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FINAL ENVIRONMENTAL ASSESSMENT

# EAST BOWLING GREEN-SOUTH SCOTTSVILLE 161-KV TRANSMISSION LINE TAP TO NORTH MILL SUBSTATION

**Warren County, Kentucky**

TENNESSEE VALLEY AUTHORITY

DECEMBER 2006

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**Final Environmental Assessment** **December 2006**

**Proposed project:** East Bowling Green-South Scottsville 161-kV Transmission Line Tap to North Mill Substation – Warren County, Kentucky

**Lead agency:** Tennessee Valley Authority

**For further information, contact:** James F. Williamson, Jr.
Senior NEPA Specialist
Tennessee Valley Authority
400 West Summit Hill Drive WT 11D
Knoxville, Tennessee 37902-1401
Phone: 865-632-6418
Fax: 865-632-6855
e-mail: jfwilliamson@tva.gov

**Abstract:** The Tennessee Valley Authority (TVA) proposes to construct a new 161-kV transmission line from its existing East Bowling Green-South Scottsville 161-kV Transmission Line to the Bowling Green Municipal Utilities' (BGMU's) North Mill Substation, which is under construction. TVA would also provide 69-kV revenue metering equipment at the new BGMU substation for distributor installation.

The need for the substation has been shown in system studies covering the period from 2004 to 2024 which forecast electrical loads high enough that the system would not have sufficient capacity in an emergency situation. Outages at some points on BGMU's 69-kV transmission system currently cause other parts of the transmission system to load near capacity. By 2007 to 2009, distribution feeders and substations in high load growth areas are expected to exceed economical load capacity. Outage restoration and maintenance during peak loads is already difficult. By 2014, neither of the two BGMU delivery points, where power is purchased from TVA, would have the capacity to serve the entire Bowling Green load by itself in an emergency.

This new transmission line would supply a third delivery point and distribution substation on the BGMU system. The delivery point and substation would satisfy transmission, distribution and delivery point needs on the BGMU system, increasing reliability and providing capacity to meet forecasted demand projections.

The proposed TVA 161-kilovolt transmission line would be approximately 6 miles long on a 75-foot wide right-of-way. Approximately 3 miles would be new construction, and about 3 miles would be located on existing Warren Rural Electric Cooperative Corporation right-of-way. Steel single-pole structures 80 to 100 feet tall would be used along most of the proposed line. Taller double pole structures would be used as necessary at crossings to maintain adequate clearance.

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# CHAPTER 1

## 1. PURPOSE OF AND NEED FOR ACTION

### 1.1. Proposed Action – Improve Power Supply

The action proposed by the Tennessee Valley Authority (TVA) is to provide electric power to a supply delivery point substation in Bowling Green, Kentucky that is under construction. The new substation is being built by the Bowling Green Municipal Utilities (BGMU) and will be known as the North Mill Substation. TVA would serve the substation by building and operating an approximately 6-mile long, 161-kilovolt (kV) transmission line connection from TVA's existing East Bowling Green-South Scottsville 161-kV Transmission Line to the new substation. The proposed in-service date is July 2007. The right-of-way for the new transmission line would occupy approximately 55 acres. TVA would also provide equipment to BGMU that would be installed in the new substation to allow metering and system protection.

### 1.2. Need for the Proposed Action

BGMU purchases its total electric power requirements from TVA. BGMU's Electric Division serves approximately 50,000 people within the city limits of Bowling Green, with over 27,000 residential service connections. They also serve over 4,200 commercial customers. BGMU has 28 miles of 69-kV transmission lines and 332 miles of distribution lines in the city. Customers are served through 13 BGMU and two customer-owned 69-kV substations. Two 161-kV delivery point substations receive electric power from TVA. In July, 2005, BGMU experienced a peak demand of 194.5 megawatts (MW). That peak was exceeded by over four percent in August of 2006 (i.e., 202.5 MW). The 2024 peak is projected to be 247 MW and 1,131,000 megawatt hours (MWHs). This estimate uses a conservative annual growth rate of 1.4 percent. The south portion of the city of Bowling Green has grown significantly. Two existing 161-kV delivery points are located in the north and west portions of the BGMU system. No 161-kV sources are located to the south or east of the city. A vicinity map showing transmission lines and substations on the south side of Bowling Green is provided as Figure 1-1.

The need for the substation has been shown in system studies covering the period from 2004 to 2024 forecasting electrical loads high enough that the system would not have sufficient capacity to serve in an emergency situation. Outages at some points on BGMU's 69-kV transmission system now cause other parts of the system to load near their capacity. By 2007 to 2009, distribution feeders and substations in areas of high load growth are expected to exceed economical load capacity. Outage restoration and maintenance during peak loads is now difficult. By 2014, neither of the two BGMU delivery points, where power is purchased from TVA, would have the capacity to serve the entire Bowling Green load by itself in an emergency.

The most critical overloads occur with the loss of the South Bowling Green 161-kV delivery point. An outage of this delivery point currently causes BGMU's 69-kV transmission lines to become overloaded and makes operating the system very difficult and severely restricts operating flexibility. Loss of BGMU's Shive Lane Substation would cause the Lovers Lane and Cave Mill Substations to be overloaded above their combined total capability during

peak conditions. Currently, BGMU cannot take the Shive Lane Substation out of service for maintenance without interrupting electrical service during parts of the year. For similar reasons, taking the Cabell Drive Substation out of service for maintenance is also very difficult. These problems become more severe with increased load growth. With loads forecast in 2014, in an emergency, one of the two existing delivery points would not have the capacity to carry the entire system load by itself.

The 69-kV sources from BGMU's Bowling Green and South Bowling Green Substations are located in the north and west portions of the city. However, major commercial growth is occurring to the east and south of the city. Some of this growth includes Super Wal-Mart, Sam's Club, Lowes, and Kohl's. Significant growth is occurring along Highway 231. There are currently plans to widen Lovers Lane and Shive Lane to five lanes to Scottsville Road (U.S. 231). This is expected to bring additional growth and development in these areas. Distribution circuits in the Smallhouse Road area, along Highway 231, and near the airport are heavily loaded.

Reliability, as well as capacity, is a concern in providing adequate electrical power service to the area. Because reliability decreases as loading increases, the predicted peak load conditions would result in a system even more likely to experience outage.

To address these issues, BGMU is constructing a new 161-kV delivery point and distribution substation west of I-65 on Cave Mill Road (see Figure 1-1). This new substation will be known as the North Mill Substation. Connecting this new substation to the TVA system is needed if the problems discussed above are to be remedied.

## 1.3. Objectives of the Proposed Action

To serve BGMU's new substation and to help address the power demand needs in the Bowling Green area, TVA proposes to construct a new 161-kV transmission line from TVA's existing East Bowling Green-South Scottsville 161-kV Transmission Line to BGMU's new North Mill Substation. TVA would also provide 69-kV revenue metering equipment at the new substation for the distributor to install.

An objective of installing this new transmission line is to supply a third 161-kV delivery point to bring TVA power into the BGMU system and to serve the new distribution station at that same location.

The presence of this third 161-kV source in the area would resolve the potential 69-kV overloads by providing additional switching capabilities on BGMU's 69-kV system. The third 161-kV source will provide new distribution substation capacity in a high growth area, which would resolve the need for additional distribution capacity. The availability of a third delivery point also will provide 161-kV delivery point capacity to avoid a situation, likely about 2014, where all of the system could not be served in a single contingency.

TVA's proposed new 161-kV transmission line would increase the system's reliability and load-serving ability by supplying an additional 161-kV source station at a key location on the BGMU system.

**Figure 1-1. Vicinity Map**

## 1.4. Decisions

The primary decision before TVA is whether to serve the planned substation and help improve the electrical service in the BGMU service area by building a new 161-kV transmission line to connect to the BGMU North Mill 161-kV Substation. If the transmission line is built, other secondary decisions are involved. These include the following considerations.

- The timing of improvements
- The best route for the transmission line.
- Determining any necessary mitigation and/or monitoring measures to implement to meet TVA standards and minimize potential damage to resources

TVA must also determine whether the selected alternative would be a major federal action significantly affecting the human environment. If TVA determines that it would not significantly affect the quality of the human environment, then TVA would prepare and sign a Finding of No Significant Impact (FONSI), and the project can proceed.

If TVA determines that the selected alternative would significantly affect the quality of the human environment, then an Environmental Impact Statement (EIS) and a Record of Decision must be prepared and signed before TVA could construct the proposed transmission line.

## 1.5. Other Pertinent Environmental Reviews or Documentation

There are no other environmental reviews of projects in this immediate area that would be relevant to this review.

## 1.6. The Scoping Process and Public Involvement

The following federal, state and local agencies and other organizations were contacted concerning this project.

- U.S. Fish and Wildlife Service, Frankfort Field Office
- Kentucky Department for Environmental Protection
- Kentucky Heritage Council, State Historic Preservation Office
- Office of State Archaeology
- Cherokee Nation
- Eastern Band of the Cherokee Indians
- United Keetoowah Band of Cherokee Indians in Oklahoma
- Chickasaw Nation
- Choctaw Nation of Oklahoma
- Jena Band of Choctaw Indians
- Muscogee (Creek) Nation of Oklahoma
- Alabama-Coushatta Tribe of Texas
- Alabama-Quassarte Tribal Town
- Kialegee Tribal Town

- Thlopthlocco Tribal Town
- Seminole Indian Tribe
- Absentee Shawnee Tribe of Oklahoma
- Eastern Shawnee Tribe of Oklahoma
- Shawnee Tribe

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

An open house meeting for landowners potentially affected by the alternative route segments (see Figure 1-2) and the general public was held at the TVA Bowling Green Service Center on August 25, 2005. Ten public officials and approximately 440 potentially affected property owners were invited by letter prior to the meeting. Advertisements were also placed in The Bowling Green Daily News, the local newspaper. TVA issued a news release to local news outlets. Over 120 people attended the meeting to obtain information about the project, offer suggestions, and ask questions. The primary concern mentioned by those in attendance was the impact a new transmission line would have on residential and commercial land development in the project area.

During the thirty-day comment period following the public meeting, TVA heard from a group of landowners affected by one of the alternative routes. They stated that they did not receive a letter about the August 25$^{th}$ public meeting. One of the potential route segments, Segment 11 (see Figure 1-2), crosses two tracts of land in the floodplain of Drakes Creek that are owned by the homeowner associations of Blue Springs Farm and Bent Creek Farm. At their request, TVA conducted an additional information meeting at the Bowling Green Customer Service Center on November 30, 2005, for the residents of those two neighborhoods. Forty-one potentially affected property owners attended that meeting. They voiced their concerns about the impact to their neighborhood by the identified transmission line route and asked questions of TVA representatives. Their primary concerns were devaluation of property values, visual impacts, environmental impacts to the Drakes Creek ecosystem, and conflicts with recreational use of the Drakes Creek floodplain.

A draft of this environmental assessment was issued for public review on October 27, 2006. An announcement of the availability of the draft document and requesting public comments was published in the *Bowling Green Daily News* on October 15, 2006. The draft document was also posted on TVA's website. A total of 12 individuals contacted TVA during the 30-day comment period. Some requested copies of the document. Others expressed opposition to the proposed project; while some offered comments on the document. Responses to all comments are provided as Appendix F. Based on the comments, appropriate additions and changes were made in this Final Environmental Assessment.

**Figure 1-2. Route Alternative Segments for the Proposed East Bowling Green-South Scottsville Tap to the North Mill Substation**

## 1.7. Necessary Federal Permits or Licenses

A permit would be required from the Commonwealth of Kentucky for construction site storm water discharge for the 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. Because some soil disturbance would occur, TVA would submit a Kentucky Pollutant Discharge Elimination System permit request to the Kentucky Division of Water once the environmental assessment process is complete. A permit would also be required for burning trees and other combustible materials removed during transmission line construction. TVA would secure all appropriate permits prior to undertaking the proposed action.

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# CHAPTER 2

## 2. ALTERNATIVES INCLUDING THE PROPOSED ACTION

As described in Chapter 1, TVA is proposing to connect a planned BGMU substation to the TVA system. Besides a No Action Alternative, two possible alternatives were developed. These alternatives are described in this chapter. Additional background information about transmission line construction, operation, and maintenance is also provided below.

### 2.1. Alternatives

The various potential route alternatives (see Figure 1-2) were analyzed and evaluated to derive a final preferred route. A detailed description of this process is provided in Section 2.3. The preferred route is shown as Figure 2-1. Alternative B, described below, involves construction of the proposed transmission line on the preferred route. Two practical alternatives were developed. A third alternative was considered but was eliminated. These alternatives are described below.

#### *2.1.1. Alternative A – The No Action Alternative – TVA Would Not Construct the East Bowling Green-South Scottsville 161-KV Transmission Line Tap to the North Mill 161-kV Substation*

Under the No Action Alternative, TVA would not construct a new 161-kV transmission line to serve the new North Mill 161-kV Substation. However, BGMU could decide to build a new transmission line to serve its new substation. BGMU could possibly use the route identified by TVA, or could select another route. If BGMU were to construct the line, the potential impacts 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 BGMU.

Absent this, portions of the transmission system in the Bowling Green area would continue to operate with a high risk level of interruption in certain situations, especially during times of high electricity use. This risk is projected to increase over time as the electrical loads in the area continue to grow with ongoing and future development. Without a new 161-kV substation and a new 161-kV transmission line, as early as 2007, in emergency situations, these increasing power loads could cause overloads of some existing 69-kV lines as well as some of the 69-kV substations in the area. By 2014, with current load projections, a load on a portion of the system would not be servable in the event of the loss of one of the two delivery points.

Another option that could occur under the No Action Alternative is that instead of completing its new substation, the distributor (BGMU) could decide to construct approximately 7.5 miles of single circuit 69-kV line and 2.5 miles of double circuit 69-kV transmission line through the center of Bowling Green, and build a new Scottsville Road-Campbell Lane area distribution substation in the southern portion of its service territory. This option also calls for BGMU to add a third transformer at the Bowling Green 161-kV Substation and complete 161-kV and 69-kV bus upgrades to facilitate the new transformer. The potential environmental effects associated with this work are likely to be greater than those from building the BGMU substation that is now under construction and TVA's proposed 6-mile transmission line because much longer transmission lines and more new

right-of-way would be required. Much of this right-of-way would be through residential areas in the central area of Bowling Green.

Alternative B, the Action Alternative (see Section 2.1.2 below), offers much better operating flexibility in the southern portion of BGMU's service area than this option because it would allow BGMU to perform necessary maintenance without long outages. In addition, if longer transmission lines were to be constructed, the risk of outages related to line exposure would be higher, and energy losses would be much higher. Given these considerations, TVA determined that implementation of the No Action Alternative would not improve reliability, was not economical, and would present aesthetic and land use issues. This alternative would not be the best remedy for the capacity concerns in the Bowling Green area and would not provide service to the BGMU substation that is under construction.

### *2.1.2. Alternative B – The Action Alternative – Construct and Operate the East Bowling Green-South Scottsville 161-KV Transmission Line Tap to North Mill 161-kV Substation*

Under the Action Alternative, TVA would construct a new 161-kV transmission line to provide power to BGMU's North Mill 161-kV Substation in Warren County, Kentucky. The proposed transmission line would connect TVA's East Bowling Green-South Scottsville 161-kV Transmission Line with the North Mill 161-kV Substation. The total length of the proposed transmission line would be approximately 6 miles. It would be built on new right-of-way for 3 miles and on existing right-of-way currently owned by Warren Rural Electric Cooperative Corporation (WRECC) for 3 miles. The width of the right-of-way would be 75 feet. The existing WRECC transmission line would be removed and rebuilt as a second circuit (i.e., another set of conductors) on the new TVA transmission line. One side would be the North Mill 161-kV tapline, and the other side would be the new WRECC circuit constructed at 161-kV and operated at 69-kV. A 13-kV underbuild would be added to the structures as well. All of the retired equipment would be returned to WRECC. TVA would have an agreement to permanently share this right-of-way easement with WRECC. All of the new transmission line right-of-way would be located on private land. TVA would also provide metering and protection equipment at the North Mill 161-kV Substation for BGMU to install.

### *2.1.3. Alternative Eliminated from Detailed Study - Construct and Operate the Memphis Junction-Portland 161-kV Transmission Line Tap to the North Mill Substation*

Under this alternative, TVA would provide a tap point and switches on the Memphis Junction-Portland 161-kV Transmission Line and construct a new 6.3-mile 161-kV tapline from the tap point eastward to the North Mill Substation.

