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FINAL ENVIRONMENTAL ASSESSMENT

BRADLEY 500-KV SUBSTATION AND TRANSMISSION LINE - SOUTHEAST AREA POWER IMPROVEMENT PROJECT

Hamilton County and Bradley County, Tennessee and Catoosa County, Georgia

TENNESSEE VALLEY AUTHORITY

JUNE 2005

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ACRONYMS

°F	Degree Fahrenheit
A.D.	Latin term, anno Domini, meaning “in the year of our Lord”
APE	Area of Potential Effect
B.C.	Before Christ
BMP	Best Management Practice
CEPB	Chattanooga Electric Power Board
CFR	Code of Federal Regulations
EA	Environmental Assessment
e.g.	Latin term, exempli gratia, meaning “for example”
EIS	Environmental Impact Statements
EMF	Electric and Magnetic Fields
EO	Executive Order
et al.	Latin term, et alii (masculine), et aliae (feminine), or et alia (neutral) meaning “and others”
etc.	Latin term et cetera meaning “and other things” “and so forth”
Ga.	Georgia
GDNR	Georgia Department of Natural Resources
GIS	Geographic Information System
HPA	Habitat Protection Areas
IBI	Index of Biotic Integrity
i.e.	Latin term, id est, meaning “that is”
kV	Kilovolt
MS4	Municipal Separate Storm Sewer System
NEPA	National Environmental Policy Act
NNL	National Natural Landmark
NPS	National Park Service
NRCS	Natural Resource Conservation Service
NRHP	National Register of Historic Places
NRI	Nationwide Rivers Inventory
OSHA	Occupational Safety and Health Administration
RM	River Mile
SMZ	Streamside Management Zone
TDEC	Tennessee Department of Environment and Conservation
Tenn.	Tennessee
TRM	Tennessee River Mile
TVA	Tennessee Valley Authority
TVARAM	Tennessee Valley Authority Rapid Assessment Method
U.S.	United States
USACE	U.S. Army Corps of Engineers
USEPA	U.S. Environmental Protection Agency
USFS	U.S. Forest Service
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
WMA	Wildlife Management Area

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CHAPTER 1

1. PURPOSE OF AND NEED FOR ACTION

1.1. Proposed Action: Improve Power Supply

To continue to provide a reliable supply of electricity to the customers in Tennessee Valley Authority's (TVA) southeastern power service region and ensure the stability of its power generation sources, TVA is proposing several actions, including the construction of a new 500-kilovolt (kV) substation and associated transmission line connections in the Bradley County area, expanding the Concord Substation and adding capacitor banks, rebuilding and adding new conductors to existing transmission lines, rearranging transmission connections, and making power control and quality improvements at several local plant switchyards and substations in Hamilton County and Bradley County, Tennessee, and in Catoosa County, Georgia.

1.2. Need

The electric power demands in TVA's southeastern power service region continue to increase. Without additional power supply, the projected load growth would cause low voltage under certain situations that would cause stability problems. To help meet the demand, four power generation units at the Raccoon Mountain Pumped Storage facility are being modernized, resulting in an increase in the facility-generation capacity by approximately 290 megawatts. Increases in generation capacity can affect the power transmission system, whether they are from TVA projects or other power generators that use the TVA transmission system. Typically, these increases would require upgrades to various parts of the transmission system. Before 2007, the combined power demands and projected electric generation in the Hamilton County and Bradley County, Tennessee, areas will be more than TVA's transmission system can effectively handle. Without upgraded improvements, the increased power generation from the Raccoon Mountain Pumped Storage facility into the TVA transmission system may cause overloading or stability problems that could cause damage to generating facilities in the Chattanooga area.

TVA has performed detailed analyses of various power generation scenarios in the Hamilton County and Bradley County, Tennessee, areas and a portion of the Catoosa County, Georgia, area that show where and under what circumstances the transmission system would fail to be self-correcting, fail to maintain proper voltage levels, or fail to maintain stability of the power generating plants in the Chattanooga area. Any failure of the transmission system could cause the direct-served customers or those served by the local power distributor to experience brownouts or power interruptions, which are costly and inconvenient. Based on those assessments, TVA has determined that improvements to the power transmission system are needed to ensure continued reliability in TVA's southeastern region.

1.3. Decisions That Must Be Made

The primary decision before TVA is whether to make the improvements to the transmission system that are needed to accommodate the growing power demands and the increase in

power generation to TVA's southeastern region, including the greater Chattanooga area. A detailed description of the alternatives is provided in Section 2.2.

If the transmission system is to be improved, other, secondary decisions are involved. These include the following considerations:

- The timing of improvements
- The best location for the new substation and transmission line connections
- Determining any necessary mitigation and/or monitoring measures to implement to meet TVA standards and minimize potential damages to resources

1.4. Public Involvement

The following Federal and state agencies have been contacted to date by TVA concerning this project.

- U.S. Army Corps of Engineers
- U.S. Fish and Wildlife Service
- Natural Resource Conservation Service
- Tennessee Department of Agriculture
- Tennessee Department of Economic and Community Development
- Tennessee Department of Environment and Conservation
- Tennessee Department of Transportation
- Tennessee Division of Natural Heritage
- Tennessee Historic Commission (State Historic Preservation Officer)
- Tennessee Conservation League
- Tennessee Wildlife Resources Agency

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

TVA also held a public meeting in the project area on April 8, 2004, to provide information about the proposed project and to provide an opportunity for the public to comment on the project. Four potential substation sites with transmission line connections were presented to the public for comment. These are described in Section 2.8.3 of this document as Sites 1 through 4 (Figure 1-1).

Twenty-one public officials and 200 potentially affected property owners were specifically invited to the meeting. TVA also invited other interested members of the public through newspaper advertisements and local news outlets. TVA issued a news release to local news outlets. Total attendance at the meeting was 108.

During a 30-day public comment period following the open house, TVA accepted public comments on potential substation sites and associated transmission line connections. A toll-free phone number and fax number were made available to facilitate comments.

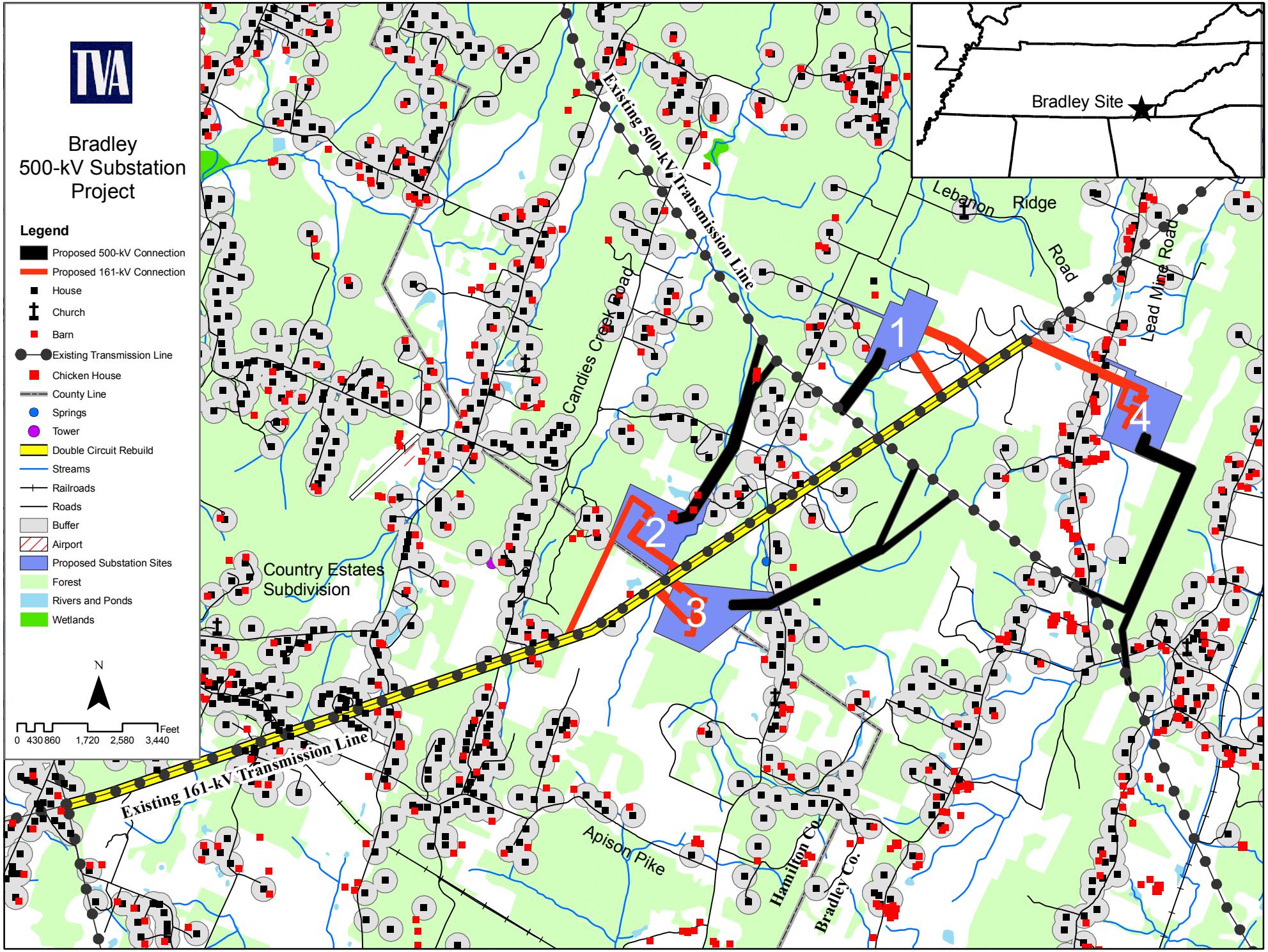

Figure 1 1. Proposed Bradley 500-kV Substation Sites in Bradley County, Tennessee

Comments were primarily related to opposition of a substation and the associated transmission lines in the community. Of the potential substation sites and associated transmission line connections presented at the public meeting, Site 1 was the preference of the majority of those expressing an opinion. This preference was due to fewer individual property owners being affected by the shorter transmission line connection's length.

1.5. Necessary Permits or Licenses

A Section 404 Nationwide Permit #12 - Utility Line Crossing has been approved and issued by the U.S. Army Corps of Engineers (USACE) for the project. In addition, a permit would be required from the state of Tennessee 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. A permit would also be required for burning trees and other combustible materials removed during substation and transmission line construction.

CHAPTER 2

2. ALTERNATIVES INCLUDING THE PROPOSED ACTION

2.1. Introduction

Chapter 2: Alternatives Including the Proposed Action is the *heart* of this Environmental Assessment (EA). This chapter has the following eight major sections:

- Description of Alternatives
- Alternatives Considered but Eliminated From Further Consideration
- Description of Construction of a 500-kV Substation
- Description of Proposed Activities on Existing TVA Transmission Lines
- Description of Proposed Activities on Existing TVA Facilities
- Description of Construction, Operation, and Maintenance of the Existing and Proposed Transmission Lines
- Project and Siting Alternatives
- Identification of the Preferred Alternative

This chapter describes all of the alternatives explored and provides a detailed description of the necessary steps in constructing a transmission line and substation.

2.2. Description of Alternatives

2.2.1. Alternative 1 – Do Not Upgrade the TVA Transmission System (No Action)

Under the No Action Alternative, TVA would not construct a 500-kV substation and associated transmission line connections or the upgrades and rebuilds to the existing transmission lines and substations. As a result, the increase in electricity demand and the increase in Raccoon Mountain generation would lessen the reliability of the TVA transmission system and potentially adversely affect those served by TVA. An overload of existing transmission facilities could result in stability problems and subsequent damage to generating facilities in the Chattanooga area, as well as possible brownouts or power interruptions. TVA would not reliably be able to provide the needed additional power for the increasing growth in the Hamilton County and Bradley County areas. In addition, TVA would not be able to meet the power demands through generation from other sources, because without the upgrades, the transmission system would not be able to sustain the additional power loads. Considering TVA's obligation to serve this area and the need to continue to provide reliable electric service, the No Action Alternative is not a reasonable alternative. It is included in the EA to be consistent with applicable regulations.

2.2.2. Alternative 2 – Construct 500-kV Substation and Transmission Line Connections and Perform Upgrades to the TVA Transmission System (Action)

Under the Action Alternative, TVA would construct a 500-kV substation and associated 500-kV and 161-kV transmission line connections, expand one existing substation for new

capacitor banks, upgrade or rebuild four existing 161-kV transmission lines, and perform modifications at several existing TVA facilities. These combined activities under the proposed action would solve the stability, overload, low voltage, and off-site power supply issues for approximately 10 years.

2.3. Alternatives Considered but Eliminated From Further Consideration

Several complex alternative plans were reviewed involving a combination of major transmission line rebuilds and upgrades, substation expansions, and/or new transmission lines and a substation. However, none of these plans solved all the problems of stability, overloads, low voltage, and off-site power supply issues, and all were of equal or greater costs than the alternative that solves all the problems. Also, the complex plans would involve taking out of service more critical transmission components during project implementation and would pose an increased risk to transmission reliability. All of the plans would require similar construction activity resulting in similar environmental impacts. As a result of these identified issues, these alternatives were eliminated as viable options.

Development and implementation of any additional conservation efforts would not be possible in a time frame that would meet the identified project need. This assumption is consistent with the findings of a 2002 study of demand-side management options for the Tennessee Valley.

2.4. Description of Construction of a 500-kV Substation

From the information gathered during the system's studies and data development phases, four potential substation sites and associated transmission line connections were identified in Bradley County, Tennessee, near the Sequoyah-Conasauga 500-kV and Concord-East Cleveland 161-kV Transmission Lines. Additional siting information for the substation site is described in Section 2.8.3. Property for the proposed substation and access road would be purchased from landowners. TVA would clear vegetation, remove topsoil, and grade the property. Once the substation site has been graded, spoil would be removed in preparation for foundations. The topsoil and spoil stored in separate piles would be reused on the property for restoration. Gravel would be placed on the substation site and access road. The substation would consist of a three-position ring bus 500-kV switchyard and a four-position ring 161-kV switchyard. Oil containment would be installed for the 500-161-26-kV transformer bank, and a retention pond would be constructed on the property. The type of breakers installed would be SF-6. The switch house would be equipped with water and sewer. A water line would be installed tapping the local water supply system. A septic tank absorption field line system would be installed to treat the generated sewage. A 250-foot microwave tower would be erected within the substation site. The tower would have a strobe light flashing red at night and flashing white during the day. The lighting for the substation would be designed to minimize light pollution while still meeting safety and security requirements.

