ecological values, valuable recreational uses, and outstanding scenery. Alternative Route 1 included more acres of right-of-way, including forest land.

Land Use

Alternative Routes 2 through 17 affected more parcels, as well as more residential and commercial properties.

Cultural

Cultural resources include features such as archaeological sites, cemeteries, historical sites, historic structures, churches, and recreational areas. No known archaeological or historical sites occured within any of the alternative routes. None of the alternative routes is within the buffer zones for churches, cemeteries, or recreational areas.

Upon completion of analysis, the preferred route that represented the minimum impact was Alternative Route 1. Alternative Route 1 has fewer homes within the 50 to 300 foot buffer, crosses fewer parcels, affects fewer property owners, avoids the Booger Swamp area, and avoids conflicts with underground utilities.

The preferred route was modified from its original alignment (see Figure 4) to reduce overall project and community impacts. The modifications were based on comments from property owners, public officials and subject matter experts, along with field surveys and available

data sources. These adjustments reduced the number of parcels from 46 to 32 and increased the line length from 4.9 to 5.2 miles. The preferred route had the following modifications:

- The tap point was moved 150 feet to the east.
- The proposed transmission line route between Points C and E were adjusted to the west at request of a property owner.
- The proposed route from Point I through Point K was adjusted to the west to avoid an existing AM radio tower to minimize possible transmission interference and minimize impacts to existing residential properties and new residential construction along Parragon Road.
- The proposed route between Points K and L was adjusted to the southwest at request of property owner to avoid residential parcels.
- From Point M westward to the new Algood Substation, the route was adjusted slightly from the original alignment because of terrain and a nearby sinkhole.

2.4. Comparison of the Alternatives

If the No Action Alternative were adopted, the proposed 161-kV transmission line would not be constructed by TVA. Consequently, there would be no environmental construction or operational-effects along the proposed route. UCEMC, however, could decide to connect its planned substation to the TVA transmission system. Should UCEMC do that, the impacts would be similar to or greater than those identified for the Action Alternative, depending on the route chosen by UCEMC and its construction techniques. In addition, under the No Action Alternative, the proposed sale of a 1.6-mile segment of the West Cookeville-East Cookeville-Algood 69-kV Transmission Line would not occur. This line would continue to be operated and maintained as before by TVA. In the absence of these proposed actions, particularly the construction of the 161-kV transmission line, equipment in the existing UCEMC Algood 69-kV Substation and in the TVA West Cookeville Substation would become overloaded in the short term. This situation would lead to equipment failures and outages. The reliability of the power transmission system in the Cookeville and Algood area would be reduced to unacceptable levels.

Under the Action Alternative, TVA would construct a new 5.2-mile long 161-kV transmission line between the new UCEMC Algood 161-kV Substation and the existing TVA West Cookeville-Peavine 161-Transmission Line. Because the proposed line would provide power to the new substation, the load on existing equipment at the West Cookeville Substation would be reduced. Consequently, reliability of the local power system would be improved and the likelihood of unplanned outages due to equipment failure would decrease. Additionally, TVA would sell a 1.6-mile segment of the TVA West Cookeville-East Cookeville-Algood 69-kV Transmission Line to UCEMC. Because TVA would require UCEMC to maintain the segment in accordance with existing TVA maintenance guidelines, no additional environmental effects are expected to result from the proposed sale. Potential environmental impacts from construction and operation of the proposed 161-kV line would be insignificant. A detailed description of the potential environmental consequences of adopting the Action Alternative is provided in Chapter 4. Adoption of the Action Alternative would provide a new source of power to the proposed UCEMC Algood 161-kV substation.

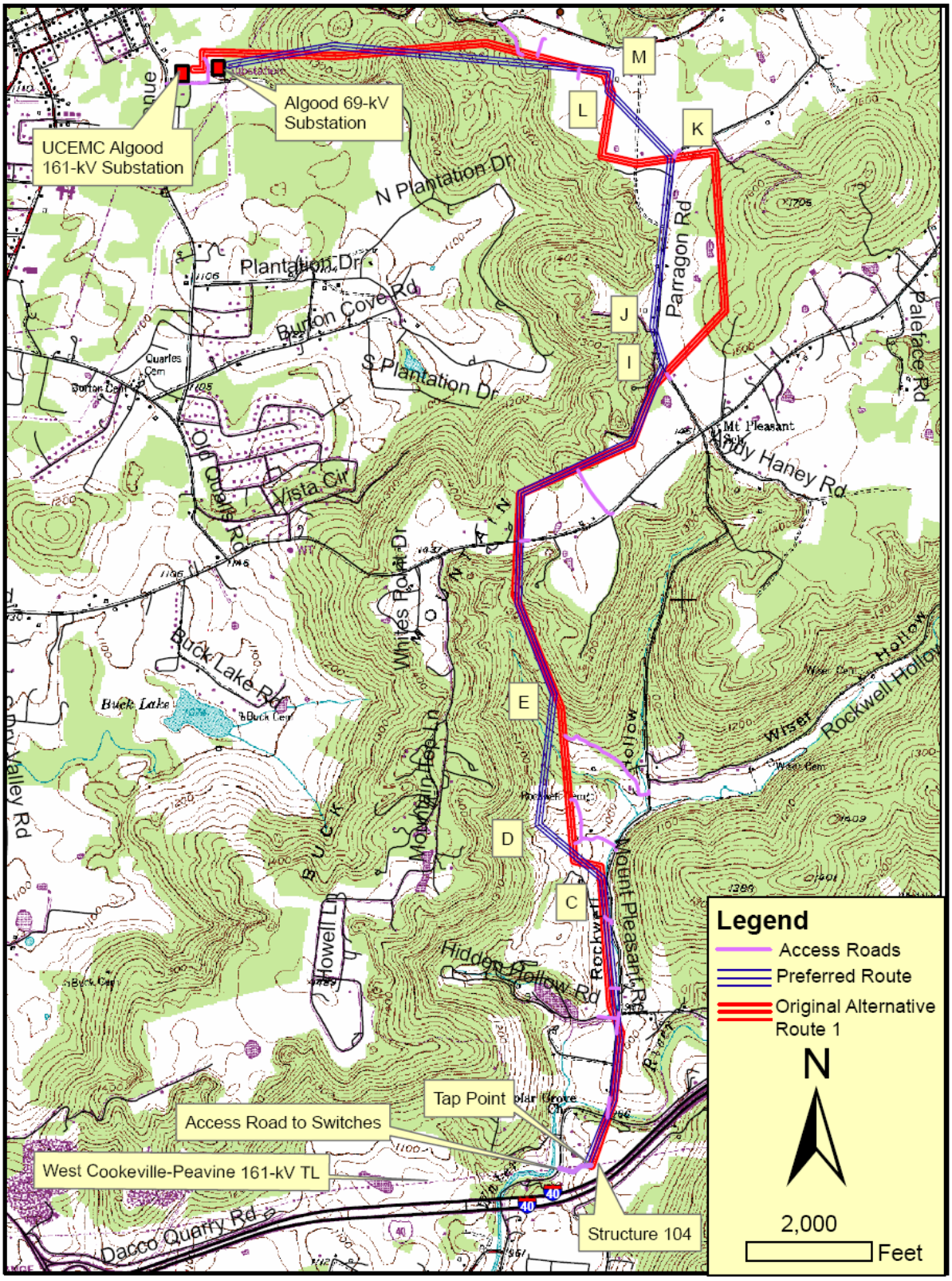

Figure 4. Preferred Transmission Line Route with Modifications

2.5. The Preferred Alternative

The Action Alternative, i.e., Construct and Operate the West Cookeville-Peavine 161-kV Transmission Line Tap to Algood Substation, is TVA's preferred alternative for this proposed project. TVA would build a 161-kV transmission line tap to the planned Algood 161-kV Substation using modified versions of the original Segment 1, which is TVA's preferred route option (see Figure 4). The new transmission line would be 5.2 miles long and would occupy 63 acres of right-of-way. Also under the Action Alternative, TVA would sell a 1.6-mile segment of the West Cookeville-East Cookeville-Algood 69-kV Transmission Line to UCEMC.

CHAPTER 3

3.0 AFFECTED ENVIRONMENT

Various environmental resources could be affected by the implementation of the alternatives described in Chapter 2. The status of these potentially affected environment resources is described in this chapter. The potentially affected environmental resources include the following: terrestrial life (wildlife and vegetation), aquatic life, threatened and endangered species, surface water, groundwater, floodplains, wetlands, natural areas, historical and archaeological resources, visual and aesthetic quality, recreation, and socioeconomics.

3.1. Terrestrial Life

Terrestrial life considered included wildlife (i.e., terrestrial animals) and vegetation. The discussion of vegetation includes invasive and exotic, non-native plant species. These resources are described further below. The descriptions below are organized into two major sections – those resources within the right-of-way of the proposed new transmission line, and those resources within the right-of-way of the transmission line segment that is proposed to be sold to UCEMC.

3.1.1. Wildlife

New Transmission Line Right-of-way

Habitats within the right-of-way for the proposed transmission line include 53 percent early successional habitats and 47 percent deciduous forested habitats. A more detailed vegetative description is provided in Section 3.1.2. Features found within the forested habitat include caves and rock outcrops. Only one major waterway, Falling Water River, crosses the proposed route.

Early successional habitats along the route include pastures, hayfields, and developed areas. Birds frequently found in these early successional habitats include Carolina wren, eastern bluebird, American robin, brown thrasher, northern cardinal, American kestrel, and mourning dove. Indigo bunting, white-eyed vireo, and gray catbird are also found here. Common mammals in this habitat type include striped skunk, eastern cottontail rabbit, white-tailed deer, Virginia opossum and rodents such as white-footed mouse. Reptiles often found in early successional habitats include black racer, rat snake, milksnake, and eastern garter snake. Wetlands within early successional habitats provide habitats for amphibians such as American toad, Fowler's toad, green frog, northern cricket frog, southeastern chorus frog, and red-spotted newt.

Deciduous forested habitats provide habitat for wild turkey, downy woodpecker, pileated woodpecker, white-breasted nuthatch, and American crow, as well as neotropical migrants such as wood thrush, blue-gray gnatcatcher, red-eyed vireo, and ovenbird. White-tailed deer and eastern gray squirrel are mammals frequently found in deciduous forests, and scattered rock outcrops within these forests provide suitable habitat for Allegheny woodrat and other small mammals. Northern zigzag salamander and slimy salamander are likely inhabitants on the forest floor of deciduous forests. Common reptiles include eastern box turtle, northern ringneck snake, rat snake, and northern copperhead.

Unique and important terrestrial habitats, such as caves, were also searched for during field investigations. At least 33 caves have been reported within three miles of the proposed new transmission line route (TVA data; Gerald Moni, Tennessee Cave Survey, personal communication, August 13 and September 17, 2007). The closest four caves are between 150 and 210 feet from the proposed new transmission line route. All other known cave locations are greater than 300 feet from the edge of the proposed right-of-way. No heron colonies occur in the immediate area of the proposed actions.

Proposed Sale Segment Right-of-Way

The existing transmission line route proposed for sale contains entirely early successional habitats, about 75 percent of which is herbaceous vegetation. The remaining 25 percent is shrubby and consists of densely spaced, deciduous saplings with a sparse herbaceous layer. A more detailed description of vegetation is provided in Section 3.1.2. Much of the right-of-way also contains wetland habitat as described in Section 3.7.

Early successional habitats consist of lawns and pastures as well as more developed scrub/shrub habitat. Emergent wetlands dominated by herbaceous vegetation comprise several acres in the existing right-of-way, while much of the scrub/shrub habitat occurs in a wetland (see Section 3.7.2). Common amphibians such as southeastern chorus frog and green frog may be found in the wetland habitat.

The landscape surrounding the existing right-of-way has been heavily influenced by previous residential development and agricultural practices, and is a matrix of forested and early successional habitats. Forested areas in the surrounding landscape consist of small fragments of deciduous forest surrounded by residential development and agricultural land. This diversity of habitats near the right-of-way indicates numerous wildlife species likely occur in the area, although the amount of development likely precludes rare species. Birds typically inhabiting these habitats include blue jay, Carolina chickadee, American robin, eastern towhee, northern cardinal and American goldfinch. Mammals associated with these habitats include raccoon, eastern gray squirrel, striped skunk and white-tailed deer, and reptiles such as brown snake and rat snake.

At least 28 caves have been reported within three miles of the transmission line segment proposed for sale (TVA data; Gerald Moni, Tennessee Cave Survey, personal communication, August 13 and September 17, 2007). The closest known cave to this existing transmission line is 1.5 miles. No heron colonies occur near the proposed transmission line or in the area of the right-of-way proposed for sale.

3.1.2. Vegetation

The proposed project occurs in central Putnam County within the Eastern Highland Rim and Plateau Escarpment Level IV Ecoregions (Griffith et al. 2001). The Eastern Highland Rim is characterized by moderately steep slopes and irregular plains. The region is underlain by Mississippian-age bedrock. The natural vegetation in the eastern portion of the ecoregion is much like the mixed mesophytic forest found on the rich slopes and deep ravines of the Plateau Escarpment (Braun 1950). The Plateau Escarpment has steep, forested slopes and is underlain by various Pennsylvanian and Mississippian-age geologic strata. Oak-hickory forest is common on the drier ridge tops; mesic forest types comprised of American beech, basswood, sugar maple, yellow-poplar, and other species are common at lower landscape positions. Approximately two-thirds of the proposed new transmission line right-of-way is in the Plateau Escarpment, and the remainder is in the Eastern Highland

Rim. All of the existing transmission line and structures proposed for sale are in the Eastern Highland Rim ecoregion.

Populations of invasive terrestrial plants are found throughout all areas proposed for transmission line construction or sale except stands of oak-hickory forest that occur between the substation and Parragon Road. Nine species considered a severe threat[4] to native plant communities were observed at least once in the subject rights-of-way during September 2007 field surveys. These are listed in Table 2.

Table 2. Invasive Plant Species Observed in the Algood Project Rights-of-way

Common Name	Scientific Name
Air-potato	*Dioscorea oppositifolia*
Autumn olive	*Elaeagnus umbellata*
Chinese privet	*Ligustrum sinense*
Japanese honeysuckle	*Lonicera japonica*
Japanese stilt grass	*Microstegium vimineum*
Kudzu	*Pueraria montana*
Princess tree	*Paulownia tomentosa*
Sericea lespedeza	*Lespedeza cuneata*
Tree-of-heaven	*Ailanthus altissima*

New Transmission Line Right-of-way

Vegetation in the proposed new transmission line right-of-way is characterized by two main types - herbaceous vegetation (53 percent) and forest (47 percent).

Herbaceous vegetation (53 percent) in the proposed transmission line right-of-way occurs in pastures, hayfields, and developed areas. Herbaceous vegetation is characterized by greater than 75 percent cover of forbs and grasses and less than 25 percent cover of other types of vegetation. The herbaceous vegetation located in the area is chiefly comprised of grass and forb species typical of heavily disturbed sites. Disturbances observed in the area of the proposed action include cattle grazing, mowing, and construction. Common species in the herbaceous vegetation type are horseweed, Queen Anne's lace, purpletop, tall fescue, and yellow crownbeard.

Forest (47 percent) observed in the proposed transmission line right-of-way is deciduous in composition. Deciduous forest is characterized by trees with overlapping crowns where deciduous species account for more than 75 percent of the canopy cover. Deciduous forests occurring along the proposed transmission line route are further subdivided into mesic forest, oak-hickory forest, and disturbed upland forest.

Mesic forest is associated with the lower portion of hill slopes, sinkholes, and the banks of the Falling Water River. Nearly all mesic forest dissected by the right-of-way is mature and relatively even-aged. Average diameter at breast height of canopy trees is 12 to 20 inches. Canopy tree species include yellow-poplar, northern red oak, black walnut, sugar maple,

[4] Rank 1 "Severe Threat" Exotic plant species are plants that possess characteristics of invasive species and spread easily into native plant communities and displace native vegetation. This includes species that are or could become widespread in Tennessee.

and basswood. Boxelder, swamp white oak and sycamore are present near the river. Shrub species present in the mesic forest include coralberry, pawpaw, and spicebush. Common herbaceous plants are bearded shorthusk, cardinal flower, fewflower tick trefoil, rattlesnake plantain, Virginia wild rye, and white crownbeard. Cover of the non-native invasive species Japanese stilt grass is extensive in some sections of mesic forest.