This alternative was eliminated for several reasons. First, an industrial park is located near the most suitable tap point in the Memphis Junction-Portland line. Any route to the new substation would have to traverse this industrial park, thereby limiting future development in this area. Secondly, the area southwest of the new substation site has recently been completely developed with apartments and townhomes. Similarly, the area to the northeast of the substation is occupied with several existing subdivisions. Consequently, there is no practical way for a new transmission line to approach the proposed substation from a westerly direction without affecting existing residential development. Finally, this

**Figure 2-1. Preferred 161-kV Transmission Line Route**

transmission line route is approximately 0.3 miles longer and would require entirely new right-of-way (a total of 3.3 miles more new right-of-way) than the proposed route under the Action Alternative). Thus, the potential environmental effects associated with this work are likely to be greater than those from adopting Alternative B. For these reasons, this alternative was eliminated from further consideration.

## 2.2. Description of Construction, Operation, and Management of the Proposed 161-kV Transmission Line

### *2.2.1. Transmission Line Construction*

Structures and Conductors

The proposed transmission line would utilize mostly single steel-pole structures (Figure 2-2). The first 3 miles would be double circuit, single steel poles with a 13-kV distribution line underbuild (attached below the higher voltage line) on existing WRECC right-of-way (see Figure 2-2a). The structure height would vary according to the terrain, but would average between 80 and 100 feet. The remaining 3 miles would be constructed single circuit on single steel poles and would utilize new right-of-way (see Figure 2-2b). At creek or highway crossings, taller double poles may be used in order to maintain adequate clearance (see Figure 2-3). These structures would average between 100 and 120 feet tall. At the Drakes Creek crossing, a clearance of at least 493.4 feet above mean sea level (i.e., 22 feet above the 100-year flood level) would be maintained.

The 13-kV distribution circuit underbuilt on the existing wood poles would be moved to a temporary location north of the existing easement to continue serving the existing homes while the 69-kV line is de-energized and removed from the right-of-way. TVA would then erect new poles on the easement and string conductors for the TVA circuit on the north side of the poles. The WRECC circuit would be installed on the south side of the poles, and the distribution circuit would be connected to the poles below the higher voltage lines. Therefore, three circuits would be built on the first three miles of line. TVA's 161-kV circuit would occupy one side, and the WRECC 13- and 69-kV circuits would occupy the other side. The new structures on this portion of the line would be set in locations at or near to the existing pole locations. The angle points would likely require guyed two pole structures in place of the single guyed poles used in the single circuit 69-kV transmission line.

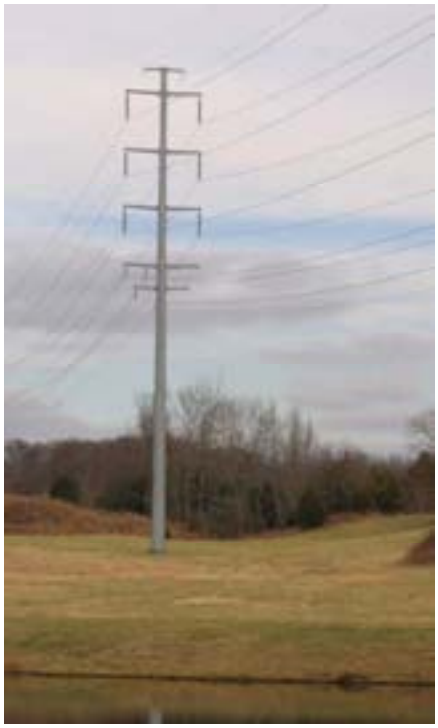
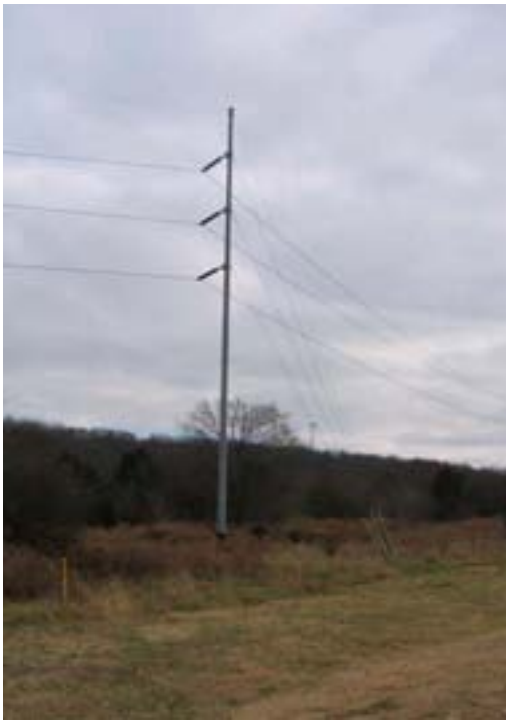
(a)  (b) 

**Figure 2-2. Single-Pole Transmission Structures Utilized for: (a) Existing Right-of-Way and (b) New Right-of-Way**

**Figure 2-3. Double-Pole Transmission Structure**

Additionally, a three-pole dead end structure with three switch structures (one on either side and one in front) would be installed at the tap point (see Figure 2-4).

**Figure 2-4. Three-Pole Dead End Transmission Structures With Switch Structures**

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.

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. Some structures may be self-supporting (non-guyed) poles fastened to a concrete foundation which is formed and poured into an excavated hole.

Equipment used during the construction phase would include trucks, truck-mounted augers and drills, as well as tracked cranes and bulldozers. Low ground pressure equipment would be used in specified locations to reduce the potential for environmental impacts. Construction is anticipated to be completed within 4 months.

Right-of-Way Acquisition and Clearing

New right-of-way 75-feet wide would be needed for 3 miles of the transmission line, while the remaining 3 miles would be constructed on existing right-of-way. TVA would purchase easements from landowners for the new right-of-way on private land. These easements and land 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 off the cleared right-of-way and are tall enough to pass within 5 feet of a conductor or structure should it fall toward the transmission line. Fee simple ownership of the land within the right-of-way would normally remain with the landowner, and a number of activities could be continued on the property by the landowner. The terms of the easement would prohibit the construction of buildings and any other activities within the right-of-way that could interfere with the transmission line or create a hazardous situation.

Most of the route on which new right-of-way would be required is open land and would require minimal clearing. 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 be removed initially from the entire width of the right-of-way that crosses forested areas. Equipment used during this right-of-way clearing would include chain saws, skidders, bulldozers, 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 offsite. 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 to soon grow tall enough, to interfere with conductors. Clearing in SMZs would be accomplished using hand-held equipment or remote handling equipment, such as a feller-buncher, in order to limit ground disturbance. Copies of TVA construction procedures, namely, *TVA Right-of-Way Clearing Specifications*, *TVA Environmental Quality Protection Specifications for Transmission Line Construction*, and *TVA Transmission Construction Guidelines Near Streams* are provided as Appendices B, C, and D.

Any trees located off the right-of-way which are tall enough to pass within 5 feet of a 161-kV conductor or structure (if it were to fall toward the line) are designated “danger trees” and would be removed.

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 seeded using native grass and other low-growing species. Erosion controls would remain in place until the ground cover is fully established. Streamside areas would be revegetated as described in Appendices B, C, and D.

Access Roads

Existing streets, roads, and the right-of-way itself would be used as access for construction and maintenance crews. Permanent off right-of-way access would be acquired for use of an existing drive from Old Scottsville Road northeast to the transmission line right-of-way. The roads would be about 20 feet wide and surfaced with dirt or gravel if necessary. Temporary culverts and other drainage devices, fences, and gates would be installed as necessary. Access points and roads used by construction and maintenance crews would be restored to previous conditions. If graveled, the gravel on the temporary access roads would remain at the discretion of the landowner, and the area would be planted with approved seed mixtures following construction. Additional applicable right-of-way clearing and environmental quality protection specifications are listed in Appendices B and C.

Construction Assembly Area

A construction assembly area would be required for worker assembly, vehicle parking, and material storage. The site identified for this project is a graveled lot adjacent to Sam’s Club, immediately west of Interstate 65 (see Figure 2-1). The site, which is approximately 2 acres in size, would be leased for the duration of the construction period (approximately 4 months). It consists of a relatively flat and previously cleared location adjacent to an existing paved road near the transmission line. Depending on site conditions, some minor grading and installation of drainage structures may be required. The area would be graveled and fenced so that trailers used during the construction process for material storage and office space could be parked at this location. Following the completion of

construction activities, all trailers, unused materials, and construction debris would be removed from the site. Removal of the fence and restoration would be at the discretion of the landowner. No potential environmental effects associated with the use of this site were identified, and no other location was identified that would have lesser 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 which might hamper the normal operation of the line or adversely impact 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.

Management of vegetation along the right-of-way would consist of two different activities: felling of danger trees adjacent to the cleared right-of-way, and control of vegetation within the cleared right-of-way. Much of the right-of-way, both the route portion on the existing WRECC right-of-way and that portion of the route on new right-of-way is open land consisting of pastures, farmed fields, and developed areas. Because very little of the route crosses wooded areas, vegetation management would be minor.

In those areas within the cleared right-of-way where vegetation management is necessary, TVA would use an integrated vegetation management approach designed to encourage the low-growing plant species while discouraging 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. 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 from the ground with backpack sprayers or vehicle mounted sprayers; however, in some cases it would be applied aerially by helicopter.

Any herbicides used would be applied in accordance with applicable state and federal laws and regulations. Only herbicides registered with the U. S. Environmental Protection Agency would be used. Appendix E contains a list of the herbicides and adjuvants (ingredients added to the herbicide solution to increase its effectiveness) currently used by TVA in right-of-way management. This list may change over time as new herbicides are developed or new information on presently approved herbicides becomes available.

Other than vegetation management, only minor additional 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 re-leveling the area surrounding the replaced structures, but there would be little, if any, additional area disturbance 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. The most practical power source is the East Bowling Green-South Scottsville 161-kV Transmission Line, which is located approximately five miles east of the planned substation. A discussion of why another source could not be used is provided in Section 2.1.3.

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 40.53 square miles, or 25,940 acres. The northern area boundary line is an east-west line originating near the intersection of U.S. Highway 31W and Campbell Lane and ending to the east near the Gotts community on Porter Road. The east boundary then turns south for five miles and crosses the Barren River, Old Cemetery Road, State Route 1288 through the community of Greenhill to a point where it turns westward. The south boundary extends westward for 8.5 miles crossing Old Scottsville Road, U.S. Highway 213, Howell Road, Plano Road, and Interstate 65 to a point near the intersection of state road 884 and Long Road. At this point, the west boundary turns northward for 4.8 miles and crosses Howell Road, Elrod Road, William Natcher Parkway, Cave Hill Road, and Campbell Lane.

Some general guidelines in routing transmission lines in this particular study area included avoidance of known major constraints (including wetlands), the major interstate highway interchange (I-65 and U.S. Highway 231), existing and potential residential and commercial

development areas, and severance of property parcels if possible. TVA tries to avoid running transmission lines parallel to streams and creeks because this would require cutting trees or low-growing vegetation along the stream banks for the entire length of the right-of-way adjacent to the water body, and this has adverse environmental effects. An important routing concern is accessibility by construction and maintenance crews to the final route chosen. Other important factors are engineering requirements, paralleling or utilizing existing utility corridors, following property lines, avoiding existing homes by a distance of at least 300 feet, and accommodating landowner requests about the line location if possible during the final stages of the project. As general guidelines, deviations from these constraints can and do occur, depending on the circumstances of each proposed project. Following is a brief description of other aspects of the study area.

- **Natural and Cultural Features**: The majority of the study area bedrock geology is St. Louis Limestone formation. Some small portions of the western portion of the study area may include the Ste. Genevieve Limestone formation. There are numerous sinkhole related depressions across the entire study area as a result of these formations. Fewer depressions occur along the flat floodplains of Drakes Creek and the Barren River. This is due to overlying alluvial soils covering or infilling many of the underlying sinkhole topographic features.

  The predominant water features in the study area are the Barren River and its tributary, Drakes Creek. There are no other named permanent streams in the area. This is likely due to the presence of numerous sinkholes.

  There are very few existing churches or cemeteries in the study area. There is one small site of historical interest along Drakes Creek consisting of an old bridge abutment. Due to the terrain, there are very few wetlands of any size. There are a few wetland areas associated with the floodplain of Drakes Creek.

- **Land Use**: The land uses in the study area are dictated by historical use and the location of transportation facilities. The eastern half of the area lies east of Drakes Creek. For years, this area was used for farming. It appears to have been used as pasture, dairy production, and cattle growing instead of row crop uses. This was probably due to the numerous sinkholes throughout the area. As the city of Bowling Green and Warren County have grown, the area is rapidly being converted to residential subdivisions and small 5- to 10-acre parcels for single homes.

  The area west of Drakes Creek is a mix of dense commercial development with dense residential apartment and townhouse construction. The interchange exit of Interstate 65 and U.S. Highway 231 has provided a nucleus for this commercial development consisting of restaurants, motels, shopping centers, a new Wal-Mart and Sam's Club, automobile dealerships, and several public and private schools.

- **Transportation**: Major transportation routes in the study area include Interstate 65, U.S. Highway 231, and the William H. Natcher Parkway. Other roads include Campbell Lane, Cave Mill Road, Nashville Road, and Scottsville Road.

### *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 a geographic information system (GIS). This system allowed the multitude of factors of the study area to be examined simultaneously to develop and evaluate numerous options and scenarios to determine the route or routes that would best meet project objectives.

Maps were created to clearly show regional opportunities and constraints. Sources included 1 inch = 500 feet true-color aerial photography, county parcel data/property boundaries, United States Geological Survey 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 the GIS. Manual calculations from aerial photographs, tax maps and other sources included the numbers 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 systems studies and data development phases, two tap point options were identified from the East Bowling Green-South Scottsville 161-kV Transmission Line to the BGMU substation. Ten major transmission line routes and seventeen alternate segments were evaluated to determine the preferred tap point and transmission line route (see Figure 1-2).

The straight-line distance from the TVA source transmission line to the BGMU substation site is about five miles. That short 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 choosing two tap point locations near Old Cemetery Road that were the beginning points of segments 1 and 2.

Segment 1 begins at the tap point of the East Bowling Green-South Scottsville 161-kV Transmission Line in a pasture and heads in a southwest direction for 2,400 feet across an area of scattered trees and sinkholes. At Point A, Segments 3 and 4 begin. Segment 3 continues in the same direction as Segment 1 for a distance of 4,800 feet to Point B. This area is open, fenced, pastureland with scattered sinkhole depressions. Segment 4 follows a parallel path 75 feet south of a 69-kV transmission line owned by WRECC. The predominant land use along this 8,300-foot long segment is open, fenced pastureland dotted with numerous sinkhole depressions and scattered residential development.

The WRECC transmission line, which is built on a 75-foot wide easement, is supported by wood structures that have an under-built 13-kV distribution circuit with occasional service drops (i.e., customer connections) and transformers attached. Segment 4 (ending at Point

C) crosses Carter Road (a narrow, paved state/county road) and several driveways to houses off Hunts Lane (another narrow, paved state/county road).

Segment 2 originates at an alternate tap point 400 feet southeast of the previous tap location. This segment is 10,150 feet long and travels in a general southwest direction. It also crosses open, fenced pastures dotted with sinkhole depressions and scattered wooded areas. It crosses Carter Road and Old Greenhill Road before terminating at Point D. Segment 6, beginning at Point B, traverses open, pasture land for a distance of 3,700 feet and terminates at Point D. This segment follows a south-southwest direction and crosses Old Greenhill Road at a crossing 1,000 feet north of Segment 2.

Segment 5 originates at Point B and extends 4,200 feet northwest to Point C. The land crossed is open pasture, fields, and wooded areas with scattered sinkhole areas. This segment does not cross any paved or gravel roads.

Segment 8, which is 4,800 feet long, originates at Point C and could be considered a continuation of Segment 4 because it also parallels the WRECC 69-kV transmission line. This segment crosses Middle Bridge Road. Its location switches from south of the existing line to the north side in order to avoid a home south of WRECC's line at Roy Thomas Road. The land use along this segment is open pasture land with scattered residential development.