2.5. Description of Proposed Activities on Existing TVA Transmission Lines

2.5.1. Falling Water-Sequoyah 161-kV Transmission Line

TVA would replace transmission line conductors on 7.7 miles of the Falling Water-Sequoyah 161-kV Transmission Line on existing right-of-way (Figure 2-1). The existing right-of-way would not be cleared; however, danger trees would be removed if necessary. Existing access roads were identified and reviewed as part of this project. TVA would also install one new dead-end structure, remove existing Structure 172, and add 8-foot extensions to six structures.

2.5.2. Concord-Sequoyah 161-kV Transmission Line

Approximately 6.6 miles of new transmission line conductors would be strung between the Concord Substation and the Sequoyah Nuclear Plant 500-kV Switching Station as a second line on the vacant side of the existing transmission line structures (Figure 2-1). This would create a new circuit between the Concord Substation and Apison Substation and would help ensure a strong voltage source for the area and facilitate the even flow of power from TVA generating facilities to the area substations. The existing right-of-way would not be cleared; however, danger trees would be removed if necessary. Existing access roads were identified and reviewed as part of this project. Near the Apison Tap structure, TVA would install a new tap structure that would require concrete foundations. Spoil from the foundation would be spread around the new structure within the right-of-way. The new transmission line would be strung from the new tap structure to the Apison Tap structure. The existing jumper connecting Apison Tap Line to the Sequoyah 161-kV Transmission Line would be removed, and a new jumper would be added to connect the new transmission line of the Concord 161-kV Transmission Line to the Sequoyah 161-kV Transmission Line. A wave trap, an electronic filtering device to exclude unwanted signals from a receiver, would also be removed and handled according to approved environmental procedures. TVA would retension existing transmission line and potentially add 12-foot extensions to six structures.

2.5.3. Concord-Catoosa 161-kV Transmission Line

TVA would remove a transmission line structure located within the Concord Substation and add a temporary structure approximately 10 feet outside of the substation fence. The overhead ground wire would be relocated to the new structure. TVA would remove a ground wire pole and alumoweld wire from the retired ground wire pole in the Concord Substation to Structure 178/168 and locate a new ground wire pole approximately 10 feet outside the substation fence. TVA would replace a structure and two poles with two new three-pole dead-end structures (166 and 167). These structures, located near the Concord Substation, would be placed 22 feet left of the right-of-way centerline. Each dead-end pole would require a 3-foot-diameter augured hole for installation. The material augured would be placed back in the hole once the structure was set. TVA would replace about 3.26 miles of existing overhead ground wire from Concord Substation to the Catoosa Substation (Figure 2-1). One wood-pole structure would be replaced with a steel-pole structure and fiber optic splice box. The existing right-of-way would not be cleared; however, danger trees would be removed if necessary. Existing access roads were identified and reviewed as part of this project.

2.5.4. East Cleveland–Apison Tap–Catoosa 161-kV Transmission Line

TVA would replace approximately 26.6 miles of transmission line on the East Cleveland-Apison Tap-Catoosa 161-kV Transmission Line from the East Cleveland Substation to the first new structure at Bradley 500-kV Substation 161-kV tap line connection and from the second new structure at Bradley 500-kV Substation 161-kV tap line connection to the Catoosa Substation (Figure 2-1). All transmission line replacements would occur on existing right-of-way ranging from 100 to 150 feet wide. Near the Sugar Grove tap line, Structure 38, a new ground wire pole would be installed within the existing right-of-way. Guy rights for the ground wire pole would be acquired. The overhead ground wire on the north side of the transmission line would be replaced with new fiber and would be strung using all the structures except Structure 38. The fiber would use the new ground wire pole instead of Structure 38. A wave trap at Structure 38 would be removed and reused.

In addition, a 161-kV transmission line from the proposed Bradley 500-kV Substation 161-kV tap line connection to the existing Apison Tap (Structure 89) would be rebuilt and new transmission lines added. The single-circuit towers would be removed to ground level. The existing Apison Tap to East Cleveland-Catoosa 161-kV Transmission Line would be removed. A wave trap at the Apison Tap would be removed and reused. Two Chattanooga Electric Power Board (CEPB) structures would be removed and provided to CEPB.

All work would be done on existing right-of-way that would not be cleared. Danger trees would be removed if necessary. Existing access roads were identified and reviewed as part of this project.

2.6. Description of Proposed Activities on Existing TVA Facilities

2.6.1. Concord Substation Expansion

TVA's Concord Substation facility would be rearranged to accept the new circuit to the Apison Substation and improve operating flexibility. In addition, a 1.8-acre area of TVA-owned property would be expanded on the southwest portion of the substation site for the installation of four 161-kV capacitor banks. Other equipment that would be added to the substation would include circuit switchers, surge arrestors, coupled capacitor voltage transformers, phase reactor, neutral capacitors, current transformers, and voltage transformers. The previously graded area would be cleared. Spoil would be removed in preparation of new foundations. The spoil would be field inspected with visual and olfactory senses for contamination. If no contamination is evident, the spoil would be spread on TVA property. If inspection is questionable or contamination noted, further testing would be required, and the spoil would be disposed of according to approved environmental procedures. The existing fence in this area would be removed and a new fence would be erected around the expanded area.

2.6.2. Raccoon Mountain Switching Station

The Raccoon Mountain switchyard would need to be reconfigured to isolate two generators to the 500-kV bulk power transmission system to lessen the electric load on the 161-kV transmission system. This would prevent overloading of the transmission system and potential equipment damage. To accomplish this, TVA would add breakers and switches to Bays 1 and 2. The 161-kV transmission line entering the switching station would be reconfigured to appropriate bays. Additional work at the switching station would include replacing associated relays, any gap-type surge arrestors, and transmitter; adding under-

voltage load shed, voltage phasor measurement, potential transformers, and receiver; removing switch and wave trap; and modifying existing bus. Relays would be assessed for possible contaminants and disposed of according to approved environmental procedures. Foundations would be required within the switching station site for new equipment. The spoil resulting from the foundations would be field inspected with visual and olfactory senses for contamination. If no contamination is evident, the spoil would be reused on site in coordination with TVA plant personnel. If inspection is questionable or contamination noted, further testing would be required, and the spoil would be disposed of according to approved environmental procedures. All work would be done on existing TVA property.

2.6.3. East Cleveland Substation

To prevent overstressing of the breakers and help ensure the proper operation of the equipment, TVA would replace three oil-filled breakers with SF-6 breakers. Oil in the breakers would be removed and both would be disposed of according to approved environmental procedures. Other equipment that would be added to the substation would include circuit switchers, surge arrestors, phase reactor, neutral capacitors, and over-current relay. TVA would remove a wave trap, line tuning unit, relay, and remote terminal unit. The capacitors in the wave trap and line-tuning unit would be inspected for PCBs, and the equipment would be disposed of separately according to approved environmental procedures. New foundations would be required for the three breakers and some of the surge arrestors. Spoil would be removed in preparation of new foundations. The spoil would be field inspected with visual and olfactory senses for contamination. If no contamination is evident, the spoil would be spread on TVA property. If inspection is questionable or contamination noted, further testing would be required, and the spoil would be disposed of according to approved environmental procedures.

2.6.4. Widows Creek Fossil Plant Switching Station

At the switching station, TVA would retire relays, wave trap, transfer trip, line tuning unit, and accessories. Relays would be assessed for possible contaminants, and the capacitors in the wave trap and line-tuning unit would be inspected for PCBs. A new transfer trip would be added requiring minor modification to steel panel. The removed equipment would be reused, recycled, or disposed of according to approved environmental procedures.

2.6.5. Sequoyah Nuclear Plant 500-kV Switching Station

At the switching station, relay protection changes would be made to improve the power system stability. TVA would also make changes to the telecommunications equipment. The removed equipment would be reused, recycled, or disposed of according to approved environmental procedures.

2.6.6. Volunteer 500-kV Substation

TVA would install a wide area network used for controlling the power system within the switch house at the substation.

2.6.7. Oswald Dome Microwave Station

TVA would install microwave radio for communication with the Bradley 500-kV Substation.

2.7. Description of Construction, Operation, and Maintenance of the Existing and Proposed Transmission Lines

2.7.1. Transmission Line Construction

2.7.1.1. Right-of-Way Acquisition and Clearing

No new right-of-way would be needed for the upgrades and builds on the existing transmission lines. New right-of-way would, however, be needed for the transmission line connections between the proposed 500-kV substation and the existing transmission lines. TVA would purchase a 300-foot-wide right-of-way easement approximately 1000 feet long for the 500-kV transmission line loop connection from the proposed substation property to the existing Sequoyah-Conasauga 500-kV Transmission Line. Approximately 7 acres of right-of-way would be cleared (Figure 1-1).

TVA would purchase a 161-kV right-of-way easement that would accommodate three 161-kV transmission line connections to the existing East Cleveland-Apison Tap-Catoosa 161-kV Transmission Line and the potential need in the future for up to two additional 161-kV transmission line connections to the substation. A 100-foot-wide right-of-way approximately 570 feet long would be cleared for one transmission line connection, and an adjoining 137.5-foot-wide right-of-way averaging approximately 1100 feet long would be cleared for two transmission line connections (Figure 1-1), totaling 5 acres.

This section of right-of-way would also accommodate the potential need in the future for up to two additional 161-kV transmission line connections to the substation. TVA would purchase easements from landowners for the new right-of-way on private land. These easements would give TVA the right to construct, operate, and maintain the transmission line, as well as remove danger trees off the right-of-way. Danger trees are those trees that are located away from the cleared right-of-way, but are tall enough to pass within 5 feet of a conductor or strike a structure should it fall toward the transmission line. Fee title, i.e., ownership, for the land within the right-of-way remains with the landowner, and a number of activities may be continued on the property by the landowner. However, the easement agreement prohibits certain activities such as 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.

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 initially removed from the entire width of the right-of-way. Equipment used during this right-of-way clearing would include chain saws, skidders, bulldozers, tractors, and/or low ground-pressure feller-bunchers. Marketable timber would be salvaged where feasible; otherwise, woody debris and other vegetation would be piled and burned, chipped, or taken off site. In some instances, vegetation may be windrowed along the edge of the right-of-way to serve as sediment barriers. Vegetation removal in streamside management zones (SMZs) and wetlands would be restricted to trees tall enough, or with the potential soon to grow tall enough, to interfere with conductors. Clearing in SMZs would be accomplished using hand-held equipment or remote handling equipment, such as a feller-buncher, in order to limit ground disturbance. TVA Right-of-Way Clearing Specifications, Environmental Quality Protection Specifications for Transmission Line Construction, and Transmission Construction Guidelines Near Streams (Appendixes II, III, and IV) would be followed in clearing and construction activities.

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

2.7.1.2. Access Roads

Permanent access roads would be needed to allow vehicle access to each structure and other points along the right-of-way. The proposed transmission line connections to the Bradley 500-kV Substation would be relatively short and would be accessed either through the substation property or by using the right-of-way access roads on the existing Sequoyah-Conasauga 500-kV Transmission Line and East Cleveland-Apison Tap-Catoosa 161-kV Transmission Line.

For the upgrades and rebuild activity along the existing transmission lines, established access roads would be used for vehicle access. These roads include privately built, farm and field roads, some of which may need upgrading. Typically, the access roads are located on the right-of-way wherever possible and designed to avoid severe slope conditions and to minimize stream crossings. The roads are typically about 20 feet wide and surfaced with dirt or gravel. The access roads were identified and included in the environmental field review.

Culverts and other drainage devices, fences, and gates would be installed as necessary. Culverts installed in any permanent streams would be removed following construction. However, in wet-weather conveyances (WWCs), they would be left or removed, depending on the wishes of the landowner or any permit conditions that might apply. Additional applicable right-of-way clearing and environmental quality protection specifications are listed in Appendixes II and III.

2.7.1.3. Construction Assembly Areas

A construction assembly area (laydown area) would be required for worker assembly, vehicle parking, and material storage. An area on the proposed Bradley 500-kV Substation site would be used as the construction assembly site. This site would be used for the duration of the construction period, approximately 18 months. The site 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.

2.7.1.4. Structures and Conductors

The proposed 161-kV transmission line connections for the Bradley 500-kV Substation would use single-steel poles and double poles (H-frame) (Figure 2-2). The proposed 4.7-mile rebuild on the East Cleveland-Apison Tap-Catoosa 161-kV Transmission Line would use double poles. Structure heights would vary according to the terrain and would range between 85 and 130 feet, averaging 100 feet.

a  b 

Figure 2-2. Single-Pole (a) and H-Frame (b) 161-kV Transmission 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 in the transmission line may require supporting guy wires. 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. The holes would normally be back-filled with the excavated material. In some cases, gravel or a cement and gravel mixture might be necessary.

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

The proposed 500-kV transmission line connection for the Bradley 500-kV Substation would use self-supporting, galvanized, laced-steel structures that would be less than 150 feet tall (Figure 2-3). The distance between structures would vary based on the terrain and land use but typically would be about 1000 feet. Tower foundations are laced-steel grillage, one per leg, buried in the ground. The tower structures at the points where the existing 500-kV transmission line connects and turns an angle toward the substation would require foundations of reinforced concrete. The electrical transmission line conductors would consist of three sets of three cables bundled in a triangular configuration, suspended beneath the structure cross-arms by two insulators. Two single ground wires would be placed on the two highest points of the structures to provide lightning protection. In some cases, these ground wires may carry fiber optic or other communication circuits.

The foundation or grillage holes would be excavated and installed for the new structure. Upon completion of the foundations, the large portions of the steel structure would be assembled on the ground near the prepared foundation. Cranes would be used to place the assembled structure on the foundation, and crews would bolt the tower to the foundation.

Figure 2-3. Typical 500-kV Transmission Structure

2.7.1.5. 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. Installation of conductors would begin with a small rope being pulled from structure to structure. This rope would then be connected to the conductor and ground wire and used to pull them down the line through pulleys suspended from the insulators mounted on the structures. A bulldozer and specialized tensioning equipment would be used to pull conductors and ground wires to the proper tension. Finally, the wires would be clamped to the insulators and the pulleys removed.

2.7.2. Operation and Maintenance

2.7.2.1. Inspection

Periodic inspections of TVA's transmission lines are performed from the ground and by aerial surveillance using a helicopter. These inspections, which occur on approximately 5-year cycles after operation begins, are conducted to locate damaged conductors, insulators, or structures, and to report any abnormal conditions that 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 or routine vegetation management.

2.7.2.2. 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. The transmission line would be designed to meet a 25-foot minimum clearance for a 161-kV transmission line and 30-foot minimum ground clearance for a 500-kV transmission line.

Management of vegetation along the right-of-way would consist of two different activities: namely, the felling of danger trees adjacent to the cleared right-of-way, as described in Section 2.7.1.1, and the control of vegetation within the cleared right-of-way.