Oak-hickory forest along the proposed transmission line right-of-way is found on mid to upper slopes and along ridge tops. Large limestone outcrops are present in much of the oak-hickory forest. The section of right-of-way between the substation and Parragon Road along the northern portion transmission line has high quality oak-hickory forest with few invasive species. Average diameter at breast height of canopy trees ranges from 12 to 18 inches. These oak-hickory forests are even-age (indicating past clearing), but are mature. Several recently fallen and cut trees in the proposed right-of-way were determined to be over 100 years old by counting growth rings. Common canopy species in oak-hickory forest are black oak, blackjack oak, pignut hickory, post oak, scarlet oak, shagbark hickory, and white oak. Common herbaceous species include small woodland sunflower, trailing lespedeza, and upland boneset.

The forested areas to the south of Buck Mountain Road tend to have younger forest stands and have more early successional species in the overstory. Typically, these areas contain more invasive species and have experienced more intensive and more recent human disturbance than other forest types in the area. Common overstory species include beech, sassafras, yellow-poplar, and white oak. Common non-native species are princess tree, autumn olive, and tree-of-heaven.

Access to the proposed right-of-way would be from existing roads, across agricultural lands, and from developed areas. No unusual or unique plant communities occur in the proposed access roads.

Proposed Sale Segment Right-of-Way

Vegetation in the right-of-way where existing transmission line and structures are proposed for sale is characterized by two main types: herbaceous vegetation and early successional forest, which comprise about 75 percent and 25 percent of the area, respectively.

Herbaceous vegetation in the existing transmission line right-of-way is affected by regular disturbance. The entire area is affected by periodic removal of woody vegetation for right-of-way maintenance; just over 1,000 feet of right-of-way is currently grazed. Emergent wetlands dominated by herbaceous vegetation cover several acres in the existing right-of-way (see Section 3.7.2). Two occurrences of the state-threatened button snakeroot (*Eryngium integrifolium*), described in more detail in Section 3.3.2, were observed in separate areas of emergent wetland.

Early successional vegetation in the existing right-of-way is shrubby in nature and is comprised of densely spaced, sapling-size trees and shrubs less than 20 feet tall. Nearly all of this vegetation type occurs in a wetland (WOO2C as described in Section 3.7.2). Common woody species include black willow, hazel alder, red maple, silky dogwood, sweetgum, and willow oak. The herbaceous layer has few species because the canopy is very thick and produces dense shade at ground level.

3.2. Aquatic Life

The proposed Algood Transmission 161-kV line crosses the Eastern Highland Rim and the Plateau Escarpment ecoregions within drainages of the Roaring River, a direct tributary to the Cumberland River, and Falling Water River, a tributary to the Caney Fork River. Several streams crossed by the subject transmission lines are located in a transitional area between the two ecoregions but retain typical characteristics of Highland Rim streams. No streams in the Roaring River occur within the proposed right-of-way, and therefore this watershed is not discussed further in this section.

Etnier and Starnes (1993) report that streams of the Highland Rim region are characterized by coarse chert gravel and sand substrates interspersed with bedrock areas, moderate gradients, clear waters, and moderate to low productivity, and thus little aquatic vegetation except near spring sources. Additionally, the Highland Rim is host to the most diverse fish fauna of any region of comparable size in North America (Etnier and Starnes 1993).

According to Natureserve (2006), the Caney Fork watershed supports 88 species of fish. Aquatic insects, mussels, snails, and other aquatic organisms are similarly diverse in this watershed. Representative fish and mussels occupying streams in the watershed are described in Etnier and Starnes (1993) and Parmalee and Bogan (1998). Some of the fish and mussels in the watershed are federally and/or state-listed as endangered, threatened, or of other conservation concern. Further discussion of these species is provided in Section 3.3.3.

3.2.1. New Transmission Line Right-of-way

Twenty watercourses including three perennial, nine intermittent, six wet-weather conveyances, and two ponds occur along the proposed transmission line route. The location of each of these was recorded using a global positioning system (GPS), and a habitat assessment form was completed for each during a September 2007 field survey. A listing of stream crossings, excluding wet-weather conveyances is provided as Table F-1 in Appendix F. Five watercourses were spring heads located in or near the right-of-way. Watercourses documented during the field survey were typical of the Highland Rim region as described above. One perennial stream that would be crossed by the proposed transmission line, the Falling Water River, is considered a high quality stream by the Tennessee Department of Environment and Conservation (TDEC) and is listed on the TDEC 303d list as impaired due to loss of biological integrity because of siltation (TDEC 2006). The Falling Water River is listed on the Nationwide Rivers Inventory (see Section 3.8).

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

- **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 shrub/scrub vegetation is present within a wider band of riparian vegetation (20 to 60 feet). Disturbance of the riparian zone is apparent.
- **Non-forested** - No or few trees are present within the riparian zone. Significant clearing has occurred, usually associated with pasture or cropland.

Table 3. Riparian Condition of Streams Located within the Algood Transmission Line Rights-of-Way

Riparian Condition	Number of Perennial Streams	Number of Intermittent Streams	Total
Forested	1	6	7
Partially Forested	1	0	1
Non-Forested	1	2	3
Total	3	8	11

3.2.2. Proposed Sale Segment Right-of-Way

Two intermittent streams occur within the right-of-way that is proposed for sale. Both of these streams are associated with a wetland (W002C) and have been channelized. Stream 001 (see Appendix F – Table F-2) has a partially forested riparian zone, and stream 002 has a forested riparian zone.

3.3. Threatened and Endangered Species

3.3.1. Terrestrial Animals

One state-listed terrestrial animal species (Rafinesque's big-eared bat) was observed during field investigations during August and September 2007, but no federally listed species were found. A review of the TVA Natural Heritage database during August 2007 indicated two federally listed terrestrial animal species reported from Putnam County, Tennessee. In addition, four state-listed terrestrial animal species have been reported from within three miles of the proposed new transmission line route and the existing transmission line proposed for sale (see Table 4).

Bachman's sparrows inhabit old fields on dry, upland sites that contain a high volume of grasses and forbs, and scattered trees and shrubs with an open understory (Dunning and Watts 1990). Most southeastern birds occur in mature pines, old fields, and edge habitats with scattered large pines. Bachman's sparrow habitat is minimal both in quantity and quality along the proposed new transmission line route.

Rafinesque's big-eared bats occur in the forested regions of the South and roost in buildings, attics, hollow trees, mines, and caves (Linzey 1998). An individual of this species was captured at a cave 210 feet from the proposed new transmission line route on August 13, 2007. Other caves in the vicinity also provide suitable habitat for this species.

Table 4. Federally Listed Terrestrial Animals Reported from Putnam County and State Protected Terrestrial Animals Reported from within Three Miles of the Proposed Actions

Common Name	Scientific Name	Tennessee Status[1](Rank[2])	Federal Status[1]
Birds			
Bachman's sparrow	*Aimophila aestivalis*	END (S2)	--
Mammals			
Allegheny woodrat	*Neotoma magister*	NMGT (S3)	--
Gray bat	*Myotis grisescens*	END (S2)	END
Indiana bat	*Myotis sodalis*	END (S1)	END
Masked shrew	*Sorex cinereus*	NMGT (S4)	--
Meadow jumping mouse	*Zapus hudsonius*	NMGT (S4)	--
Rafinesque's big-eared bat	*Cornorhinus rafinesquii*	NMGT (S3)	--

[1]Status abbreviations: ***END*** *= Endangered,* ***NMGT*** *= Deemed in Need of Management*
[2]Rank abbreviations: ***S1*** *= rare,* ***S2*** *= imperiled,* ***S3*** *= rare or uncommon,* ***S4*** *= abundant*

Gray bats roost in caves year-round and typically forage over streams, rivers, and reservoirs. Foraging habitat exists along Falling Water River, which is crossed by the proposed new transmission line route. Other small streams in the area provide low-quality foraging habitat. Two caves in Putnam County have records of gray bats; these caves are 3.2 and 3.8 miles from the proposed new transmission line, and 2.7 and 3.2 miles from the existing transmission line to be sold.

Numerous other caves occur closer to the proposed new transmission line route and offer potential gray bat roosting habitat, although gray bats have not been recorded from them. Three of the four closest caves, located between 150 and 210 feet from the proposed route were surveyed for bats. The closest cave (Kane Cave) has no records of animals. It was not surveyed because an existing road separates it from the proposed new transmission line route and the proposed actions would not disturb this cave.

The other three caves were examined for evidence of gray bats. Walled-up Cave was mist-netted August 6 and 7, 2007 (Ramley 2007) and Trench Cave was mist-netted August 13, 2007 (Fiedler 2007). No gray bats were caught during either survey. On June 25, 2007, emergence surveys yielded only six bats at Red Rag cave, and one bat at Trench Cave (David Pelren, USFWS, personal communication, September 24, 2007), indicating that large, important gray bat colonies do not exist in these caves during summer. Breakdown in the entrance of Walled-up Cave prevented further investigation, but exploration of Trench Cave failed to find evidence of gray bats (e.g., ceiling stains or guano piles). The Tennessee Cave Survey record for Red Rag cave does not mention any evidence of cave animals (Gerald Moni, Tennessee Cave Survey, personal communication, August 13, 2007). However, there is potential for small numbers of gray bats to use Red Rag Cave and Walled-up Cave during migration or hibernation.

Indiana bats roost in caves during the winter and typically roost under the bark of dead or dying trees during the summer (Menzel, et al., 2001). Optimal summer roosts occur in forests with an open understory and available roost trees, and usually near water (Romme,

et al., 1995). Indiana bats forage primarily in forested areas along streams or other corridors. The closest record of Indiana bats occurs in a cave approximately 3.2 miles from both the proposed new transmission line and the segment proposed for sale. Although there are no other records of Indiana bats in Putnam County, other caves may provide suitable hibernation sites for Indiana bats, and mature forested habitat in the area could provide summer habitat for this species.

Caves near the proposed new transmission line route offer potential Indiana bat hibernation habitat. However, Indiana bats have not been recorded from these caves. Three nearby caves were examined for evidence of Indiana bats. Walled-up Cave was mist-netted on August 6 and 7, 2007 (Ramley 2007) and Trench Cave was mist-netted August 13, 2007 (Fiedler 2007). Indiana bats were not expected at this time of year, and no Indiana bats were caught at either survey. Temperatures inside Walled-up Cave (59 degrees Fahrenheit) indicate that this cave is not used by hibernating Indiana bats (Ramley 2007). No evidence (e.g., ceiling stains or guano piles) of Indiana bats was present in Trench Cave. The Tennessee Cave Survey record for Red Rag Cave did not mention any evidence of cave animals (Gerald Moni, Tennessee Cave Survey, personal communication, August 13, 2007) and it is unlikely that Indiana bats use any of these three caves for hibernation.

In order to assess their suitability as summer roost habitat for Indiana bats, forests along the proposed route were sampled using a protocol based on information in Romme et. al. (1995). Five forest variables were estimated at forested sites containing at least some mature trees and consisting of primarily deciduous trees. Average canopy cover, average height to bottom of canopy, and average diameter at breast height of overstory trees were measured. Sub-canopy density was categorized as open (less than 5 percent), moderately dense (5 to 20 percent), dense (20 to 60 percent), and very dense (greater than 60 percent). Potential roost trees included snags greater than 3 meters (approximately 10 feet) in height, hollow trees or trees with large cavities, and trees with exfoliating bark. Percent exfoliating bark was used to categorize the quality of potential roost trees. High quality trees exhibited greater than 25 percent of the remaining bark exfoliating; moderate trees had 11 to 25 percent remaining exfoliating bark, and low quality trees exhibited less than 10 percent. High-quality habitat plots contained a mature forest with a relatively open sub-canopy and at least one moderate or high-quality potential roost tree. Low-quality habitat plots consisted of either young stands lacking mature trees or strands with a dense subcanopy, or they lacked potential roost trees.

Twenty sample points were taken in forests along the proposed transmission line route. Nineteen points were rated as low quality habitat, which indicated that overall the forested areas were unsuitable for Indiana bats. However, one point indicated moderate suitability for Indiana bats. Mist-net surveys were conducted in the area of moderately suitable habitat, and in another area where the exact location of the right-of-way was uncertain. Protocols from the USFWS Indiana bat (*Myotis sodalis*) Draft Recovery Plan: first revision (April 2007) were used. No Indiana bats were found during these surveys.

Allegheny woodrats occur in rocky bluffs, caves, and other rocky habitats (Whitaker and Hamilton 1998). Numerous caves and small rock outcrops provide suitable habitat for this species along the proposed new transmission line route.

Masked shrews are found in a variety of habitats but are most commonly found among rocks and logs in moist woods, marshy meadows, and sphagnum bogs, but also occur

occasionally in dry upland fields (Linzey 1998). Moderately suitable habitat exists along the proposed new transmission line route and the transmission line proposed for sale.

Meadow jumping mice inhabit wet meadows, bogs, grassy fields, and forest glades. Habitat for this species is minimal along the proposed new transmission line route, but common along the existing transmission line proposed for sale.

Although cerulean warblers were not observed during field inspections of the proposed transmission line or the existing transmission line to be sold, numerous records exist for Putnam County. Cerulean warblers occur largely in unfragmented, mature deciduous forests, particularly along floodplains or other mesic areas. The mature forests found along the proposed new transmission line route provide habitat for this species, specifically, the one mile of dry ridgetops and moist coves east of the proposed substation site. Habitat along the proposed route as it heads south towards the proposed tap point is of lower quality.

3.3.2. Plants

A review of the TVA Natural Heritage database indicated that no federal-listed plant species are known from Putnam County, Tennessee. However, five Tennessee state-listed species (see Table 5) are known from within five miles of the subject rights-of-way. No federally listed plants were observed during field surveys conducted in September of 2007; however, two previously unreported occurrences of the state-threatened button snakeroot were found during these surveys. Both occurrences were in wet, grazed areas of existing transmission line right-of-way and contained less than 50 individual plants. One area was actively grazed, and the other area had been mowed recently, which made exact counts of individual plants difficult. Button snakeroot was not previously known from Putnam County.

Table 5. State-Listed Plant Species Known from within Five Miles of the Proposed Actions

Common Name	Scientific Name	Tennessee Status[1](Rank[2])
Alabama grapefern	*Botrychium jenmanii*	THR(S1)
Button snakeroot[3]	*Eryngium integrifolium*	THR(S1)
Canada lily	*Lilium canadense*	THR(S2)
Least trillium	*Trillium pusillum* var. *pusillum*	END(S2)
Running strawberry-bush	*Euonymus obovatus*	SPCO(S2)

*[1]State status abbreviations: **END** = Endangered, **THR**= Threatened, **SPCO**= Special Concern.*
*[2]State rank abbreviations: **S1** – critically imperiled often with 5 or fewer occurrences, **S2** – Imperiled often with less than 20 occurrences.*
[3]Populations observed during field surveys.

New Transmission Line Right-of-way

Forests in the proposed right-of-way contain suitable habitat for the other species in Table 5, but those species were not observed by TVA botanists during field surveys. No designated critical plant habitat is located within the area of the proposed actions.

3.3.3. Aquatic Animals

Seven federally listed and five state-listed aquatic species are known to occur in Putnam County and within a ten-mile radius of the proposed transmission line. Species occurring in affected watersheds along the proposed transmission line are identified in Table 6. The following are descriptions of the federally and state-listed species that occur within the watersheds affected by the proposed project.

Table 6. Federally Listed Aquatic Animals Reported from Putnam County and State-listed Aquatic Animals Known from within 10 Miles of the Proposed Actions

Common Name	Scientific Name	Tennessee Status[1] (Rank[2])	Federal Status[1]
Fish			
Bedrock shiner	*Notropis rupestris*	NMGT (S2)	-
Sooty darter	*Etheostoma olivaceum*	NMGT (S3)	-
Southern cavefish	*Typhlichthys subterraneus*	NMGT (S3)	-
Mussels			
Clubshell[3]	*Pleurobema clava*	END (SH)	END
Cumberland bean[3]	*Villosa trabalis*	END (S1)	END
Cumberland combshell[3]	*Epioblasma brevidens*	END (S1)	END
Cumberland pigtoe	*Pleurobema gibberum*	END (S1)	END
Fanshell[3]	*Cyprogenia stegaria*	END (S1)	END
Oyster mussel[3]	*Epioblasma capsaeformis*	END (S1)	END
Pink mucket[3]	*Lampsilis abrupta*	END (S2)	END
Crayfish			
Obey crayfish[4]	*Cambarus obeyensis*	THR (S2)	-
Tennessee cave crayfish[4]	*Orconectes incomptus*	END (S1)	-

[1]*Status Codes: **END** = Endangered; **NMGT** = In Need of Management; **THR** = Threatened*
[2]*Rank abbreviations: **S1** = rare, **S2** = imperiled, **S3** = rare or uncommon, **SH** – of historical occurrence in Tennessee*
[3]*Historic record of occurrence*
[4]*Record of occurrence does not occur within the potentially affected watershed*

The sooty darter, formally known as dirty darter, is restricted to the Nashville Basin tributaries to the Cumberland River and lower Caney Fork River. It inhabits small, low gradient streams with limestone bedrock substrates. Adults prefer slabrock pools, but they are not confined to this habitat. Spawning occurs from April to May (Starnes and Etnier 1993). This occurrence is known from downstream of an impoundment (City Lake) on the Falling Water River.