Segment 7 begins at Point D and extends southwest for a distance of 7,500 feet across sparsely developed open pasturelands. This area is also marked by numerous sinkhole depressions. The segment crosses Stone Valley Road, a narrow, paved state/county highway. There is a large residential development north of the route between Drakes Creek and the road that is made up of large homes on large lots (5 to 15 acres each). To the south of the route is an extremely large golf course/home development. This segment avoids both areas and crosses Drakes Creek in a perpendicular path. This segment continues for another 12,500 feet to the west, following an open area east of U.S. Highway 231 between Drakes Creek and Peachtree Lane. After crossing Highway 231 it passes through a small commercial area, crosses Plano Road north of an existing subdivision, follows an open agricultural area with a patch of woods, and terminates at Point G.

Segment 17 begins at Point G and continues for 13,000 feet to its terminal point at the BGMU substation site on Cave Mill Road. Point G begins an area that appears to be unaffected by the sinkholes that were prevalent to the east. The route crosses open, row-crop agricultural use areas up to Greenwood Lane. At that point, a wide commercially developed area is crossed. Interstate 65 is crossed in a perpendicular manner, avoiding existing commercial buildings between the Interstate and west to Three Springs Road. Upon crossing Three Springs Road, the route closely follows property lines and the boundaries of apartment complexes and townhouse developments for the final 8,000 feet of this segment to reduce the potential impact on property owners. Many large angles were required in this segment to avoid impacting residential buildings.

Segment 9 (between Points E and F) is 450 feet long and serves as a connection from the beginning point for Segment 10 to 11, and 12. It crosses a vacant pasture area.

Segment 10 begins at Point E and follows a northwest to west path for 6,550 feet around the top of a bluff area east of Drakes Creek and west of Middle Bridge Road before crossing the creek and the narrow floodplain area west of the creek, ending at Point J. The

portion of this route east of the creek traverses hayfields and is well back from the edge of the bluff area to protect the trees growing on the area that slopes down to the creek. The area from the creek to Point J is a hayfield and lies in the 100-year floodplain of Drakes Creek.

Segment 11 begins at Point F immediately east of Roy Thomas Road. This segment (5,600 feet long) begins westward toward Drakes Creek across a hayfield, and then turns to the northwest at a point east of the creek. This segment then traverses an open hayfield area which is in the 100-year floodplain of Drakes Creek to Point J (which is also the end of Segment 10).

Segment 12 begins at Point F and heads in a southwest direction parallel to the WRECC 69-kV transmission line for 7,000 feet to a point in a business park, where it then turns northward at the north edge of Vanderbilt Drive at Point H. The initial 5,000 feet of this segment crosses residential development before entering the commercial business park.

Segment 14 begins at Point H and proceeds in a general northward path following the western edge of a large residential area for 6,000 feet. To the west of this segment is an active commercial area under development that fronts U.S. Highway 231 and Cumberland Trace Road, which parallels Interstate 65. Segment 14 terminates at the western edge of Interstate 65 at the southeast property corner of the newly constructed Sam's Club store (Point K).

Segment 15 begins at Point J in the floodplain of Drakes Creek, crosses a small tributary of Drakes Creek which is fed by a spring at the foot of a bluff, proceeds up the bluff and west southwest for 2,750 feet across currently undeveloped land to a point on the west side of Interstate 65 (Point K). This segment crosses Cumberland Trace Road and then immediately crosses Interstate 65. The Cumberland Trace Elementary School is located approximately 700 feet north of this segment on Cumberland Trace Road.

Segment 13 begins at Point H adjacent to Vanderbilt Drive and proceeds south through the business park to its south boundary. It then turns to the west, crossing U.S. Highway 231 at a farm implement dealership. It proceeds to the southwest and west around the perimeter of a mobile home park and the Greenwood High School property. This segment is 5,000 feet in length.

Segment 16, the final segment under study, begins at Point K along the west edge of Interstate 65. This segment is only 3,500 feet long but crosses the most costly real estate in the project area. This is the area of Bowling Green that is experiencing rapid and extensive commercial growth near the intersection of Interstate 65 and U.S. Highway 231. At Point K, the segment follows a BGMU distribution circuit for 1,600 feet along the right-of-way of the former Alvalon Road. The segment follows the north property line of the Baymont Inn to the eastern edge of an apartment complex. The route then turns to the north, following the apartment complex boundary to Point L in the vacant commercial area in which the original substation site was located. At Point L, Segment 16 proceeds directly into the original substation site across vacant land.

### *2.3.4. Establishment and Application of Siting Criteria*

TVA has long employed a set of evaluation criteria that represent opportunities and constraints for development of transmission line routes. The 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. 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 mean more potential for erosion and potential water quality impacts), consideration of visual aesthetics, number of forested acres occupied by the proposed right-of-way, number of open water crossings, presence of sensitive stream (those supporting endangered or threatened species) crossings, number of perennial and intermittent stream crossings, presence of wetlands or rare species habitat, natural area crossings, and proximity to wildlife management areas.

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

- *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*

Following the public open house and during the subsequent comment period, many landowners along alternative route segments east of Drakes Creek provided comments to TVA and to the management of Warren Rural Electric Cooperative Corporation (WRECC) suggesting that the Hardcastle–Plano 69-kV Transmission Line be more fully utilized by

TVA for the new circuit to minimize impacts to the rapidly developing areas along those alternate routes. WRECC officials suggested that they could work out accommodations with TVA for that to occur.

At the conclusion of the extended comment period, TVA developed ten distinct transmission line routes from the seventeen alternative route segments (see Figure 1-2). Each tap point and route alternative was evaluated using the updated constraint model along with the modified routing criteria obtained during the public involvement.

TVA uses several tools to evaluate alternative routes for new transmission lines and to identify a preferred route. Included are information from the property owners in the study area, interest groups, elected officials, subject matter experts, aerial photography, topographic maps, GIS constraint maps, field surveys, and professional experience. In making a final route decision, TVA weighs and balances public input and all pertinent environmental, engineering, and land use considerations. Although individual property owners may be distressed, the objective of the process is to ensure that overall project impacts, as well as impacts to the community at large, are minimized.

The ten alternative routes for the proposed transmission line were developed from the various combinations of the seventeen route segments (see Figure 1-2). The ten alternative routes and their constituent segments are summarized in Table 2-1 below.

**Table 2-1. Transmission Line Route Alternatives and Constituent Segments**

| Route Alternative | Segments |
|---|---|
| 1 | 1A, 4, 8, 10, 15, 16 |
| 2 | 1A, 4, 8, 9, 11, 15, 16 |
| 3 | 1, 3, 5, 8, 10, 15, 16 |
| 4 | 1, 3, 5, 8, 9, 11, 15, 16 |
| 5 | 1, 4, 8, 9, 12, 14, 16 |
| 6 | 1, 3, 5, 8, 9, 12, 14, 16 |
| 7 | 1, 4, 8, 9, 12, 13, 17 |
| 8 | 1, 3, 5, 8, 9, 12, 13, 17 |
| 9 | 1, 3, 6, 7, 17 |
| 10 | 2, 7, 17 |

Each alternative route offers different opportunities and constraints for power line construction. Opportunities include characteristics such as open land, existing utility corridors, areas less suitable for development and lack of sensitive environmental features. Constraints include obstacles such as steep terrain, sensitive environmental areas and land use conflicts. The assessment of the opportunities and constraints for these 10 alternative routes are summarized in Table 2-2.

Several of the alternative routes, particularly routes 1-4, have similar opportunities and constraints. Of these four routes, alternative routes 3 and 4 are less desirable because

they do not share as much existing right-of-way with WRECC as alternative routes 1 and 2. In addition, alternative routes 3 and 4 are longer, would require more right-of-way, and would involve a greater number of tracts.

By sharing 3 miles of existing right-of-way with WRECC, alternative routes 1 and 2 would avoid new impacts to approximately 27 acres. Of alternative routes 1 and 2, route 2 is preferred because it is shorter, would require less right-of-way acreage, and it would affect less developable land.

**Table 2-2. Comparison of Route Alternatives**

| Criteria | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Engineering | | | | | Environmental | | | | Land Use | | | | | | |
| **Route Alternative** | Length of Route (miles) | Road Crossings - Interstate | Road Crossings – US Hwy | Transmission Line Crossings | Right-of-Way (acres) | Forest (acres) | New Stream Crossings | Wetlands (acres) | Developable Property Used (acres) | Apartments w/i 300 ft | Schools w/i 1200 ft | Houses w/i 300 ft | Barns w/i Corridor | Commercial w/I 300 ft | Parcels Crossed |
| 1 | 5.7 | 1 | 1 | 1 | 41.4 | 8.7 | 1 | 0 | 35.3 | 22 | 2 | 4 | 1 | 8 | 41 |
| 2 | 5.6 | 1 | 1 | 1 | 38.6 | 10.6 | 1 | 0 | 25.5 | 22 | 2 | 3 | 1 | 8 | 46 |
| 3 | 6.1 | 1 | 1 | 1 | 62.9 | 10.5 | 1 | 0 | 56.8 | 22 | 2 | 6 | 1 | 8 | 65 |
| 4 | 5.9 | 1 | 1 | 1 | 60.1 | 12.5 | 1 | 0 | 47.0 | 22 | 2 | 5 | 1 | 8 | 70 |
| 5 | 6.4 | 1 | 1 | 2 | 34.2 | 13.1 | 0 | 0.3 | 28.0 | 22 | 2 | 28 | 1 | 10 | 58 |
| 6 | 6.8 | 1 | 1 | 2 | 55.6 | 14.9 | 0 | 0.3 | 49.4 | 22 | 2 | 30 | 1 | 10 | 75 |
| 7 | 7.4 | 1 | 1 | 3 | 45.6 | 14.3 | 0 | 0.3 | 40.9 | 11 | 1 | 117 | 1 | 2 | 71 |
| 8 | 7.8 | 1 | 1 | 3 | 67.2 | 16.1 | 0 | 0.3 | 62.5 | 11 | 1 | 119 | 1 | 2 | 88 |
| 9 | 8.2 | 1 | 1 | 0 | 99.4 | 14.1 | 1 | 0 | 94.2 | 11 | 1 | 50 | 1 | 2 | 85 |
| 10 | 8.2 | 1 | 1 | 0 | 98.5 | 13.7 | 1 | 0 | 93.3 | 11 | 1 | 52 | 0 | 2 | 73 |
| **Proposed Route** (with route adjustments) | | | | | | | | | | | | | | | |
| | 6 | 1 | 1 | 1 | 24.8 | 1.8 | 0 | 0 | 12.7 | 12 | 2 | 8 | 1 | 13 | 36 |

Route alternatives 5 and 7 involve an equal amount of existing right-of-way as route alternatives 1 and 2. However, alternative 5 and alternative 7 are less desirable because they are longer and would affect more developable land. Routes 5 and 7 would also affect more existing residential development and would affect more tracts overall.

In addition, route alternative 5 would be expensive to develop due to the amount of commercial property that would be needed for the right-of-way and the need for special engineering and design required for construction in the more densely-developed commercial area.

Route alternatives 6, 8, 9, and 10 present more constraints and would be more expensive to develop than the other alternatives for several reasons. First, these routes are longer than

other routes and would require more right-of-way acreage. Also, these routes do not allow the opportunity to share existing right-of-way. Finally, these four routes would likely affect more residences, and would involve more landowners.

## 2.4. Identification of the Preferred Route Alternative

Route alternative 2 (see Tables 2-1 and 2-2) presents the least amount of constraints and fewest potential impacts for a transmission line route. Therefore it is TVA's preferred route alternative.

After being identified, the preferred route was modified to further minimize overall project and community impacts. The modifications were based on comments received from property owners, public officials and subject matter experts, along with field surveys and available data sources. TVA's proposed route includes the following adjustments:

- Adding segment 1A and extending segment 9 to allow additional sharing of right-of-way with the existing WRECC transmission line and to move the proposed transmission line farther from an existing wetland
- Adjusting segment 11 to eliminate a new stream crossing
- Adjusting segments 11, 15, and 16 to reduce the number of parcels crossed by the line (by 10)
- Adjusting segments 15 and 16 to minimize impacts to proposed commercial development
- Adjusting segment 15 to minimize impacts to developable parcels
- Adjusting the final route segment (W-X, see Figure 2-1) into the substation because of BGMU's need to relocate the substation site due to unsuitable soil conditions

The preferred route would originate at a future three-pole tap structure (see Figure 2-1) located northeast of the existing TVA East Bowling Green-Scottsville 161-kV Transmission Line near structure 44. The route would proceed southwest to Point B where it would turn south to avoid a church building and intersect the existing WRECC 69-kV transmission line at Point C on the south side of Old Cemetery Road (Highway 234). The route from A to C would be slightly less than 700 feet long and would require 75-foot wide new easement. Disconnect switches would be installed on structures north and south of the tap structure in the source line and west of the tap structure in the tapline itself. Most of the new easement in this area would be on WRECC's existing Hardcastle Substation property; an easement over a small amount of acreage would be obtained from a nearby church.

At Point C, the preferred route would follow the existing 69-kV line for 2,319 feet to Point D. This area is fenced, open pasture land, and the route would cross one farm road. At Point D the line would turn to the right to a more southerly direction and would cross more open fenced pasture area for slightly over 3,700 feet to Point E. The route would cross Carter Road 1,000 feet south of its intersection with Hunts Lane and one farm road west of Carter Road.

At Point E, the route would make a slight angle to the left and continue for 6,080 feet to Point F. The area crossed here is a mixture of pasture and scattered wood lots. The route would cross several long driveways connecting house sites south of the route to Hunts Lane, which is north of and parallel to the route. Several property line fences would be

crossed in this area. Point F is at the route's intersection with Middle Bridge Road, an 18-foot wide paved road.

From Point F, the route would continue in the same direction for 2,900 feet to Point G, an angle to the left at a point on the east side of Roy Thomas Road. The land crossed in this area is also open, pastureland. There are nearby homes north and south of the route on the west side of Middle Bridge Road. There is one home very near and south of the route at Point G.

Upon leaving Point G, the route would turn to the southwest, cross Roy Thomas Road, a cultivated and wooded area, then cross State Road 2629 (Old Scottsville Road), follow the edge of a cultivated field, cross Drakes Creek (at the existing crossing of the WRECC line) and continue slightly further in its southwest direction ending at Point H. This section is 1,940 feet in length, and about 700 feet of this section overlaps the Old Scottsville Road right-of-way. Point H is at the foot of the Old Scottsville Road roadbed fill and just east of a wetlands area. At this point, the route would turn northward, leaving the WRECC transmission line easement.

The shared easement from Points C to H would be kept at the existing 75-foot width. The distribution circuit underbuilt on the existing wood poles would be moved to the north of the existing easement to a temporary location to continue serving the existing homes while the 69-kV line is de-energized and removed from the right-of-way. TVA would then erect new poles on the easement and string conductors for the TVA circuit on the north side of the poles with the WRECC circuit on the south side of the poles and the distribution circuit connected to the poles below the higher voltage lines. The new structures would be single steel poles and would be set in locations at or near to the existing pole locations. At angle points, guyed two pole structures would be used in place of the single guyed poles used in the single circuit 69-kV transmission line. Only very minor danger tree clearing would be required in this three-mile section. Some obstructions along the easement may need to be removed by WRECC prior to beginning of construction. TVA would pay property owners for additional rights to place the second circuit on the easement.

The remaining half of the project would begin at Point H. This section would be on new 75-foot wide right-of-way with single steel poles supporting a single 161-kV TVA transmission line. The section from Point H to I would cross Old Scottsville Road just west of its crossing of Drakes Creek. The route would proceed north for 2,090 feet across grassland that is in the 100-year floodplain of Drakes Creek. About half of this section is used for quail hunting and recreation associated with Drakes Creek.

At Point I, the route would turn to the northwest, cross a property line accented with large hardwood trees, and enter another open, hayfield area lying between the foot of a ridge and Drakes Creek. This area is in the 100-year floodplain. This 2,160-foot long section would end at Point J. This angle (Point J) was chosen to ensure that the route is removed far enough from Drakes Creek to prevent the cutting of any large trees along the west bank of the creek. At Point J, the route would turn slightly to the right and proceed for about 1,000 feet across more of the open floodplain land to Point K. The entire area from Point I to Point K is used by the homeowners as recreation and is cut for hay each year.