Management of vegetation within the cleared right-of-way would use an integrated vegetation management approach designed to encourage the low-growing plant species and discourage tall-growing plant species. A vegetation-reclearing plan would be developed for each transmission line segment based on the results of the periodic inspections described above. Given the land use in the area of this project, right-of-way maintenance is expected to be minimal. 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.

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

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

2.8. Project and Siting Alternatives

The process of siting the substation and associated transmission line connections adhered to the following basic steps used by TVA:

- Determine potential existing power sources to supply the substation.
- Define the study area.
- Collect data to minimize potential impacts to cultural and natural features.
- Develop substation options and associated transmission line connection routes.

- Gather public input.

- Incorporate public input into the final identification of the substation location and associated transmission line connections.

2.8.1. Definition of Study Area

The first task in defining the study area was to identify the existing transmission lines required to connect to the new substation that would satisfy the electrical requirements of the project. After careful consideration, the existing transmission lines identified were the Sequoyah-Conasauga 500-kV Transmission Line and the East Cleveland-Apison Tap-Catoosa 161-kV Transmission Line. Therefore, the substation site would have to be located near both of these transmission lines to minimize system losses and reduce the length of new transmission line connections to the substation. The study area encompassed an area located within Hamilton and Bradley Counties, Tennessee, and within a 2-mile radius from the intersection of the Sequoyah-Conasauga 500-kV and Concord-East Cleveland 161-kV Transmission Lines.

A geographic information system - (GIS) based siting map and color orthophotography were developed. The GIS data generated a “constraint” model that served to guide the siting process by identifying potential sites having approximately 60 acres of vacant land, suitable topography for construction, and sufficient hard-surface road access to allow delivery of substation equipment and no obvious conflicts or sensitive areas including, but not limited to, houses, rivers, historical sites, and wetlands (Figure 1-1).

2.8.2. Collect Data

Geographic data such as topography, land use, transportation, environmental features, cultural resources, near-term future development, and land conservation information were collected for the study area. Analysis of the data was aided by using 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 sites that would best meet project needs, including avoiding or reducing potential environmental impacts.

Maps were created to show regional opportunities and constraints clearly. Sources included 1 inch = 500 feet aerial photography, 1 inch = 2000 feet aerial photography, county tax maps/property boundaries, U.S. Geological Survey (USGS) digital line graphs, digital elevation models, National Wetlands Inventory, and cultural resource data, among others. Aerial photography was interpreted to obtain land use and land cover data, such as forests, agriculture, wetlands, houses, barns, commercial and industrial buildings, churches, and cemeteries. Data were analyzed both manually and with GIS. Manual calculations from aerial photographs, tax maps, and other sources included the number of road crossings, stream crossings, and property parcels.

2.8.3. Develop Substation Site Options and Potential Transmission Line Connection Routes

From the information gathered during the system’s studies and data development phases, four potential substation sites and associated transmission line connections were identified near the Sequoyah-Conasauga 500-kV and Concord-East Cleveland 161-kV Transmission Lines (Figure 1-1). These sites, identified as Sites 1 through 4, met the general required design criteria such as size, suitable topography for construction, sufficient hard-surface

road access to allow delivery of substation equipment, and transmission line connectivity to existing transmission lines. A desktop review indicated the four substation sites were very similar. The biggest difference among the sites was the length of required new transmission lines and new right-of-way area to connect the substation to the existing transmission lines. The overall length of the transmission line connections for Site 1 would be shorter than the other three sites. However, the length of the existing transmission line required to be rebuilt would be longer than for Sites 2 and 3 by approximately 2 miles. The new 500-kV transmission line loop connection would be about 1 mile long for Sites 2 through 4 and would share most of the right-of-way. As the new 500-kV transmission line loop connection for sites 2 through 4 neared the existing Conasauga-Sequoyah 500-kV Transmission Line, it would start to split and require separate rights-of-way. The three new 161-kV transmission line connections for Site 4 would parallel each other sharing a right-of-way, but the rebuild length of the existing transmission line would be the longest, approximately 5 miles.

Since the substation sites were similar and were the largest area to be impacted by the project, a preliminary on-site environmental field review was conducted in April 2004 on three of the four sites. The property owner of Site 2 did not provide TVA permission to perform the survey; however, enough environmental information was available to make a relative comparison of the site. The environmental field review resulted in Site 1 being the most favorable from an environmental perspective. Although Site 3 had been heavily disturbed from logging activities, the access road into Site 3 would impact a stream and an associated wetland. Site 2 did not have any environmental issues associated with the substation site, but an endangered plant was found on the adjacent ridge where the new 500-kV transmission line connection would be located.

2.8.4. Establish and Apply Siting Criteria

TVA has long employed a set of evaluation criteria that represent opportunities and constraints for development of substation sites and 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, property, and right-of-way acquisition cost being the most important cost elements. Information gathered and comments made at the public meeting and subsequent comment period were taken into account, while refining criteria to be specific to the study area.

Each of the site options 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 means a bigger constraint. For example, a greater number of streams crossed or impacted, a longer transmission line route length, or a greater number of historic resources affected would give the site, substation, and transmission line connections a worse score.

- *Engineering Criteria*: degree of grading activity for a substation, balance of cut and fill, total length of the transmission route, length of new right-of-way and rebuilt right-of-way, primary and secondary road crossings, pipeline and transmission line crossings, and total line cost

- *Environmental Criteria*: slopes greater than 30 percent (steeper slopes mean more potential for erosion and potential water quality impacts), slopes between 20 and 30

percent, visual aesthetics, forested acres, open water, sensitive stream (those supporting endangered or threatened species), perennial and intermittent streams, wetlands, rare species habitat, natural areas, and wildlife management areas

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

- *Cultural Criteria*: archaeological and historic sites, churches, and cemeteries

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

A weighted score was produced for each site in each subcategory. This made it possible to understand which sites would have the lowest and highest impacts on engineering, environmental, land use, and cultural resources. Finally, to determine total impacts, the scores from each category were combined for an overall score.

2.8.5. Site Evaluation and Identification

Following the public open house and subsequent comment period, each site was evaluated using the constraint model and preliminary environmental field review information on the substation sites, along with the modified siting criteria obtained during the public involvement.

During the public meeting, Site 1 was the preference of the majority of those expressing an opinion. This preference was due to the fact that the other sites would impact more property owners.

Each of the proposed substation sites would impact between 50 to 60 acres as well additional acreage for the associated transmission line connections. Of the four sites, Site 1 would impact fewer total acres, about 72 acres. Because of the additional length of transmission line connections needed, at least 30 more acres would be impacted for Sites 2, 3, and 4. Overall, Site 1 would have shorter transmission line connections and, therefore, less new right-of-way acreage than the other sites. All four potential substation sites or transmission line connections would cross at least two streams. The new 500-kV transmission line connection for Site 2 would parallel a stream. The new 500-kV transmission line connections for Sites 2 through 4 would require at least one angle. The new 161-kV transmission line connections for Site 1 would require one angle. Sites 2 and 3 would require more clearing of woodlands and additional site preparation activity. Site 1 and 4 consist of mostly pasture at the proposed substation sites and would require some clearing for the transmission line connection right-of-way. The preliminary environmental field review identified wetland and stream issues at the entrance to Site 3 and the potential for endangered plants in new 500-kV transmission line connection right-of-way. Construction accessibility would be more difficult for Site 3 and Site 4 because of the steep terrain associated with the 500-kV transmission line connections.

In summary, the overall scoring of the four potential substation site options indicated that Site 1 was the best alternative for minimizing impacts. In addition, Site 1 was the

preference of the majority of the public attending the April 8, 2004, meeting and during the 30-day public comment period.

2.9. Identification of the Preferred Alternative

Alternative 2: Construct 500-kV Substation and Transmission Line Connections and Perform Upgrades to the TVA Transmission System (Action) is TVA's Preferred Alternative. TVA would upgrade and rebuild the TVA transmission system by building the Bradley 500-kV Substation at Site 1, which is TVA's preferred substation site, and the associated 161-kV and 500-kV transmission line connections (Figure 2-4). In addition, TVA would expand the Concord Substation and upgrade or rebuild sections of four existing transmission lines and perform modifications at several existing TVA facilities (Figure 2-1). New construction on the proposed project would affect approximately 72 acres.

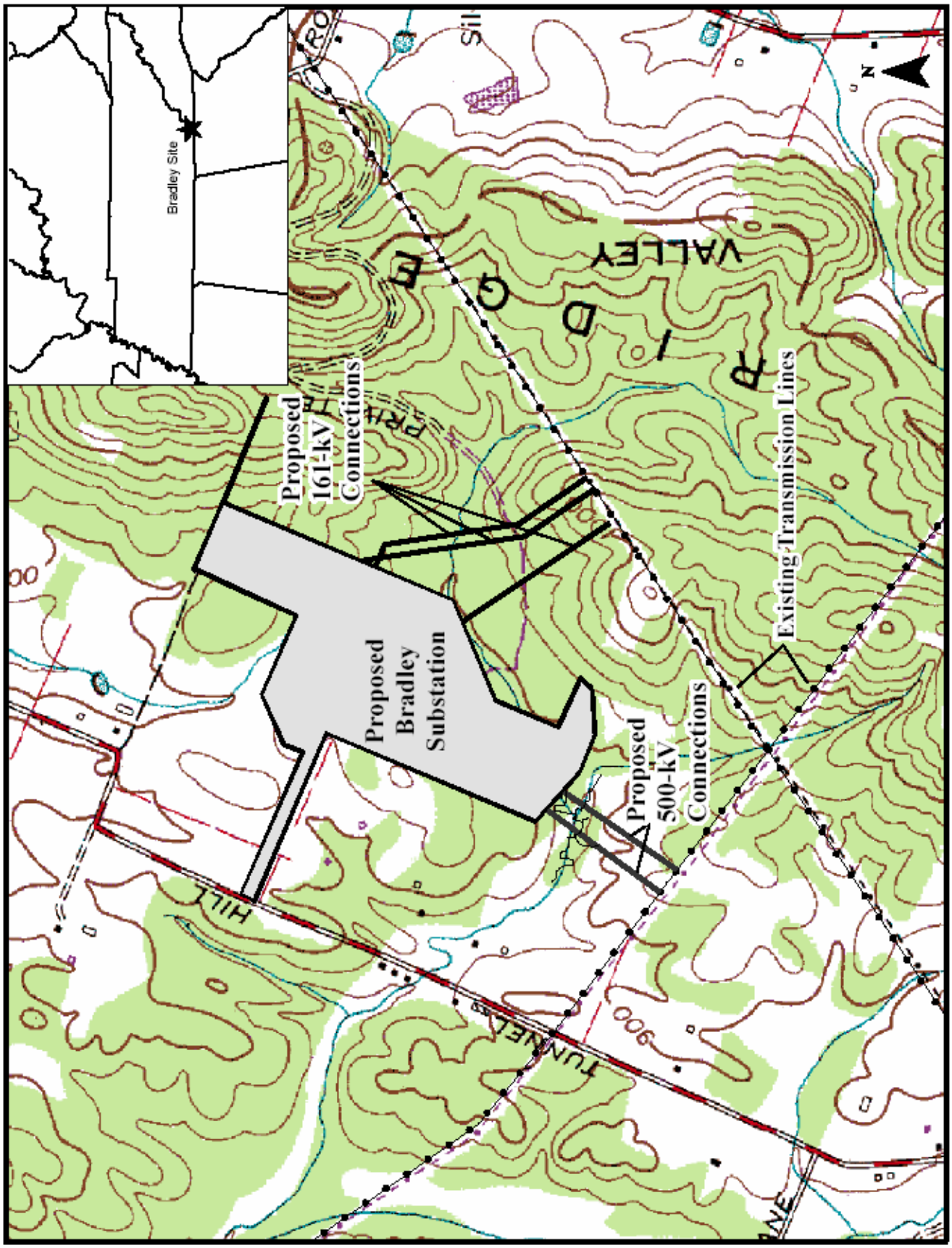

Figure 2-4. TVA's Preferred Substation Site With Associated 161-kV and 500-kV Transmission Line Connections Shown

CHAPTER 3

3. AFFECTED ENVIRONMENT

3.1. Introduction

Chapter 3: Affected Environment succinctly describes the existing condition of the environmental resources and factors of the Bradley and Hamilton Counties, Tennessee, and Catoosa County, Georgia, project areas that would affect or that would be affected by implementing either Alternative 1 or Alternative 2.

This description of the existing environment in Chapter 3, the description of the activities of Alternative 1: Do Not Upgrade the TVA Transmission System (No Action) in Chapter 2 and the predicted effects of Alternative 1 in Chapter 4 combine to establish the baseline conditions against which the decision maker and the public can compare the potential effects of Alternative 2: Construct 500-kV Substation and Transmission Line Connections and Perform Upgrades to the TVA Transmission System (Action).

3.1.1. Terrestrial Ecology

3.1.1.1. Terrestrial Plants

The proposed project area is within the southern part of the Ridge and Valley Physiographic Province (Fenneman, 1938). This province lies between the Blue Ridge Mountains and the Cumberland Plateau and is characterized by prominent, northeast-trending ridges and their associated valleys. The Tennessee River flows through this province, roughly paralleling the alignment of the valleys. The ridges are occasionally bisected by creeks or rivers flowing into the Tennessee River from adjacent provinces.

The vegetation was variously classified by Braun (1950) as the Oak-Chestnut Forest Region and by Kuchler (1964) as the Appalachian Oak Forest Region. Most of the broader valleys have been cleared of forest cover and converted to permanent pasture or other agricultural uses. The ridges remain largely forested, though they have been subjected to selective or clear-cut timber harvest. Pine plantations are frequent. With chestnut trees essentially eliminated by a blight fungus in the twentieth century, the predominant species present in this region include chestnut oak, white oak, northern and southern red oak, black oak, post oak, scarlet oak, tulip tree, red maple, and sugar maple on cooler and moister sites. Successional plant communities of this region range from broomsedge fields, bramble thickets, pine stands, and mixed pine-hardwood stands to pine and hardwood stands, depending on the time since disturbance and topographic setting. Little or no undisturbed vegetation remains within this region.

Plant communities observed during field surveys within the proposed substation and associated transmission line connection project areas include successional communities, mixed mesophytic communities on north- and east-facing slopes, oak-hickory/oak-pine forest on south- and west-facing slopes, palustrine forests, and pine plantations.

Successional communities include old fields and pastures, consisting primarily of tall fescue and broomsedge, and occupy approximately 31 percent of the project area. The edges of

the fields are occupied by several exotic invasive species such as Chinese privet, Japanese honeysuckle, kudzu, and Bradford pear.

Mixed mesophytic communities occupy approximately 22 percent of the total area and are commonly found on north- and east-facing slopes. This community is dominated by common trees such as sugar maple, northern red oak, white oak, shagbark hickory, bitternut hickory, white ash, and yellow poplar. The understory vegetation includes pawpaw, flowering dogwood, spicebush, and sweet shrub. During the spring, the herbaceous groundcover would be composed of a wide variety of wildflowers such as blue phlox, bloodroot, May apple, and various trillium and fern species.