In Tennessee, the clubshell mussel can be found in the lower Tennessee River and the Cumberland River. It once occurred in the Clinch and Sequatchie rivers. It inhabits medium-sized and large rivers with firm substrate of sand and gravel. Although it was once numerous, the clubshell has been nearly extirpated from most of the state, including upper Cumberland River Tributaries, due to loss of desirable habitat from impoundments (Parmalee and Bogan 1998). This historic occurrence is known from downstream of City Lake on the falling Water River.

The Cumberland bean mussel occurs in small rivers and streams in gravel or sand substrate with fast current in riffle areas (Parmalee and Bogan 1998). It is restricted to very few streams and rivers in the upper Cumberland River and its tributaries in Kentucky (Bogan and Parmalee 1983). This historic occurrence is known from downstream of City Lake.

The Cumberland combshell mussel is restricted to the Tennessee and Cumberland rivers. This mussel inhabits headwater streams, including the Powell, Clinch, Holston, and Nolichucky. It prefers clear streams with rocky bottoms, but this species has been found in sand and gravel bottoms of the Clinch River (Parmalee and Bogan 1998). This historic occurrence is known from downstream of City Lake.

The Cumberland pigtoe mussel is found in the tributaries of the Cumberland River in Middle Tennessee. It prefers stretches with moderately strong current and substrate of firm sand and small gravel (Parmalee and Bogan 1998).

The fanshell mussel occurs in the Ohio, Cumberland, and Tennessee River systems. All viable populations are restricted to unimpounded stretches of the Clinch River on substrate of coarse sand gravel in strong flowing waters (Parmalee and Bogan 1998). This historic occurrence is known from downstream of City Lake.

The pink mucket, a mussel, is typically a big river species, but occasionally individuals become established in small to medium sized tributaries of large rivers. This historic occurrence is known from downstream of City Lake. It inhabits rocky bottoms with swift current usually in less than three feet of water (Parmalee and Bogan 1998).

The oyster mussel is found throughout the Tennessee and Cumberland River system. It prefers shallow riffles in fast current (Parmalee and Bogan 1998). This historic occurrence is known from downstream of City Lake.

3.4. Surface Water

Precipitation in the area averages about 58 inches per year. The wettest month is March, with 5.9 inches of precipitation, and the driest month is October, with 3.5 inches. The average annual air temperature is 57 degrees Fahrenheit. Temperatures range from a monthly average of 36 degrees Fahrenheit in January to 77 degrees Fahrenheit in July. Stream flow varies with rainfall and averages about 17 inches of runoff per year. This equates to approximately 1.2 cubic feet per second per square mile of drainage area.

The project area drains to Falling Water River of the Caney Fork River and to Bear Creek and Turkey Creek of Spring Creek of the Roaring River, all of which are in the Cumberland River Basin. Falling Water River and Roaring River are classified by TDEC for domestic water supply, fish and aquatic life, recreation, irrigation, and livestock watering and wildlife. Bear Creek, Turkey Creek and Spring Creek are classified for fish and aquatic life, recreation, irrigation, and livestock watering and wildlife. Falling Water River, Spring Creek and Roaring River are also designated by the state as high quality (Tier 2) streams. Falling Water River is on the state 303 (d) list as impaired (i.e., not fully supporting its designated uses) due to loss of biological integrity due to siltation, low dissolved oxygen, and nutrients from pasture grazing, municipal point source, and discharges from a municipal separate storm sewer system. Spring Creek is listed due to bacterial (*Escherichia coli*) contamination from pasture grazing.

3.5. Groundwater and Geology

The general project area is underlain by the Highland Rim aquifer system, which is part of the Interior Low Plateaus Physiographic Province. The Highland Rim aquifer consists of flat lying carbonate rocks of Mississippian age. Locally, the formations that make up the Highland Rim aquifer are the Monteagle Limestone, the Ste. Genevieve Limestone, the St. Louis Limestone, the Warsaw Limestone, and the Fort Payne Formation (Lloyd and Lyke 1995). The bedrock formations weather to form a thick chert regolith[5], which stores and releases groundwater into fractures and solution openings in the bedrock (TDEC 2002a).

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

Karst systems are readily susceptible to contamination as the waters can travel long distances through conduits with no chance for natural filtering processes of soil or bacterial action to diminish the contamination. “Mature” or well-developed karst is particularly susceptible to contamination, and some karst in the project area is considered mature. In unconfined or poorly confined conditions, karst aquifers have very high flow and contaminant transport rates under rapid recharge conditions such as storm events (TDEC 2002a).

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

The groundwater in the Mississippian strata aquifers in Tennessee generally contains concentrations of dissolved solids and iron less than secondary maximum contaminant levels for drinking water established by the U.S. Environmental Protection Agency. The water is either a calcium magnesium bicarbonate type or a calcium bicarbonate type and generally of adequate quality, or can be treated and made adequate for most uses (Lloyd and Lyke 1995).

Three caves occur within 200 feet of the project right-of-way, and a one large sinkhole occurs within the right-of-way. The majority of public drinking water for Putnam County is supplied by surface water with a small population within the county supplied by a groundwater source (TDEC 2002b). No karst features were found within the areas of the proposed access roads. Neither the proposed transmission line no the proposed access roads are located not within a state designated source water protection area. Residential wells may occur near the project area.

[5] A regolith is a layer of heterogeneous material, including soil, which lies over the bedrock of an area.

3.6. Floodplains

A floodplain is that 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.

3.6.1. New Transmission Line Right-of-way

The proposed transmission line route crosses the identified 100-year floodplain of the Falling Water River, an unnamed tributary to the Falling Water River, and other minor floodplain areas in Putnam County.

3.6.2. Proposed Sale Segment Right-of-Way

The portion of the existing transmission line proposed for sale does not cross any areas located within a 100-year floodplain.

3.7. Wetlands

Wetlands are areas inundated by surface or ground water such that vegetation adapted to saturated soil conditions are prevalent. Examples include swamps, marshes, bogs, wet meadows, and lacustrine or palustrine shoreline fringes. On September 7, 2007, a ground survey was conducted to delineate wetland areas within the existing and proposed transmission line rights-of-way.

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

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

The project area includes a landscape that is predominantly upland forest, although the majority of the project land consists of forested, scrub-shrub, and herbaceous upland and wetland communities. Portions of the lines cross cropland, pastures, residential areas,

creeks, and drainage ways. Four wetlands, totaling 12.38 acres, were identified within the subject rights-of-ways.

3.7.1. New Transmission Line Right-of-way

Two wetlands were identified within the proposed right-of-way (see Table 7).

Table 7. Wetlands in the Proposed Transmission Line Right-of-way

Wetland ID	Type[1]	Wetland Area within Right-of-Way (acres)	Estimated Forested Wetland Acreage in Proposed Right-of-Way	TVARAM Category (score)
W001B	PFO1B	0.46	0.46	2 (49)
W002B	PEM1B	0.25	0.00	1 (17.5)
	TOTAL	**0.71**	**0.46**	

[1]*Classification codes as defined in Cowardin et al. (1979): **PEM1**=palustrine emergent, persistent vegetation; **PFO1**=palustrine forested, broadleaf deciduous; **B**=saturated*

The proposed right-of-way would cross a 0.46-acre portion of a forested wetland (W001B) near the Algood Substation. W001B is located along an intermittent stream that flows into a sinkhole just outside the proposed right-of-way. W001B exhibits hydric soils. W001B is dominated by hydrophytic vegetation, including red maple, sweetgum, green ash, and Nepalese browntop. W001B was rated as a Category 2 wetland using TVARAM. This wetland exhibits moderate wetland condition and provides moderate wetland functions.

Wetland 002B (W002B) is a 0.25-acre, emergent wetland within the proposed transmission line corridor east of Parragon Road near the intersection with Buck Mountain Road. W002B is located in a cow pasture, exhibits hydric soils, and is hydrologically isolated. W002B is dominated by hydrophytic vegetation, including soft rush, barnyard grass, and tall fescue. W002B was rated as a Category 1 wetland using TVARAM because it exhibits impaired wetland condition and poor provision of wetland functions.

3.7.2. Proposed Sale Segment Right-of-Way

Two wetlands (see Table 8) were identified within the existing transmission line right-of-way. Neither wetland contained any forested wetland areas within the right-of-way.

Table 8. Wetlands in the Existing Right-of-way

Wetland ID	Type[1]	Wetland Area within Right-of-Way (acres)	TVA RAM Category (score)
W001C	PEM1C	3.60	2 (54.5)
W002C	PEM1E/PSS1E/PFO1E	8.07	3 (75)
	TOTAL	**11.67**	

[1]*Classification codes as defined in Cowardin et al. (1979): **PEM1** = palustrine emergent, persistent vegetation; **PSS1** = palustrine scrub-shrub, broadleaf deciduous; **PFO1A** =*

palustrine forested, broadleaf deciduous; ***C*** *= seasonally flooded;* ***E*** *= Seasonally flooded/saturated.*

Wetland 001C (W001C) is an emergent wetland with 3.60 acres located on the existing, maintained transmission line right-of-way, but it extends beyond the right-of-way for a total of approximately 20 acres. W001C exhibits hydric soils and is hydrologically connected to an intermittent stream that drains into a large, shallow sinkhole. Dominant hydrophytic vegetation includes willow oak, green ash, and sugarberry. This wetland also has a small population of button snakeroot, a state-threatened plant. The plant occurs in areas of the wetland that are actively grazed by cattle. W001C was rated as a Category 2 wetland using TVARAM. This wetland demonstrates moderate wetland condition and provides moderate wetland functions.

Wetland 002C (W002C) is a complex of emergent, scrub-shrub, forested wetlands with 8.07 acres located on the proposed right-of-way. However, it extends west and north of the right-of-way for a total area in excess of 50 acres. The existing, maintained right-of-way consists of emergent and scrub-shrub wetlands. The forested portions of W002C are outside the maintained right-of-way. W002C exhibits hydric soils, and it is connected hydrologically to an intermittent stream that drains into a large, shallow sinkhole. W002C is separated from W001C by First Avenue South (Old Qualls Road). Dominant wet-site vegetation in the existing right-of-way includes silky dogwood, green ash, red maple, black willow, and smooth alder. Button snakeroot, a state-threatened plant, also occurs in the pasture-areas of this wetland that are actively grazed by horses. W002C was rated as a Category 3 wetland using TVARAM because it exhibits superior wetland condition and provides superior wetland functions.

3.8. Natural Areas

3.8.1. New Transmission Line Right-of-way

The proposed transmission line right-of-way would not be within or adjacent to any managed areas or ecologically significant sites. However, it would cross a Nationwide Rivers Inventory (NRI) stream. One managed area and an additional NRI stream are within three miles of this proposed action.

- **Falling Water River** in White and Putnam counties from river mile 12 above Center Hill Lake to river mile 41 at the headwaters near the town of Monterey, is listed on the NRI and would be crossed by the proposed new transmission line. The National Park Service recognizes this 29-mile stream segment for its scenic, recreational, geologic, and fish and wildlife values. Burgess Falls, an excellent example of these values, is almost 27 river miles southwest of the point of crossing by the transmission line. At Burgess Falls, a state designated natural area features several falls, bluffs, and trails. This area also offers the amenities and recreational opportunities of a Tennessee state park.

  The point at which the proposed transmission line would cross falling Water River is near the intersection of two paved roads, Mount Pleasant and Poplar Grove, in rural Putnam County. Interstate 40 is approximately 1,300 feet southeast of the river crossing. The proposed transmission line taps into the existing West Cookeville-Peavine 161-kV transmission line approximately 900 feet south of the river. The

existing transmission line crosses the Falling Water River approximately 600 feet west of the tap point.

As shown in Figure 4, the proposed new transmission line would parallel a tributary of Falling Water River for approximately 2,300 feet in Rockwell Hollow.

- **Spring Creek**, in Jackson, Overton, and Putnam counties from river mile 0 at the confluence with Roaring River to river mile 25 and its headwaters two miles northeast of Brotherton, is listed on the NRI and is approximately 3.0 miles from the proposed transmission line. The National Park Service recognizes this 25-mile stream for its scenic, recreational, geologic, and fish and wildlife values.

- **Booger Swamp Registered State Natural Area** is approximately 1.1 miles west of the proposed new transmission line. Tennessee's Natural Areas Registry Program develops non-binding voluntary agreements with private and public landowners to protect such sites. This 60-acre area is one of the best remnants of swamp forest on the Highland Rim and is privately owned.

3.8.2. Proposed Sale Segment Right-of-Way

The existing transmission line proposed to be sold to UCEMC is not be within or adjacent to any natural areas. One managed area and one NRI stream are within three miles of this line. Booger Swamp Registered State Natural Area is approximately 0.7 miles south of the line and approximately 2.7 miles northwest of Falling Water River (see descriptions above).

3.9. Historical and Archaeological Resources

3.9.1. New Transmission Line Right-of-way

The area of potential effect (APE) for archeological resources was determined as all areas in which land-disturbing activities would take place. Background research identified no previously recorded archaeological resources within the archaeological APE. However, 16 previously recorded architectural resources (PM-793, PM-886 through PM-893, PM-899, and PM-901 through PM-906) were identified within the architectural APE, based on background research. PM-893, also known as the Algood Methodist Church, is listed on the National Register of Historic Places.

The archaeological survey conducted for this project (Hockersmith 2007) identified seven previously unidentified archaeological resources (40PM121 through 40PM127). Sites 40PM121 through 40PM122, 40PM124, 40PM125, and 40PM127 consist of open habitations of indeterminate age. Sites 40PM123 and 40PM126 consist of prehistoric open habitations as well as historic rural domestic scatters. These archaeological resources are considered ineligible for listing in the NRHP.

The architectural APE included a 0.5-mile buffer around the proposed transmission line "footprint," for a total area of approximately 5 square miles. The architectural survey identified 11 architectural resources (HS-1 through HS-11) within the APE. HS-1 is a typical example of an early twentieth-century bungalow influenced double-pen house. HS-2 and HS-10 are typical examples of an early twentieth-century hall-and-parlor house. HS-3 (Hyder Cemetery) and HS-6 (Rockwell Cemetery) are typical examples of rural cemeteries. HS-4 is a typical example of an early twentieth-century farmstead anchored by double-pen

house. HS-5 is an example of an early twentieth-century farmstead anchored by a hip-roof house. HS-7 and HS-8 are typical examples of an early twentieth-century farmstead anchored by a gable-front house. HS-9 is a typical example of an early twentieth-century massed-plan, side-gable house, and HS-11 is a typical example of an early twentieth-century center hall plan house. These architectural resources are considered ineligible for listing in the NRHP due to their lack of architectural distinction and loss of integrity caused by modern alterations and damage.

The architectural survey also revisited two previously identified architectural resources, i.e., PM-793 and the Algood Methodist Church (PM-893). The survey revealed that PM-793, a house, had been destroyed since its initial recordation. The Algood Methodist Church was listed on the NRHP because of its association with Algood's religious community and for its architectural significance as a local example of a Queen Anne influenced church. However, since its listing, the Algood Methodist Church has been altered by the construction of a two-story west elevation wing, the concealment of original window openings along the south elevation, and the construction of a projecting gable roof over the façade entrance. This church is located outside the visual line-of-sight to the proposed undertaking.

3.9.2. Proposed Sale Segment Right-of-Way

The archaeological APE included 1.6 miles of existing transmission line right-of-way. The architectural APE for the line segment proposed sale was limited to the existing right-of-way. Viewsheds to and from the existing right-of-way were terminated where topography and vegetation obstructed lines of sight.

Background research identified no previously recorded archaeological resources within the archaeological APE. Seven architectural resources (PM-788, PM-790 through PM-792, PM-833, PM-915, and PM-916) were identified by background research within the architectural APE. These architectural resources are located outside the visual line-of-sight to the proposed undertaking. Thus, these resources are considered ineligible due to their lack of architectural distinction and loss of integrity caused by modern alterations or damage.