At Point K the route would turn to the southwest, cross a small stream that originates from a spring east of the route (at the bottom of a steep ridge), proceed up the wooded ridge side, and cross an open field to Point L. This section is 1,050 feet long and the 350-foot portion

that is wooded is the ridge slope area. This sloped area would likely need to be hand cleared to prevent erosion problems. Also, clearing of this wooded portion would be subject to the conditions in Section 4.14 to protect Indiana bats.

The route would then pass through Points L through Q for a distance of slightly over 1,900 feet. These angles are necessary to keep the route around the edge of this commercial area that is planned for development. It was recently approved for a commercial/residential tract. The location around the perimeter of the parcel would minimize the cost of the easement. The area from this parcel westward to the BGMU substation site is some of the most expensive land in Bowling Green. This portion of the route is in the vicinity to the Cumberland Trace Elementary School. Point M (see Figure 2-1) is approximately 730 feet from the school, while Point P is approximately 675 from the school.

At Point Q, the route would turn westward, paralleling Old Scottsville Road, cross Cumberland Trace Road, then Interstate 65 to Point R just beyond the west right-of-way fence of I-65. This is the southeast property corner of the newly constructed Sam's Club. From Point R to Point S, the route would follow a BGMU distribution line along the edge of the abandoned Alvalon Road right-of-way. From this point to the BGMU substation on Cave Mill Road, the TVA poles would be designed to support a BGMU distribution circuit below the 161-kV circuit. This section is 6,070 feet long. Four self-supporting steel pole structures would be necessary in this section because installation of guy wires, which are required for the angles in the transmission line, would interfere with existing land uses and would create hazards in this heavily developed commercial area.

The route would make a small angle at Point S, and the section between S and U would avoid the intersection of Ken Bales Boulevard, U.S. Highway 231, and Three Springs Road, which is a heavily used intersection. The T-U section would follow a lot line and avoid the Baymont Inn motel to the south and a convenience store and automobile dealership to the north. This section would cross Kenilwood Way about 200 feet east of Point U.

The 1,025 foot section between Points U to V would be located along the back property line of vacant commercial lots on Kenilwood Way. To the west of this section is a large apartment complex (Sunnydale Acres). This section of route crosses Pascoe Boulevard just south of Point V. At Point V, the route would turn to the west and closely follow the north property line of the apartment complex for 1,315 feet to Point W. Point W is near the southwest corner of the area north of an apartment complex that is currently under development.

At Point W, the route would turn northward for 1,000 feet to Point X. This section follows the property line between vacant land under development and Anchored Christian School to the west. All the easement in this area would be on open lands. As modified, none of the right-of-way would be located on the Anchored Christian School property. At Point X, the route turns to the west and terminates at the future BGMU substation. After the public meetings, the substation site was moved from its original location behind Thornton's Furniture store (see Figure 1-2). Due to unsatisfactory soil conditions on this site, BGMU decided to move the location of its substation approximately 1,400 feet west as shown in Figure 2-1.

The preferred route is approximately 6 miles in length, and the right-of-way would occupy approximately 55 acres. Approximately half of this acreage is existing right-of-way.

## 2.5. Comparison of Alternatives

Under the Action Alternative, TVA would build a 161-kV transmission line to serve the BGMU North Mill Substation. The proposed line would be approximately 6 miles long and would be placed on 75-foot wide right-of-way. The proposed line would occupy existing right-of-way for about 3 miles and would tap into the TVA East Bowling Green-South Scottsville 161-kV Transmission Line. The existing WRECC line on the right-of-way would be retired, and TVA would rebuild the line using new steel pole structures. The TVA and WRECC lines would share these structures, along with a 13-kV underbuilt line. The potential effects of the construction and operation, including right-of-way maintenance are described in Chapter 4.

Conversely, under the No Action Alternative, TVA would not construct the proposed tapline. In this case, BGMU would take measures to meet a growing demand for reliable power. BGMU could proceed with construction of the North Mill Substation and construct a tapline independent of TVA involvement. BGMU could either use the route proposed by TVA or could possibly choose an alternate route. One option considered by BGMU was to construct a substation on Scottsville Road (rather than the North Mill Substation) and construct about 14.1 miles of single circuit 69-kV line and 3.3 miles of double circuit line. This option would also require installation of a new transformer and associated upgrades at the BGMU Bowling Green 161-kV Substation. Because this particular option would not provide operating flexibility, would not improve reliability of the power supply, and would not remedy the need for additional power capacity, it is considered impractical and was not selected by BGMU.

Under the No Action Alternative, there would likely be no environmental effects resulting from any TVA action because there would be no action by TVA. However, actions taken by BGMU could have environmental effects. The exact nature and extent of these potential effects are difficult to determine, and would depend on the particular course of action chosen by BGMU, construction techniques, the extent of any construction actions, application of controls to prevent environmental degradation, and other factors. BGMU is subject to various environmental regulations and permitting processes and would comply with these requirements. Nevertheless, the potential environmental consequences of BGMU's actions in securing additional power are expected to be comparable to or greater than those anticipated under the Action Alternative.

## 2.6. The Preferred Alternative

The preferred alternative is the Action Alternative. Under that alternative, TVA would construct and operate a 6-mile long transmission tapline from the East Bowling Green-South Scottsville 161-kV Transmission Line to the BGMU North Mill 161-kV Substation.

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# CHAPTER 3

## 3. AFFECTED ENVIRONMENT

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

### 3.1. Terrestrial Life

#### *3.1.1. Wildlife*

The area in the vicinity of the proposed transmission line route consists of a mixture of commercial, residential, and pasture lands with small blocks of fragmented forest. The forested areas are located mainly along Drakes Creek. A moderately diverse bird community exists in the area due to the large amount of edge habitat along the existing right-of-way. Common bird species within these habitats include red-bellied woodpecker, American crow, blue jay, Carolina wren, Carolina chickadee, northern mockingbird, European starling, eastern towhee, brown-headed cowbird, and house sparrow. One field area on the south side of Drakes Creek is currently managed as a small private shooting preserve for quail hunting by the landowner. Mammals, reptiles, and amphibians in the project area include species that are adapted to largely disturbed habitats. Common amphibians in the area include northern cricket frog, Cope's gray treefrog, spring peeper, southeastern chorus frog, American bullfrog, green frog, American and Fowler's toads, various mole salamanders, southern two-lined, long-tailed, northern slimy and northern zigzag salamanders, and eastern newts. Reptiles common to the area include snapping, common musk, and eastern box turtles, spiny softshells, eastern worm, rat, eastern garter, northern water, and ring-necked snakes. Common mammals include skunks, cottontail rabbits, white-tail deer, opossums, and various rodents.

#### *3.1.2. Vegetation*

The proposed project occurs within the Western Pennyroyal Karst Plain of the Interior Plateau ecoregion (U. S. Environmental Protection Agency, 2006). This portion of the Interior Plateau consist of gently sloping to rolling karst plain with sinking streams, underground drainage, many sinkholes and ponds with scattered knobs. The region consists mainly of cropland or pastureland and in poorly drained areas with patches of woodlands. Three basic vegetation types are present in the project area. These are herbaceous vegetation, deciduous woodlands, and deciduous forest and comprise about 80, 15 and 2 percent of the area, respectively.

Herbaceous vegetation occurs in pastures, fields, and existing transmission line rights-of-way. These areas are dominated by grasses such as annual blue grass, canary grass, Johnson grass, tall fescue, Kentucky bluegrass, and broomsedge. In addition, corn speedwell, goldenrod, pepper weed, purple rocket, ragweed, spring forget-me-not, wild mustard and various asters are common herbaceous vegetation.

The woodland vegetation type is defined as an open stand of trees with crowns not usually touching, generally forming 25-60 percent cover. Deciduous woodlands are present along stream banks within the project area. Dominant woodland type tree species include box elder, hackberry, red maple, silver maple, slipper elm, sycamore, water locust and white oak. Common understory species are eastern redbud, deciduous holly, pawpaw, wild black cherry, spicebush, Chinese privet, river cane and snowberry. Poison ivy is common in the herb layer along with several wildflowers such as chickweed, phlox, and spring beauty and several fern species (e.g., lowland bladder fern, blunt lobed woodsia, and glade fern).

Deciduous forests are found in a narrow strip of proposed new right-of-way along a steep slope (i.e., between Points K and L, Figure 2-1). The forest vegetation type differs from the woodland type in that it has a more overlapping canopy (i.e., 60-100 percent) cover. The common overstory trees include oaks (black, white and northern red) and hickories (pignut, mockernut). Flame azalea, pawpaw, Carolina buckthorn, and bladdernut are common in the shrub-layer. Wildflowers such as Dutchman's breeches, jack-in-the-pulpit, little sweet Betsy, rue anemone, Solomon's seal, spring beauty, wood poppy, and waterleaf are common on the forest floor.

Several invasive plant species were observed within the proposed transmission line corridor. These include multiflora rose, Johnson grass, Chinese privet and Japanese honeysuckle. All of these species have the potential to adversely impact native plant communities because of their potential to spread rapidly and displace native vegetation. Approximately eighty percent of the proposed right-of-way is on land in which the native vegetation has been altered as a result of previous land-use history (e.g., pasture).

## 3.2. Aquatic Life

The project area drains to the Barren River drainage in the Pennyroyal Plain region of Kentucky. Typical streams in this physiographic region are deeply entrenched, with a moderate gradient, and exhibit low to moderate productivity. The region is characterized by sinkhole plains, sinking streams and caverns (Burr and Warren, 1986).

Field surveys documented a total of four watercourses that would be crossed by the proposed transmission line right-of-way or by access roads. The proposed line would cross two perennial streams and two wet-weather conveyances. A summary of streams crossed by the proposed transmission lines, streamside management zone (SMZ) protection categories and widths, and a brief description of each stream is presented in Table 3-1.

**Table 3-1. Stream Crossings Along the Proposed Transmission Line Route for the North Mill161-kV Delivery Point in Warren County, Kentucky**

| Field ID | Stream Type[1] | SMZ Width[2] | | SMZ Category | Notes |
|---|---|---|---|---|---|
| | | Right Bank | Left Bank | | |
| asjtb03 | Per | 100 | 50 | A | 20 ft wide x 4 ft deep. Poor quality silt-bottom headwater stream flowing next to a forested bluff. Stream is fed by a large sulfurous spring. |
| asjtb01 | WWC | - | - | BMPs | |
| ash01 | Per | 50 | 50 | A | 50 ft wide x 10 ft deep. Main channel of Drakes Creek. Medium depth silt-bottom stream running through developed area. Narrow riparian zone, but large woody debris present in channel. |
| ash02 | WWC | - | - | BMPs | |

[1]Stream Type: Per = Perennial Stream, WWC = Wet Weather Conveyance
[2]Streamside Management Zone, expressed in feet.

## 3.3. Threatened and Endangered Species

### *3.3.1. Terrestrial Animals*

Two federally listed terrestrial animals (the gray bat and the Indiana bat) and one state-listed terrestrial animal (the yellow-crowned night-heron) have been reported previously from the project area (see Table 3-2). Although none of these species, or other listed terrestrial animals was encountered during field investigations conducted in April, 2006, suitable habitat for them does occur in the project area.

**Table 3-2. Endangered, Threatened, and Other Species of Conservation Concern Known from Warren County, Kentucky**

| Common Name | Scientific Name | Status/Rank[1] | |
|---|---|---|---|
| | | Federal | State |
| **Birds** | | | |
| Yellow-crowned night-heron | *Nyctanassa violacea* | - | THR (S2) |
| **Mammals** | | | |
| Gray bat | *Myotis grisescens* | END | END |
| Indiana bat | *Myotis sodalis* | END | END |
| **Plants** | | | |
| Blackfoot quillwort | *Isoetes melanopoda* | - | END (S1) |
| Blue mud-plantain | *Heteranthera limosa* | - | SPCO (S2S3) |
| Buffalo clover | *Trifolium reflexum* | - | END (S1S2) |
| Butler's quillwort | *Isoetes butleri* | - | END (S1) |
| Carolina larkspur[2] | *Delphinium carolinianum* | - | THR (S1S2) |
| Cream wild indigo | *Baptisia bracteata* var. *glabrescens* | - | SPCO (S1S2) |
| Crossleaf milkwort | *Polygala cruciata* | - | END (S1) |
| Eastern yampah[2] | *Perideridia americana* | - | THR (S2) |
| Eggert's sunflower | *Helianthus eggertii* | - | THR (S2) |
| French's shooting star | *Dodecantheon frenchii* | - | SPCO (S3) |
| Gattinger's lobelia | *Lobelia gattingeri* | - | END (S1) |

| Common Name | Scientific Name | Status/Rank[1] | |
|---|---|---|---|
| | | Federal | State |
| Grassleaf arrowhead | *Sagittaria graminea* | - | THR (S1S2) |
| Hairy ludwigia | *Ludwigia hirtella* | - | END (S1) |
| Large sedge | *Carex gigantean* | - | THR (S2) |
| Least trillium | *Trillium pusillum* | - | END (S1) |
| Necklace gladecress | *Leavenworthia torulosa* | - | THR (S2) |
| Ovate catchfly[2] | *Silene ovata* | - | THR (S1) |
| Price's potato-bean | *Apios priceana* | THR | END (S1) |
| Royal catchfly | *Silene regia* | - | END (S1) |
| Royal pennyroyal | *Hedeoma hispidum* | - | THR (S2) |
| Side-oats grama grass | *Bouteolua curtipendula* | - | SPCO (S3) |
| Southern shagbark hickory | *Carya carolinae-septentrionalis* | - | THR (S1S2) |
| Spreading false foxglove | *Aureolaria patula* | - | SPCO (S3) |
| St. Peter's-wort | *Hypericum crux-andreae* | - | THR (S2S3) |
| Stemless evening-primrose | *Oenothera triloba* | - | THR (S1S2) |
| Tansy rosinweed | *Silphium pinnatifidum* | - | SPCO (S3) |
| Turk's cap lily | *Lilum superbum* | - | THR (S1S2) |
| Upland swamp privet[2] | *Forestiera ligustrina* | - | THR (S2S3) |
| Water purslane | *Dipiplis diandra* | - | SPCO (S2S3) |
| Wedge-leaf whitlow-grass | *Draba cuneifolia* | - | END (S1) |
| Western hairy rockcress | *Arabis hirsute* | - | THR (S1S2) |
| White heath aster | *Symphyotrichum priceae* | - | THR (S2) |
| Yellow gentian | *Gentiana flavida* | - | END (S1S2) |
| **Crayfish** | | | |
| Bottlebrush crayfish | *Barbicambarus cornutus* | - | SPCO |
| **Fish** | | | |
| Longhead darter[3] | *Percina macrocephala* | - | END |
| Mountain brook lamprey[3] | *Ichthyomyzon greelyi* | | THR |
| Spotted darter | *Etheostoma maculatum* | - | THR |
| Stargazing minnow[3] | *Phenacobius uranops* | - | SPCO |
| **Mussels** | | - | |
| Long solid | *Fusconaia subrotunda* | - | SPCO |
| Pink mucket | *Lampsilis abrupta* | END | END |
| Pocketbook | *Lampsilis ovata* | - | END |
| Rough pigtoe | *Pleurobema plenum* | END | END |
| Pyramid pigtoe | *Pleurobema rubrum* | - | END |
| Little spectaclecase[3] | *Villosa lienosa* | - | SPCO |
| Kentucky creekshell | *Villosa ortmanni* | - | THR |

[1]Status codes: END = Endangered; THR = Threatened; SPCO = species of special concern; LT = federal listed threatened; S1 = critically imperiled (one to five occurrences); S2 = Very rare and imperiled within the state, six to twenty occurrences; S3 = Rare and uncommon in state, from 21 to 100 occurrences.
[2]Known to occur within 5 miles of the project area.
[3]Known to occur in the Drakes Creek drainage within ten miles of the proposed route.

Yellow-crowned night-herons nest within swamps, marshes, woodland ponds, and along sluggish woodland streams (Hancock and Kushlan, 1984). Nesting birds have been reported in lowland woods approximately 1.2 miles from the proposed transmission line. Nesting habitat for this species exists along Drakes Creek and the Barren River.

Gray bats roost in caves and typically forage over open-water habitats including streams. A large maternity cave is located approximately 8.6 miles from the proposed transmission line, and another cave used by transient gray bats is located approximately 11 miles from the proposed line. Suitable gray bat foraging habitat exists along Drakes Creek.