Oak-hickory and oak-Pine forests occupy the steeper parts of the landscape, on ridges and on the west- and south-facing slopes. They are made up of white, southern red, chestnut, chinquapin, and black oak, Virginia and some loblolly pine, and mockernut, pignut, red, and shagbark hickory. In places, the shrub layer is made up of blueberries, huckleberries, and sparkleberries. The herbaceous ground cover is sparse, with widely scattered herbs and few grasses. Oak-hickory/oak-pine forests make up about 40 percent of the project area.

Palustrine forests are located in wetlands and are comprised of woody vegetation that is at least 20 feet tall. Most of these forested wetland areas are found in temporarily flooded riparian zones. In this region, these areas are typically dominated by red and silver maple, slippery elm, box elder, sycamore, and green ash. Water and white oak may also be members of this type community. Palustrine forests occupy 6 percent of the project area.

A small pine plantation composed of loblolly pine makes up less than 1 percent of the landscape. Pines in plantations are closely planted resulting in a closed canopy with little understory vegetation.

Bradley 500-kV Substation

The project area for the proposed Bradley 500-kV Substation consists of a successional community (pasture), an oak-pine forest that is heavily disturbed by the presence of cattle, and a young pine plantation.

Bradley 500-kV Substation Connections to Sequoyah-Conasauga 500-kV Transmission Line and East Cleveland-Apison Tap-Catoosa 161-kV Transmission Line

Four new transmission lines are proposed to connect the Bradley 500-kV Substation to existing transmission lines near the site. The proposed transmission line routes for three 161-kV transmission line taps would cross a young pine plantation. This habitat consists of a monotypic stand of loblolly pines with little understory. There is a small sphagnum moss wetland (less than 0.1 acre) within the pine plantation. Additionally, a 500-kV transmission line loop would cross an approximate 3-acre parcel composed of mostly pastureland, but also an approximate 0.27-acre parcel that is palustrine forest (bottomland hardwoods) and an emergent wetland. The common trees in the forested area are red and silver maple, slippery elm, box elder, sycamore, green ash, and water and white oak.

Concord Substation Expansion

The Concord Substation would be expanded approximately 1.8 acres on the southwest side of the existing substation. Vegetation in this area consists of an isolated patch of eastern

red cedar and Bradford pear trees forming the overstory with mixed forbs and grasses in the ground cover. Many of these species are weedy native and non-native plants such as sericea lespedeza, and broomsedge.

Existing TVA Transmission Lines

The rights-of-way for the four existing transmission lines cross pastures and fields that are primarily composed of grasses and weedy species such as tall fescue, broomsedge, buttercup, ragweed, cocklebur, ironweed, and common ragweed. Transmission line sections that were previously cut through forested areas have a variety of invasive species, such as Chinese privet, kudzu, Japanese honeysuckle, and native blackberries and cat briars, encroaching into the open areas. In addition, seedlings of white ash, red buckeye, sweet gum, tulip popular, and forbs such as phlox, blue-eyed grass, groomwell, and various species of composites (members of the sunflower family) are commonly found in these open areas of the right-of-way.

3.1.1.2. Terrestrial Animals

Bradley 500-kV Substation

The project area for the proposed Bradley 500-kV Substation consists of pasture, an upland mixed mesophytic forest that has been heavily disturbed by cattle, and a young pine plantation. Animal species observed during field surveys in this mixture of habitats include white-tailed deer, mourning dove, wild turkey, northern cardinal, Carolina wren, eastern bluebird, and red-eyed vireo.

Bradley 500-kV Substation Connections to Sequoyah-Conasauga 500-kV Transmission Line and East Cleveland-Apison Tap-Catoosa 161-kV Transmission Line

The proposed areas for the three 161-kV transmission line connections to the Bradley 500-kV Substation consist of young loblolly pines. Although terrestrial animal diversity is typically low in monotypic habitat such as pine plantations, some animals such as white-tailed deer, raccoon, and white-breasted nuthatch will use this habitat. A small wetland with some sphagnum moss habitat was observed within the pine plantation. During a February 2005 field survey of this area, several chorus frogs were heard calling, and two egg masses were observed.

The proposed area for the 500-kV transmission line connection to the Bradley 500-kV Substation is predominantly pasture, but includes 0.27 acre of bottomland hardwood forest. Terrestrial animals commonly using pastureland include eastern bluebird, American kestrel, red fox, eastern cottontail, and white-footed mouse. A stream with a spring associated with the bottomland hardwood forest occurs along this route, and chorus frogs, southern two-lined salamanders, and spotted dusky salamanders were observed in this habitat during field surveys. Evidence of other species such as white-tailed deer and wild turkey were also observed. Reptiles, including water snakes and eastern mud turtles, are also expected in this habitat.

Concord Substation Expansion

Habitat for terrestrial animals at the Concord Substation is isolated due to development and agricultural practices in the vicinity. The site provides poor quality habitat within an isolated

patch of red cedar and Bradford pear trees. Although common species would be expected at this site, no terrestrial animals were observed during a February 2005 field survey.

Existing TVA Transmission Lines

Four existing 161-kV transmission lines would require upgrades and/or rebuilds as a result of the construction of the Bradley 500-kV Substation. All of the proposed project activities would occur within the existing transmission line rights-of-way that consist of predominantly early successional, grassy, and modified habitats. Terrestrial animal species typically occurring in these areas include white-tailed deer, coyote, eastern cottontail, short-tailed shrew, American kestrel, field sparrow, and rat snake.

Several unique terrestrial animal resources occur in the project area of Bradley and Hamilton Counties, Tennessee, and Catoosa County, Georgia. These include 12 heronries and 33 caves. Of these, 16 caves and four heronries occur within a 3-mile radius of the project area. All of the heronries are greater than 1.2 miles from the project sites. Of the caves, one occurs within 200 feet of the East Cleveland–Apison Tap-Catoosa 161-kV Transmission Line. Cave salamanders and hibernating eastern pipistrelles were observed in this cave during field surveys.

3.1.2. Threatened and Endangered Species

3.1.2.1. Terrestrial Plants

The TVA Natural Heritage database indicated that three federally and state-listed plant species and an additional 32 state-listed plant species (Georgia and Tennessee) have been reported within a 5-mile radius of the proposed project areas (Table 3-1).

Bradley 500-kV Substation

No federally or state-listed terrestrial plant species were found during field surveys in April 2004 or January and February 2005.

Bradley 500-kV Substation Connections to Sequoyah-Conasauga 500-kV Transmission Line and East Cleveland-Apison Tap-Catoosa 161-kV Transmission Line

Habitat observed in and near the palustrine forest area of the proposed project area for the 500-kV transmission line right-of-way could potentially support federally or state-listed plants. Monkey-face orchid is known to occur in open wet areas in and adjacent to mature forested areas, and mountain bitter cress, Florida hedge hyssop, creek grass, and lanceleaf trillium occur in alluvial woods, wet ravines, and marshes. Field surveys conducted in May 2005 did not reveal any federally or state-listed species occurring in the project area. However, the monkey-face orchid does not flower until late July to mid-August, and habitat is present for this species; accordingly, TVA plans to resurvey this location in midsummer.

The area that would be cleared for the 161-kV transmission line right-of-way occurs mainly within a pine plantation. This area does not provide suitable habitat for any federally or state-listed species.

Table 3-1. Federally and State-Listed Terrestrial Plant Species Reported From Within 5 Miles of the Bradley 500-kV Substation Site and Associated Project Upgrades in Bradley and Hamilton Counties, Tennessee, and Catoosa County, Georgia

Common name	Scientific name	Federal status	State status		A	B	C	D	E	F	Habitat
			Tenn.	Ga.							
American ginseng	*Panax quinquefolius*		S-CE		X		X				Mixed mesophytic forests
Canada lily	*Lilium canadense*		THR			X		X	X	X	Swamps
Chalk maple	*Acer saccharum spp. leucoderme*		SPCO			X		O	X	X	Rocky woodlands
Compass-plant	*Silphium laciniatum*		THR		X						Shallow, very rocky soil
Creek grass	*Potamogeton epihydrus*		SPCO		X						Marshes
Florida hedge hyssop	*Gratiola floridana*		END					X	X	X	Wet woods
Four-flowered loosestrife	*Lysimachia quadriflora*		SPCO							X	Open marsh-like wetland
Fraser loosestrife	*Lysimachia fraseri*		END	RARE	X						Dry, deciduous slope
Gibbous panic-grass	*Sacciolepis striata*		SPCO				X	X			Floodplains and shallow pools
Glade cress	*Leavenworthia exigua var exigua*		THR	THR		X		X	X	X	Open area of cedar glades; shallow soil
Great plains ladies'-tresses	*Spiranthes magnicamporum*			END					X	X	Shallow soil, grassy areas of cedar glades; limestone outcrop
Lanceleaf trillium	*Trillium lancifolium*		END		X	X		X	X	X	Alluvial woods and moist ravines
Large-flowered skullcap	*Scutellaria montana*	THR	THR	END	X		X	X	X	X	Rocky slopes; Steep ravine with mesophytic forests; mature oak-pine forest
Leather-flower	*Clematis glaucophylla*		END					X	X	X	Riparian wetlands
Manna-grass	*Glyceria acutiflora*		SPCO				X				Acidic wetlands
Monkey-face orchid	*Platanthera integrilabia*	C	END	THR	X						Open wet areas
Mountain bitter cress	*Cardamine clematitis*		THR		X						Rich, rocky, wet woods

Common name	Scientific name	Federal status	State status		A	B	C	D	E	F	Habitat
			Tenn.	Ga.							
Mountain bush-honeysuckle	*Diervilla rivularis*		THR		X		X				Dry cliffs and rocky bluffs
Mountain honeysuckle	*Lonicera dioica*		SPCO				X				Mountain woodlands and thickets
Nestronia	*Nestronia umbellula*		END				X				Dry hardwood-pine forests
Northern bush-honeysuckle	*Diervilla lonicera*		THR		X						Rocky woodlands and bluffs
Ovate-leaved arrowhead	*Sagittaria platyphylla*		SPCO					X			Wetlands
Prairie-dock	*Silphium pinnatifidum*		THR							X	Mowed roadside area
Rose-gentian	*Sabatia capitata*		END	RARE			X				Dry open woodlands; transmission line rights-of-way
Roundleaf fameflower	*Talinum teretifolium*		THR		X						Sandstone outcrops
Southern morning-glory	*Stylisma humistrata*		THR		X						Dry pine woodlands
Southern nodding trillium	*Trillium rugelii*		END			X		X	X	X	Rich mountain woods
Swamp lousewort	*Pedicularis lanceolata*		SPCO							X	Along creek
Tall larkspur	*Delphinium exaltatum*		END					X			Hillsides
Three-parted violet	*Viola tripartita var Tripartita*		SPCO		X		X				Wooded slopes
Virginia chainfern	*Woodwardia virginica*		SPCO				X				Plateau pond; acidic wetlands
Virginia spiraea	*Spiraea virginiana*	THR	END	THR			X				Gravel or rocky stream bars
Wood lily	*Lilium philadelphicum*		END		X						Dry openings
Yellow honeysuckle	*Lonicera flava*		PT		X						Rocky woodlands
Yellow jessamine	*Gelsemium sempervirens*		SPCO		X			X			Dry openings

Status abbreviations: C = Candidate for Federal Listing; END= Endangered; PT = Proposed threatened; S-CE = Special Concern, Commercially exploited; SPCO = Special Concern; THR = Threatened; X = Reported within a 5-mile Radius; O = Observed in Affected Project Area

A = Bradley 500-kV Substation and Interconnections to Sequoyah-Conasauga 500-kV Transmission Line and East Cleveland-Apison 161-kV Transmission Line
B = Concord Substation Expansion
C = Falling Water-Sequoyah 161-kV Transmission Line
D = Concord-Sequoyah 161-kV Transmission Line
E = Concord-Catoosa 161-kV Transmission Line
F = East Cleveland-Apison Tap 161-kV Transmission Line and Catoosa-Apison Tap 161-kV Transmission Line

Concord Substation Expansion

Five state-listed species (Table 3-1) are known within 5 miles of the proposed project area. These species, as well as federally and/or state-listed plants not known with the 5-mile radius, were sought during field surveys. No occurrences of these or other rare species or their habitats were observed on or immediately adjacent to the proposed project area, nor was habitat suitable for any of the listed plants in the project area.

Falling Water-Sequoyah 161-kV Transmission Line

Two federally and state-listed and an additional nine state-listed plant species have been reported from within 5 miles of the transmission line (Table 3-1). No occurrences of these or other rare species or their habitats were observed during field surveys in January and February 2005.

Concord-Sequoyah 161-kV Transmission Line

One plant species federally and state-listed and an additional 11 state-listed plant species have been reported from within 5 miles of the transmission line (Table 3-1). Within this right-of-way, a record exists for lanceleaf trillium; however, no specimens were located during field surveys conducted in May 2005. Chalk maple, (state-listed special concern) was seen adjacent to the transmission line, out of the danger tree zone, during field surveys in January and February 2005. No other occurrences of these or other rare species or their habitats were observed during field surveys.

Concord-Catoosa 161-kV Transmission Line

One plant species federally and state-listed and an additional eight state-listed plant species have been reported from within 5 miles of the transmission line. No occurrences of these or other rare species or their habitats were observed during field surveys in January and February 2005.

East Cleveland–Apison Tap-Catoosa 161-kV Transmission Line

One federally and state-listed plant species has been reported from within 5 miles of the transmission line (Table 3-1). Additionally, 11 state-listed plant species have been reported from within 5 miles of the transmission line (Table 3-1). No occurrences of these or other rare species or their habitats were observed during field surveys in January and February 2005.

3.1.2.2. Terrestrial Animals

The TVA Natural Heritage database indicated that two federally listed and 14 state-listed terrestrial animal species have been reported from Hamilton County, Tennessee, and Catoosa County, Georgia (Table 3-2). No records of protected terrestrial animal species occur in Bradley County, Tennessee.