The archaeological survey (Hockersmith 2007) identified one previously unidentified archaeological resource, 40PM120. Site 40PM120 is an open habitation of indeterminate age. It is not considered eligible for listing in the NRHP.

The architectural survey identified one architectural resource (HS-12) within the APE. HS-12 is a typical example of an early twentieth-century farmstead anchored by a double-pen house. This architectural resource is considered ineligible for listing in the NRHP due to its lack of architectural distinction and loss of integrity caused by modern alterations and damage.

3.10. Visual and Aesthetic Quality

The physical, biological, and cultural features of an area combine to make the visual landscape character both identifiable and unique. Scenic integrity indicates the degree of unity or wholeness of the visual character. Scenic attractiveness is the evaluation of outstanding or unique natural features, scenic variety, seasonal change, and strategic location. Where and how the landscape is viewed would affect the more subjective perceptions of its aesthetic quality and sense of place. Views of a landscape are described

in terms of what is seen in foreground, middleground, and background distances. In the foreground, an area within one half mile of the observer, details of objects are easily distinguished in the landscape. In the middleground, normally between a mile and four 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 general landscape character of the study area is described in this section with additional details in the following section.

3.10.1. New Transmission Line Right-of-way

The new 161-kV transmission line would begin at the tap point along the existing West Cookeville-Peavine 161-kV line located just west of Rocky Point Ridge and north of I-75 in Putnam County. This area is mainly open field and is visible to motorists from Dry Valley Road and I-75. Numerous laced-steel towers can be seen in the landscape along the existing transmission line route.

The line would cross Falling Water River to the north and Mount Pleasant Road approximately one-half mile north of the tap point. This area is mostly open valley to the east and steep knolls to the northwest. There are several barns and homes in all directions. Numerous wood utility poles can be seen along this section of Mount Pleasant Road. Scenic attractiveness is common. Scenic integrity is low because of human development.

The proposed line route would be adjacent to the west side of Mount Pleasant Road for approximately one-half mile. The landscape character of this area is similar to the previously described road crossing. There are several homes and barns in the foreground of the proposed transmission line. The proposed route would continue north across steep terrain and traverse Buck Mountain Road. This area is characterized by open fields with foreground and middleground views. There are numerous wooden utility poles located along the roadway that provide service to homes in the area. A cell tower to the northeast and a repeater station to the northwest can be seen from the roadway.

The line would turn northeast and cross Parragon Road twice. This area is mainly open pasture on each side of the roadway. Level topography adjacent to the road becomes steep to the east and west. There are no homes in the immediate area. Scenic attractiveness is common. Scenic integrity is moderate because of pasture-clearing and other human alterations seen in the landscape.

The line would parallel Brotherton Mountain road to the north, following along the south side and continuing east. The line route would follow steep, heavily vegetated terrain before entering the UCEMC Algood Substation. Scenic attractiveness is common. Scenic integrity is moderate.

3.10.2. Proposed Sale Segment Right-of-Way

The transmission line segment proposed for sale begins west of Dry Valley Road just east of SR 111 at existing structure 48 and continues along the route to the UCEMC Algood 69-kV Substation. This line route is mainly in the foreground of urban residential development and open pastures. The line route can be seen by numerous residents in the area and from local roads by motorists.

3.11. Recreation

The Cookeville Leisure Services Department operates the city parks, the Drama Center, the Cane Creek Recreation Center, the Depot Museum and History Museum, the Cane Creek SportsPlex, and the Park View Pool. There are nine city parks in the Cookeville area, all of which are located west of Highway 111. Four golf courses are located in the area. One of these, the White Plains Golf Course is located between the West Cookeville-East Cookeville-Algood 69-kV Transmission Line and the proposed route of the new 161-kV transmission line (see Figure 2). The other three golf courses are located west of Highway 111, outside the project area.

Other, informal recreational opportunities in the project area include outdoor activities such as hiking, hunting, birding, and camping. These activities occur primarily on private lands at various locations. Such activities likely occur within portions of the proposed right-of-way of the new transmission line. They likely occur to a lesser extent on the proposed sale right-of-way due to the more developed nature of the area along the right-of-way.

3.12. Socioeconomics

According to the latest census data (U.S. Census Bureau 2007) the estimated population of Putnam County in 2006 was 68,284, a 9.6 percent increase from 2000 and a 33 percent increase from 1990. In 2005, there were 29,082 housing units (op. cit.), an increase of over 35 percent since 1990. As of 2000, there were 24,865 households in Putnam County (op. cit.), an increase of over 25 percent since 1990. Median household income in 2004 was $33,355 (op. cit.). The median value of owner-occupied housing units in 2000 in Putnam County was $92,600; the median value for Tennessee was $93,000.

Putnam County contains approximately 401 square miles. The population density in the county is approximately 155 persons per square mile. For Tennessee, the population density is 138 persons per square mile.

3.12.1. New Transmission Line Right-of-way

Going north from the tap point, the proposed transmission line would pass along the eastern edge of Census Tract 2 and the western edge of Census Tract 13 in Putnam County and then westward going through part of Census Tract 2 as it approaches the UCEMC Algood 161-kV Substation. Most of the area immediately around the proposed line is in sparsely populated areas (see Table 9). The area also has a very low minority population share and low poverty rates relative to Putnam County, the state, and the nation. In Block 4000, Census Tract 2, (along Mount Pleasant Road, south of Buck Mountain Road), the minority population is 6.6 percent of the total, the highest of any of the blocks along the proposed route. This share is still below the county average of 6.8 percent and well below the state average of 20.8 percent and the national average of 30.9 percent. Poverty data are not available for individual blocks. However, block group 4 has the highest poverty level in the area, 10.8 percent, which is lower than the county average of 16.4 percent, the state average of 13.5, and the national average of 12.4. Median household income in both Census Tracts is above the county level. In Census Tract 13, it is higher than the state level but still below the national level, while it is below the state level in both Block Groups, 3 and 4, in Census Tract 2.

Table 9. Minority and Low-Income Population along the New Transmission Line Right-of-way

Location	Total Population, 2000	Minority (Percent of Total Population)			Median Household Income, 1999	Percent Below Poverty Level, 1999
		Total Minority	Nonwhite	White Hispanic		
Census Tract 2	***7,459***	***4.7***	***3.9***	***0.7***	***31,509***	***12.0***
Block Group 3	**1,315**	**2.1**	**1.5**	**0.5**	**35,481**	**4.5**
Block 3012	11	0.0	0.0	0.0	n.a.	n.a.
Block 3013	361	1.7	0.3	1.4	n.a.	n.a.
Block Group 4	**2,772**	**6.1**	**5.6**	**0.5**	**27,030**	**10.8**
Block 4000	91	6.6	6.6	0.0	n.a.	n.a.
Block 4006	0	0.0	0.0	0.0	n.a.	n.a.
Block 4007	1	0.0	0.0	0.0	n.a.	n.a.
Block 4009	0	0.0	0.0	0.0	n.a.	n.a.
Census Tract 13[1]	***2,115***	***3.1***	***2.4***	***0.8***	***38,600***	***10.4***
Block Group 1	**2,115**	**3.1**	**2.4**	**0.8**	**38,600**	**10.4**
Block 1020	15	0.0	0.0	0.0	n.a.	n.a.
Block 1022	96	1.0	0.0	1.0	n.a.	n.a.
Block 1028	6	0.0	0.0	0.0	n.a.	n.a.
Block 1067	261	0.0	0.0	0.0	n.a.	n.a.
Block 1070	103	3.9	3.9	0.0	n.a.	n.a.
Putnam County	**62,315**	**6.8**	**5.5**	**1.3**	**30,914**	**16.4**
Tennessee	**5,689,283**	**20.8**	**19.8**	**1.0**	**36,360**	**13.5**
U. S.	**281,421,906**	**30.9**	**24.9**	**6.0**	**41,994**	**12.4**

[1]*Census Tract 13 has only one block group.*
Source: U.S. Bureau of the Census, Census of Population, 2000.

3.12.2. Proposed Sale Segment Right-of-Way

The section of the existing West Cookeville-East Cookeville-Algood 69kV transmission line proposed for sale to UCEMC is all located in Census Tract 2, Block Groups 3 and 4. On the north end at the Algood 69kV substation, it is located in Block 3027. It goes to the east through part of Block 3013 and then south through Blocks 4086, 4083, 4082, and ends in Block 4023, near Block 4054.

As shown in Table 10, minority populations are a smaller percent of the total population in each of the affected blocks than in the county, the state, and the nation. The total population in the area is small, with several blocks having no population or fewer than ten persons. Income and poverty data are not available for individual blocks. However, both of the affected block groups have lower poverty levels than the county, the state, or the nation. Median income levels are higher than the county level in Block Group 3, but somewhat

lower than the state and national levels. In Block Group 4, the median income level is lower than the county, state, and nation.

Table 10. Minority and Low-Income Population along the Existing Right-of-way

Location	Total Population, 2000	Minority (Percent of Total Population)			Median Household Income, 1999	Percent Below Poverty Level, 1999
		Total Minority	Nonwhite	White Hispanic		
Census Tract 2	***7,459***	***4.7***	***3.9***	***0.7***	***31,509***	***12.0***
Block Group 3	**1,315**	**2.1**	**1.5**	**0.5**	**35,481**	**4.5**
Block 3013	361	1.7	0.3	1.4	n.a.	n.a.
Block 3027	4	0	0	0	n.a.	n.a.
Block Group 4	**2,772**	**6.1**	**5.6**	**0.5**	**27,030**	**10.8**
Block 4023	8	0	0	0	n.a.	n.a.
Block 4054	0	0	0	0	n.a	n.a.
Block 4082	0	0	0	0	n.a.	n.a.
Block 4083	154	2.7	2.7	0	n.a.	n.a.
Block 4086	58	0	0	0	n.a.	n.a.
Putnam County	**62,315**	**6.8**	**5.5**	**1.3**	**30,914**	**16.4**
Tennessee	**5,689,283**	**20.8**	**19.8**	**1.0**	**36,360**	**13.5**
U. S.	**281,421,906**	**30.9**	**24.9**	**6.0**	**41,994**	**12.4**

Source: U.S. Bureau of the Census, Census of Population, 2000.
n.a.: not available or not applicable.

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CHAPTER 4

4.0 ENVIRONMENTAL CONSEQUENCES

This chapter contains a discussion of the potential effects of implementing the alternatives. The discussion of the potential effects to the various resources is presented in the same order as the previous chapter. Potential effects anticipated under the No Action and the Action Alternatives are provided under each resource area. The discussion of the No Action Alternative that follows assumes that UCEMC would not connect is planned substation to the TVA transmission system. If it chose to do that, the potential impacts identified for the Action Alternative likely would be similar to or greater than the impacts if TVA decides to construct the line connecting the substation to the transmission system, depending on the route chosen by UCEMC and its construction techniques.

4.1. Terrestrial Life

4.1.1. No Action Alternative

New Transmission Line Right-of-way

Under the No Action Alternative, the proposed new transmission line would not be built, and the area within the proposed right-of-way would remain in its current condition. Wildlife and wildlife habitats would not be affected by any project-related actions. Likewise, no project-related changes to the terrestrial ecology of the region would occur. Thus, adoption of the No Action Alternative would not affect plant life in the area of the proposed right-of-way because

Adoption of the No Action Alternative would not significantly affect the extent or severity of invasive terrestrial plants within the right-of-way of the proposed transmission line. Because no project related work would take place, adoption of the No Action Alternative would allow non-native invasive plants present in the project area to remain. All invasive species found in the project area are common throughout the region.

Proposed Sale Segment Right-of-way

Under the No Action Alternative, TVA would not undertake the proposed transfer of a 1.6-mile section of 69-kV transmission line. Maintenance of the right-of-way on the line would continue as before. Thus, there would be no additional effects to wildlife or plants along the right-of-way from implementing the No Action Alternative. Adoption of the No Action Alternative would have no effect on the state of invasive terrestrial plants along this right-of-way or in the region because there would be no change from current conditions with respect to right-of-way maintenance.

4.1.2. Action Alternative

New Transmission Line Right-of-way

Construction of the proposed transmission line would result in a change in the composition of wildlife habitats and associated wildlife populations in the project area. Most forested habitats and other woody vegetation would be removed from the proposed right-of-way, which would be maintained as early successional habitats. The initial clearing would likely temporarily displace larger animals, such as deer and turkey, from the project right-of-way

into nearby areas. Some smaller animals occupying the areas to be cleared, such as mice, shrews, frogs, and salamanders, may be destroyed by construction activities. Following the construction and re-vegetation of the site, wildlife that favor edges and early successional habitats would occupy the right-of-way. This would change the overall species composition of the area slightly in that there would be more individuals of those species that inhabit early successional habitats, while numbers of forest-dwelling species could decline.

Potential environmental effects resulting from the proposed actions include the loss of approximately 32.8 acres of forested habitat, increased fragmentation of remaining adjacent forests, and an increase in both early successional and edge habitats within the proposed right-of-way. The increase in early successional and edge habitats would benefit early successional species and species that tolerate disturbance well. The loss of forested habitats in the proposed right-of-way and the further fragmentation of adjacent forested areas would negatively affect neotropical migratory birds and other wildlife that depend on forest-interior habitats. Clearing of forested habitat along the route would result in minimal habitat fragmentation and would increase the percentage of forest edge slightly. Overall, forest conversion would be regionally insignificant due to the high amount of habitat fragmentation that already exists along the proposed route. Most species that would be affected by these changes are locally and regionally common. However, some regionally common birds, such as the wood thrush, are experiencing long-term regional declines.

Thirty-three caves are known to occur within three miles of the proposed transmission line route, with the closest four being 150, 170, 175, and 210 feet from the proposed right-of-way, respectively. All other caves are 300 feet or greater in distance from the proposed route and would not be impacted by the proposed actions. There are no records of animals inhabiting the closest cave (Kane Cave), and because an existing road separates it from the proposed transmission line route, the proposed actions are not expected to disturb this cave further. Bats are known from the caves that are 170 and 175 feet away, although none of these bat species is considered rare or endangered.

Trench Cave is 210 feet from the edge of the proposed right-of-way, and several cave species have been recorded there. Four species of bats including the state-listed Rafinesque's big-eared bat, cave salamanders, and cave invertebrates occupy this cave. Trench Cave and the caves located 170 and 175 feet from the proposed route would all be protected from pollution and disturbance by implementing the following restrictions during construction and maintenance activities.

- Within 200 feet of the cave entrance, herbicides would be prohibited and vegetation would be cleared by hand or with low ground-pressure equipment. Any additional construction activities would be performed using low ground-pressure equipment or with mats.

- With the exception of Trench Cave, heavy equipment and vehicles would also be restricted to existing access roads within the designated 200-foot buffers.

- Vehicles and heavy equipment would be prohibited on the trail in front of entrance to Trench Cave, and this trail would not be improved or used for used for this project.

With these restrictions in place, the proposed actions would not directly or indirectly affect caves or animals species inhabiting them. Thus, construction and operation of the

proposed transmission line is not expected to result in any significant direct or indirect impacts to terrestrial wildlife or habitats.

Central Tennessee is one of the faster growing areas in the United States. The Cookeville area has experienced residential and commercial growth into previously rural areas and forested areas. The study area has been disturbed and modified by previous human alterations of the landscape. Thus, the changes from the proposed project would not be regionally significant. Construction of the proposed 161-kV transmission line would convert approximately 32.8 acres of forested habitat to early successional habitat. Because the landscape in the project area is already fragmented, the proposed right-of-way is not expected to contribute significantly to additional forest fragmentation. Although wildlife populations would likely become more isolated due to continued development in the area, overall impacts to terrestrial wildlife and their habitats are not expected to be significant.

Adoption of the Action Alternative would not significantly affect the vegetation of the region. Adoption of this alternative would require clearing of about 32.8acres of forest including over 10 acres of minimally disturbed oak-hickory and mesic forest located between the substation and Parragon Road. However, these communities are common and well represented throughout the region. No rare plant communities occur in the proposed right-of-way area. Because access to the proposed right-of-way would be accomplished via existing roads or across agricultural or developed areas, the placement of access roads would not affect local plant communities. Any impact to vegetation is expected to be minor and regionally insignificant.

Adoption of the Action Alternative would not significantly affect the extent or severity of invasive plants at the municipal, county, regional, or state level, but invasive species could become more prevalent in certain areas of newly constructed right-of-way. Most of the project area currently has a large component of invasive plants, and adoption of the Action Alternative would not change the current situation. Some areas of mature oak-hickory forest between the substation and Parragon Road currently have low concentrations of invasive plants. TVA standard operating procedure of revegetating with non-invasive species (Muncy 1999) would help prevent introduction and spread of invasive species at the project site.