Indiana bats roost in caves during the winter but typically make summer roosts under the bark of dead or dying trees (Menzel, et al., 2001). Their summer roosts are found in forests with an open understory, usually near water (Romme, et al. 1995). Indiana bats forage primarily in forested areas along streams or other corridors. A small population of Indiana bats is reported from a cave approximately 11 miles from the proposed transmission line. Drakes Creek provides suitable foraging habitat for Indiana bats. No suitable summer habitat for gray bats was identified.

### *3.3.2. Plants*

A review of the TVA Regional Natural Heritage database and the Kentucky Heritage database (Kentucky State Nature Preserves Commission, 2006) indicated there are one federal listed and 32 state-listed plant species known from Warren County, Kentucky (see Table 3-2). Only four of these 32 state-listed species are known to occur within five miles of the proposed transmission line. TVA conducted a field survey of the project area in April, 2006. No listed plant species or their habitats were identified during the survey.

### *3.3.3. Aquatic Animals*

According to the TVA Regional Natural Heritage database, 12 listed aquatic animal species are known to occur in Warren County, Kentucky. However, only four such species are recorded from within ten miles of the proposed transmission line route (see Table 3-2) in the Drake Creek drainage. The two federally listed mussels, the pink mucket and the rough pigtoe, are not known to occur in the Drakes Creek drainage. The four listed aquatic species known to occur within ten miles are described briefly below.

In Kentucky, the longhead darter occurs sporadically in the upper Green River and Barren River systems. This darter is found most often in swift-flowing runs and riffles of clean upland streams and rivers over cobble substrates. It is often associated with flow refuges created by boulders (Burr and Warren, 1986). Neither of the perennial streams crossed by the proposed transmission line contains suitable longhead darter habitat within or adjacent to the proposed right-of-way. Thus, the longhead darter is not likely to occur within the general area or immediately downstream. The major threat to the species is habitat degradation due to pollution, siltation, and stream alteration projects (NatureServe, 2006)

The mountain brook lamprey occurs sporadically in Kentucky in the Green River and Cumberland River drainages. Adults are most often found in riffle areas of clean, high-gradient streams of small to medium size over sand and gravel substrates. Larval lampreys inhabit low-gradient sections of the same streams in sand/silt substrates, and are often associated with organic debris such as leaf packs and stick piles (Burr and Warren, 1986). The Drakes Creek crossing (i.e., ash01 in Table 3-1) contains suitable habitat for larval lampreys (known as ammocoetes). Thus, this species may possibly occur in the vicinity of the proposed transmission line route. The major threat to this species is habitat degradation due to pollution, siltation, and stream alteration projects (NatureServe, 2006)

In Kentucky, the stargazing minnow is found occasionally in the upper Green River and Barren River systems and is distributed patchily in the Cumberland River system. This minnow is most often found in shallow riffles and runs of medium to high-gradient permanent streams over pebble and gravel substrates (Burr and Warren, 1986). Neither of the perennial streams crossed by the proposed transmission line contains suitable stargazing minnow habitat within or adjacent to the proposed right-of-way, so the stargazing minnow is not likely to occur within the area.

The little spectaclecase mussel occurs throughout the Ohio River Valley but is locally uncommon. It is typically found in slow-flowing, shallow, mud-bottomed streams and rivers (Parmalee and Bogan, 1998). The Drakes Creek crossing contains suitable spectaclecase mussel habitat. Thus, this species possibly occurs in the vicinity of the proposed transmission line route.

## 3.4. Surface Water

Precipitation in the project area averages about 52 inches per year. The wettest month is May, which has about 5.4 inches of precipitation, and the driest month is October, with 3.2 inches. The average annual air temperature is 57 degrees Fahrenheit. Temperature ranges from a monthly average of 34 degrees Fahrenheit in January to 79 degrees Fahrenheit in July. Stream flow varies with rainfall and averages about 19 inches of runoff per year or approximately 1.4 cubic feet per second per square mile of drainage area.

The project area drains to the Barren River and its tributary Drakes Creek. Barren River is classified by the Kentucky Department of Environmental Protection (KDEP) for warm water aquatic habitat, primary contact recreation, secondary contact recreation, and domestic water supply. The Barren River from mile 15 to the Green River is also designated an Outstanding State Resource Water. Drakes Creek is classified for warm water aquatic habitat, primary contact recreation (e.g., swimming), and secondary contact recreation (wading). Drakes Creek is on the state 303 (d) list as impaired (i.e., not fully supporting its designated uses) due to polychlorinated biphenyl (PCB) contamination from industrial point sources.

## 3.5. Groundwater and Geology

The project area is a slightly rolling, karst (sinkhole) plain characterized by few surface streams but numerous sinkholes. In general, karst terrains are underlain by weathered soluble rocks such as limestone or dolomite. Well-developed karst terrain is typically characterized by sinkholes, sinking and losing streams, subterranean drainage, caves, and large springs. The karst terrains of Kentucky are mostly on limestone. Over time, as water moves underground, from hilltops toward a stream through small fractures in the limestone bedrock, the rock is slowly dissolved away by weak acids found naturally in rain and soil water (Carey and Stickney, 2004).

The project area is underlain by the Mississippian Plateau aquifer system, which is part of the Interior Low Plateaus Physiographic Province. The Mississippian Plateau aquifer consists of carbonate rocks, mainly limestone, of Mississippian age. Locally, the formations that make up the Mississippian Plateau aquifer are the Ste. Genevieve Limestone and the St. Louis Limestone (Lloyd and Lyke, 1995). Both the Ste. Genevieve and the St. Louis Limestones underlie rolling karst areas. The St. Louis Limestone commonly has less relief than karst in areas underlain by the Ste. Genevieve. However, the St. Louis Limestone typically contains steeper sinkholes and forms steep bluffs along the Barren River. The section of the right-of-way located along Drakes Creek is underlain by unconsolidated alluvium of Quaternary age. The alluvium has formed terraces and floodplains along Drakes Creek and its tributaries.

The Ste. Genevieve Limestone and the St. Louis Limestone yield more than 50 gallons per minute to wells from large solution openings in karst areas. Most wells penetrate solution openings, but in areas high above perennial streams, these solution openings go dry in late

summer and fall, and many wells are inadequate. Wells that do not intersect karst conduits generally are inadequate for domestic use. Springs with flows ranging from less than 10 gallons per minute to more than 1,500 gallons per minute occur at or near stream level or near the contact of the Ste. Genevieve with the underlying St. Louis Limestone. Smaller springs discharge from perched water bodies in upland areas, but many go dry during late summer and fall. Most wells in thin alluvium furnish less than 100 gallons per day, which is inadequate for a domestic supply. Groundwater in Warren County obtained from most drilled wells in limestone aquifers is considered hard. Common salt and hydrogen sulfide are the two naturally-occurring constituents most often encountered in objectionable amounts in groundwater. Water obtained from wells and springs in many limestone aquifers is subject to pollution (Carey and Stickney, 2004).

Most karst springs used previously for a public water supply have been abandoned because of groundwater contamination. However, water from karst aquifers remains very important because karst springs support the base flow of the streams to which they discharge. Thus, most public systems in karst areas are actually using water from a karst aquifer when they withdraw from a stream or reservoir. Water recharge to karst aquifers occurs directly, either through swallow holes and sinkholes, or indirectly through the pores in the soil overlying the limestone bedrock. Although the soil overlying a karst aquifer provides some filtration of contaminants from in-flowing water, little filtration takes place between swallow holes and springs. The water also has little opportunity to be filtered by the soil or for the contaminants to become bound to the bedrock as the water flows rapidly through the karst conduits (Kentucky Geological Survey, 2005).

Because of karst terrain's low filtering capacity, the Kentucky Department of Environmental Protection has given the Mississippian Plateaus region its highest sensitivity rating. Storm water runoff and non-point source pollution are major contributors to groundwater contamination in the region. Specifically, nutrients and pesticides enter into the groundwater system and are then redistributed to surface water because these systems are connected hydraulically.

Besides vulnerability to groundwater pollution, other hazards such as cover-collapse sinkholes and sinkhole flooding are associated with karst terrains. Cover-collapse sinkholes occur when the soil overlying a solution opening collapses into the opening. Sinkhole flooding occurs when rate of inflow to a solution opening exceeds the rate at which it can be transported. This causes sinkholes and springs to fill.

An extensive groundwater tracer study of the area performed by the Kentucky Geological Survey revealed that the runoff that collects in the sinkhole depressions discharges to either Drakes Creek or the Barren River through several groundwater basins (Ray and Currens, 2001). The proposed right-of-way would cross several of these groundwater basins. From the substation to the point where the route turns to the southeast along the Drakes Creek floodplain (i.e., at Point K on Figure 2-1), the right-of-way would cross 6 sinkholes. An outflow spring discharges to Drakes Creek along the bluff to the south of the proposed right-of-way. The portion of the transmission line route that would use existing right-of-way intersects approximately 21 sinkholes.

## 3.6. Floodplains

A floodplain is a relatively level land area along a stream or river that is subject to periodic flooding. The area subject to a one percent chance of flooding in any giver year is normally called the 100-year floodplain. About 5,500 feet of the proposed transmission line route would be in the identified 100-year floodplain of Drakes Creek (see Figure 2-1). The 100-year flood elevation at Drakes Creek Mile 7.8 (the crossing) is 471.4 feet above mean sea level.

## 3.7. Wetlands

The proposed transmission line right-of-way is located in the Drakes Creek subwatershed. This watershed drains into the Barren River basin, which is tributary to the Green River and the Ohio River. According to available land use/land cover data, the proposed 6-mile transmission line route traverses a landscape dominated by cropland and residential development with smaller areas of woodland. Wetlands are relatively uncommon in the watershed, although there are some small areas of forested wetlands associated with Drakes Creek.

Wetlands are defined as 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. A ground survey was conducted within the proposed transmission line corridor to identify all wetlands present in the proposed project area. Two wetlands were identified (W1 and W2) and classified according to the Cowardin system (Cowardin et al., 1979). Wetland determinations were performed according to the U.S. Army Corps of Engineers (USACE) standards, which require documentation of hydrophytic 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 U.S. Fish and Wildlife Service (USFWS) (Cowardin et al., 1979) and the TVA Environmental Review Procedures definition (TVA, 1983), were also considered in this review. In addition, the TVA Rapid Assessment Method (TVARAM) was used to assess wetland condition and identify wetlands with potential ecological significance (Mack, 2001).

Under TVARAM, wetlands may be classified into 3 categories. Category 1 wetlands are considered “limited quality waters” and represent degraded aquatic resources that have limited potential for restoration and 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 could be restored. Avoidance and minimization are the first lines of 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.

Wetland W1 (see Table 3-3) is part of a narrow forested wetland complex associated with Drakes Creek. It is separated into two wetland types by the transmission line right-of-way. This 0.07-acre (3,050 square feet) wetland lies adjacent to and immediately southwest of the proposed transmission line corridor at the point where the line shifts to the northwest as it crosses SR 872. This wetland contains forested bottomland and emergent wetland. Tree species include red maple, silver maple, and green ash. The emergent wetland area contains a variety of rush (*Juncus*) and sedge (*Carex*) species, jewelweed, and lizards tail. According to the TVARAM, wetland W1 was rated as a Category 2 wetland.

**Table 3-3. Potentially Affected Wetlands Along the Proposed Route**

| Wetland ID | Type[1] | Estimated Acreage on Right-of-Way | TVA RAM Score | TVA RAM Category |
|---|---|---|---|---|
| W1 | PEM1/PFO1E-F | approximately 0.07 acres | 40 | 2 |
| W2 | PEM1E/PFO1E | approximately 0.08 acres | 39 | 2 |
| **TOTAL Wetland Acres** | | **approximately 0.15 acres** | | |

[1] Based on Cowardin et al. (1979).

Wetland W2 is a 0.08-acre palustrine emergent seasonally saturated/flooded forested/emergent wetland located approximately 0.4 miles east of Middle Bridge Road along the existing right-of-way. The emergent portion of the wetland lies within the exiting right-of-way; however, the forested portion of the wetland is outside the existing right-of-way. Dominant vegetation includes southern blackberry, American pokeweed, black willow, fox sedge, elderberry, and goldenrod. This wetland scored as a Category 2 wetland according to TVARAM.

## 3.8. Natural Areas

A review the TVA Natural Heritage database indicated that the proposed action is not within or adjacent to any managed areas and/or ecologically significant sites. However, one managed area, Greenhill Woods, is within three miles of the proposed transmission line.

The tap point for the proposed transmission line to the East Bowling Green-South Scottsville Transmission Line (see Figure 2-1) is adjacent to the Barren River, which is on the Nationwide Rivers Inventory. The proposed transmission line would cross Drakes Creek, a tributary of the Barren River.

Greenhill Woods is approximately 2.0 miles southeast of the proposed line. This ecologically significant site is an upland forest and habitat for a population of the state endangered least trillium (see Table 3-2). Greenhill Woods is proposed for the natural area registry by the Kentucky State Nature Preserves Commission.

The Barren River is approximately 0.1 miles east of the tap point in the vicinity of Cemetery Road. Barren River, in Butler and Warren counties from river mile 0 at the confluence with Green River to river mile 31, is listed on the Nationwide Rivers Inventory (NRI). The National Park Service recognizes this stream for its scenic, recreational, and fishing values. It is a broad stream with heavily vegetated banks exhibiting various degrees of steepness. Islands are common in the Barren River.

## 3.9. Historical and Archaeological Resources

Prehistoric occupation of the region is likely to have started at least 12,000 years ago. This 12,000-years period is divided into four prehistoric periods: Paleo Indian, Archaic, Woodland, and Mississippian. Prehistoric land use and settlement patterns vary during each period, but short-and long-term habitation sites were located typically on floodplains and alluvial terraces along rivers and tributaries. Specialized campsites tend to be located on older alluvial terraces and in upland areas. During the early period of European exploration in the Ohio River valley, Kentucky was primarily a hunting ground for Native American tribes, which included the Shawnee, the Delaware, the Cherokee, and the Mingo.

Warren County was created in 1796 from portions of Logan County. The earliest recorded permanent settlement in the county was established on the north bank of the Barren River. The growth of the county during the nineteenth century relied primarily on its navigable river system, which fostered a lucrative riverboat trade. Warren County has historically maintained an agricultural-based economy focused on the production of tobacco, corn, and hay. During the Civil War, the county was subject to several raids and skirmishes (Bryant, 1992). Following the Civil War, the continued strength of Warren County's agricultural trade, coupled with the establishment of numerous higher education institutions, made it one of the wealthiest counties in Kentucky (Parker et al., 2000).

The archaeological Area of Potential Effect (APE) for the project was determined to be all areas in which soil-disturbing activities would take place. This includes 6.1 miles of 161-kV transmission line corridor. An initial background search was conducted to determine if any previously-recorded historic resources were located within the APE. Records indicated no archaeological resources within the archaeological APE.

The historic/architectural APE for the project was determined to be a 0.5-mile area surrounding the proposed transmission line corridor. Three previously-recorded architectural resources (WA-81, WA-200, and WA-201) were identified within the historic/architectural APE. No previously-recorded archaeological resources were identified within the historic/architectural APE. Site WA-81 consists of historic bridge footings associated with the original path of Old Scottville Road. However, the survey revealed that WA-81 has been destroyed. WA-200 is a one-and-one-half-story early twentieth century Queen Anne style house. Due to the lack of architectural merit, as well as the inability to associate the dwelling and/or its original owner(s) with an important historical event or series of events, it is considered ineligible for listing in the National Register of Historic Places (NRHP). WA-201 is a one-story, front-gable building with a full-length shed wing. It is considered eligible for listing in the NRHP due to its local significance and architectural merit.

The archaeological survey was conducted on April 19 and 20, 2006 (Deter-Wolf, 2006). Two previously unrecorded sites (15WA156 and 15WA157) were identified within the APE. Site 15WA156 is a Late Woodland/Mississippian open habitation and is located in a cultivated field. This site is considered potentially eligible for listing in the NRHP. Site 15SW157 is a Late Archaic/Early Woodland; Late Woodland/Mississippian open habitation and historic farmstead/residence. It is also located in a cultivated field. Site 15SW157 is considered potentially eligible for listing in the NRHP.

The historic/architectural survey (Karpynec, 2006) identified four previously unrecorded architectural resources (WA-1016, WA-1017, WA-1018, and WA-1019) within the historic/architectural APE. WA-1016 and WA-1017 are one-story Minimal Tradition style houses that appear to have been constructed during the 1940s. WA-1018 is a one-and-one-half-story pyramidal roof house that appears to have been constructed about 1900. WA-1019 is an abandoned one-story front-gable building that was a former tollhouse constructed about 1890-1900. Based upon the lack of architectural merit, as well as the inability to associate these dwellings and/or its original owner(s) with an important historical event or series of events, they were determined ineligible for listing in the NRHP.