Table 3-2. Federally and State-Listed Terrestrial Animal Species Reported From Hamilton County, Tennessee, and Catoosa County, Georgia

Common name	Scientific name	Federal status	State status	
			Tenn.	Ga.
Amphibian				
Eastern Hellbender	*Cryptobranchus alleganiensis*	-	NMGT	Rare
Tennessee Cave Salamander	*Gyrinophilus palleucus*	-	THR	-
Mammals				
Allegheny Woodrat	*Neotoma magister*	-	NMGT	-
Southeastern Shrew	*Sorex longirostris*	-	NMGT	-
Bird				
Sharp-shinned Hawk	*Accipiter striatus*	-	NMGT	-
Bachman's Sparrow	*Aimophila aestivalis*	-	END	Rare
Great Egret	*Casmerodius albus*	-	NMGT	-
Peregrine Falcon	*Falco peregrinus*	END	END	END
Bald Eagle	*Haliaeetus leucocephalus*	THR	NMGT	END
Least Bittern	*Ixobrychus exilis*	-	NMGT	-
Swainson's Warbler	*Limnothlypis swainsonii*	-	NMGT	-
King Rail	*Rallus elegans*	-	NMGT	-
Virginia Rail	*Rallus limicola*	-	NOST	-
Appalachian Bewick's Wren	*Thryomanes bewickii altus*	-	END	Rare
Common Barn-owl	*Tyto alba*	-	NMGT	-

Status abbreviations: END = Endangered; NMGT = Deemed in Need of Management; NOST = No Status; THR = Threatened

The eastern hellbender is a large, aquatic salamander. In the vicinity of this project area, this species typically inhabits cool, well-oxygenated small streams or tributaries to rivers and infrequently occurs in sections of larger rivers. Habitat for this species does not occur in the proposed project areas of the Bradley 500-kV Substation and associated connections or the Concord Substation. Among the existing transmission lines, suitable habitat occurs only in South Chickamauga Creek along the East Cleveland-Apison Tap-Catoosa 161-kV Transmission Line in Catoosa County, Georgia.

The Tennessee cave salamander is restricted to shallow water systems in caves or sinkholes. Sixteen caves exist within a 3-mile radius of the proposed project area, but only one occurs closer than 200 feet. A field survey of this cave conducted in January 2005 near the East Cleveland-Apison Tap-Catoosa 161-kV Transmission Line did not find either the presence of Tennessee cave salamanders or suitable habitat for the species at this location.

The Allegheny woodrat occupies rocky outcrops or brushy, lowland habitat north and west of the Tennessee River. Of the proposed project area, only the Falling Water-Sequoyah

161-kV Transmission Line occurs within the distribution range of this species and some habitat likely exists within the transmission line right-of-way.

The southeastern shrew inhabits a wide variety of habitats ranging from grasslands to forests, usually preferring moist woodlands near wetlands, bogs, or streams with decaying logs or leaf litter. This species was not observed during field visits, but suitable habitat exists throughout the project area except in the vicinity of the Concord Substation.

The sharp-shinned hawk occurs in mixed pine-hardwoods and is more common during spring and fall migration than summer. The proposed area for the Bradley 500-kV Substation and associated connections provides appropriate habitat for this species, as does the forested edges adjacent to the existing project transmission lines.

The Bachman's sparrow is native to the southeastern United States and inhabits savannahs with grassy openings and mature trees, usually pines. One record of this species has been reported on an island within Chickamauga Reservoir approximately 2.4 miles from the Falling Water-Sequoyah 161-kV Transmission Line and 2.8 miles from the Concord-Sequoyah 161-kV Transmission Line in 1969. This location would not be affected by the proposed actions and suitable habitat for this species does not exist elsewhere in the affected project area.

The great egret prefers to nest in forested wetland habitats. The species has been reported within 1.9 miles of the Concord-Sequoyah 161-kV Transmission Line on an island in Chickamauga Reservoir. Two additional forested wetlands were identified within the project area that could provide suitable habitat for nesting. One of these locations occurs along the proposed 500-kV transmission line loop between the Sequoyah-Conasauga 500-kV Transmission Line and the proposed Bradley 500-kV Substation. The other location occurs adjacent to the Falling Water-Sequoyah 161-kV Transmission Line right-of-way. These two wetlands provide a relatively small amount of nesting habitat for this species and no evidence of former heronries was observed during field surveys.

The peregrine falcon nests on cliffs or large man-made structures. Suitable habitat for this species was not observed in the proposed project areas.

Bald eagles feed primarily on fish and are often found near large bodies of water such as the nearby Chickamauga Reservoir. Habitat for this species occurs in the project area wherever existing transmission lines cross large bodies of water. This includes the Falling Water-Sequoyah 161-kV Transmission Line crossing at Chickamauga Reservoir, the Concord-Sequoyah 161-kV Transmission Line crossing at Wolftever Creek, and the East Cleveland-Apison Tap-Catoosa 161-kV Transmission Line crossing at South Chickamauga Creek. Wintering eagles have been observed within 0.5 mile of the Falling Water-Sequoyah 161-kV Transmission Line near the Sequoyah Nuclear Plant. In addition, as recently as 1999, a bald eagle pair was observed 1.7 miles from this transmission line. Although suitable habitat exists in this area, no individuals or nesting structures were observed in the proposed affected project area during a field survey in January 2005.

The least bittern is a small, migratory heron that nests in marshes with dense emergent vegetation. The king rail and Virginia rail are also found in swamps and marshes containing sufficient emergent vegetation. Suitable habitat does not exist in either the Concord Substation area or the proposed Bradley 500-kV Substation and associated connection sites, and only marginal habitat exists in a few locations on the existing transmission lines.

The Swainson's warbler inhabits bottomland forests that have a dense, woody understory. Marginally suitable habitat for this species exists along a stream adjacent to the proposed 500-kV transmission line loop between the Sequoyah-Conasauga 500-kV Transmission Line and the proposed Bradley 500-kV Substation.

The Appalachian subspecies of the Bewick's wren is usually found in thick, woody hedges or brush piles within relatively open land, such as farmyards or young clear-cuts. Suitable habitat likely exists for this species within the existing transmission line rights-of-way.

The barn owl feeds primarily in open habitats and nests in hollow trees or abandoned man-made structures. The open habitat of the existing transmission line rights-of-way for the proposed Bradley 500-kV Substation, its associated 500-kV transmission line connection, and any adjacent areas of pastureland would provide suitable foraging habitat for this species. Suitable habitat does not exist in either the Concord Substation area or the proposed 161-kV transmission line connections to the Bradley 500-kV Substation.

3.1.2.3. Aquatic Animals

The TVA Natural Heritage database indicated that several federally and state-listed aquatic animal species are known to occur in streams in the Tennessee River system of Hamilton and Bradley Counties, Tennessee, and Catoosa County, Georgia (Table 3-3). Additionally, in Catoosa County several listed fish and mussel species are present in the Conasauga River system; however, none of the existing project transmission lines cross any streams in this system. Several additional federally listed mussel species have historically been reported from the Tennessee River, and its tributaries within the project area, but are no longer thought to occur in this portion of the Tennessee River system.

No federally or state-listed aquatic animal species are present within the proposed Bradley 500-kV Substation site and associated 161-kV transmission line connections or the Concord Substation expansion site. However, one particularly sensitive aquatic resource, a 3-acre wetland consisting of forested and emergent vegetation with a spring/stream complex, was identified in and adjacent to the proposed right-of-way for the 500-kV transmission line connection to the proposed Bradley 500-kV Substation. A fish survey conducted in the springs and associated unnamed tributary to Taylor Branch located a population of the state-listed Tennessee dace.

Table 3-3. Federally and State-Listed Aquatic Animal Species Reported From Streams in Bradley and Hamilton Counties, Tennessee, and Catoosa County, Georgia

Common name	Scientific name	Federal status	State status	
			Tenn.	Ga.
Fish				
Highfin carpsucker	*Carpiodes velifer*		NMGT	
Flame chub	*Hemitremia flammea*		NOST	
Bigeye chub	*Hybopsis amblops*			NOST
Ohio lamprey	*Ichthyomyzon bdellium*			NOST
Popeye shiner	*Notropis ariommus*			THR
Dusky darter	*Percina sciera*			NOST
Snail darter	*Percina tanasi*	THR	END	END
Stargazing minnow	*Phenacobius uranops*			THR
Tennessee dace	*Phoxinus tennesseensis*		NMGT	
Crayfish				
Chickamauga crayfish	Cambarus extraneus		THR	
Mussel				
Pink mucket	*Lampsilis abrupta*	END	END	

Status abbreviations: END = Endangered; NMGT = Deemed in Need of Management; NOST = No Status; THR = Threatened

3.1.3. Wetlands

Activities in wetlands are regulated under Sections 404 and 401 of the Federal Clean Water Act. To conduct activities in wetlands, a nationwide general permit or an individual permit from the USACE is required. In Tennessee, 401 Water Quality Certification and/or an Aquatic Resource Alteration Permit are required for activities in "Waters of the State," including wetlands. Additionally, EO 11990 requires all Federal agencies to provide leadership and take action to minimize the destruction, loss, or degradation of wetlands and to preserve and enhance the natural and beneficial values of wetlands in carrying out the agency's responsibilities. It also requires agencies to consider factors relevant to a proposal's effect on the survival and quality of the wetlands, including maintenance of natural systems, conservation and long-term productivity of existing flora and fauna, species and habitat diversity and stability, hydrologic utility, fish, wildlife, timber, and food and fiber resources, as well as other uses of the wetlands in the public interest.

A Federal "no-net-loss" policy for wetlands states an interim goal of no overall net loss of the nation's remaining wetlands, and the long-term goal of increasing the quality and quantity of the Nation's wetlands resource base (White House Office on Environmental Policy, 1993). Although the no-net-loss policy is not interpreted strictly on the basis of wetland class (forested, emergent), such an interpretation may be appropriate for those wetland types that have experienced historic and current high levels of loss and conversion, as have forested wetlands.

Wetland determinations were performed in the proposed project area according to USACE standards (Environmental Laboratory, 1987), which require documentation of hydrophytic vegetation (Reed, 1997), hydric soil, and wetland hydrology. Broader definitions of wetlands, such as the classification of wetland and deepwater habitats used by the U.S.

Fish and Wildlife Service (USFWS) (Cowardin et al., 1979), and the TVA Environmental Review Procedures (TVA, 1983), were also considered in this review.

A field survey of the proposed Bradley 500-kV Substation site was conducted in April 2005. No wetlands were identified on the site. Additional field surveys were conducted January and February 2005 along the proposed and existing project transmission line rights-of-way and at the Concord Substation. No wetlands were identified in the Concord Substation expansion area.

Thirty-three wetland areas, totaling approximately 25.11 acres, were delineated in the project area (Tables 3-4 and 3-5). The wetlands occur in floodplains, stream riparian zones, and headwater areas. Twenty-seven of the wetlands occur in Tennessee River subwatersheds, including Savannah Creek, Wolftever Creek, Ryall Springs Branch, Hurricane Creek, Candies Creek, South Chickamauga Creek, and Chickamauga Creek. Six of the wetlands occur in Conasauga River subwatersheds, including Chatata Creek and Coahulla Creek.

In the four existing transmission line rights-of-way, 31 wetland areas were delineated (Table 3-4). The acreages of these wetlands were estimated from engineering drawings to be approximately 24.7 acres. As described in Section 2.7.2.2, vegetation along transmission line rights-of-way is periodically managed to ensure access to the structures and to maintain an adequate distance between the transmission line conductors and vegetation. The wetlands identified within the right-of-way areas were palustrine emergent (PEM1) and scrub-shrub (PSS1) wetlands, or a combination of PEM1, PSS1, and ponds (PUB; unconsolidated bottom wetlands). Table 3-5 provides a summary of the total wetland acreage by wetland class.

Two wetlands were delineated within the proposed transmission line rights-of-way that would connect the Bradley 500-kV Substation to existing transmission lines. An 0.11-acre PSS1 wetland (JW10) was delineated in the proposed 161-kV connection alignment. A 3.13-acre forested wetland/emergent wetland (PFO1/PEM1; JW9)) was delineated in and adjacent to the proposed 500-kV connection alignment. At the southern edge of this wetland, the 500-kV right-of-way would cross 0.27 acre of the forested wetland area.

The acreage in the right-of-way for wetland JW9, and the total wetland acreage and acreage of impact of wetland JW10, were calculated based on a survey of the flagged boundary points.

All of the wetlands meet the USACE parameters for jurisdictional wetlands, which may be regulated under the Clean Water Act. All wetlands would require a jurisdictional determination from the USACE and the Tennessee Department of Environment and Conservation (TDEC) (for wetlands in Tennessee) before TVA could take action that could disturb these wetlands.

Table 3-4. Wetlands Located Along or Within the Existing and Proposed Project Transmission Line Rights-of-Way

Wetland ID[1]	Wetland classification[2]	Acreage in right-of-way	Structure ID# in Wetland
Falling Water-Sequoyah 161-kV Transmission Line			
W1	PEM	0.92	N/A
Concord-Sequoyah 161-kV Transmission Line			
W1	PEM	0.5	N/A
W2	PEM	0.11	N/A
W3	PEM	0.09	N/A
W4	PEM	0.34	N/A
W5	PEM	0.39	N/A
W6	PEM	2.64	82
Concord-Catoosa 161-kV Transmission Line			
W1	PEM	2.30	165
W2	PEM/PUB	0.23	N/A
W3	PSS/PEM/ PUB	1.54	164
W4	PEM/PSS	0.34	N/A
W5	PEM/PSS/ PUB	1.22	160
W6	PEM	0.11	N/A
W7	PEM	2.75	151 and 152
W8	PEM	0.34	N/A
W9	PEM	0.64	N/A
W10	PEM/PSS	0.46	N/A
W11	PSS/PEM	0.22	N/A
East Cleveland-Apison Tap-Catoosa 161-kV Transmission Line			
RW1	PEM	0.22	N/A
JW1	PEM	0.09	N/A
JW2	PEM/PSS/ PUB	0.75	N/A
RW3	PSS	0.14	N/A
JW3	PEM	0.69	N/A
JW4	PEM	0.39	N/A
RW4	PEM	0.69	N/A
RW5	PEM	0.28	46
JW5	PSS/PEM	0.30	N/A
JW6	PEM	0.34	N/A
RW6	PEM	5.53	31
JW7	PEM	0.08	N/A
JW8	PEM	0.09	N/A
Proposed 500-kV Transmission Line Connection to the Bradley 500-kV Substation			**TVARAM Score/ Category**
JW9	PFO/PEM	0.27[3]	76/3
Proposed 161-kV Transmission Line Connections to the Bradley 500-kV Substation			
JW10	PSS	0.11	53/2

[1] Federal and/or state jurisdictional determinations subject to confirmation by USACE and/or TDEC regulatory staff
[2] As defined by Cowardin, et al. (1979). PEM = emergent; PSS = scrub-shrub; PFO = forested; PUB = Pond
[3] Total JW9 wetland acreage = 3.13
ID = Identification
# = Number

Table 3-5. Summary of Project Area Wetlands In and Adjacent to the Proposed and Existing Transmission Line Rights-of-Way

Wetland classification[1]	Affected Project Transmission Line	Acreage within right-of-way
PEM1	Falling Water-Sequoyah 161-kV Transmission Line	0.92
	Concord-Sequoyah 161-kV Transmission Line	4.07
	Concord-Catoosa 161-kV Transmission Line	6.14
	East Cleveland-Apison Tap-Catoosa 161-kV Transmission Line	8.40
PEM1/PUBh; PSS1/PEM1/ PUBH; PEM1/PSS1; PSS1/PEM1	Concord-Catoosa 161-kV Transmission Line	4.01
	East Cleveland-Apison Tap-Catoosa 161-kV Transmission Line	1.05
PSS1	East Cleveland-Apison Tap-Catoosa 161-kV Transmission Line	0.14
	Proposed 161-kV Transmission Line Connection to the Bradley 500-kV Substation	0.11
PFO1E/PEM1E	Proposed 500-kV Transmission Line Connection to the Bradley 500-kV Substation	0.27

[1]As defined by Cowardin, et al. (1979). PEM = emergent; PSS = scrub-shrub; PFO = forested; PUB = Pond

Wetland functions performed in the project area include attenuation of flood flows, nutrient cycling, contaminant removal and transformation, sediment retention, wildlife habitat, and maintenance of biological and landscape diversity. The ecological and economic values provided by these functions include sustaining wildlife and aquatic resources, flood control, water quality improvement and maintenance, preservation of biodiversity, and ecosystem support (via nutrient cycling, biomass production, and nutrient export).