Converting forest land to managed right-of-way for construction of the proposed transmission line would be long-term in duration, but insignificant when compared to regional land use changes expected to occur in the foreseeable future. Completion of the project, as currently proposed, would result in clearing of 32.8 acres of forest including approximately 10 acres of minimally disturbed oak-hickory and mesic forest. As of 2004, Putnam and the six adjacent counties (DeKalb, Cumberland, Jackson, Overton, Smith, and White) contain an estimated 1,127,051 acres of forested land (U.S. Forest Service, Forest Inventory and Analysis Data 2004). The estimated forest acreage for this area in 1999 was 1,141,160. Thus, this area has experienced a reduction in forest land of about 1.2 percent between 1999 and 2004.

The level of population growth in the Cookeville and Algood areas will likely result in the conversion of forested areas to other land uses. Annual building permits for residential units in Putnam County averaged 177 units per year between 1996 and 2001 and 583 units per year between 2002 and 2006. Currently, developers own large areas of forested land near Buck Mountain. Development of these properties for residential or commercial purposes, if it were to occur, would result in a much larger impact to forested land than the

proposed transmission line project. Reasonably foreseeable forest conversion resulting from residential and commercial development will likely overshadow the relatively small impact of the proposed transmission line project. Thus, the cumulative effect to forest cover from the proposed action would be minor and insignificant.

Proposed Sale Segment Right-of-way
The sale of 1.6 miles of a 69-kV transmission line connected to the Algood 69-kV Substation would maintain early successional habitats in the existing right-of-way. Habitats that have developed into scrub/shrub habitats would return to earlier successional herbaceous vegetation following future maintenance activities, and these habitats would likely re-develop between maintenance cycles. Although animals may be displaced temporarily during maintenance activities, early successional habitat used by these animals would be maintained. This sale would not cause significant direct or indirect impacts to terrestrial wildlife or their habitats.

Adoption of the Action Alternative would not affect the terrestrial ecology of the region. The proposed sale of the existing transmission line segment and structures to UCEMC would not have any negative effects on local terrestrial life, including vegetation, because the subject right-of-way is already highly disturbed by previous and on-going vegetation maintenance activities. No rare plant communities occur within the sale right-of-way.

Adoption of the Action Alternative would not affect the extent or severity of invasive terrestrial plant infestations at the local or regional level. Invasive plant species are already present on much of the right-of-way and the proposed sale would not change current conditions.

4.2. Aquatic Life

4.2.1. No Action Alternative

Under the No Action Alternative, the transmission line, right-of-way, and access roads would not be built, and the proposed sale would not occur. Thus, no changes to aquatic resources within these areas would occur. Adoption of the No Action Alternative is not expected to result in any additional effects to local aquatic life.

4.2.2. Action Alternative

New Transmission Line Right-of-way
Aquatic life could be affected by the proposed action 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. Potential impacts due to removal of streamside vegetation within the riparian zone include increased erosion and siltation, loss of instream habitat, and increased stream temperatures. Other potential construction and maintenance impacts include alteration of stream banks and stream bottoms by heavy equipment and runoff of herbicides into streams.

Siltation has a detrimental effect on many aquatic animals adapted to riverine environments. Turbidity caused by suspended sediment can negatively affect spawning and feeding success of many fish species (Sutherland et al. 2002). Several mussel species

found in the potentially affected watersheds are adapted to sand and gravel bottom environments. These mussels cannot survive for long periods in a bottom environment composed of fine sediment because they are quickly destroyed by silt that clogs the gills, which smothers the animal (Parmalee and Bogan 1998).

Watercourses that convey only surface water during storm events (i.e., wet-weather conveyances) and that could be affected by the proposed transmission line route would be protected by standard BMPs as identified in Muncy (1999). These BMPs are designed in part to minimize disturbance of riparian areas, and subsequent erosion and sedimentation that can be carried to streams.

All perennial and intermittent streams along the proposed transmission line and sale segment, with the exception of five springs, would be protected by Standard Stream Protection (Category A) of 50 feet as defined in Muncy (1999). The Falling Water River, the only stream listed as impaired on the TDEC 303d list, would receive a minimum 60-foot buffer as outlined in the TDEC General NPDES Permit (TDEC 2005). Five springs documented during a September 2007 field survey would be protected by category B stream protections (Muncy 1999). These springs would receive 250-foot buffers due to the steep slopes on either side of the stream channels. These categories of protection are 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. The width of the SMZs is determined by the type of watercourse, primary use of the water resource, topography, or other physical barriers (Muncy 1999).

An unnamed tributary to the Falling Water River in Rockwell Hollow would be paralleled by the proposed transmission line for approximately 2,300 feet, i.e., approximately 2,300 feet southward from Point C as shown in Figure 4. The transmission line would be constructed in a pasture adjacent to the creek. The structures would be tall enough that clearing of riparian vegetation would be minimal. However, any danger trees would be removed.

Because appropriate BMPs and SMZs would be implemented during construction, operation, and maintenance of the proposed transmission line, and minimal riparian vegetation (with the exception of danger trees) along the main channel of the nearby creek in Rockwell Hollow would be cleared, any impacts to aquatic life resulting from the proposed action would be insignificant.

Proposed Sale Segment Right-of-way
Under the Action Alternative, TVA would require UCEMC to maintain this right-of-way consistent with TVA guidelines. Thus, there no additional effects to aquatic life within this segment of right-of-way or in the immediate area are expected under the Action Alternative.

4.3. Threatened and Endangered Species

4.3.1. No Action Alternative

New Transmission Line Right-of-way
Under the No Action Alternative, the proposed new transmission line and sale would not occur. Thus, and protected terrestrial animals and their habitats would not be affected directly by any project-related actions. Likewise, adoption of the No Action Alternative would have no effect on federal or state-listed plant species in the project area because no

project-related work would take place. No federally listed threatened or endangered plants are known to occur on the proposed right-of-way. No additional effects to federally listed terrestrial animal species or plant species are anticipated under the No Action Alternative.

Adoption and implementation of the No Action alternative would cause no changes to environmental conditions in the Falling Water River. Therefore, no effects to listed aquatic species listed in Table 6 or their habitats would occur under the No Action Alternative. No additional effects to such species or their habitats are expected from the adoption of the No Action Alternative.

Proposed Sale Segment Right-of-way
Under the No Action Alternative, TVA would retain the 69-kV right-of-way and would continue to maintain it. No federally listed threatened or endangered animals or their habitats were located within the right-of-way proposed for sale to UCEMC. Adoption of the No Action Alternative would not affect any federally listed threatened or endangered plant or animal species or their habitats. No additional effects to such species are expected. For similar reasons, no effects to any federally listed aquatic species are anticipated under the No Action Alternative. Likewise, no additional effects to listed aquatic animal species are expected under this alternative.

4.3.2. Action Alternative

New Transmission Line Right-of-way
Only minimal habitat for Bachman's sparrow and meadow jumping mouse exists in the proposed transmission line route, and the proposed actions would not affect populations of either species. Abundant suitable habitat exists in the proposed transmission line route for Allegheny woodrats and masked shrews. Some individuals of these species may be displaced or destroyed during construction activities, but ample similar habitat exists in the surrounding landscape, and these impacts would be temporary. Overall impacts to populations of Allegheny woodrats or masked shrews would not be significant.

Rafinesque's big-eared bats occupy Trench Cave, which is located approximately 210 feet from the proposed transmission line route. The nearest known gray bat cave and Indiana bat cave both occur 3.2 miles from the proposed transmission line route. Because of this distance, the proposed actions would not affect this cave. Other caves in the area also provide suitable habitat for all three species of bats; however, only three caves are located close enough to the proposed route to potentially experience impacts. Of these three, none offers winter habitat for Indiana bats. Two caves provide potential migratory or winter habitat for gray bats, and all provide suitable habitat for Rafinesque's big-eared bats.

During construction and maintenance, these three caves will be protected from pollution and disturbance with the restrictions described in Section 4.1.2. With these safeguards in place, the proposed actions would not directly or indirectly affect cave habitats for Rafinesque's big-eared bats, gray bats or Indiana bats.

The Falling Water River and a few streams crossed by the proposed route provide marginal foraging habitat for gray bats; however, implementation of the Action Alternative is not expected to change or affect this foraging habitat. Therefore, gray bats and their habitats would not be affected adversely by the proposed actions. Potential summer roosting habitat for Indiana bats within the proposed route is mostly of low quality. Nineteen of 20

points were scored as low quality and the remaining point was of moderate quality. The area of moderate quality habitat and another area potentially within the line route were mist-netted using USFWS protocols (U.S. Fish and Wildlife Service 2007). No Indiana bats were found during these surveys. Therefore, the proposed action would not affect summer or winter habitat for Indiana bats, and would not adversely affect Indiana bats or their habitats.

The area of dry ridgetops and moist coves east of the proposed substation site to Parragon Road provides habitat for cerulean warblers, and forested habitat along the rest of the proposed transmission line route is of lower quality. The creation of early successional habitat within this forest interior will decrease habitat quality for this species in this section, but because only a small portion of forested habitat in the region would be lost, the proposed actions would not significantly affect this species. The proposed action is not expected to result in significant direct or indirect impacts to listed terrestrial animal species or their habitats.

Adoption of the Action Alternative would have no effect on federally listed plant species because no such plant species or their habitats occur in areas proposed for right-of-way or access road construction. Effects to state-listed plant species by the project are unlikely, as no such species were observed in the proposed right-of-way or in the vicinity of proposed access roads.

Clearing of riparian vegetation and soil disturbance associated with construction of stream crossings and other construction or maintenance activities have the potential to result in runoff entering watercourses in the project area. However, appropriate BMPs and SMZs would be implemented to reduce runoff and instream impacts.

All federally and state-listed mussels listed in Appendix Table F-1 and Table 6 are known to occur in the Caney Fork River. The Falling Water River may provide habitat for any mussels listed in Table 6. However, the Falling Water River at the transmission line crossing consists of pocket pools with riffles that may be dry or have subterranean flow during dry periods. This is not considered suitable habitat for any mussel listed in Table 6. Additionally, any sediment that may result from construction or maintenance of the transmission line would settle out quickly due to the presence of an impoundment on the Falling Water River downstream of the transmission line. Therefore, no impacts are expected to occur to any federal- or state-listed mussels in the Caney Fork or Falling Water River watersheds because of the proposed Algood Transmission Line.

The Falling Water River, at the transmission line crossing, may provide suitable habitat for the bedrock shiner and sooty darter. However, because BMPs and SMZs would be used during construction, operation, and maintenance of the proposed transmission line, any impacts that may occur to these state-listed fish would be insignificant.

Proposed Sale Segment Right of-way

The sale of 1.6 miles of a 69-kV transmission line connected to the Algood 69-kV substation would not affect habitat for Bachman's sparrow, Rafinesque's big-eared bat, gray bat, Indiana bat, Allegheny woodrat, or cerulean warbler. Suitable habitat for masked shrew and meadow jumping mouse occurs in the existing transmission line right-of-way. Although the transmission line would be sold, maintenance of the right-of-way would be continued using TVA standard maintenance practices. Future right-of-way re-clearing activities may disturb individuals of either species, but these practices would also maintain the early successional habitat in the right-of-way and would continue to provide suitable habitat for

both species. Therefore, the proposed sale would not affect these or any other listed or protected terrestrial animal species.

Adoption of the Action Alternative would have no effect on federal-listed plant species because no federally listed plant species or their habitat occurs in areas proposed for right-of-way construction. No federally listed plants are known from the area of Putnam County where the project would occur. State-listed plant species would be positively affected by the project because TVA botanists identified two new occurrences of the state-threatened button snakeroot in the right-of-way during September 2007 field surveys. With the commitments listed in Section 4.18, the occurrences of button snakeroot would have a higher level of protection than if the project did not occur.

No impacts are expected to result from the proposed sale because no suitable habitat for any aquatic species listed in Table 6 occurs in either of the intermittent streams documented in the September 2007 field survey.

4.4. Surface Water

4.4.1. No Action Alternative

Under the No Action Alternative, the proposed 161-kV transmission line would not be constructed. Thus, there would be no project-related effects to surface water or to surface water quality along the proposed right-of-way. In addition, under this alternative, the proposed sale of a 1.6-mile segment of TVA transmission line would not occur. Therefore, there would be no additional effects to surface water along this segment under the No Action Alternative.

4.4.2. Action Alternative

Soil disturbances associated with access roads or other construction activities can potentially result in adverse water quality impacts. Soil erosion and sedimentation can clog small streams and harm 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 can potentially result in runoff to streams and subsequent aquatic impacts.

TVA routinely includes precautions in the design, construction, and maintenance of its transmission line projects to minimize these potential impacts. Permanent stream crossings would be designed to prevent the impedance of runoff patterns and the blockage of the natural movement of aquatic fauna. Temporary stream crossings and other construction and maintenance activities would comply with appropriate state permit requirements and TVA requirements as described in Muncy (1999). Canopies in all streamside management zones (SMZs) would be left undisturbed unless there were no practicable alternative. Right-of-way maintenance would employ manual and low impact methods wherever possible. In areas requiring chemical treatment, only USEPA-registered herbicides would be used in accordance with label directions designed in part to restrict applications near receiving waters and to prevent unacceptable aquatic impacts. Proper implementation of these controls is expected to result in only minor temporary impacts to surface waters. No cumulative impacts are anticipated.

4.5. Groundwater and Geology

4.5.1. No Action Alternative

Under the No Action Alternative, there would be no direct effects to groundwater or geological resources because the proposed transmission line would not be built. The existing West Cookeville-East Cookeville-Algood Transmission Line would remain in operation, and periodic and routine maintenance of the right-of-way would continue. Thus, there would be no additional effects to groundwater or geological resources along this existing line under the No Action Alternative.

4.5.2. Action Alternative

Potential impacts to groundwater could result if sediments from excavated materials enter or clog karst features and from the transport of contaminants such as herbicides and fertilizers into sinkholes and caves. BMPs (Muncy 1999) would be used during right-of-way and access road construction to control sediment infiltration from storm water runoff to avoid contamination of groundwater in the project area.

During revegetation and maintenance activities, application of herbicides and fertilizers would be avoided in the areas along the right-of-way where sinkholes and caves occur to prevent groundwater contamination. If herbicides must be applied along the right-of-way, they would be applied according to the manufacturer's label. Herbicides with groundwater contamination warnings would not be used in areas where sinkholes and caves occur. With the use of BMPs, impacts to groundwater from the proposed action would be insignificant.

4.6. Floodplains

4.6.1. No Action Alternative

Under the No Action Alternative, the proposed transmission line and access roads would not be constructed. Likewise, a portion of the TVA 69-kV transmission line would not be sold to UCEMC. Therefore, no floodplains would be affected under this alternative because there would be no physical changes to the current condition of local floodplains.

4.6.2. Action Alternative

The proposed transmission line route crosses several floodplain areas in Putnam County, Tennessee. Consistent with Executive Order 11988, an overhead transmission line and related support structures are considered a repetitive action in the 100-year floodplain. The construction of the support structures for the power line is not expected to result in any increase in flood hazard either because 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 right-of-way would be revegetated where natural vegetation is removed and the removal of unique vegetation would be avoided. BMPs would be used during construction activities.

The access road to the switch structures and some of the proposed access roads would involve construction in the 100-year floodplain. Consistent with Executive Order 11988, a road is considered a repetitive action in the 100-year floodplain. To reduce adverse impacts, any improvements to the road would be done in such a manner that upstream flood elevations would not be increased.

The proposed sale of transmission line right-of-way involves an existing transmission line section located outside of the 100-year floodplain. Therefore, no special restrictions are needed for compliance with Executive Order 11988.

4.7. Wetlands

Activities in wetlands are regulated under Sections 401 and 404 of the Clean Water Act and are addressed by Executive Order 11990. Activities in jurisdictional wetlands require authorization through a Nationwide General Permit or Individual Permit issued by the U.S. Army Corps of Engineers (USACE) pursuant to Section 404. Section 401 requires water quality certification by the state for projects with discharges permitted by the federal government (Strand 1997). Executive Order 11990 requires agencies to minimize wetland destruction, loss, or degradation, and preserve and enhance natural and beneficial wetland values while carrying out agency responsibilities. TVARAM can be used as aid in guiding wetland mitigation decisions consistent with TVA's independent responsibilities under the National Environmental Policy Act and the Executive Order 11990.