## 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 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 general landscape character of the project area is described below.

The proposed transmission line would begin at a tap point on the existing East Bowling Green – South Scottsville 161-kV transmission line northeast of SR 234 (Cemetery Road) near the Church of God of Prophecy. The area is mainly pastoral with slightly rolling topography. Vegetation outside of road right-of-way consists of hardwoods interspersed with pine and cedar. Several residents and occasional motorists would have foreground views of the tap point. Scenic attractiveness is common, and scenic integrity is low.

The proposed route would cross SR 234 to the southwest on existing transmission line right-of-way and traverse open pastoral land before crossing Carter Lane. Residential development in this area is sparse, and residents have occasional views of existing double wood-pole structures. Views for these residents are mainly in the foreground due to elevation changes in the landscape. To the southwest, the existing route parallels Hunt Road and is in the foreground of motorists and intermittent homes scattered in the landscape. The route crosses Roy Thomas Road and SR 872 to the southwest before traversing Drakes Creek near Reginald F. Kirby Bridge.

The visual character of the area along Drakes Creek, a tributary to the Barren River, is mainly a river setting that evolves into pastoral open lands outside of the narrow floodplain. The river banks are moderate to steep and are heavily vegetated with mature hardwoods and herbaceous understory, which is in contrast to the visual character of the adjacent pasture lands. Motorists have minimal views of the creek from SR 872 (Old Scottsville Road). Motorists crossing the bridge over Drakes Creek have views of the existing transmission line crossing and portions of the existing right-of-way. Most views are limited to the dense vegetation along the creek banks. Views from the water, for recreation users in the area, include scenic panoramas of a mostly riverine setting, characterized by dense vegetation along the banks and riffles along the pebble stream bottoms.

Immediately southwest of Drakes Creek, the proposed line route would turn northwest on new right-of-way. The proposed line would remain in the foreground of Drakes Creek as it bends farther to the northwest, where it would cross rolling topography and numerous sinkholes. Approximately one half mile east of Interstate 65, the line would turn southeast, crossing bluffs south of the river channel, I-65, and US 231 before entering the proposed substation on Cave Mill Lane. This area is extremely congested and consists of numerous commercial establishments, professional office buildings, myriad signage, and service poles typical of growth associated with major interstate exchanges. In this area, scenic attractiveness is minimal, and scenic integrity is low.

## 3.11. Recreation

Outdoor recreation in the vicinity of the proposed transmission line route is primarily informal and dispersed. Primary activities include hunting, trail use and wildlife observation. These occur primarily on privately-owned land. The floodplain area along Drakes Creek is used for informal outdoor activities by nearby residents. A small private shooting preserve is located in one of the fields along Drakes Creek. This area is used for hunting quail. A field inspection revealed some informal recreational use of Drakes Creek at the Reginald F. Kirby Bridge. However, because of limited parking and typical shallow water conditions, recreational use of this area is limited.

The Bowling Green metropolitan area offers various organized recreation opportunities. The nearest city park to the proposed line route is Basil Griffin Park, which is operated by Warren County Parks and Recreation Department. It includes ball fields, disc golf, playgrounds and a lake. This park is located approximately 1.5 miles south of the proposed North Mill Substation and the proposed transmission line.

## 3.12. Socioeconomics

The Bowling Green area is experiencing economic growth along with commercial, industrial and residential expansion. Generally, the area between the North Mill Substation site and Interstate 65 is a commercial/industrial zone. Commercial development is evident mainly along major roadways, especially SR 231, Cave Mill Road, Three Springs Road, and Interstate 65. Much of the area to the south and west of this portion of the route is experiencing residential expansion.

The area in the vicinity of the proposed route between the Interstate and the Drakes Creek floodplain is experiencing both commercial and residential growth. Most of the homes in the general vicinity of the route, i.e., along Old Scottsville Road, are located in subdivisions. Residences are generally middle- to upper-income level housing. The area to the east of Drakes Creek is mostly farmland with scattered residences. However, this area is experiencing some residential growth.

# CHAPTER 4

## 4. ENVIRONMENTAL CONSEQUENCES

This chapter contains a discussion of potential environmental effects that are anticipated under the Action Alternative. As discussed earlier, there would be no impacts associated with TVA activities under the No Action Alternative, but BGMU could choose to construct the proposed tap line into the TVA system if TVA chose not to do so. Impacts associated with the No Action Alternative could therefore be similar to or greater than those associated with the Action Alternative, depending on decision made by BGMU. The discussion below of the Action Alternative likely captures the nature and potential significance of the impacts of BGMU's actions in constructing the tap line if TVA chose not to build the proposed line. The potentially affected resources are discussed in the same order that they were presented in Chapter 3.

### 4.1. Terrestrial Life

#### *4.1.1. Wildlife*

Because about half of the proposed route would utilize an existing transmission line corridor and due to the lack of large forested tracts along the proposed right-of-way, implementation of the Action Alternative would have minor impact on wildlife in the vicinity. Potential impacts to the area currently managed for quail hunting would be minimized by coordinating construction and maintenance activities with the landowner. The presence of structures in this area is not expected to significantly affect the use of this area. Because much of the local area has been disturbed previously by agriculture and development, adoption of the Action Alternative would not result in any significant adverse direct, indirect or cumulative impacts to common wildlife or wildlife habitat.

#### *4.1.2. Vegetation*

Under the Action Alternative, less than 2 acres of forest would be converted to, and maintained as, early successional habitat within the project right-of-way. Such early successional habitat communities are common and representative of the region. Therefore, the impact to local terrestrial plant communities is expected to be minor and regionally insignificant. Likewise, implementation of the Action Alternative is not expected to significantly facilitate the spread of invasive plants.

### 4.2. Aquatic Life

Aquatic life can be affected either directly by alteration of conditions in the streambed, or indirectly due to modification of the riparian zone or storm water runoff from construction and maintenance activities along the transmission line corridor. Potential impacts due to removal of streamside vegetation include increased siltation and erosion, altered thermal regime, and loss of habitat. Other potential impacts related to construction and maintenance include alteration of stream banks and stream bottoms by heavy equipment and runoff of herbicides into streams.

Under the Action Alternative, Category A protection (see Appendix D) would be applied to intermittent and perennial streams crossed within the project area during construction. Wet

weather conveyances would be protected by implementing standard Best Management Practices (BMPs) as identified in Muncy (1999). These BMPs are designed to minimize erosion and subsequent sedimentation in streams.

With the use of TVA BMPs and adherence to the appropriate stream protection requirements, potential impacts to aquatic resources from the construction and maintenance of the proposed North Mills 161-kV delivery point would be insignificant.

With proper implementation of standard BMPs, there would be no cumulative effects on aquatic communities or habitat as a result of construction and operation of this transmission line.

## 4.3. Threatened and Endangered Species

Potential habitat for three listed terrestrial animal species was identified along Drakes Creek. State listed yellow-crowned night herons could potentially nest in forested portions of Drakes Creek. These habitats also provide potential foraging habitat for Indiana and gray bats. Under the Action Alternative, TVA would use an existing power line corridor to cross Drakes Creek. Use of this corridor would result in no loss of forested habitat at this riparian corridor. However, suitable roosting trees may be located along the forested bluff area between Points K and L (see Figure 2-1). To avoid potential effects to Indiana bat roosting trees, clearing of trees along this segment would take place only between October 15 and March 31, when the bats are hibernating. Alternatively, TVA may conduct a spring/summer survey could be performed to determine the presence or absence of Indiana bats in forested sections of the right-of-way. If this survey confirmed that no Indiana bats are present, clearing could proceed (see Section 4.14) outside of the October-March time period. During field surveys, no caves or sinkholes than could provide winter and/or summer habitat for Indiana or gray bats were found. Therefore implementation of the proposed project would not result in any significant adverse direct, indirect or cumulative impacts to these listed species or their foraging habitat. USFWS stated in a letter of December 18, 2006 (see Appendix A) that TVA's requirements under Section of the Endangered Species Act have been fulfilled.

Because no federally or state-listed plant species were found during field surveys of the proposed transmission line route, no impacts to such species are anticipated as a result of the proposed action.

The surveyed route crosses two perennial watercourses in the Drakes Creek drainage (see Table 3-1). Given the descriptions of the preferred habitat presented by Burr and Warren (1986), field observations suggested that these two watercourses are likely to support populations of the longhead darter, the mountain brook darter, the stargazing minnow, and the little spectaclecase mussel (see Table 3-2).

Because the only major stream crossing would occur at an existing crossing, no direct effects on listed aquatic species are likely to occur as a result of the proposed action. However, indirect and cumulative effects are possible. The proposed action may cause a temporary increase in siltation, which has a detrimental effect on many aquatic animals adapted to riverine environments. Turbidity caused by suspended sediment can negatively impact spawning and feeding success of many fish species (Sutherland et al., 2002).

To reduce the potential for any indirect or cumulative effects to the species discussed above, all construction and maintenance work would be conducted in accordance with the requirements and recommendations presented in TVA's *Guide for Environmental Protection and Best Management Practices for TVA Transmission Construction and Maintenance Activities* (Muncy, 1999). With the proper implementation of BMPs, potential impacts to listed aquatic animal species in the Drakes Creek drainage related to the construction and maintenance of the proposed North Mills 161-kV Delivery Point would be insignificant.

Because no federally listed aquatic species are known from or are likely to occur in Drakes Creek, there would be no impacts to federally listed aquatic animals or their habitats.

With proper implementation of standard BMPs, there would be no cumulative effects to listed aquatic animals as a result of construction and operation of the proposed transmission line under the Action Alternative.

## 4.4. Surface Water

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

TVA routinely includes precautions in the design, construction, and maintenance of its transmission line projects to minimize these potential impacts. The two permanent stream crossings (see Table 3-1) would be designed not to impede runoff patterns and the natural movement of aquatic fauna. The crossing of Drakes Creek would occur at an existing right-of-way crossing; thus, disturbance at this crossing would be minor. Temporary stream crossings and other construction and maintenance activities would comply with applicable state permit requirements (e.g., storm water construction permit) and TVA requirements as described in Muncy (1999). Canopies in all stream side 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 in the vicinity of receiving waters and to prevent unacceptable aquatic impacts. With the proper implementation of these controls, any potential effects to surface water quality are expected to be minor and temporary. No cumulative impacts to surface water quality are anticipated.

## 4.5. Groundwater and Geology

In general, there are several potential impacts to groundwater that could occur from transmission line construction and maintenance. Right-of-way clearing and site grading for structures and access roads could create erosion. Sediments from this erosion could potentially clog sinkholes or springs. Sedimentation of springs can cause groundwater levels to artificially rise, while sedimentation of sinkholes can reduce groundwater levels.

Herbicides that are applied to the right-of-way either for clearing the site for construction or to control vegetation for maintenance could potentially contaminate groundwater resources

if applied incorrectly. Some herbicides break down before entering the water table, but some are known to have a long residence time in groundwater.

Fertilizers that are applied to a project area to establish ground cover could leach into groundwater if applied incorrectly. Phosphorous from fertilizers could affect the odor and taste of groundwater supplies.

A majority of the proposed project area is underlain by karst terrain. The proposed right-of-way intersects approximately 27 sinkholes; many of these are on the existing right-of-way. Best Management Practices (BMPs) as described in *A Guide for Environmental Protection and Best Management Practices for Tennessee Valley Authority* would be used to avoid impacts on groundwater (Muncy, 1999). BMPs would be used to control sediment infiltration.

TVA applies herbicides in accordance with the manufacturers' labels. Only one herbicide used by TVA has groundwater contamination warnings. Neither this herbicide nor any other herbicides with groundwater contamination warnings would be used by TVA in the future maintenance of the proposed line. The use of fertilizers and herbicides would be applied according to the manufacturer's label. BMPs dealing with herbicide and fertilizer application would also be followed to reduce the risk of potential adverse impacts to groundwater.

With the use of TVA's BMPs and the application of control measures normally applied by TVA, potential effects to groundwater quality would be insignificant.

## 4.6. Floodplains

The proposed transmission line crosses the Drakes Creek 100-year floodplain. Consistent with Executive Order 11988, an overhead transmission line and related support structures are considered to be a repetitive action in the 100-year floodplain. The construction of the support structures for the proposed power line are not expected to result in any increase in flood hazard either as a result of increased flood elevations or changes in flow carrying capacity of the streams being crossed. To minimize adverse impacts on natural and beneficial floodplain values, the 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.

## 4.7. Wetlands

Activities in wetlands are potentially regulated under Section 404 and Section 401 of the Clean Water Act. Executive Order 11990 also identifies measures respecting the avoidance and protection of wetlands that federal agencies consider. Section 404 states that activities in wetlands are subject to authorization through a Nationwide General Permit or Individual Permit issued by the U.S. Army Corps of Engineers (USACE). Section 401 requires water quality certification by the state for projects 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.

No direct impacts to wetlands are associated from the implementation of the Action Alternative. Wetland W1 is located outside the proposed project area for transmission line

construction, and would be avoided during construction. No impacts would occur to wetland W2, as the emergent portion of this wetland is within the existing right-of-way and would be spanned. The forested portion of W2 is outside the existing right-of-way, and no clearing would be necessary.

There could be some minor, insignificant impacts to wetlands associated with routine transmission line maintenance such as periodic reductions in vegetative cover and minor impacts to wildlife habitat. Some limited impacts to vegetation may occur, but given the small size of the wetland areas and the ability of wetland vegetation to recover from periodic right-of-way maintenance, potential wetland impacts would be insignificant.

There would be no cumulative impacts to wetlands in the Drakes Creek watershed and the surrounding area as the result of implementing this alternative.

## 4.8. Natural Areas

Under the Action Alternative, no impacts to Greenhill Woods are anticipated because of the distance (approximately 2.0 miles) between Greenhill Woods and the proposed action. Although the Barren River is near the proposed tap point, the river would not be crossed, and there would be no construction activities in the riparian area near the river. Because of the distance and the nature of the work at the tap, no effects to the Barren River are expected.

Approximately three miles west of the tap point, the transmission line would cross Drakes Creek, a tributary of the Barren River. TVA would use the existing crossing of the old 69-kV transmission line for the new line. Implementation of TVA's Best Management Practices for stream crossings and installations in floodplains would reduce the potential for adverse impacts to the NRI stream and its tributary to an insignificant level (see Section 4.4).

## 4.9. Historical and Archaeological Resources

One previously recorded historic resource (WA-201) is considered eligible for listing in the NRHP. However, the visual line-of-sight from site WA-201 to the project area is obstructed by trees and rolling terrain. Therefore, site WA-201 would not be adversely affected. Two previously unrecorded archaeological sites (15WA156 and 15WA157) are considered potentially eligible for listing in the NRHP. Two transmission line structures would be located within the site boundary of 15WA156, and none would be within the site boundary of 15WA157. TVA, in consultation with the Kentucky State Historic Preservation Officer (SHPO), conducted investigations at the locations of the two proposed structures within site 15WA156. The results of these investigations indicated that no intact deposits were present at the proposed structure locations. The SHPO concurred with these findings (see Appendix A). The proposed action would be implemented with the condition that all work would be conducted in dry conditions or using low ground pressure equipment or mats to prevent rutting. This would protect both archaeological sites during the proposed construction and maintenance operations.

## 4.10. Visual and Aesthetic Quality

Visual consequences are examined in terms of visual changes between the existing landscape and proposed actions, sensitivity of viewing points available to the general

public, their viewing distances, and visibility of proposed changes. 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. The foreground, middleground, and background viewing distances were described previously in the affected environment section.

Potential impacts to the visual and aesthetic character of the local area resulting from the construction and operation of the proposed transmission lines and associated right-of-way would be minor. Additional features associated with new poles and locations for the proposed 161-kV transmission line would increase the number of adversely contrasting elements in the rural landscape. These incremental changes would not be individually significant, but together would add to existing disruptions of visual coherence and harmony.