A version of the *Ohio Rapid Assessment Method* (Mack, 2001) specific to the TVA region (TVARAM) was developed for use in guiding wetland mitigation decisions consistent with TVA's independent responsibilities under the National Environmental Policy Act (NEPA) and EO 11990. Wetlands identified in the proposed Bradley 500-kV Substation's transmission line connection right-of-way were evaluated using TVARAM since they would be subject to new disturbance (Table 3-5). The Ohio Rapid Assessment Method is designed to distinguish between three categories of wetlands: These are identified as Categories 1, 2, and 3.

Category 1 wetlands are described as "limited quality waters." They are considered to be a resource that has been degraded, has limited potential for restoration, or is of such low functionality, that lower standards for avoidance, minimization, or mitigation can be applied.

Category 2 includes wetlands of moderate quality and also wetlands that are degraded but could be restored. Avoidance and minimization are the first lines of mitigation.

Category 3 generally includes wetlands of very high quality and wetlands that are of concern regionally and/or statewide, such as wetlands which provide habitat for threatened or endangered species. All practicable attempts would be made to avoid any disturbance of Category 3 wetlands and their buffer zones.

3.1.4. Aquatic Ecology

The proposed project area lies within the Ridge and Valley Physiographic Province of Hamilton and Bradley Counties, Tennessee, and Catoosa County, Georgia, and would span portions of two major watersheds: the Tennessee River and the Conasauga River. The geology and the consequential topography of this province have led to low gradient, generally linear streams with tributaries that drain the ridge slopes joining at right angles. Streams of the Ridge and Valley Province are also highly productive, and provide a variety of substrate and habitats for aquatic life. For this reason, this region harbors a great diversity of freshwater invertebrate, mussel, and fish species (Etnier and Starnes, 1993).

Field surveys of watercourses within the existing and proposed rights-of-way were conducted January and February 2005. Within the potentially affected project areas, 167 watercourses were encountered. Of these, 71 were identified as perennial, 6 as perennial complexes, 15 as intermittent, and 74 as WWCs, (Appendix VI). In addition, one pond would be crossed. The majority of these watercourses were associated with upgrade activities within existing transmission line corridors with established SMZs. The proposed Bradley 500-kV Substation site and the 500-kV and 161-kV transmission line tap connections to the substation would require four new perennial stream crossings and two perennial complex watercourse crossings.

The different types of watercourses in the project area are expected to support aquatic life to varying degrees. Perennial streams typically support a permanent assemblage of aquatic life, including fish, invertebrates, reptiles, and amphibians. Creeks in proximity to Chickamauga and Nickajack Reservoirs (such as Wolftever and South Chickamauga Creeks) could also provide seasonal spawning and nursery habitat for some reservoir and large river fish species. Intermittent streams receive both surface and subsurface flow and have defined channels, but usually flow only during wetter portions of the year. Because they periodically dry up into isolated pools, intermittent streams support a limited aquatic life assemblage. WWCs, also known as ephemeral streams, typically only flow for 24 to 48 hours after a rain event, receive negligible subsurface flow, and usually do not have a well-defined channel. These factors make it difficult for aquatic life to survive in WWCs. Springs are relatively uncommon stream features that are usually found in the headwater areas of watersheds. This important habitat, often a location of imperiled fishes, provides an important source of cool, clean water that benefits the aquatic life within them, as well as within the receiving streams (Etnier, 1997). Along the existing transmission line rights-of-way and proposed transmission line connections, a mixed stream complex occurred within some right-of-way sections that included several of these watercourse types. At these watercourse crossings, the stream complex would be crossed at that same location by one or more transmission lines, and aquatic life could be expected to occur based on the watercourse types included (Appendix VI).

Bradley 500-kV Substation

The proposed Bradley 500-kV Substation is located in southwestern Bradley County, just inside the Tennessee River drainage divide, on the ridge separating it from the Alabama River drainage. The substation project area drains to a headwater tributary of Taylor Branch that flows northwestwardly into Candies Creek, a tributary of the Hiwassee River. Perennial watercourses at the substation site and along the proposed transmission line connection routes to the substation are small and include numerous springs.

Bradley 500-kV Substation Connections to Sequoyah-Conasauga 500-kV Transmission Line and East Cleveland-Apison Tap-Catoosa 161-kV Transmission Line

The proposed 500-kV transmission line connection route would cross a large spring, which arises from a wooded hillside of mature trees. Flow from this spring and at least one other spring converge as part of a wooded stream/wetland complex, which also lies within the proposed transmission line corridor. Because of the observation of numerous fish within the springs and adjacent perennial streams, and the unique habitat that springs provide for some fish species, a qualitative fish survey was conducted at this location. Seven native and one introduced fish species were collected including one that is state-listed (Section 3.3.2.3; Table 3-6).

Table 3-6 Fish Species Collected from the Springs and Unnamed Tributary of Taylor Branch, Bradley County, Tennessee, in February 2005

Common Name	Scientific Name
Least brook lamprey[1]	*Lampetra aepypters*
Largescale stoneroller	*Campostoma oligolepis*
Tennessee dace[1]	*Phoxinus tennesseensis*
Fathead minnow	*Pimephales promelas*
Blacknose dace	*Rhinichthys atratulus*
Creek chub	*Semotilus atromaculatus*
Black darter[1]	*Etheostoma duryi*
Banded sculpin	*Cottus carolinae*

[1]Headwater intolerant species

Typically, a stream of this size and drainage area (0.6 square mile) would not be expected to have this number of species present. The most abundant species collected was the state-listed Tennessee dace. This species is restricted to very small, low-gradient woodland tributaries in the upper Tennessee River drainage and inhabits shallow pools in association with undercut banks and debris (Etnier, 1997). Also collected at this site was the first recorded presence of least brook lamprey in the Hiwassee River drainage. This species prefers smaller stream habitats usually with some gravel and sand substrate. Of the seven native species collected, three of these are classified as 'headwater intolerant,' i.e., species that are especially sensitive to water pollution.

The springs and streams in the proposed Bradley 500-kV Substation project area are tributaries of the Upper Candies Creek Hydrologic Unit (06020002-350). As indicated in Section 3.3.10, Candies Creek is on the 2004 TDEC 303 (d) list of impaired waters (TDEC, 2004a). Candies Creek at Black Fox Road is located approximately 10 creek miles downstream from the proposed substation and includes a drainage area of 40.1 square miles. A TVA Index of Biotic Integrity (IBI) fish survey of this site rated it as poor to fair in 1995 and good to excellent in 2001. Additional fish IBI sites of more comparable size in the hydrologic unit (06020002) and within the same ecoregion include Cane Creek (4.6 square miles.; fair), Lick Creek (4.8 square miles; fair to poor), Sugar Creek (5.6 square miles; fair to poor), and Price Creek (5.2 square miles; fair to poor). A rough calculation using TVA's IBI calculator indicated that the fish community in the springs and associated tributary

streams in the project area is of good to excellent quality as compared to other streams of comparable size in this hydrologic unit located in the ecoregion.

The three proposed 161-kV transmission line tap connections would share one right-of-way area and would each cross the unnamed tributary to Taylor Branch within the same section of right-of-way. Along this stretch of the stream, the qualitative fish survey found three species of fish, including the state-listed Tennessee dace.

Concord Substation Expansion
No watercourses were found at this location during field surveys in January 2005.

Falling Water-Sequoyah 161-kV Transmission Line
One pond, four perennial streams, and ten WWCs are crossed by the transmission line west of Chickamauga Reservoir and south of the Sequoyah Nuclear Plant. Because of their small size, the perennial streams are not likely to support a very diverse fish fauna.

Concord-Sequoyah 161-kV Transmission Line
Watercourses crossed by this transmission line include 15 perennial and 6 intermittent streams, and 24 WWCs. Perennial crossings include the Tennessee River section of Chickamauga Reservoir, the Wolftever Creek embayment, Mackey Branch and Ryall's Branch. The fish community at Mackey Branch was rated poor in a 1998 IBI, scoring 34 points out of a possible 60. Ryall's Branch and many of its tributaries fall within the existing right-of-way. The number of stream crossings in this area makes this segment of right-of-way particularly sensitive; however, these areas have established SMZs and Best Management Practices (BMPs) are implemented during maintenance activities. Chickamauga Reservoir supports a typical mix of warmwater, reservoir-dwelling species. TVA biological surveys conducted in 2004 rated the fish communities as good at all four stations evaluated.

Concord-Catoosa 161-kV Transmission Line
Watercourses crossed by this transmission line include one perennial/intermittent stream complex, five perennial and three intermittent streams, and seven WWCs. Perennial stream crossings include South Chickamauga Creek. Downstream of the transmission line crossing, a 2001 IBI of South Chickamauga Creek rated the fish community as fair. South Chickamauga Creek flows into nearby Nickajack Reservoir, which supports a typical mix of warmwater, reservoir-dwelling species. TVA biological surveys conducted in 2003 rated the fish communities as good at both of the Nickajack Reservoir stations evaluated.

East Cleveland–Apison Tap-Catoosa 161-kV Transmission Line
This transmission line segment crosses 43 perennial streams, 6 intermittent streams, 3 mixed stream complexes, and 33 WWCs. Perennial streams include Hurricane Creek, Chestnut Creek, Candies Creek, Taylor Branch, and Black Fox Creek. Approximately 10 miles downstream of the existing transmission line crossing on both Candies Creek and Black Fox Creek, and the Bradley 500-kV Substation site, the Candies Creek fish community was rated good to excellent in a 2001 IBI survey.

3.1.5. Managed Areas

The TVA Natural Heritage database indicated that the proposed project would cross one managed area and one Nationwide Rivers Inventory (NRI) stream. In addition, the proposed project is within 0.5 mile of another NRI-listed stream and within 3 miles of 12 additional managed areas and/or ecologically significant sites (Table 3-7).

Harrison Bay State Park surrounds Wolftever Creek and is crossed by the existing Concord-Sequoyah 161-kV Transmission Line between Structures 27 and 28. The structures themselves lie outside of the park boundary. Additionally, the existing Falling Water-Sequoyah 161-kV Transmission Line is approximately 1.8 miles north of this managed area (Structure 201). This 1500-acre park near Chattanooga offers a diversity of outdoor recreation including boating, fishing, swimming, hiking, picnicking, camping, and golfing. The parkland is historically significant because the waters of Harrison Bay cover the last Cherokee Campground.

South Chickamauga Creek from river mile (RM) 17 at the Tennessee state line to RM 28 at Ringgold, Georgia, is recognized by the National Park Service (NPS) as an NRI-listed stream for its scenic, wildlife, recreation, and historic values. It is noted as a scenic, pastoral float stream. South Chickamauga Creek is crossed once by the existing Concord-Catoosa 161-kV Transmission Line between Structures 154 and 155 and once by the existing Catoosa-Apison Tap 161-kV Transmission Line between Structures 115 and 116. Structure 156 on the Concord-Catoosa 161-kV Transmission Line is immediately adjacent to the stream.

North Chickamauga Creek is approximately 0.3 mile north of the existing Falling Water-Sequoyah 161-kV Transmission Line Structure 172. This stream is NRI-listed by the NPS from RM 13 at the confluence with Falling Water Creek southeast of Falling Water to RM 31 at the headwaters north of Lone Oak. This stream is a spring-fed, crystal clear, mountain stream with a variety of flora and abundance of wildlife. It is recognized for its scenic, recreational, geologic, fish and wildlife, historic, and cultural values.

Three TVA Habitat Protection Areas (HPAs) are located within 3 miles of existing transmission line project areas. TVA HPAs are established to protect populations of species that have been identified as either federally or state-listed endangered or threatened. Unusual or exemplary biological communities or geological features also can receive protection. Activities that could damage the ecological quality of these areas are deterred. Chigger Point TVA HPA, a 15-acre area, is habitat for the federally listed large-flowered skullcap. Soddy Creek TVA HPA, a 35-acre area occupying over 1 mile of very steep shoreline is habitat for bald eagles and several species of water birds. Ware Branch TVA HPA, a 42-acre area, is habitat for large-flowered skullcap and provides excellent perching sites for bald eagles. Concord-Sequoyah 161-kV Transmission Line is 0.9 mile south of Chigger Point TVA HPA, 2.2 miles south of Soddy Creek TVA HPA, and 2.7 miles south of Ware Branch TVA HPA. Falling Water-Sequoyah 161-kV Transmission Line is 1.1 miles west of Chigger Point TVA HPA, 2.0 miles south of Soddy Creek TVA HPA, and 2.6 miles south of Ware Branch TVA HPA.