4.7.1. No Action Alternative

Under the No Action Alternative, there would be no disturbance to wetlands within the proposed transmission line right-of-way. Therefore, no wetlands along the right-of-way for the proposed transmission line would be affected. Under this alternative, TVA would not sell the West Cookeville-East Cookeville-Algood 69-kV Transmission Line to UCEMC. The wetlands in the right-of-way of this existing transmission line would continue to experience the same periodic, routine vegetation clearing and maintenance that they currently experience. Therefore, there would be no additional effects to wetlands under the No Action Alternative along the existing transmission line right-of-way.

4.7.2. Action Alternative

<u>New Transmission Line Right-of-way</u>

The proposed Algood transmission line project would have the following impacts on wetland areas: 1) clearing a total of 0.46 acre of forested wetland in W001B and 2) long term maintenance of the new transmission line. Because the forested wetland acreage proposed for clearing is part of a much larger forested wetland complex, the functions this larger wetland area provide would be maintained sufficiently post-conversion. In addition, the USACE may require compensatory mitigation for forested wetland impacts, which would further ensure that potential impacts to wetlands are insignificant. Potential impacts to all other wetland areas resulting from possible access across these wetlands during the proposed transmission line construction would be minimized sufficiently with BMPs (Muncy 1999). Similarly, BMPs would be used during all line maintenance activities to ensure that wetland impacts are temporary and insignificant. Therefore, the conversion of 0.46 acre of forested wetland to emergent/scrub-shrub with potential compensatory mitigation and the use of BMPs to minimize impacts associated with vehicular access and long-term maintenance, collectively, would result in insignificant impacts to the wetland areas within the project site.

Cumulative impact analysis of wetland impacts took into account wetland loss and conversion at a watershed-level scale, in this case the within in the Falling Water River/ Caney Fork River watershed. EPA Region 4 data from 1992 Multi-Resolution Land Characterization (MRLC) satellite imagery indicates there are approximately 2,806-acres of

forested wetlands within the Caney Fork watershed (Tennessee Department of Environment and Conservation 2003). Although there is some loss of wetlands due to residential and commercial development, the rate of loss is relatively low. Conversion of 0.46-acres of forested wetlands to emergent/scrub-shrub wetland habitat would affect less than one-hundredth of a percent of overall forested wetland acreage in the watershed. Thus, cumulative project-related effects on wetlands would be insignificant.

Proposed Sale Segment Right-of-Way

Under the Action Alternative, TVA would transfer ownership of the transmission line and associated structures but would retain ownership of the easement for the line. The wetlands identified within the existing transmission line corridor are already subject to periodic, routine vegetation clearing and maintenance. Because TVA would still own the transmission line easement, all maintenance would occur subject to existing TVA maintenance requirements. All wetlands in the section to be sold would continue to receive the same maintenance they currently receive. Therefore, the sale of the subject transmission line would not adversely affect local wetlands.

4.8. Natural Areas

4.8.1. No Action Alternative

Under the No Action Alternative, the proposed transmission line would not be constructed, and the existing transmission line would not be sold to UCEMC. Thus, adoption of the No Action Alternative would have no effect on managed areas in the proposed project area. However, over the long term, these features as well as their management objectives could be subject to change from various factors. These factors include local population trends, surrounding land use, area development, regional recreational patterns, and changes in cultural, ecological and educational interests.

4.8.2. Action Alternative

New Transmission Line Right-of-way

As mentioned in Section 3.8.1, the Falling Water River near the proposed action is listed on the Nationwide Rivers Inventory (NRI). The outstanding values for which this 29-mile stream segment was listed on the NRI are not reflected at the point where the proposed transmission line would cross the river. However, at this point, the river does exhibit some scenic value. Two county roads are adjacent to the point of crossing, and a major east-west interstate (Interstate 40) and an existing transmission line are nearby. Thus, the construction of a new transmission line at the proposed point of crossing would result in minor and insignificant impacts to the scenic integrity of the NRI stream segment (see Section 4.10).

The proposed right of way would parallel an unnamed creek along Mount Pleasant Road for approximately 2,300 feet south of Point C as shown on Figure 4 (also see Section 4.2.2). Removal of streamside vegetation in this area would be minimal. However, any danger trees located within the SMZ would be removed as necessary to protect the transmission line. Because of this minor amount of disturbance to the stream shoreline, no impacts to the qualities that qualify the Falling Water River as an NRI stream are anticipated under the Action Alternative.

Because the right-of-way for the proposed transmission line is a sufficient distance (1.1 to 3.0 miles) from Booger Swamp Registered State Natural Area and Spring Creek, no effects to this area or any NRI streams are anticipated because of the proposed action.

Proposed Sale Segment Right-of-Way
Because the proposed transmission line sale is a sufficient distance (0.7 to 2.7 miles) from Booger Swamp Registered State Natural Area and Falling Water River, no impacts to this managed area or this NRI stream are anticipated because of the proposed action.

4.9. Historical and Archaeological Resources

4.9.1. No Action Alternative

Under the No Action Alternative, the proposed actions would not be undertaken, and there would be no project-related effects to historic or archaeological resources if this alternative were adopted. Likewise, no additional new effects or cumulative effects to these resources either along the proposed line route or on the right-of-way to be sold are expected under this alternative.

4.9.2. Action Alternative

New Transmission Line Right-of-way
Sixteen previously recorded architectural resources (PM-793, PM-886 through PM-893, PM-899, and PM-901 through PM-906) are located within the architectural APE. PM-793, a house, has been destroyed since its initial recordation. The remaining 15 previously recorded architectural resources (PM-886 through PM-893, PM-899, and PM-901 through PM-906) are located outside the visual line-of-sight to the proposed undertaking and would not be affected by the proposed undertaking. These resources are considered ineligible due to their lack of architectural distinction and loss of integrity caused by modern alterations and/or damage.

Seven previously unidentified archaeological resources (40PM121 through 40PM127) were identified during the archaeological survey (Hockensmith 2007). These archaeological resources are considered ineligible for listing in the NRHP. The architectural survey identified 11 architectural resources (HS-1 through HS-11) within the proposed APE for the new transmission line. These architectural resources are considered ineligible for listing in the NRHP due to their lack of architectural distinction and loss of integrity caused by modern alterations and/or damage.

Proposed Sale Segment Right-of-Way
The seven previously recorded architectural resources (PM-788, PM-790 through PM-792, PM-833, PM-915, and PM-916) within the proposed APE are located outside the visual line-of-sight to the proposed undertaking and are considered ineligible due to their lack of architectural distinction and loss of integrity caused by modern alterations and/or damage.

The one previously unidentified archaeological resource (40PM120) is considered ineligible for listing in the NRHP. The single architectural resource (HS-12) with the proposed APE is considered ineligible for listing in the NRHP due to its lack of architectural distinction and loss of integrity caused by modern alterations and/or damage.

TVA has determined that the proposed undertaking would not adversely affect any historic properties that are potentially eligible, eligible or currently listed on the National Register of Historic Places. The Tennessee Historical Commission concurred with this determination (see Appendix A).

4.10. Visual and Aesthetic Quality

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

4.10.1. No Action Alternative

Under this alternative, the new transmission line would not be constructed, and there would be no project-related effects to the visual resources of the area. Because the existing 69-kV line would continue to be maintained as before, there would be no additional visual or aesthetic effects in the area of the existing under the No Action Alternative.

4.10.2. Action Alternative

New Transmission Line Right-of-way

The new 161-kV transmission line would begin at the tap point along the existing West Cookeville-Peavine 161-kV line located just west of Rocky Point Ridge and north of Interstate 40. Numerous laced-steel towers can be seen in the landscape along the existing transmission line route. There are no homes in the immediate area of the tap point, and the new line would likely not be seen by motorists along Interstate 40.

The line would cross Falling Water River to the north and Mount Pleasant Road approximately one-half mile north of the tap point. There are numerous wooden utility poles along the roadway that are in the foreground of several homes. The new single-pole steel structures would contribute to an increase in discordantly contrasting structures seen in the landscape by area residents and motorists along Mount Pleasant Road. Initially, these views would be of bright structures that would increase vertical contrast in the foreground. However, this contrast would decrease as the poles become weathered over time.

The proposed line route would follow adjacent to the west side of Mount Pleasant Road for approximately one-half mile. There are several homes and barns in the foreground of the proposed transmission line. New poles and lines may be seen intermittently along the roadway. However, the landscape in this area has a greater capacity to absorb visual change. Rolling topography and vegetation along the roadway would obscure views and diminish visibility for motorists and area residents.

The proposed line route would continue north across steep terrain and traverse Buck Mountain Road. A cell tower to the northeast and a repeater station to the northwest are visible from the roadway, providing adverse visual contrast in the landscape. The line would be in the foreground of several homes as it crosses the roadway. However, the line would be less visible to area residents as it traverses along dense vegetation to the west.

The line would turn northeast and cross Parragon Road twice. This area is mainly open pasture on each side of the roadway with dense vegetation along the steeper slopes to the east and west. Prior to crossing Parragon Road the second time, the route would follow dense vegetation to the east. Motorists would likely have brief views of the structures and lines. However, details of the poles and lines would be absorbed by vegetation, lessening the impacts of new line construction.

The line would parallel Brotherton Mountain road to the north, following along the south side and continuing east. The line route would follow steep, heavily vegetated, terrain. Most likely, it would not be seen by area motorists or residents before it enters the UCEMC Algood Substation.

Operation, construction, and maintenance of the proposed transmission line would be visually insignificant. There may be some minor visual discord during the construction period due to an increase in personnel and equipment and the use of laydown and materials storage areas. These minor visual obtrusions would be temporary until the proposed 100-foot right-of-way and laydown areas have been restored using TVA standard BMPs (Muncy 1999). Therefore, there are no significant visual impacts anticipated because of this project.

Proposed Sale Segment Right-of-Way

The segment of transmission line proposed for sale begins west of Dry Valley Road just east of SR 111 at structure 48 and continues to the UCEMC Algood substation. In order to sell this section of transmission line, TVA does not expect to upgrade the line or add any appurtenances to the existing poles. Therefore, no additional visual effects as a result of this sale are expected.

4.11. Recreation

4.11.1. No Action Alternative

Because the proposed actions would not be undertaken under the No Action Alternative, no effects to local recreational opportunities or experiences are anticipated under this alternative. No additional effects to these resources are likely under the No Action Alternative for similar reasons.

4.11.2. Action Alternative

With the exception of the White Plains Golf Course, local organized recreation facilities are located west of Highway 111, outside of the project area. Because of the intervening distance, these facilities and the recreational opportunities they provide would not be affected by the proposed transmission line or by the proposed sale.

Portions of the White Plains Golf Course are located within approximately one-fourth mile of the proposed transmission line route. Because of the intervening forest vegetation and the elevation differences between the proposed transmission line and the golf course, the line is not expected to influence the recreational experiences afforded by the golf course to a significant extent. Construction and operation of the proposed transmission line is not expected to affect local informal recreation opportunities significantly. The proposed sale would not affect recreational opportunities or experiences in the area.

4.12. Socioeconomics

4.12.1. No Action Alternative

Under the No Action Alternative, the proposed actions would not be undertaken. TVA would not negotiate easements for the proposed right-of-way, and no payments would be made.

Without the provision of a reliable power source to the new UCEMC Algood 161-kV Substation, there is strong likelihood of overloading at the existing 69-kV substation. This overloading could lead to outages. Such outages could be expensive, especially for commercial or industrial consumers.

A noticeable increase in the risk of an outage could diminish the desirability of property located in the impacted area, which would in turn negatively affect property values and marketability. It could also decrease the attractiveness of the area for location of businesses.

As discussed in Chapter 3, there are no major concentrations of economically disadvantaged or minority populations in the area. Therefore, adoption of the No Action Alternative would not disproportionately affect any such populations. However, economically disadvantaged persons would be less able to utilize alternatives in case of outages, especially extended outages.

4.12.2. Action Alternative

New Transmission Line Right-of-way

Along that part of the proposed transmission line route that would require the acquisition of new right-of-way, TVA would purchase easements from property owners, who would be offered fair market value for these rights. The easement would give TVA the right to construct the transmission line, including the placement of structures, operate the transmission line, and to maintain the line and the right-of-way. Because construction would be short-term, and most materials would be brought into the area, the economic effect on the local economy would be minor and insignificant.

In situations where the proposed transmission line is near homes, some short-term adverse impacts on property value and marketability could occur. However, these impacts would be highly variable and not readily predictable. Long-term adverse effects on property values are unlikely. Research results vary, and some early studies found little or no impact of transmission lines on property values. Some more recent studies, however, indicate that impacts in the range of 5 to 10 percent are possible for properties adjacent to a transmission line. The size of the impact appears to be sensitive to distance, with little or no impact to properties that are not adjacent or very close to the transmission line. The degree of effect depends on distance as well as the appearance of the right-of-way and how it blends visually with the neighborhood. Effects on property value tend to diminish over time, and virtually disappear in about 5 years (Hamilton and Schwann 1995; Gregory and Winterfeldt 1996; Electric Power Research Institute 2003).

The proposed 161-kV transmission line would be 5.2 miles long and the right-of-way would be 100 feet wide. Total area required by the right-of-way would be approximately 63 acres. Preparation for the right-of-way would require the clearing of 32.8 acres of forest. About 10 acres of this is oak-hickory forest that has been subject to minimal disturbance. This

forested area lies along the proposed right-of-way between the proposed substation and Parragon Road. The balance consists of mixed-aged forest areas dispersed at various locations along the proposed line route.

The value of the standing timber (also known as “stumpage”) would be taken into account in the purchase of easements for the right-of-way. Because the buying and selling of timber is widespread, regional price guidelines are available commercially. In the Cookeville area, stumpage prices tend to fall in the $500 to $1,500 per acre range. The value of standing timber depends on several factors including whether the trees are sold as sawtimber or pulpwood, the species present, stocking (i.e., number of trees per acre), accessibility of the trees, and timber quality.

In certain situations, trees may have greater actual value than just their stumpage value. For instance, trees in a well-landscaped lawn can add value to residential or commercial property, and this realized value can be reasonably estimated. Guidelines for valuating trees in urban and residential settings have been published (International Society of Arboriculture 2000). However, valuation of trees in such situations is subject to many external factors. Because the proposed line route avoids lawns, valuating trees on a landscape basis is not appropriate here.

Besides producing timber, forests provide other benefits and amenities, such as providing wildlife habitat, shade, aesthetic quality, and recreational opportunities; stabilizing soil; and, producing oxygen. Although these benefits are real, even tangible, expression of these values in direct economic terms is very difficult, as there are few established markets for such amenities. Indirect valuation is often used in such instances to determine relative value. In addition, much of the recent research in valuating the environmental benefits of trees has focused on urban and suburban settings rather than rural areas. The potential economic effects with respect to other tangible and intangible environmental amenities or benefits provided by forests cannot be quantified accurately.

Because the stumpage value of any standing timber would be considered in the amount paid by TVA for the right-of-way easement, the economic effect of the loss of 32.8 acres of forest would not be significant on the affected property owners or on the local area. According to U. S. Forest Service (2007) estimates, in 2004 Putnam County contained over 135,000 acres of forest. Estimates for Putnam County and the six adjacent counties (Cumberland, DeKalb, Jackson, Overton, Smith, and White) indicate that these seven counties contain over a million forested acres. Thus, the loss of 32.8 acres of forest constitutes a miniscule amount of forest land compared to the total forested acreage in Putnam and surrounding counties. In light of the above, the incremental loss of these benefits would be minor and insignificant.

There are no significant concentrations of minority or low-income populations near the proposed transmission line. For this reason and because of the relatively low minority population and poverty rates in the general area, no disproportionate impacts to disadvantaged groups or minority populations are expected.

Proposed Sale Segment Right-of-way

The proposed sale of a 1.6-mile segment of existing transmission line is not expected to cause any significant socioeconomic effects to the properties adjacent to the right-of-way because there would be no change in the current operation or maintenance of the existing

line. Because there would be no change other than in ownership of the line, there would be no socioeconomic effects. Values of adjacent or nearby properties would not be affected.

4.13. Post-construction Effects

Transmission lines, like all other types of electrical wiring, generate both electric and magnetic fields (EMF). The voltage on the conductors of the 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 right-of-way, and the residual very low amount is reduced to background levels near the right-of-way 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, like other transmission lines, 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 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. 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 right-of-way 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 and concerns have included potential interference with AM radio reception, television reception, satellite television, and implanted medical devices. Interference with radio or television reception is typically due to unusual failures of power line insulators or poor alignment of the radio or television antenna and the signal source. Both conditions are correctable and would be repaired if reported to TVA.