The new line would begin at the tap point along SR 234, and approximately the first three miles of line would be constructed on existing transmission line right-of-way. Currently, this segment of existing line has both wooden and steel pole structures. Some are single pole; others are H-frame type structures. Motorists and area residents would have views of the new poles and lines. The existing poles and lines would be removed prior to new line construction, minimizing the potential for cumulative visual impacts. New single steel-pole construction would be visually similar to the wood poles seen in the landscape now. The new poles may initially be brighter and contrast more in the landscape than existing wood poles. However, as the new poles weather and become darker, visual contrast would be lessened.

The route crosses SR 234 to the southwest on existing transmission line right-of-way and traverses open pastoral land before crossing Carter Lane, Hunt Road, Roy Thomas Road, SR 872, and Drakes Creek. For residents in this area, views of new structures would be similar to those described at the tap point. The visual character of the pastoral landscape would not be adversely affected permanently because the new structures would be located on existing right-of-way and would be visually similar to those being replaced. Minor, unavoidable visual impacts would occur during existing transmission line removal and during the construction phase of the new line. These impacts would be temporary, and would end when activities are complete.

At Drakes Creek, new structures viewed by motorists would be visually similar to existing wood and steel poles currently used in the vicinity of the Reginald F. Kirby Bridge. Because the creek is lined with dense vegetation and the channel is recessed below the adjacent floodplain, views of the proposed line would likely be obscured from recreation users. There may be some decline in visual character when duration of views becomes longer for certain activities, such as bank fishing. However, this change in visual character would be individually insignificant.

Immediately southwest of Drakes Creek, the new line would be constructed on new right-of-way. The line turns to the northwest and follows the creek for approximately one mile to the north and east sides of existing bluffs. Local residents to the south would likely have limited views of the proposed route, particularly during the growing season. Residences located along the bluffs in this area are at approximately the same elevation as the tops of the poles. Thus, the bluffs would serve as a vertical visual buffer. Dense vegetation along the south side of Drakes Creek would obscure most views for recreation users along this section of the route. Due partly to the existing landscape character and the siting of the

proposed route within existing cleared corridors, the area has a high capacity to absorb change without adverse visual affects.

The line continues southwest and crosses Cumberland Trace Road, I-65, and US 231 before entering the Bowling Green Municipal Utilities substation along Cave Mill Road. The area is extremely developed, and traffic is heavily congested, particularly during peak commuter periods in the mornings and evenings. New transmission lines and associated poles would be visually similar to other vertical structures currently seen in the landscape, particularly along US 231. Adding new structures would increase the number of discordantly contrasting elements seen in the landscape, contributing to an overall decline in visual quality. However, this decline would be negligible and insignificant.

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 right-of-way and laydown areas have been restored through the use of TVA standard BMPs (Muncy, 1999). Therefore, there are no significant visual impacts anticipated as a result of this project.

## 4.11. Recreation

No developed recreational facilities would be affected by the construction and operation of the proposed transmission line. During construction, there would be some potential impacts to informal recreation activities occurring on private land in the area along Drakes Creek due to the presence of workers and equipment. However, these effects would be temporary and are expected to be insignificant. Location of the proposed line is not expected to preclude any informal recreational use of the fields along Drakes Creek. No effects to water-based recreation are anticipated. Any potential cumulative effects to local recreational opportunities resulting from the adoption of the Action Alternative are expected to be insignificant.

## 4.12. Socioeconomics

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.

In situations where the 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 effects is sensitive not only to distance, but also to 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; EPRI, 1993).

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.

## 4.13. Post-construction Effects

TVA recognizes there is public concern about whether any adverse health effects are caused by electric and magnetic fields (EMF) that result from generation, transmission, distribution, and use of electricity. Many scientific research efforts and other studies examining the potential health and other effects of EMF have been and are being done. TVA is aware of, and ensures that it stays aware of, published research and study results and directly supports some of the research and study efforts.

Studies, interpretations, and research to date are far from conclusive about potential associations between EMF and possible health impacts. A few studies have been interpreted as suggesting a weak statistical relationship between EMF and some rare forms of cancer. During the summer of 2001, the International Association for Research on Cancer reviewed available epidemiological studies and concluded that childhood leukemia appears to be associated with magnetic fields, but that there was not a cause and effect relationship. It was concluded that the risk is small but may in some circumstances of higher exposure result in one type of childhood leukemia. The Association also concluded that electric fields do not have a connection with cancer.

However, equal or greater numbers of similar studies show no association or cannot reproduce data interpreted as demonstrating an association. No laboratory research has found cause and effect health impacts from EMF and certainly none that are adverse. Neither has any concept of how these fields could cause health effects achieved scientific consensus.

There is also no agreement in the scientific or EMF research community as to what if any electric or magnetic field parameters might be associated with potential health effects. There are no scientifically or medically defined safe or unsafe field strengths, although state regulatory bodies in Florida and New York have established edge of right-of-way magnetic field strength limits for 230-kV and larger power transmission lines.

TVA has analyzed and continues to analyze the fields associated with its typical line designs using the best available models and has measured actual fields for a large number of locations along its transmission line easements. Both model data and measurements show that the field strengths for TVA transmission lines are well within Florida and New York limits. Based on such models, expected field strengths for the proposed lines discussed in this document would also be within those existing state guidelines.

TVA's standard location practice has the effect of minimizing continuous public exposures to transmission line EMF. The transmission line route selection team uses a constraint model that places a 300-foot-radius buffer around occupied buildings, except schools, for which a 1,200-foot buffer is used. The purpose of these buffers is to reduce potential land use conflicts with yard trees, outbuildings, and ancillary facilities and potential visual

impacts as well as exposures to EMF. Although not absolute location constraints, these buffers weigh heavily in location decisions, and they influence the selection of route options and alignments. Because EMF diminishes quickly with distance from the conductors, the routing of transmission lines using constraint buffers effectively reduces potential continuous public exposure to EMF. Crossing under lines or otherwise being near them for short periods may increase overall EMF exposure, but only minutely.

During the comment periods, concerns were raised about the safety of children at the Anchored Christian School. The School is located approximately 350 feet from the location of electrical equipment in the BGMU North Mill Substation. The substation would be surrounded by a fence to maintain physical security. Neither the proposed transmission line nor any of the right-of-way would be located on the School property. At its closest point, the line would be approximately 412 feet from the Anchored Christian School building. The calculated exposure level from magnetic fields from the proposed transmission line is 0.35 milligauss (mG) at 400 feet. By comparison, a hairdryer can produce 300 to 700 mG at 6 inches, or 1 to 70 mG at one foot. Virtually all appliances, lights, and even wiring, produce magnetic fields. However, levels decrease dramatically with distance from the source. Therefore, the cumulative amount of EMF exposure to students at the school from the proposed transmission line would be very small.

Similar concerns were raised about the safety of children at the Cumberland Trace Elementary School. At its closest point (Point P, Figure 2-1), the proposed route would be approximately 675 from the school building. An angle point (Point M, Figure 2-1) would be located approximately 340 feet from the school softball field. At these distances, EMF levels from the transmission line would be extremely low.

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. Summary of TVA Commitments and Proposed Mitigation Measures

The following routine commitments 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.

- No herbicides with label restrictions limiting use when groundwater could be potentially impacts shall be used to maintain the new transmission line.

The following non-routine measure, which was developed in consultation with the Kentucky SHPO and other interested parties, would be applied during construction and operation of the proposed transmission line to reduce the potential for adverse environmental effects to archaeological resources.

- To protect archaeological sites 15WA156 and 15WA157, all work would be conducted in dry conditions or using low ground pressure equipment or mats to prevent rutting.

In order to reduce or eliminate the chance that Indiana bat roosts could be affected during right-of-way clearing, the following non-routine measure, which was developed in consultation with the Frankfort Field Office of the U.S. Fish and Wildlife Service, would be applied.

- TVA would remove any potential Indiana bat roost trees only between October 15 and March 31. If TVA needs to clear the right-of-way outside of this period, TVA would hire a third party with appropriate qualifications to perform a summer mist-net survey for Indiana bats in forested sections of the right-of-way route. This survey would be performed between May 15 and August 15 using U.S. Fish and Wildlife Service guidelines. If no Indiana bats are encountered, the U.S. Fish and Wildlife Service would not object to TVA clearing trees along the proposed route outside of the October 15 and March 31 period.

# CHAPTER 5

## 5. LIST OF PREPARERS

### 5.1. NEPA Project Management

**Todd C. Liskey**

| | |
|---|---|
| Position: | Environmental Engineer, TVA Power Supply Operations, Chattanooga, Tennessee |
| Education: | B.S. Civil Engineering, M.B.A. |
| Experience: | 12 years in transmission line planning and preparation of environmental review documents |
| Involvement: | Document Preparation and Coordination |

**W. Steve Pitt**

| | |
|---|---|
| Position: | Senior Engineer, MESA Associates, Chattanooga, Tennessee |
| Education: | B.S. Civil Engineering, M.B.A. |
| Experience: | 30 years in transmission line and substation siting |
| Involvement: | Project and Siting Alternatives |

**James F. Williamson, Jr.**

| | |
|---|---|
| Position: | Senior NEPA Specialist, TVA Environmental Stewardship and Policy, Knoxville, Tennessee |
| Education: | Ph.D., Fisheries and Wildlife Sciences; M.S., Wildlife Ecology; B.S., General Science/Zoology |
| Experience: | 10 years in forest management, inventory, and software development; 16 years in NEPA compliance |
| Involvement: | NEPA Compliance and Document Preparation |

### 5.2. Other Contributors

**John (Bo) T. Baxter**

| | |
|---|---|
| Position: | Senior Aquatic Biologist, TVA Environmental Stewardship and Policy, Knoxville, Tennessee |
| Education: | M.S. and B.S., Zoology |
| Experience: | 16 years in Protected Aquatic Species Monitoring, Habitat Assessment, and Recovery; 6 years in Environmental Review |
| Involvement: | Aquatic Ecology/Threatened and Endangered Species |

**W. Nannette Brodie**

| | |
|---|---|
| Position: | Senior Environmental Scientist, TVA Research & Technology Applications, Chattanooga, Tennessee |
| Education: | B.S., Environmental Science; B.S., Geology; Professional Geologist |
| Experience: | 12 years in environmental analyses, surface water quality, and groundwater hydrology evaluations |
| Involvement: | Groundwater |

**Patricia B. Cox**

| | |
|---|---|
| Position: | Botanist, TVA Environmental Stewardship and Policy, Knoxville, Tennessee |
| Education: | Ph.D., Botany; M.S. and B.S., Biology |
| Experience: | 28 years in plant taxonomy at the academic level; 2 years with TVA Heritage Project |
| Involvement: | Sensitive Plants |

**Ella Christina Guinn**

| | |
|---|---|
| Position: | Project Control Specialist, TVA Environmental Stewardship and Policy, Knoxville, Tennessee |
| Education: | M.S. and B.A., Geography |
| Experience: | 12 years in Land Use Analysis; 7 years in Environmental Services |
| Involvement: | Technical Staff Coordinator |

**Kelie H. Hammond**

| | |
|---|---|
| Position: | Specialist, Navigation Operations, TVA River Operations, Navigation and Hydraulic Engineering, Knoxville, Tennessee |
| Education: | M.S., Environmental Engineering; B.S., Civil Engineering |
| Experience: | 4 years navigation; 3 years in specialty engineering positions at TVA |
| Involvement: | Navigation/Transportation |

**Travis Hill Henry**

| | |
|---|---|
| Position: | Terrestrial Zoologist Specialist, TVA Environmental Stewardship and Policy, Knoxville, Tennessee |
| Education: | M.S., Zoology; B.S., Wildlife Biology |
| Experience: | 17 years in zoology, endangered species, and NEPA compliance |
| Involvement: | Terrestrial Biology |

**John M. Higgins**

| | |
|---|---|
| Position: | Water Quality Specialist, TVA River Operations, Chattanooga, Tennessee |
| Education: | Ph.D., Environmental Engineering; B.S. and M.S., Civil Engineering; Registered Professional Engineer |
| Experience: | 31 years in environmental engineering and water resources management |
| Involvement: | Surface Water |

**Clinton E. Jones**

| | |
|---|---|
| Position: | Aquatic Community Ecologist, TVA Environmental Stewardship and Policy, Knoxville, Tennessee |
| Education: | B.S., Wildlife and Fisheries Science |
| Experience: | 15 years in environmental consultation and fisheries management |
| Involvement: | Aquatic Ecology and Aquatic Threatened and Endangered Species |

**Roger A. Milstead**

| | |
|---|---|
| Position: | Manager, TVA Flood Risk and Data Management, Knoxville, Tennessee |
| Education: | B.S., Civil Engineering; Registered Professional Engineer |
| Experience: | 30 years in floodplain and environmental evaluations |
| Involvement: | Floodplains |

**Jason M. Mitchell**

| | |
|---|---|
| Position: | Natural Areas Biologist, TVA Environmental Stewardship and Policy, Knoxville, Tennessee |
| Education: | M.P.A. (Environmental Policy); B.S., Wildlife and Fisheries Science |
| Experience: | 13 years in natural resource planning and ecological assessment with emphasis on sensitive resources |
| Involvement: | Natural Areas |

**W. Chett Peebles**

| | |
|---|---|
| Position: | Specialist, Landscape Architect, TVA Environmental Stewardship and Policy, Knoxville, Tennessee |
| Education: | Bachelor of Landscape Architecture; Registered Landscape Architect |
| Experience: | 18 years in site planning and visual assessment |
| Involvement: | Visual Resources |

**Richard L. Pflueger**

| | |
|---|---|
| Position: | Recreation Specialist, TVA Environmental Stewardship and Policy, Muscle Shoals, Alabama |
| Education: | M.B.A.; B.S., Accounting |
| Experience: | 29 years in recreation resources and economic development |
| Involvement: | Recreation |

**Kim Pilarski**

| | |
|---|---|
| Position: | Senior Wetlands Biologist, TVA Environmental Stewardship and Policy, Knoxville, Tennessee |
| Education: | M.S., Geography |
| Experience: | 12 years in watershed assessment and wetland regulation and assessment |
| Involvement: | Wetlands |

**Marianne M. Shuler**

| | |
|---|---|
| Position: | Archaeologist Technician, TVA Environmental Stewardship and Policy, Knoxville, Tennessee |
| Education: | B.A., Religion/Middle Eastern Archaeology |
| Experience: | 6 years in Middle Eastern archaeology; 5 years in Southeastern U.S. archaeology |
| Involvement: | Cultural Resources |

**Jan K. Thomas**

| | |
|---|---|
| Position: | Contract Natural Areas Specialist, TVA Environmental Stewardship and Policy, Knoxville, Tennessee |
| Education: | M.S., Human Ecology |
| Experience: | 10 years in Health and Safety Research, Environmental Restoration, Technical Writing; 3 years in Natural Area Reviews |
| Involvement: | Managed Areas and Sensitive Ecological Sites |

**Allan J. Trently**

| | |
|---|---|
| Position: | Contract Terrestrial Zoologist, TVA Environmental Stewardship and Policy, Knoxville, Tennessee |
| Education: | M.S., Biology; B.S., Environmental Resource Management |
| Experience: | 13 years in field biology |
| Involvement: | Threatened and Endangered Species; Wildlife |

# CHAPTER 6

## 6. LIST OF AGENCIES AND PERSONS CONSULTED

**Federal Agencies**

U.S. Fish and Wildlife Service
Frankfort, Kentucky

**State Agencies**

Kentucky Department for Environmental Protection
Frankfort, Kentucky

Kentucky State Historic Preservation Officer
Frankfort, Kentucky

**Native American Organizations**

Cherokee Nation
Eastern Band of the Cherokee Indians
United Keetoowah Band of Cherokee Indians in Oklahoma
Chickasaw Nation
Choctaw Nation of Oklahoma
Jena Band of Choctaw Indians
Muscogee (Creek) Nation of Oklahoma
Alabama-Coushatta Tribe of Texas
Alabama-Quassarte Tribal Town
Kialegee Tribal Town
Thlopthlocco Tribal Town
Seminole Indian Tribe
Absentee Shawnee Tribe of Oklahoma
Eastern Shawnee Tribe of Oklahoma
Shawnee Tribe

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# CHAPTER 7

## 7. SUPPORTING INFORMATION

### 7.1. Literature Cited

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## 7.2. Glossary of Terms

**alluvium** A general term for clay, silt, sand, or similar unconsolidated material deposited by a stream or other body of running water

**ampere** The basic unit of electrical current. The ampere is that constant current which, if maintained in two straight parallel conductors of infinite length, of negligible circular cross section, and placed 1 meter apart in vacuum, would produce between these conductors a force equal to $2\times10^{-7}$ newton per meter of length.