Table 3-7 Managed Areas and Ecologically Significant Sites near the Bradley 500-kV Substation and Associated Project Upgrades in Bradley and Hamilton Counties, Tennessee, and Catoosa County, Georgia

Managed Area or Ecologically Significant Site	Closest Distance to Proposed Project	A	B	C	D	E	F
Harrison Bay State Park	0 miles			X	X		
South Chickamauga Creek - NRI-listed	0 miles					X	X
North Chickamauga Creek - NRI-listed	0.3 mile			X			
Chigger Point TVA HPA	0.9 mile			X	X		
Soddy Creek TVA HPA	2.0 miles			X	X		
Ware Branch TVA HPA	2.6 miles			X	X		
Red Clay State Historic Area	2.6 miles	X					
Red Clay Council Grounds State Archaeological Area	2.6 miles	X					
Elise Chapin Wildlife Sanctuary	0.6 mile		X		X	X	X
Friendship Forest	1.5 miles			X	X		
Savannah Bay/Chickamauga State Wildlife Observation Area	1.0 mile				X		
Gilliland Glade and Oak Forest Potential National Natural Landmark	1.4 miles						X
Falling Water Falls State Natural Area	3.0 miles			X			
Chickamauga Wildlife Management Area (WMA)	0.6 mile			X			
North Chickamauga WMA	1.2 miles			X			

A = Bradley 500-kV Substation and Interconnections to Sequoyah-Conasauga 500-kV Transmission Line and East Cleveland-Apison 161-kV Transmission Line
B = Concord Substation Expansion
C = Falling Water-Sequoyah 161-kV Transmission Line
D = Concord-Sequoyah 161-kV Transmission Line
E = Concord-Catoosa 161-kV Transmission Line
F = East Cleveland-Apison Tap 161-kV Transmission Line and Catoosa-Apison Tap 161-kV Transmission Line

Red Clay State Historic Area, including the Red Clay Council Grounds State Archaeological Area, is 2.8 miles south of the proposed Bradley 500-kV Substation and 2.6 miles southeast of the existing East Cleveland-Apison Tap 161-kV Transmission Line. Red Clay is the location of the last council grounds of the Eastern Cherokee Indian Nation. This 280-acre area, managed by the TDEC, includes an interpretive center, Indian council house, and a reconstructed Indian farmstead. A large amphitheater presents interpretive programs. The area is managed to protect the archaeological resources present on the site.

The Elise Chapin Wildlife Sanctuary at Audubon Acres is within 3 miles of the Concord Substation and three existing transmission lines. This 130-acre historic site is in the National Register of Historic Places (NRHP) and contains a Cherokee log cabin from the 1700s managed by the Chattanooga Audubon Society, Inc. The wildlife sanctuary, bisected by South Chickamauga Creek, contains a mix of open meadows, pines, and hardwood forest that provides an excellent environment for migrating birds, owls, and hawks. It is the only known local nesting site for the state-listed sharp-shinned hawk. Walking and hiking trails and a swinging bridge are other features of this area. It is 0.6 mile west of the Concord-Catoosa 161-kV Transmission Line, 0.9 mile west of the Concord-

Sequoyah 161-kV Transmission Line and the Concord Substation, and 2.6 miles northwest of the East Cleveland-Apison Tap 161-kV Transmission Line.

Friendship Forest (University of Tennessee Forestry Research Area) is 1.5 miles northeast of the Concord-Sequoyah 161-kV Transmission Line and 1.6 miles northeast of Falling Water-Sequoyah 161-kV Transmission Line. This 680-acre area is owned by TVA and leased to the University of Tennessee for forestry research. It contains some of the oldest documented research on genetic tree breeding and pine management in Tennessee.

Savannah Bay/Chickamauga State Wildlife Observation Area is 1.0 mile east of the Concord-Sequoyah 161-kV Transmission Line. This 300-acre area, managed by the Tennessee Wildlife Resources Agency and located in the Savannah Bay embayment on Chickamauga Reservoir, is an extensive area of moist mudflats and aquatic bed wetlands, attracting large numbers of shorebirds and waterfowl.

Gilliland Glade and Oak Forest Potential National Natural Landmark (NNL) is 1.4 miles west of East Cleveland-Apison Tap 161-kV Transmission Line. This ecologically significant site is a small area consisting of an opening in the forest, a border stand of open cedar and pine, and an oak forest. The glade is a level, rocky opening with massive bedrock exposed. Herbs dominate the area. The NNL program was established in the 1970s by the NPS to identify nationally significant examples of ecologically pristine or near pristine landscapes. This tract, while meeting the criteria for listing, has not to date been registered as an NNL.

Falling Water Falls State Natural Area is 3 miles southwest of Falling Water-Sequoyah 161-kV Transmission Line. This 132-acre area managed by TDEC features a scenic waterfall that plunges over 100 feet off the Cumberland Plateau into a deep narrow gorge. It offers an outstanding view of the Tennessee Valley from the top of the falls.

Portions of Chickamauga Wildlife Management Area (WMA) and North Chickamauga WMA are within 3 miles of Falling Water-Sequoyah 161-kV Transmission Line. Soddy Creek, a tract within Chickamauga WMA, is approximately 2.9 miles north of Falling Water-Sequoyah 161-kV Transmission Line. Another tract is approximately 0.6 mile northwest of Falling Water-Sequoyah 161-kV Transmission Line (Structure 177). North Chickamauga WMA tracts are approximately 1.2 miles southwest and northwest of this transmission line.

3.1.6. Recreation

The proposed project upgrades and rebuilds on the existing transmission lines are located close to or over some existing recreational resources. The existing Concord-Sequoyah 161-kV Transmission Line crosses Chickamauga Reservoir at Tennessee River Mile (TRM) 483.4 and is located less than 2 miles from Harrison Bay State Park and the backwaters of Wolftever Creek. Concord-Catoosa 161-kV Transmission Line crosses South Chickamauga Creek, which is recognized by the NPS as an NRI-listed stream for its scenic, wildlife, recreation, and historic values.

The Falling Water-Sequoyah 161-kV Transmission Line and East Cleveland-Apison Tap-Catoosa 161-kV Transmission Line do not cross or run close to any organized recreational resources. The proposed Bradley 500-kV Substation and associated transmission line connections and the existing Concord Substation are not in close proximity to any organized recreational resources.

3.1.7. Floodplains

A small stream would cross through the southern edge of the property for the proposed Bradley 500-kV Substation in Bradley County, Tennessee; however, the footprint of the substation would not be located within the 100-year floodplain. The 500-kV and 161-kV transmission line rights-of-way into the proposed Bradley 500-kV Substation would cross this small stream. The existing transmission lines that would be rebuilt, have conductors added, replaced, or be reconductored cross floodplain areas in Hamilton County, Tennessee; Bradley County, Tennessee; and Catoosa County, Georgia. Some of the existing construction access roads cross small streams. The existing Concord Substation is not located within the 100-year floodplain.

3.1.8. Navigation

The proposed project could potentially affect navigation at one location. A new conductor would be added to the existing Concord-Sequoyah 161-kV Transmission Line that crosses the Tennessee River at TRM 483.4 and other embayment areas on Chickamauga Reservoir. The minimum clearing allowance for transmission lines is 82 feet above the normal pool elevation of 682.5 feet mean sea level. At regulated high water, the minimum clearance is 72 feet above the normal pool elevation.

3.1.9. Groundwater

The project area is underlain by Ordovician and Cambrian aged rocks of the Valley and Ridge aquifer. The Valley and Ridge aquifer consists of folded and faulted carbonate, sandstone, and shale. Soluble carbonate rocks and some easily eroded shale underlie the valleys in the province, and more erosion-resistant siltstone, sandstone, and cherty dolomite underlie ridges. The arrangement of the northeast-trending valleys and ridges are the result of a combination of folding, thrust faulting, and erosion. Compressive forces from the southeast have caused these rocks to yield, first by folding and subsequently by repeatedly breaking along a series of thrust faults. The result of the faulting is that geologic formations are repeated several times across the region. Carbonate-rock aquifers in the Chickamauga, the Knox, and the Conasauga Groups are repeated throughout the project province (Lloyd and Lyke, 1995).

Groundwater in the Valley and Ridge aquifers primarily is stored in and moves through fractures, bedding planes, and solution openings in the rocks. These aquifers are typically present in valleys and are rarely present on the ridges. Most of the carbonate-rock aquifers are directly connected to sources of recharge, such as rivers or lakes, and solution activity has enlarged the original openings in the carbonate rocks. In the carbonate rocks, the fractures and bedding planes have been enlarged by dissolution of part of the rocks. Slightly acidic water dissolves some of the calcite and dolomite that compose the principal aquifers. Most of this dissolution takes place along fractures and bedding planes where the largest volumes of acidic groundwater flow (Lloyd and Lyke, 1995).

Groundwater movement is localized, restricted by the repeating lithology created by thrust faulting. Older rocks, primarily the Conasauga Group and the Rome Formation, have been displaced upward over the top of younger rocks (the Chickamauga and the Knox Groups) along thrust fault planes, thus forming a repeating sequence of permeable and less permeable hydrogeologic units. The repeating sequence, coupled with the stream network, divides the area into a series of adjacent, isolated, shallow groundwater flow systems. The water moves from the ridges where the water levels are high toward lower water levels

adjacent to major streams that flow parallel to the long axes of the valleys. Most of the groundwater is discharged directly to local springs or streams (Lloyd and Lyke, 1995).

The carbonate rocks that form the valleys of the Valley and Ridge aquifer are typical of karst systems. The term karst refers to carbonates rocks (limestone and dolostone) in which groundwater flows through solution-enlarged channels and bedding planes within the rock. Karsts are characterized by sinkholes, springs, disappearing streams, and caves. Karst systems are quite easily contaminated since the waters can travel long distances through conduits with no chance for natural filtering processes of soil or bacterial action to diminish the contamination (TDEC, 2002).

The chemical quality of water of the Valley and Ridge aquifers is similar for shallow wells and springs. The water is hard, is a calcium–magnesium-bicarbonate type, and typically has a dissolved-solids concentration of 170 milligrams per liter or less. In places where the residuum that overlies the carbonate rocks is thin, the aquifers are susceptible to contamination by human activities (USGS and TDEC, 1995).

Sources for public water supply in Hamilton and Bradley Counties are from both groundwater and surface water (TDEC, 2003). Total fresh groundwater withdrawals during 1995 from Bradley County, Tennessee, were about 4.08 million gallons per day and from Hamilton County 12.99 million gallons per day (USGS and TDEC, 1995). Privately owned wells occur throughout the project area.

The proposed project occurs within three groundwater protection areas. A section of the Falling Water-Sequoyah 161-kV Transmission Line, between Falling Water Substation and Sequoyah Nuclear Plant, is within a large groundwater protection zone. Part of the Concord-Sequoyah 161-kV Transmission Line, between Wolftever Creek and the Apison Tap, occurs within a groundwater protection zone. The right-of-way of the East Cleveland–Apison Tap-Catoosa Transmission Line, between Lead Mine Ridge and Hunt Road, is within another groundwater protection zone.

The proposed Bradley 500-kV Substation and transmission line connections are located in the vicinity of several named springs. These springs are not sources for public supply, but may be used for private drinking water. Small springs have been located within the proposed right-of-way of the 500-kV transmission line connection. These springs could also act as sources for contamination to local groundwater supplies.

Many springs and sinkholes are located near the proposed upgrades and rebuilds on the existing transmission line rights-of-way. Several springs are located near the Concord-Sequoyah 161-kV Transmission Line and East Cleveland-Apison Tap-Catoosa 161-kV Transmission Line, and the Catoosa Substation is located near Indian Springs.

Several sinkholes are located near the rights-of-way on the Falling Water-Sequoyah 161-kV Transmission Line, Concord-Sequoyah 161-kV Transmission Line, and East Cleveland-Apison Tap-Catoosa 161-kV Transmission Line.

No groundwater infiltration zones occur near the Concord Substation.

3.1.10. Surface Water

Precipitation in the project area averages about 53 inches per year with the wettest month in March at 6.0 inches and the driest month in October at 3.2 inches. The average annual air temperature is 59 degrees Fahrenheit (°F), ranging from a monthly average of 37°F in January to 79°F in July. Stream flow varies with rainfall and averages about 22 inches of runoff per year or approximately 1.6 cubic feet per second per square mile of drainage area.

The project area drains to tributaries of the Conasauga River in the Alabama River Basin and to tributaries of Chickamauga Reservoir and Nickajack Reservoir on the Tennessee River. Table 3-8 identifies streams in the project area and their use classification as defined by the states of Georgia and Tennessee (Georgia Department of Natural Resources [GDNR], 2004a and TDEC, 2004b).

The proposed Bradley 500-kV Substation and transmission line connections are drained by Allen Branch and Taylor Branch of Candies Creek in the Hiwassee River watershed. Allen Branch, Taylor Branch, and Candies Creek are classified by the state for fish and aquatic life, recreation, irrigation, and livestock watering and wildlife. The Hiwassee River is classified for domestic and industrial water supply, fish and aquatic life, recreation, irrigation, livestock watering and wildlife, and navigation. Candies Creek and the Hiwassee River are on the state 303 (d) list of impaired waters as indicated in Table 3-9. Candies Creek is impaired by siltation and physical habitat alteration from discharges from municipal separate storm sewer system (MS4) area, pasture grazing, and stream bank modification.

The Concord Substation expansion site drains to South Chickamauga Creek (of the Tennessee River at Nickajack Reservoir) via small, unnamed tributaries. South Chickamauga Creek is classified by the state of Tennessee for industrial water supply, fish and aquatic life, recreation, irrigation, and livestock watering and wildlife. It is on the state 303 (d) list as impaired due to phosphorus, physical habitat alteration, pathogens, and siltation from land development, discharges from MS4 area, channelization, and sources in Georgia.

The remainder of the project would involve upgrades on existing transmission lines. The area covered by this work would include all of the streams identified in Tables 3-8 and 3-9. North Chickamauga Creek (including Cooper, Mossy, and Cain Creeks) is the only stream in the project area designated by Tennessee as Tier II high quality water from the headwaters downstream to Nickajack Reservoir. The state's antidegradation statement was declared to apply to this stream by the Water Quality Control Board. The stream is popular for whitewater canoeing and has a greenway along its lower portion. It is also recognized by the NPS as a NRI-listed stream with unique values. North Chickamauga Creek is on the state 303 (d) list of impaired streams because historical mining activities have impacted some tributaries (i.e., pH and physical habitat alteration from abandon mining and hydromodification). South Chickamauga Creek from RM 17 (Tennessee-Georgia state line) to RM 28 (at Ringgold, Georgia) is also included in the NRI. Both Tennessee and Georgia include South Chickamauga Creek on their 303 (d) lists of impaired streams (Table 3-9). In addition to North and South Chickamauga Creeks, seven other streams in the project area are listed as impaired (Table 3-9).