Implanted medical devices historically had a potential for power equipment strong-field interference when they come within the influence of low frequency, high-energy workplace exposure. However, the older devices and designs (i.e., those beyond five to 10 years old) have been replaced with different designs and different shielding that prevent potential for

interference from external field sources up to and including the most powerful magnetic resonance imaging (MRI) 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 concerning EMF and possible effects 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 2007). Effects associated with ungrounded, metallic object, static charge accumulation and discharge in dairy facilities have been found when the connections from a distribution line meter have not been properly installed on the consumer's side of a distribution circuit.

TVA transmission lines are built with overhead ground wires which 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 right-of-way. The National Electrical Safety Code is strictly followed when installing, repairing, or upgrading TVA lines, substations, or equipment.

There is some public concern as to the potential for adverse health effects that may be related to long-term exposure to 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 EMF 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 of 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 World Health Organization (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 EMF.

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 (World Health Organization 2007b).

Neither medial 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.

TVA maintains a current awareness of medical and health research related to EMF, along with media coverage of reports of information that may not have been peer reviewed by scientists or medical personnel. The current and continuing scientific and medical communities' position regarding the research and any potential for health effects from low-

frequency power equipment or line fields is that there is no reproducible or conclusive data demonstrating an effect or an adverse health effect from such fields (World Health Organization 2007a). 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 EM field strengths for transmission lines, two states (New York and Florida), do have such regulations. The expected magnetic field strengths at the edge of the proposed right-of-way would fall well below these standards. Consequently, the construction and operation of the proposed transmission line is not anticipated to cause any significant impacts related to EMF.

4.13.1. No Action Alternative

Under the No Action Alternative, no new electric and magnetic fields would be created from the construction of the proposed transmission line. The electrical loading on portions of TVA's existing transmission system would likely be increased, resulting in increases in EMF. However, this increase would not result in any significant impacts.

4.13.2. Action Alternative

Electric and magnetic fields would be produced along the length of the proposed transmission line. The strength of the fields within and near the right-of-way would vary with the electric load on the line as well as with the terrain. Public exposure to EMF would be determined by final routing decisions, and would change over time after the line is completed as adjacent land uses change. As described above, TVA would minimize public exposure to EMF through engineering features and line routing decisions. No significant impacts from EMF are anticipated.

Transmission line structures are well grounded, and the conductors are insulated from ground. Therefore, touching a structure supporting a 161-kV transmission line poses no inherent shock hazard. The structures that would be used on the proposed transmission line have demonstrated a good safety record. Unlike lattice-type structures, they are difficult to climb without special equipment. 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. Thus, the proposed structures do not pose any significant physical danger. For this reason, TVA does not typically construct barricades or fences around structures.

During construction of the proposed transmission line, equipment would generate some noise above ambient levels. Because of the general lack of nearby sensitive receptors and the short construction period, noise-related effects are expected to be temporary and insignificant. For similar reasons, noise related to periodic line maintenance is also expected to be insignificant. Construction and operation of the line is not expected to produce any noticeable odors.

4.14. Global Warming

Global warming is a phenomenon believed to be the result of the production of various "greenhouse" gasses, notably carbon dioxide, carbon monoxide, and the oxides of nitrogen and sulfur. These gasses are by-products of the burning of coal and other fossil fuels.

They are also produced by automobiles, various industrial processes, and natural events. The implementation of amendments to the Clean Air Act has reduced the production of some greenhouse gasses.

4.14.1. No Action Alternative

Under the No Action Alternative, TVA would not construct the proposed 161-kV transmission to serve UCEMC's new Algood 161-kV Substation. In this event, two outcomes are possible. First, UCEMC could proceed with construction of the proposed substation, but power it from some other utility. This would require that UCEMC break its contract with TVA. Second, UCEMC could postpone the completion of the new substation and continue to use its existing 69-kV substation to supply power to customers. In either case, demand for electric power in the Cookeville and Algood is likely to increase due to population and commercial growth. In all likelihood, this additional power demand will be met. Thus, implementation of the No Action is not expected to result in any significant decrease in the amount of electric power produced in the area or any decrease in the production of greenhouse gasses. Nevertheless, the anticipated increase in power production to serve the Algood area, when compared to global power demand, is not expected to have any measurable contribution to global warming.

4.14.2. Action Alternative

TVA is proposing to provide electric power to UCEMC's new Algood 161-kV substation under the Action Alternative. As stated above, an increase in the demand for electric power is likely to occur regardless of the source of this power. Construction of the proposed transmission line would not generate increased power demands, nor is it expected to cause increased global warming to any measurable degree.

4.15. Unavoidable Adverse Impacts

Construction and operation of the proposed transmission line has the potential to cause unavoidable adverse effects to several environmental resources. These adverse effects could include the loss of forest area and associated wildlife populations; increased forest fragmentation; removal of the tree canopy at stream crossings; restrictions on future land use within the right-of-way; and changes to the visual character within the local area. TVA has reduced the potential for such adverse effects during the planning process. Also, TVA would implement mitigation measures (see Section 4.18) to reduce potential adverse effects to certain environmental resources.

4.16. Relationship of Short-Term Uses and Long-Term Productivity

The construction and operation of the proposed transmission line would increase the capacity and reliability of the power supply in the TVA service area, and specifically, in the Algood and Cookeville areas. Not doing this could undermine the economic and population growth that is occurring in the Cookeville and Putnam County area. The provision of additional power capacity and the improvement power reliability of power would also reduce or prevent costs to local commerce and industry from an outage.

Construction and operation activities associated with the proposed transmission line would result in short-term and long-term effects on timber and wildlife production within the right-of-way. A minor amount of agricultural productivity would be lost for the life of the

transmission line due to the placement of poles. There would be long-term visual effects along some portions of the proposed transmission line route due to the visual intrusions of the transmission line and its structures. These potential effects have been reduced to the extent possible during the planning process.

4.17. Irreversible and Irretrievable Commitments of Resources

Irreversible commitments of resources cannot be reversed, except perhaps in the extreme long term. For example, mining of ore is an irreversible commitment of a resource; once the ore is removed and used, it cannot be replaced. Irretrievable commitments are those in which a resource is lost for a finite period -- even a long period of time. For example, the construction of a road through a forest would be an irretrievable commitment of the productivity of timber within the road right-of-way as long as the road remains.

The materials used for construction of the proposed transmission line would be committed for the life of the line, a period of 50 years or more. Some materials, such as ceramic insulators may be irrevocably committed. However, metals in conductors, structures, and other equipment could be recycled.

Constructing the proposed transmission line would result in the irretrievable loss of 32.8 acres of forest. Similarly, the right-of-way used for the proposed transmission line would be committed irretrievably, but the approximately 63 acres of right-of-way could be returned to other uses upon retirement of the line. In the meantime, compatible uses of the right-of-way such as farming and the provision of open-land wildlife habitat could continue. However, the provision of forest products, forest wildlife habitat, and other forest-dependent amenities on those forested sections of the proposed right-of-way would be lost for the life of the transmission line.

4.18. Summary of TVA Commitments and Proposed Mitigation Measures

TVA would undertake the following routine measures would be taken to reduce the potential for adverse environmental effects.

- Appropriate BMPs would be implemented during construction activities.
- During construction and operation of the proposed transmission line, the environmental quality protection specifications as described in Appendices B, C, D, and E of this document would be implemented.
- Any improvements to the access road for the proposed switches would be done in manner such that upstream flood elevations would not be increased.

The following nonroutine measures would be applied during construction and operation of the proposed transmission line to reduce the potential for adverse environmental effects.

- Locations of button snakeroot would be included in the transmission line and access road engineering design specification drawings that would be used for maintenance activities. Vegetation management within 100-feet of either of these sensitive areas in which state-listed species occur would be accomplished through mechanical clearing; no herbicides would be used.

- TVA would stipulate as a term of the sale agreement for a portion of the West Cookeville-East Cookeville-Algood 69-kV Transmission Line to UCEMC that UCEMC shall use and maintain the line in accordance with TVA specifications as described in Appendix E.

CHAPTER 5

5.0 LIST OF PREPARERS

5.1. NEPA Project Management

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Position:	Senior Environmental Engineer – Siting and Environmental Design, TVA Power System Operations, Chattanooga, Tennessee
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Involvement:	Purpose of and Need for Action, Alternatives including the Proposed Action

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5.2. Other Contributors

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Position:	Senior Aquatic Biologist, TVA Environmental Stewardship and Policy, Knoxville, Tennessee
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Involvement:	Aquatic Ecology/Threatened and Endangered Species

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Marianne M. Shuler

Position:	Archaeologist Technician, TVA Environmental Stewardship and Policy, Knoxville, Tennessee
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Involvement:	Cultural Resources

J. Hunter Terrell

Position:	Contract Aquatic Community Ecologist, TVA Environmental Stewardship and Policy, Knoxville, Tennessee
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Jan K. Thomas

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CHAPTER 6

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

Federal Agencies

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Cookeville, Tennessee

Dr. Jeffrey R. Duncan
National Park Service
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State Agencies

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Tennessee Department of Economic and Community Development
Nashville, Tennessee

Mrs. Jennifer Barnett
Tennessee Division of Archaeology
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Mr. Paul Davis
Division of Water Pollution Control
Nashville, Tennessee

Mr. Jim Fyke
Department of Environment and Conservation
Nashville, Tennessee

Mr. E. Patrick McIntyre
Tennessee Historical Commission
Nashville, Tennessee

Mr. Reggie Reeves
Division of Natural Heritage
Nashville, Tennessee

Mr. Robert M. Todd
Tennessee Wildlife Resources Agency
Nashville, Tennessee

Mr. Mark Tummons
Division of Recreation Education Services
Nashville, Tennessee

Elected Officials

Office of U.S. Senator Bob Corker
Chattanooga, Tennessee

Office of Congressman Bart Gordon
Murfreesboro, Tennesse

The Honorable Charlotte Burks
Nashville, Tennessee

The Honorable Henry Fincher
Cookeville, Tennessee

The Honorable Kim Blaylock
Cookeville, Tennessee

Local Organizations

Upper Cumberland Development District
Cookeville, Tennessee

Buck Mountain Community Organization
Cookeville, Tennessee

CHAPTER 7

7.0 LITERATURE CITED

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Appendix A – Correspondence

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TENNESSEE HISTORICAL COMMISSION
DEPARTMENT OF ENVIRONMENT AND CONSERVATION
2941 LEBANON ROAD
NASHVILLE, TN 37243-0442
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October 26, 2007

Dr. Thomas O. Maher
Tennessee Valley Authority
400 West Summet Hill Dr.
Knoxville, Tennessee, 37902-1499

RE: TVA, CULTURAL RESOURCES SURVEY REPORT, 69 KV ALGOOD LINE/EXISTING & PROPOSED, UNINCORPORATED, PUTNAM COUNTY

Dr. Maher:

Pursuant to your request, received on Wednesday, October 17, 2007, this office has reviewed documentation concerning the above-referenced undertaking. This review is a requirement of Section 106 of the National Historic Preservation Act for compliance by the participating federal agency or applicant for federal assistance. Procedures for implementing Section 106 of the Act are codified at 36 CFR 800 (Federal Register, December 12, 2000, 77698-77739)

Considering the information provided, we find that the area of potential effects for this undertaking contains no historic properties eligible for listing in the National Register of Historic Places. You should notify interested persons and make the documentation associated with this finding available to the public.

If your agency proposes any modifications in current project plans or discovers any archaeological remains during the ground disturbance or construction phase, 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.

This office appreciates your cooperation.

E. Patrick McIntyre
Executive Director and
State Historic Preservation Officer

EPM/jyg

Tennessee Department of Agriculture
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Ken Givens
Commissioner

Phil Bredesen
Governor

November 7, 2007

Ms. Kimberly D. Choate, P.E.
Siting and Environmental Design Department
Tennessee Valley Authority
1101 Market Street
Chattanooga, TN 37402-8914

Re: Proposed 161kV Transmission Line
Upper Cumberland Electric Membership Corporation
Putman County

Dear Ms. Choate:

Thank you for the opportunity to comment on the above-referenced project. This proposal will have no affect on the planning of our department, but we would offer one comment relative to transmission line right-of-way maintenance.

The department's Water Resources Program is currently funding the planning and subsequent restoration of the Post Oak Creek watershed along the Putnam and White County boundary. It has been brought to our attention the concerns from some individual landowners in this watershed regarding the erosion occurring along portions of the TVA transmission line right-of-way. Consequently, we would request that TVA take proper steps regarding this new transmission line to maintain the right-of-way in such a way as to prevent soil erosion. TVA should also take particular care to maintain appropriate vegetation within the portions of the right-of-way that are adjacent to or cross waters of the state, in order to maintain good water quality and streambank stability.

Thank you again for the opportunity to comment.

Sincerely,

Terry Oliver
Deputy Commissioner

Appendix B – TVA Right-of-Way Clearing Specifications

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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 Practice (BMP) 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 Electric 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 the TVA's Transmission, Operations, and Maintenance 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 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.

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

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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 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 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.

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Appendix D – TVA Construction Guidelines Near Streams

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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 TVA Construction and Maintenance Activities.*

Three Levels of Protection

During the preconstruction review of a proposed transmission line, TVA Resource Stewardship staff will have studied each possible stream impact site and will have identified it as falling into one of three categories: (A) standard stream protection, (B) protection of important permanent streams, 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 state and Federal requirements to avoid harming certain species. The category designation for each site will be marked on the 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 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 will be done using pertinent Best Management Practices (BMPs) such as those described in *A Guide for Environmental Protection and Best Management Practices for TVA Construction and Maintenance Activities,* especially Chapter 6, Standards and Specifications.

2. All equipment crossings of streams 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 by the actions of plowing, disking, blading, or other tillage or grading equipment will not be allowed in SMZs; however, a minimal amount of soil disturbance may occur as a result of clearing operations. Shorelines that have to be disturbed must be stabilized as soon as feasible.

(B) Protection of Important Permanent Streams

This category will be used when there is one or more specific reason(s) why a permanent (always-flowing) stream requires protection beyond that provided by standard BMPs. Reasons for requiring this additional protection include the presence of important sports fish (trout, for example) and habitats for Federal endangered species. 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 TVA Construction and Maintenance Activities*, especially Chapter 6, Standards and Specifications.

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. Proposed crossings of permanent streams must be discussed in advance with Resource Stewardship staff and may require an on-site planning session before any work begins. The purpose of these discussions will be to minimize the number of crossings and their impact on the important resources in the streams.

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 Electric 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 not be allowed in SMZs; however, a minimal amount of soil disturbance may occur as a result of clearing operations. 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 (for example, a particular spring run) or protected species (for example, one that breeds in a wet-weather ditch) is known to occur on or adjacent to the construction corridor. 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 TVA Construction and Maintenance Activities*, especially Chapter 6, Standards and Specifications.

2. All construction activity in and within 30 meters (100 feet) of the unique habitat must be approved in advance by Resource Stewardship staff, preferably as a result of an on-site planning session. The purpose of this review and approval will be to minimize impacts on the unique habitat. All crossings of streams also must comply with appropriate state (and, at times, Federal) permitting requirements.

3. Cutting of trees within 30 meters (100 feet) of the unique habitat must be discussed in advance with Resource Stewardship staff, preferably during the on-site planning session. Cutting of trees near the unique habitat must be kept to an absolute minimum. Stumps must not be removed, uprooted, or cut shorter than 0.30 meter (1 foot) above the ground line.

4. Other vegetation near the unique habitat must be disturbed as little as possible during construction. The soil must not be disturbed by plowing, disking, blading, or grading. Areas that have to be disturbed must be stabilized as soon as possible and revegetated as soon as feasible, in some cases with specific kinds of native plants. These and other vegetative requirements will be coordinated with Resource Stewardship staff.

Additional Help

If you have questions about the purpose or application of these guidelines, please contact your supervisor or the environmental coordinator in the local Transmission Service Center.

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Comparison of Guidelines Under the Three Stream and Waterbody Protection Categories (Page 1)

Guidelines	A: Standard	B: Important Permanent Streams	C: Unique Water Habitats
1. Reference	• All TVA 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 TVA Construction and Maintenance Activities,* especially Chapter 6, BMP Standards and Specifications.	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 TVA Construction and Maintenance Activities,* especially Chapter 6, BMP Standards and Specifications.	• 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 TVA Construction and Maintenance Activities,* especially Chapter 6, BMP Standards and Specifications.
2. Equipment Crossings	• All crossings of streams must comply with appropriate state and Federal 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 crossings of streams must comply with appropriate state and 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. • Proposed crossings of permanent streams must be discussed in advance with Resource Stewardship staff and may require an on-site planning session before any work begins. The purpose of these discussions will be to minimize the number of crossings and their impact on the important resources in the streams.	• All crossings of streams also must comply with appropriate state and Federal permitting requirements. • All construction activity in and within 30 meters (100 feet) of the unique habitat must be approved in advance by Resource Stewardship staff, preferably as a result of an on-site planning session. The purpose of this review and approval will be to minimize impacts on the unique habitat.