**angle point** A point (structure) at which a transmission line changes direction

**APE** Acronym for Area of potential Effect

**base flow** Ground water that enters a stream channel, maintaining stream flow at times when it is not raining

**BGMU** Acronym for the Bowling Green Municipal Utility

**BMP** Acronym for Best Management Practice, i.e., accepted construction practice designed to reduce environmental effects

**bus** Non-flexible conductors typically used within a substation

**conductor** The "wire" or cable that carries electric current

**danger tree** A tree that could pose a threat of grounding a line if allowed to fall near a transmission line or onto a structure

**delivery point** The point at which a TVA transmission line connects to a customer's facility

**distribution line** A series of electrical conductors ("wires") and their supporting structures used to transmit electric power to a consumer

**EMF** Acronym for electromagnetic field

| | |
|---|---|
| **EO** | Acronym for Executive Order |
| **e.g.** | Latin term exempli gratia, meaning “for example” |
| **et al.** | Latin term et alii (masculine), et aliae (feminine), or et alia (neuter), meaning “and others” |
| **etc.** | Latin term et cetera, meaning “and others things” or “and so forth” |
| **firm capability** | The maximum load that a generating unit, generating station, or other electrical apparatus can carry under specified conditions for a given period of time without exceeding approved limits of temperature and stress |
| **i.e.** | Latin term id est, meaning “that is” |
| **karst** | A landform or terrain typically formed over limestone and characterized by numerous sinkholes, caves, and springs |
| **KDEP** | Acronym for the Kentucky Department of Environmental Protection |
| **kV** | Symbol for kilovolt (one kV equals 1,000 volts) |
| **load** | The amount of electric power delivered or required at a specific point on a system |
| **NEPA** | Acronym for National Environmental Policy Act |
| **NHPA** | Acronym for National Historic Preservation Act |
| **NRHP** | Acronym for National Register of Historic Places |
| **PCB** | Acronym for polychlorinated biphenyl, a pollutant |
| **riparian** | Related to or located on the banks of a river or stream |
| **SHPO** | Acronym for State Historic Preservation Officer |
| **SMZ** | Acronym for Streamside Management Zone |
| **solution opening** | An opening to the ground of an underground cavity caused by the action of water dissolving the rock |
| **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 |
| **tap** | The point at which a substation connects electrically to a transmission line |
| **tapline** | A transmission line that connects a substation to an existing transmission line |
| **tap point** | A point in an existing transmission line where a connection is feasible |

| | |
|---|---|
| **transmission line** | A series of electrical conductors (“wires”) and their supporting structures used to transmit electric power from one location to another |
| **TVA** | Acronym for Tennessee Valley Authority |
| **underbuild** | The practice of placing a power line on existing structures that currently support another power line |
| **WRECC** | Acronym for the Warren Rural Electric Cooperative Corporation |
| **WWC** | Acronym for wet weather conveyance, an intermittent stream that flows only after a precipitation event |

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# APPENDIX A – CORRESPONDENCE

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COMMERCE CABINET
KENTUCKY HERITAGE COUNCIL

**Ernie Fletcher**
Governor

The State Historic Preservation Office
300 Washington Street
Frankfort, Kentucky 40601
Phone (502) 564-7005
Fax (502) 564-5820
www.kentucky.gov

**George Ward**
[redacted]
Secretary

**David L. Morgan**
Executive Director and
State Historic Preservation Officer

October 27, 2006

Mr. Thomas O. Maher
Manager, Cultural Resources
Tennessee Valley Authority
400 West Summit Hill Drive
Knoxville, TN 37902-1401

**Re: Architectural and Historic Survey of the Proposed TVA North Mills 161-kV Transmission Line Corridor, Warren County, Kentucky**

Dear Mr. Maher:

The State Historic Preservation Office has received the above-referenced survey report for a proposed 6.1 mile 161-kV transmission line route in Warren County, Kentucky. The Tennessee Valley Authority proposes to construct this line between the existing East Bowling Green-South Scottsville Transmission line and the planned Bowling Green Municipal Utilities substation west of Highway 231 in Warren County. The survey was conducted by Ted Karpynec of TRC, Inc. The Area of Potential Effect contained three previously surveyed resources: WA-81 (destroyed) WA-200 and WA-201. Additionally, four previously unrecorded resources were identified.

We concur with the author that WA-200, WA-1016, WA-1017, WA-1018 and WA-1019 appear to be ineligible for listing in the National Register of Historic Places (NRHP) either individually or as part of a district. We also concur that WA-201 retains its eligibility for NRHP listing, but that this project as proposed will not negatively impact those characteristics which qualify it for listing.

Therefore, it is our determination that pursuant to 36 CFR Part 800.5 (b), this undertaking will have **No Adverse Effect**. Should you have any questions regarding these comments, please feel free to contact Janie-Rice Brother of my staff at (502) 564-7005, extension 121.

Sincerely,

David L. Morgan, Executive Director
Kentucky Heritage Council and
State Historic Preservation Officer

Cc: Ted Karpynec, TRC

COMMERCE CABINET
KENTUCKY HERITAGE COUNCIL

**Ernie Fletcher**
Governor

**The State Historic Preservation Office**
300 Washington Street
Frankfort, Kentucky 40601
Phone (502) 564-7005
Fax (502) 564-5820
www.kentucky.gov

**George Ward**
Secretary

November 14, 2006

Mr. Thomas O. Maher
Manager, Cultural Resources
Tennessee Valley Authority
400 West Summit Hill Drive
Knoxville, Tennessee 37902-1401

Dear Mr. Maher:

The State Historic Preservation Office has received for review and approval a revised final archaeological survey report entitled "A Phase I Archaeological Survey of the Proposed TVA North Mills 161-kV Transmission Line Corridor, Warren County, Kentucky" by Aaron Deter-Wolf and Ted Karpynec.

During the course of the investigations, two archaeological sites (15Wa156 and 15Wa157) were located. Site 15Wa156 is a prehistoric lithic scatter dating from the Early Archaic and Late Woodland/Mississippian periods while site 15Wa157 has Late Archaic, Early Woodland, Late Woodland/Mississippian, and historic components. Since both sites have potential for containing intact sub-plowzone deposits, the authors felt that 15Wa156 and 15Wa157were potentially eligible for listing in the National Register of Historic Places. Following the review of the draft report, TVA decided to span site 15Wa157 without any impacts to the site. At site 15Wa156, it was determined that two metal poles would be placed on this site. Phase II test excavations consisting of 1.5 x 1.5 m hand excavated units were placed at each pole location. No intact deposits or features were found at either pole location. No further archaeological investigations are recommended in connection with the current project. I concur with the authors' findings and recommendations. In accordance with 36CFR Part 800.4 (d) of the Advisory Council's revised regulations our finding is that there are No Historic Properties Present within the undertaking's area of potential impact. Therefore, we have no further comments and TVA's responsibility to consult with the Kentucky State Historic Preservation Officer under the Section 106 review process is fulfilled for archaeological sites.

Should you have any questions, feel free to contact Charles Hockensmith of my staff at (502) 564-7005.

Sincerely,

David L. Morgan, Director
Kentucky Heritage Council and
State Historic Preservation Officer

cc: Mr. Aaron Deter-Wolf
Dr. George Crothers

Jena Band of Choctaw Indians
P. O. Box 14 • Jena, Louisiana 71342-0014 • Phone: 318-992-2717 • Fax: 318-992-8244

November 8, 2006

**TENNESSEE VALLEY AUTHORITY**
**400 WEST SUMMIT HILL DRIVE**
**KNOXVILLE, TN 37902-1401**

**RE: TENNESSEE VALLEY AUTHORITY PROPOSED NORTH MILLS 161-KV TRANSMISSION LINE CORRIDOR, WARREN COUNTY, KENTUCKY**

**To Whom It May Concern:**

Reference is made to your letter dated October 4, 2006, concerning the above- proposed projects.

After thorough review of the documents submitted, it has been determined that there will be no significant impact in regards to the Jena Band of Choctaw Indians. We have no objections to its implementation.

If I may be of any further assistance, please do not hesitate to call.

Sincerely,

Lillie Strange

Lillie Strange
Environmental Director
Jena Band of Choctaw Indians
lstrangejbc@centurytel.net
318-992-8258

Tennessee Valley Authority, 400 West Summit Hill Drive, Knoxville, Tennessee 37902-1401

October 4, 2006

Ms. Lisa Stopp
Acting Tribal Historic Preservation Officer
United Keetoowah Band
Post Office Box 746
Tahlequah, Oklahoma 74464

The United Keetoowah Band of Cherokee Indians in Oklahoma has no objection to the referenced project. However, if any remains, artifacts or other items are inadvertnetly discovered, please cease construction immediately and contact us at 918-456-6533 or by letter.

OCT 12 2006

Lisa C. Stopp, Tribal NAGPRA POC Date

Dear Ms. Stopp:

TENNESSEE VALLEY AUTHORITY PROPOSED NORTH MILLS 161-KV TRANSMISSION LINE CORRIDOR, WARREN COUNTY, KENTUCKY

The Tennessee Valley Authority (TVA) proposes to construct and operate a 6.1-mile long 161-kV transmission line (TL) between the existing East Bowling Green - South Scottsville 161-kV Transmission Line and the Bowling Green Municipal Utilities planned substation west of Hwy 231 in Warren County, Kentucky.

TVA identified the archaeological area of potential effect (APE) for the undertaking to be the 6.1 miles of a 100 feet wide TL right-of-way (ROW) and contracted with TRC to conduct the archaeological survey (Figure 1). TRC conducted the initial archival research at the Kentucky Heritage Council (KHC) and the Office of State Archaeology (OSA) and found no previously recorded archaeological sites in the APE.

The survey methods for identifying archaeological sites included a combination of shovel testing and visually examining exposed ground surfaces for artifacts. Shovel tests were 30 cm x 30 cm wide; excavated until sterile soil was encountered; conducted in 20 meter intervals in areas of less than 20 percent slope; and conducted where less than 50 percent ground surface visibility was present. Visual examination of ground surfaces was conducted at 10 meter intervals and in areas with greater than 50 percent ground surface visibility.

TRC identified two new archaeological sites (15WA156 and 15WA157) during the archaeological survey. These sites are situated along the top of a bluff overlooking Drakes Creek and consist of prehistoric artifacts mixed in a plowzone context, dating from the Early Archaic period (10,000-8,000 B.P.) to the Late Woodland/Mississippian period (ca. 1650-1100 B.P.). TVA proposes to span the TL over 15WA157 to avoid impacts to the site. However for 15WA156, TVA would need to place two adjacent TL poles within the site's boundary. These poles would be situated at the eastern and western limits of the site. As agreed upon with the KY SHPO, TVA conducted additional archaeological investigations of the site to determine if intact archaeological deposits

# EASTERN SHAWNEE TRIBE
## OF OKLAHOMA

P.O. Box 350 · Seneca, MO 64865 · (918) 666-2435 · FAX (918) 666-2186


*October 12, 2006*

***RE:*** **TVA Proposed North Mills 161-KV Transmission Line Corridor, Warren County, KY**

*Tennessee Valley Authority*
*400 West Summit Hill Drive*
*Knoxville, TN 37902-1401*

*To Whom It May Concern:*

*Thank you for notice of the referenced project(s). The Eastern Shawnee Tribe of Oklahoma is currently unaware of any documentation directly linking Indian Religious Sites to the proposed construction. In the event any items falling under the Native American Graves Protection and Repatriation Act (NAGPRA) are discovered during construction, the Eastern Shawnee Tribe request notification and further consultation.*

*The Eastern Shawnee Tribe has no objection to the proposed construction. At present, the Eastern Shawnee Tribe does not wish to participate as a consulting party on the above referenced project(s). However, if any human skeletal remains and/or any objects falling under NAGPRA are uncovered during construction, the construction should stop immediately, and the appropriate persons, including state and tribal NAGPRA representatives contacted.*

*Sincerely,*

Dorothy W McCormick

*Dorothy W. McCormick, Administrative Assistant*
*Eastern Shawnee Tribe of Oklahoma*

**CHOCTAW NATION OF OKLAHOMA**
**Cultural Resources**
P.O. Drawer 1210 • Durant, OK 74702-1210
1-580-924-8280 • 1-800-522-6170 • Fax: 580-920-3102

October 19, 2006

Pat Bernard-Ezzell
Tennessee Valley Authority
400 West Summit Hill Drive
Knoxville, Tennessee 37902-1401

Dear Pat Bernard-Ezzell:

We have reviewed the following proposed project (s) as to its effect regarding religious and/or cultural significance to historic properties that may be affected by an undertaking of the projects area of potential effect.

Entity Requesting Service: Proposed North Mills 161-KV Transmission Line Corridor

County: Warren County, Kentucky

Comments: After further review of the above mentioned project (s), to the best of our knowledge it will have no adverse effect on any historic properties in the project's area of potential effect. However, should construction expose buried archaeological or building materials such as chipped stone, tools, pottery, bone, historic crockery, glass or metal items, this office should be contacted immediately @ 1-800-522-6170 ext. 2137.

Sincerely,

Terry D. Cole
Tribal Historic Preservation Officer
Choctaw Nation of Oklahoma

By: Caren A. Johnson
Caren A. Johnson
Administrative Assistant

CAJ: cp

# United States Department of the Interior

FISH AND WILDLIFE SERVICE
3761 Georgetown Road
Frankfort, Kentucky 40601

December 18, 2006

Mr. Jim Williamson
Tennessee Valley Authority
400 West Summit Hill Drive (WT 11D)
Knoxville, Tennessee 37902-1401

Subject: FWS #2007-B-0237; Draft Environmental Assessment for the East Bowling Green-South Scottsville 161 kV Transmission Line Tap to North Mill Substation, Warren County, Kentucky

Dear Mr. Williamson:

Thank you for your correspondence of October 29, 2006, requesting the review of a Draft Environmental Assessment (DEA) for the proposed construction of approximately 6 miles of 161 kV transmission line near Bowling Green in Warren County, Kentucky. Approximately half the route would be located on an existing transmission line right-of-way operated by the Warren Rural Electric Cooperative Corporation. The purpose of the new line is to provide power to the North Mill Substation, which is being planned and built by the Bowling Green Municipal Utilities. The connection would increase available power and help to improve the reliability of the power supply in the south Bowling Green area. Fish and Wildlife Service (Service) personnel have reviewed the information submitted, and we offer the following comments.

According to our records, potential habitat for the Indiana and gray bat may occur within the project vicinity. However, based on the DEA, no potential summer and/or winter habitat, i.e., caves and sinkholes, for gray bats or winter habitat for Indiana bats are located within the project corridor. Additionally, in order to avoid impacting summer roosting Indiana bats, TVA has agreed to only clear trees between the October 15 and March 31 to avoid impacts to Indiana bat summer habitat. If tree clearing cannot take place between those times, TVA would hire a third party with appropriate qualifications and permits to perform a summer mistnetting survey between May 15 and August 15 to determine the presence or absence of Indiana bats within the project area.

Based on the above information and TVA's commitments regarding Indiana bat summer habitat, we believe that the requirements of Section 7 of the Endangered Species Act of 1973, as amended, are fulfilled. Obligations under Section 7 of the Act must be reconsidered if (1) new information reveals impacts of the proposed action that may affect listed species or critical habitat in a manner not previously considered, (2) the proposed action is subsequently modified to include activities which were not considered during this consultation, or (3) new species are listed or critical habitat designated that might be affected by the proposed action.

TAKE PRIDE IN AMERICA

Thank you for the opportunity to comment on this proposed action. If you have any questions regarding the information we have provided, please contact Mindi Lawson at (502) 695-0468 (ext. 103).

Sincerely,

Virgil Lee Andrews, Jr.
Field Supervisor

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# 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.

Revision July 2003

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# APPENDIX C – TVA ENVIRONMENTAL QUALITY 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.<br>• 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.<br>• 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.<br>• Crossings of drainage channels and intermittent streams must be done in ways that avoid erosion problems and long-term changes in water flow.<br>• 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.<br>• 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.<br>• 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.<br>• Cutting of trees near permanent streams must be limited to those meeting National Electric Safety Code and danger tree requirements.<br>• 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.<br>• 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.<br>• 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.<br>• 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.<br>• 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.<br>• 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.<br>• The soil must not be disturbed by plowing, disking, blading, or grading.<br>• 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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