Comparison of Guidelines Under the Three Stream and Waterbody Protection Categories (Page 2)

Guidelines	A: Standard	B: Important Permanent Streams	C: Unique Water Habitats
3. Cutting Trees	• 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.	• Cutting of trees with 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 an impacts to the SMZ and surrounding area. • Cutting of trees near permanent streams must be limited to those meeting National Electric Safety Code and danger tree requirements. • Stumps can be cut close to ground level but must not be removed or uprooted.	• Cutting of trees within 30 meters (100 feet) of the unique habitat must be discussed in advance with Resource Stewardship staff, preferably during the on-site planning session. Cutting of trees near the unique habitat must be kept to an absolute minimum. • Stumps must not be removed, uprooted, or cut shorter than 1 foot above the ground line.
4. Other Vegetation	• 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 not be allowed in SMZs; however, a minimal amount of soil disturbance may occur as a result of clearing operations. • 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 not be allowed in SMZs; however, a minimal amount of soil disturbance may occur as a result of clearing operations. • 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 must not be disturbed by plowing, disking, blading, or grading. • Areas that have to be disturbed must be stabilized as soon as possible and revegetated as soon as feasible, in some cases with specific kinds of native plants. These and other vegetative requirements will be coordinated with Resource Stewardship staff

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Appendix E – TVA Right-of-Way Vegetation Management

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TENNESSEE VALLEY AUTHORITY RIGHT-OF-WAY VEGETATION MANAGEMENT

Tennessee Valley Authority (TVA) must manage 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 ensure National Electrical Safety Code electrical clearances between tall-growing vegetation and any other structures. Trees located off right-of-way trees that could fall or be cut into a transmission line are also very important.

These requirements are imperative to the maintenance of the transmission system and, in some cases, underbuilt distribution lines. It is seldom understood by customers or the general public that electricity must continuously be produced and transmitted on an instant-to-instant basis to serve the demand placed on the system by continuously changing electrical load. When a switch is turned on, electricity must flow instantaneously. With increasingly complex and diverse electronic equipment controlled by computers, microchips, and other systems that respond to microsecond interruptions, any disturbance on transmission or distribution lines instantaneously affects the overall reliability of critical devices, especially production devices; security systems; process controls; medical devices; water purification and sewage treatment systems; fire and safety protection systems; communication and control systems; etc. These systems have little tolerance of even a few microseconds of interruption.

Each year, TVA must assess the conditions of the vegetation on and along its rights-of-way. This is accomplished by aerial inspections of each line, periodic walking inspections, information from aerial photographs, information from TVA field personnel, property owners, and the general public. Information is developed regarding vegetation species present, the mix of 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 that may be adjacent to the right-of-way and that may be a danger to the line or structures. TVA right-of-way program administrators develop a vegetation-reclearing plan that is specific to each line segment; it is based on terrain conditions, species mix, growth, and density. They evaluate accessibility, right-of-way, and adjacent sensitive areas, land use and development, and a series of additional parameters. To the maximum extent possible, line segments from substation busbar to substation busbar should be recleared in the same year so a line can be made as reliable as reasonably possible.

Complicating factors are the rich diversity of tall-growing and climbing vegetation species in the power service area. The long growing season with abundant rain greatly accelerates growth in the moderate to rich soils of the TVA power service area. In addition, many rapid growing species are accelerated growers when competing vegetation is removed or reduced. Diverse geographic features, slopes, and conditions along line easements create many sensitive environmental and public interest areas on or adjacent to rights-of-way.

For the above reasons, TVA uses an integrated vegetation management approach. In farming areas of right-of-way crops and pasture, TVA encourages property owner management of the right-of-way using low-growing crops year after year. In dissected terrain with rolling hills and interspersed woodlands traversed by the rights-of-way, TVA uses mechanical mowing to a large extent.

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 segments of tall-growing vegetation are present but accessibility along the right-of-way is difficult or the path to such segments is very long compared to the amount present, herbicides may be used.

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 Health and Safety Administration. For that reason, TVA is actively looking at better control methods including use of low-volume herbicide applications, occasional singletree injections, and tree-growth regulators.

TVA does not encourage individual property owner tree reclearing activity 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 reclear the right-of-way with trained reclearing professionals.

TVA's experience initially was completely with hand clearing. World War II manpower shortages forced TVA to look toward developments in herbicide research. An era of near exclusive use of herbicides existed. Then, because of the discovery of residue accumulations with many pesticides and price increases of herbicides, high-volume applications lost favor, and TVA sought other modes of vegetation control. Farm equipment of greater power and efficiency allowed use of tractor-mounted rotary mowers. These mowers not only cut the tall saplings and seedlings on the right-of-way, they shatter the stump and the supporting near-surface root crown. The tendency of resistant species is to resprout from the root crown, and shattered stumps produce a multistem dense stand in the immediate area. Repeated use of the mowers on short-cycle reclearing with many original stumps regrowing in the above manner creates a single-species thicket or monoculture. With the original large root system and multiple stems, the resistant species can and usually do produce regrowth 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 created, 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 concern. They tend to spread off the right-of-way into more desirable species areas. Increasingly, TVA is receiving complaints about the shatter sapling debris density. The potential exists for insect invasion or fungus infection resulting from the easy invasion of damaged specimens or debris. Once started, such infestations or invasions can spread into valuable timber of the same or related species off the right-of-way.

Therefore, TVA has been working with universities (such as Mississippi State University, University of Tennessee, Purdue University, and others), chemical companies, other utilities, and personnel of the U.S. Department of Transportation, U.S. Fish and Wildlife Service, and U.S. Forest Service to explore other means of dealing with problem vegetation. 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.

The above-named universities strongly recommend low-volume herbicide applications since their research demonstrates much wider plant diversity after such applications. They report better ground erosion protection and the development of more wildlife food plants and cover plants. 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.

Wildlife managers are specifically requesting the use of herbicides in place of rotary mowing in order to avoid damage to nesting and tunneling wildlife. This method retains groundcover year-round 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).

Property owners interested in tree production are requesting 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 rights-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.

Some property owners have special interests. In those cases, TVA attempts to work with them to either have them sign agreements in which they maintain the right-of-way in right-of-way crops or pasture or they do the actual right-of-way maintenance. Some may choose to use low-growing trees or fruit trees, sod, vegetable crops, or other low vegetation types.

TVA discusses with property owners the potential to sign an agreement to manage their land for wildlife under the auspices of "Project Habitat," a joint TVA/American Cyanamid wildlife organization. The property owner maintains the right-of-way in wildlife food and cover with emphasis on quail, turkey, deer, or related forms. 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.

TVA places strong emphasis on developing 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 and vegetation effective and efficient manner possible.

Approved Herbicides for Usage on TVA Rights-of-Way

Trade Name	Active Ingredients	Label Signal Word
Accord	Glyphosate/Liquid	Caution
Arsenal	Imazapyr/Liquid/Granule	Caution
Escort	Metsulfuron Methyl/dry flowable	Caution
Garlon	Triclopyr/Liquid	Caution
Garlon 3A	Triclopyr/Liquid	Danger
Diuron	Diuron/Flowable powder	Caution
Spike 40P	Tebuthiuron/Pellet	Caution
Spike 80W	Tebuthiuron/Wettable powder	Caution
Transline	Clopyralid/Liquid	Caution
Pathfinder II	Triclopyr/RTU	Caution
Krenite UT	Fosamine Ammonium	Warning
Vanquish	Diglycolamine	Caution

Approved Herbicides for Bare Ground Areas

Trade Name	Active Ingredients	Label Signal Word
Chopper	Imazapyr/RTU	Caution
Topsite	Diuron/Imazapyr	Caution
Roundup	Glyphosate/Liquid	Caution
SpraKil SK-26	Tebuthiuron and Diuron	Caution
Sahara	Diuron/Imazapyr	Caution
Roundup Pro	Glyphosate	Caution
Endurance	Prodiamine	Caution
Predict	Norflurazon	Caution

Tree growth regulators (TGRs) are being considered for use on tall trees that have special circumstances where they must be trimmed on a regular cycle.

Approved TGRs for Use on TVA Property

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

The herbicide Pathway is being considered for use following initial clearing. Test plots have been established to determine the effectiveness of Pathway. Pathway is a mix of Picloram and 2,4-D and carries a "Warning" signal word.

These herbicides have been evaluated in extensive studies at universities in support of registration applications and label requirements. Most have been reviewed in the U.S. Forest Service (USFS) Vegetation Management Environmental Impact Statements (EISs), and those evaluations are incorporated here by reference. 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 to resources (including buffer zones for listed threatened or endangered species) when applied by trained applicators following the label and registration procedures.

Those not addressed in the USFS EISs or their supporting research have been peer reviewed in university research, addressed in U.S. Environmental Protection Agency (USEPA) literature reviews, or are discussed in documents on file at USEPA and U.S. Fish and Wildlife Service libraries. On the basis of this literature and TVA's reviews, the approved list above has been compiled and is reviewed again each year as new information is published.

The rates of application utilized are those listed on the USEPA-approved label and consistent with the revised application rates of the USFS Vegetation Management EIS Record of Decision. These typical application rates, in pounds/acre of active ingredient, are as follows:

Herbicide	Application Method					
	Aerial Liquid	Aerial Granule	Mechanical Liquid	Mechanical Granule	Manual Hand	Manual Foliar
2,4-D amine	2.0		2.5			2.0
2.4-D ester	2.5		4.0			2.0
2.4-DP	3.0		4.0			1.0
Dicamba			2.0			2.0
Krenite	6.0		7.8			
Glyphosate	1.5		1.5			1.0
Hexazinone	4.0	4.0	4.0	4.0	4.0	4.0
Imazapyr	0.75		0.75			0.75
Fuel oil	0.5		2.0			1.5
Limonene	0.9		0.9			0.9
Picloram	0.5		0.7			0.4
Sulfomet	0.13		0.17			0.06
Tebuthiuron	1.0	1.0	1.0	1.0		4.0
Triclopyr amine	4.0		4.0			4.0
Triclopyr ester	4.0		4.0			4.0

TVA currently uses primarily low-volume applications of foliar and basal applications of Accord (Glyphosate) and Accord (Glyphosate)-Arsenal (Imazapyr) tank mixes. Glyphosate is one of the most widely used herbicidal active ingredients in the world and has been continuously the subject of numerous exhaustive studies and scrutiny to determine its potential impacts on humans, animals, and the environment.

Accord, labeled for vegetation management in forestry and utility rights-of-way applications, has a full aquatics label and can be applied to emergent weeds in all bodies of fresh and brackish water. There is no restriction on the use of treated water for irrigation, recreation, or domestic purposes.

Accord is applied to the foliage of actively growing plants. The active ingredient is absorbed through the leaves and rapidly moves throughout the plant. Glyphosate prevents the plant from producing amino acids that are unique to plants and are building blocks of plant proteins. The plant, unable to make proteins, stops growing and dies.

The favorable environmental fate characteristic of Accord herbicide and its major metabolite (breakdown product) aminomethylphosphonic acid (AMPA) is well known. Continuing research is underway with more than 400 studies conducted to date in the laboratory and under field use conditions. These studies show rapid breakdown, little soil or plant debris retention, and little vertical movement into soil below the surface.

Glyphosate is naturally degraded by microbes in soil and water under both aerobic (with oxygen) and anaerobic (without oxygen) conditions. AMPA is further degraded in soil and sediments to phosphorus, nitrogen, hydrogen, and carbon dioxide. Glyphosate binds rapidly and completely to a wide range of soils and sediment when introduced into the environment. This essentially eliminates movement in the soil. The average half-life of glyphosate in soils is

less than 45 days. Half-life for the dissipation of glyphosate in environmental waters ranges from 1.5 to 14 days.

Glyphosate is nontoxic to birds, mammals, and bees and has been shown not to bioaccumulate since it acts in plants through an enzyme system that does not exist in animals or humans.

Arsenal (Imazapyr) has been similarly tested, and it is found to have low-leaching potential in soils. When available on or in the soil, it is broken down rapidly by soil microbes to naturally occurring compounds. When not available, Imazapyr is bound tightly to soil colloids and is unavailable for movement. The half-life in soil is 25 to 65 days.

Extensive chronic and acute toxicity studies have made Arsenal a USEPA-classified herbicide as practically nontoxic to humans, mammals, birds, fish, aquatic invertebrates, and insects. The chronic studies demonstrate that Imazapyr is non-teratrogenic, non-mutagenic, and not a carcinogen.

The mode of action suppresses amino acids of the plant via an enzyme system containing acetohydroxy acid synthase. This enzyme system does not exist in other forms of life including humans and animals.

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Appendix F – Stream Crossings within the Algood Project

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Appendix Table F-1. Stream Crossings on the Proposed Algood 161-kV Transmission Line within the Falling Water River Drainage, Putnam County, Tennessee

Sequence ID	Stream Type	SMZ Category	Stream Name	Comments
001	Intermittent	Category A (50 ft)	Tributary to Burtons Branch	3'x1' channel. Forested. Eventually enters a sinkhole.
002	Intermittent	Category A (50 ft)	Tributary to Burtons Branch	12'x7' channel. Recent ground fire has burned off vegetation on right bank, making it highly erodable. No water present at time of survey.
003	Intermittent	Category B (250 ft)	Tributary to Burtons Branch	Spring, currently dry (during drought year). Cave located north of spring (Johnston property). Steep slopes located on either side. Category B assigned due to presence of spring.
004	Intermittent	Category B (250 ft)	Tributary to Burtons Branch	Spring head. Small 1'x6" channel straight down side of steep (65%) slope. Feeds SMZ007.
005	Intermittent	Category B (250 ft)	Tributary to Burtons Branch	3-8'x1' channel with slabrock/rubble substrate. Steep slopes and presence of spring is reason for Category B SMZ. Fed by another spring Northeast of spring (SMZ006).
006	Perennial	Category B (250 ft)	Tributary to unnamed creek in Rockwell Hollow	3.5'x6" channel. Spring emerging from base of slope. Spring head is not in ROW but SMZ is. Category B due to presence of spring.
007	Intermittent	Category A (50 ft)	Tributary to unnamed creek in Rockwell Hollow	8'x3' channel heavily impacted by previous logging. Forested. Ford through stream channel.
008	Other	Category A (50 ft)	Tributary to unnamed creek in Rockwell Hollow	Pond with small WWC[1] feeding it. Area around pond is cleared and heavily impacted by cattle. WWC is cleared but still heavily impacted.
009	Intermittent	Category B (100 ft)	Tributary to unnamed creek in Rockwell Hollow	3'x2' channel. No water present at time of survey. Drains into two sink holes ~ 30 yards from spring head.
010	Intermittent	Category A (50 ft)	Unnamed creek in Rockwell Hollow	14'x8' channel. ROW[2] extends into ripiarian zone. No water present at time of survey
011	Intermittent	Category A (50 ft)	Unnamed creek in Rockwell Hollow	14'x8' channel. ROW extends into ripiarian zone. No water present at time of survey
012	Perennial	Category A (60 ft)	Falling Water River	50'x8' deep channel with gravel/silt/bedrock substrate. Forested. Fish/snails/macroinvertebrates observed. Impoundment begins approximately 100 yards downstream.
013	Other	Category A (50 ft)	N/A	Cattle pond.
014	Perennial	Category A (60 ft)	Falling Water River	Falling Water River crossing between structures 103-104. This section of stream is impounded.

[1] WWC = wet weather conveyance, i.e., a stream that has water in it only after a rainfall or other precipitation event.
[2] ROW = Right-of-way

Appendix Table F-2. Stream Crossings on the Existing Right-of-way within the Falling Water River Drainage, Putnam County, Tennessee

Sequence ID	Stream Type	SMZ Category	Stream Name	Comments
001	Intermittent	Category A (50 ft)	Tributary to Burton Branch	Stream flowing out of wetland through culvert and then through cow pasture. Stream has been channelized through pasture.
002	Intermittent	Category A (50 ft)	Tributary to Burton Branch	Channelized stream running through wetland. No water present at time of survey