Table 3-8. Stream Use Classifications for Waterbodies Near the Bradley 500-kV Substation and Associated Project Upgrades in Bradley and Hamilton Counties, Tennessee, and Catoosa County, Georgia

Stream	Project Area[1]	Use Classification[2,3]							
Georgia[2]			**DWS**	**FAL**	**REC**	**WR**			**SR**
Tennessee River (Nickajack Reservoir)									
South Chickamauga Creek	B, C			F					
Peavine Creek	C			F					
East Chickamauga Creek	C			F					
Tiger Creek	C			F					
Tennessee[3]		**DWS**	**IWS**	**FAL**	**REC**	**LWW**	**IRR**	**NAV**	**HQ**
Tennessee River (Nickajack Reservoir)	B, C	X	X	X	X	X	X	X	
South Chickamauga Creek	B, C		X	X	X	X	X		
Mackey Branch	C			X	X	X	X		
Ryall Springs Branch	C			X	X	X	X		
Hurricane Creek	C			X	X	X	X		
Tennessee River (Chickamauga Reservoir)	A, C	X	X	X	X	X	X	X	
Wolftever Creek	C			X	X	X	X		
Chestnut Creek	C			X	X	X	X		
Savannah Creek	C			X	X	X	X		
Frog Level Branch	C			X	X	X	X		
Wolfe Branch	C			X	X	X	X		
Hiwassee River	A, C	X	X	X	X	X	X	X	
Candies Creek	A, C			X	X	X	X		
Allen Branch	A, C			X	X	X	X		
Taylor Branch	A, C			X	X	X	X		
Black Fox Creek	C			X	X	X	X		
Chatata Creek	C			X	X	X	X		
Little Chatata Creek	C			X	X	X	X		
Five Mile Branch	C			X	X	X	X		
North Chickamauga Creek[4]	C			X	X	X	X	X	X
Conasauga River	C								
Coahulla Creek	C			X	X	X	X		
Mill Creek	C			X	X	X	X		
Red Hill Branch	C			X	X	X	X		
Blackburn Branch	C			X	X	X	X		

[1]A = Bradley 500-kV Substation and Connections to Sequoyah-Conasauga 500-kV Transmission Line and East Cleveland-Apison Tap-Catoosa 161-kV Transmission Line; B = Concord Substation; C = Existing Transmission Line Upgrades

[2]In Georgia (GDNR, 2004a), DWS = drinking water supply, FAL = fishing, game and other aquatic life, REC = recreation, WR = wild river, SR = scenic river

[3]In Tennessee (TDEC, 2004b), DWS = domestic water supply, IWS = industrial water supply, FAL = fish and aquatic life, REC = recreation, LWW = livestock watering and wildlife, IRR = irrigation, NAV = navigation; HQ = high quality waters

[4]North Chickamauga Creek is classified as a trout stream from RM 13.2 to RM 15.0.

Table 3-9 State 303 (d) Listings for Waterbodies Near the Bradley 500-kV Substation and Associated Project Upgrades in Bradley and Hamilton Counties, Tennessee, and Catoosa County, Georgia

Stream	Project Area[1]	303 (d) Impaired Stream[2]			
Georgia		**Use Support**	**Cause**	**Source**	**High Quality**
Tennessee River (Nickajack Reservoir)					
South Chickamauga Creek	B, C	Impaired	Fecal Coliform	Nonpoint/Unknown Sources	
Peavine Creek	C	Impaired	Biota Impacted, Fecal Coliform	Nonpoint/Unknown Sources	
East Chickamauga Creek	C				
Tiger Creek	C	Impaired	Fecal Coliform	Nonpoint/Unknown Sources	
Tennessee					
Tennessee River (Nickajack Reservoir)	B, C	Impaired	PCBs, Dioxins	Contaminated Sediment	
South Chickamauga Creek	B, C	Impaired	Phosphorus, Physical Substrate Habitat Alteration, Pathogens, Siltation	Land Development, Discharges from MS4[3] area, Channelization, Sources Outside of State	
Mackey Branch	C				
Hurricane Creek	C				
Tennessee River (Chickamauga Reservoir)	A, C				
Wolftever Creek	C				
Chestnut Creek	C				
Savannah Creek	C				
Frog Level Branch	C				
Wolfe Branch	C				
Hiwassee River	A, C	Impaired	Escherichia coli (E. coli), Total Fecal Coliform	Collection System Failure, Pasture Grazing	
Candies Creek	A, C	Impaired	Siltation, Physical Substrate Habitat Alteration	Discharges from MS4 Area, Pasture Grazing, Stream Bank Modifications	
Allen Branch	A, C				
Taylor Branch	A, C				
Black Fox Creek	C				
Chatata Creek	C	Impaired	Siltation, Physical Substrate Habitat Alteration, E. coli	Discharges from MS4 Area, Pasture Grazing	
Little Chatata Creek	C	Impaired	Siltation, Physical Substrate Alteration in streamside or littoral vegetative cover, E. coli	Discharges from MS4 area, Pasture Grazing	
Five Mile Branch	C				
North Chickamauga Creek	C	Impaired	pH, Physical Substrate Habitat Alteration	Abandon Mining, Hydromodification	Yes
Conasauga River	C				
Coahulla Creek	C				
Mill Creek	C				
Red Hill Branch	C				
Blackburn Branch	C				

[1]A = Bradley 500-kV Substation and connections to Sequoyah-Conasauga 500-kV Transmission Line and East Cleveland-Apison Tap-Catoosa 161-kV Transmission Line; B = Concord Substation; C = Existing Transmission Line Upgrades
[2]Year 2004 Draft 303(d) List; GDNR, 2004b, and TDEC, 2004a
[3]Notes: MS4--Municipal Separate Storm Sewer Systems
PCBs = polychlorinated biphenyls

3.1.11. Visual

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

The existing Concord Substation is located southwest of Davidson Road approximately 2.8 miles east of the Interstate 24/75 interchange. The area is sparse residential with a new subdivision development under construction just east of the substation access road off Davidson Road. The existing topography is relatively flat. Vegetation ranges from open grasslands near the Davidson Road right-of-way to dense woodlands farther south. Area residents have views to the southwest of existing transmission lines and structures. Scenic attractiveness is minimal. Scenic integrity is low to very low.

The existing transmission line route from the Concord Substation to the Catoosa Substation is characterized by mainly open land over relatively flat topography. Homes are sporadic except at road crossings and alignments that parallel existing subdivisions. Traffic is light to moderate along local roads. Views of the existing transmission line are mainly in the middleground for local residents. These views are of existing double-steel poles, generally hidden by moderate to dense vegetation. At the north Georgia Electric Membership Corporation's Catoosa Substation, numerous residents have foreground views of the existing transmission lines, structures, and wood poles, as well as the transmission equipment within the substation area. Along U.S. Highway 41, motorists have views mainly between structures and under the transmission lines.

From the Catoosa Substation to the proposed Bradley 500-kV Substation to the northeast, the existing East Cleveland-Apison Tap-Catoosa 161-kV Transmission Line route traverses a variety of north Georgia and southeast Tennessee countryside. The route crosses Peavine Ridge to the east and continues across Chickamauga Creek. Homes are sparsely located along this section of the route, and views would be from the foreground and middleground distances by area residents and motorists along State Route 151 farther east. The transmission line crosses White Oak Mountain to the northeast and can be seen up to 3 miles away from the southeast and southwest by motorists along local roads. The existing route continues across mostly open, gently sloping terrain and numerous road crossings. The transmission line continues to McGhee Road. At this point, the CEPB transmission line intersects the East Cleveland-Apison Tap-Catoosa 161-kV Transmission Line at the Apison Tap structure and continues toward the proposed Bradley 500-kV Substation, crossing the southern end of Pine Hill to the east.

At the Apison Tap structure on the East Cleveland-Apison Tap-Catoosa 161-kV Transmission Line, the CEPB transmission line turns north toward the existing CEPB's Apison Substation, located just east of Collegedale. The existing route is in the foreground of Plowman Cemetery and Apison School. The transmission line follows mostly level terrain in low-lying areas and crosses Apison Pike before entering the Apison Substation. Motorists along Apison Pike have brief views of the tops of existing structures within the substation.

The proposed Bradley 500-kV Substation would be constructed approximately 4.25 miles east of the existing Apison Substation along Tunnel Hill Road on approximately 58 acres. There are several homes in the area. Topography ranges from open, relatively flat pastoral adjacent to Tunnel Hill Road to rolling wooded slopes to the east and west. The area closest to the proposed Bradley 500-kV Substation ranges from mildly sloping, sparsely vegetated to severely sloped and heavily vegetated farther west. Existing laced-steel towers along the East Cleveland-Apison Tap-Catoosa 161-kV Transmission Line can be seen in the landscape by area residents and motorists as well as other contrasting vertical elements such as wood service poles along residential driveways and the road right-of-way. The area southwest of the proposed Bradley 500-kV Substation that would be the new Sequoyah-Conasauga 500-kV Transmission Line loop connection is sparsely wooded with gently sloping terrain. Scenic attractiveness is common. Scenic integrity is low.

From the Concord Substation, the existing Concord-Sequoyah 161-kV Transmission Line crosses East Brainerd Road and turns north toward Sequoyah Nuclear Plant. The existing transmission line right-of-way can be seen in the foreground from East Brainerd Heritage Park and several local roads northeast of the Concord Substation. The route continues north, traversing terrain ranging from low-lying areas near Shallowford Road to higher peaks near Interstate 75 just south of Volunteer Army Ammunition Plant. Residents and motorists along local roads have foreground views of existing transmission lines and structures.

North of Volunteer Army Ammunition Plant, residential areas and road crossings are sparsely located. Terrain becomes steep near Wolftever Creek and the transmission line can be seen in the foreground and middleground by area residents as it crosses ridgelines southeast of Orr Slough. The transmission line crosses Chickamauga Reservoir and enters Sequoyah Nuclear Plant to the northwest. Scenic attractiveness is common. Scenic integrity is low.

From the proposed Bradley 500-kV Substation, the existing East Cleveland-Apison Tap-Catoosa 161-kV Transmission Line crosses Lead Mine Valley Road to the northeast toward the East Cleveland Substation. This area is mainly agricultural land situated in low-lying valleys between higher ridges to the east and west. The transmission line crosses Lead Mine Ridge and Blue Springs Ridge before crossing County Road 74 (Spring Place Road) just south of Vulcan Quarry. County Road 74 is a major thoroughfare with numerous homes and commercial establishments. Existing laced-steel towers can be seen in the middleground distance up to a mile away by local residents and motorists.

The route continues to the north across Bates Pike and Water Level Highway (Old Copper Road). The existing right-of-way follows the west side of Beeler Ridge and can be seen, along with numerous other transmission lines in the area, by residents up to 3 miles away, depending upon viewer location and atmospheric conditions. The transmission line terminates at the existing East Cleveland Substation. This area is mainly industrial and is

characterized by numerous wood and steel pole service poles along road right-of-way. Scenic attractiveness is minimal. Scenic integrity is very low.

The Falling Water-Sequoyah 161-kV Transmission Line runs from Falling Water Substation to Sequoyah Nuclear Plant. The transmission line route traverses a mixture of agricultural land, residential areas, open countryside, and rolling terrain. The existing towers are prominent focal points in the landscape, particularly at road crossings and sections of the route that parallels road right-of-way.

The area closest to Falling Water Substation is mainly residential interspersed with frequent agricultural land. Traffic is light to moderate along local roads. The route turns to the east at West Ridge Trail Road, and continues across undulating terrain. The transmission line route can be seen intermittently from Sequoyah Access Road, a major thoroughfare paralleling the transmission line route approximately 0.5 mile to the north. East, at Hixson Pike Road, the rolling terrain transitions to open countryside and Sequoyah Nuclear Plant can be seen from the middleground distance. Numerous laced-steel towers and associated equipment dominate the landscape, becoming intermediate focal points. Scenic attractiveness is minimal. Scenic integrity is very low.

3.1.12. Prime Farmland

Prime farmland has the best combination of soil physical and chemical characteristics for producing food, feed, fiber, forage, oilseed, and other agricultural crops with minimum inputs of fuel, fertilizer, pesticides, and labor, and without intolerable soil erosion. This land can be cropland, pastureland, rangeland, forestland, or other land not urban or water. The conversion of prime farmland to industrial and other nonagricultural uses essentially precludes farming the land in the foreseeable future. Creation of the 1981 Farmland Protection Policy Act (Act) addressed this issue and set guidelines that require all Federal agencies evaluate impacts to farmland prior to permanently converting to a nonagriculture land use. The Act requires that Form AD 1006, “Farmland Conversion Impact Rating,” be completed by Federal agencies with assistance from the Natural Resource Conservation Service (NRCS) before an action is taken. The rating has two parts: the relative value of farmland score and the site assessment score. NRCS staff assigns a relative value of farmland based on county land evaluation criteria. The Federal agency completes the site assessment portion and may use a local site assessment or determine the score based on criteria as explained in 7 CFR 658.5 b. This rating is based on the rural versus urban nature of the site, distance from urban support services, creation of nonfarmable farmland, etc. A combined rating above 160 suggests that the farmland be protected and another site be considered.

The 58-acre site proposed for construction of the Bradley 500-kV Substation contains 13.7 acres of soil with properties to be classified as prime farmland. These soils are the Minvale, Greendale, Pace, and Cotaco silt loams (Appendix VII). The most prevalent is the Minvale silt loam on 11.1 acres. These soils developed in local alluvium and old colluvium washed from nearby soils. They are well suited for pasture and other cultivated crops.

Form AD 1006 was completed with assistance from Resource Soil Scientist Clarence Conner, NRCS office in Clinton, Tennessee. He assigned a score of 78 for the relative farmland value (Appendix VII). The site assessment score is 48 for a total rating of 126.

3.1.13. Cultural Resources

East Tennessee has been an area of human occupation for the last 12,000 years. This includes five broad cultural periods: Paleo-Indian (11,000-8,000 B.C.), Archaic (8000-1600 B.C.), Woodland (1600 B.C.-1000 A.D.), Mississippian (1000-1700 A.D.), and Historic (1700 A.D.-to present). Prehistoric land use and settlement patterns vary during each period, but short- and long-term habitation sites are generally located on floodplains and alluvial terraces along rivers and tributaries. Specialized campsites tend to be located on older alluvial terraces and in the uplands. In East Tennessee, during the seventeenth and eighteenth centuries, Europeans and Native Americans began interacting through the fur trading industry. European-American settlement increased in the early nineteenth century as the Cherokee were forced to give up their land.

Hamilton County was created by an act of the General Assembly of the State of Tennessee on October 25, 1819, with lands taken from Rhea County. The creation of the new county on the southwestern frontier was brought about by a treaty with the Cherokees in 1817. Only lands north of the Tennessee River were included in its boundaries. The area south of the Tennessee River remained part of the Cherokee Nation until 1835. Chattanooga became a growing railroad center with numerous lines, from all directions, passing through the city. Being a major rail center, Chattanooga became a crucial location for the Civil War. The Confederate Army controlled the region until late 1863. After the Battle of Chattanooga, the area remained firmly under Union control. Following the war, railroads and waterways were reconstructed and improved. Chattanooga grew with the discovery of coal, iron, and lead deposits in the region. Hamilton County and the city of Chattanooga have had a lasting economic and population boom that began in 1899, when the first franchised bottling plant for the Coca-Cola Company was built. TVA has played an important role in the area since the construction of the Chickamauga Dam (Wilson, 1998).

Bradley County was organized in May 1836, just before the cession of the Ocoee District by the Indians. At that time, it also encompassed all of Polk County and a portion of James County. The Red Clay Historical Area is associated with the removal of the Cherokees Indians and is considered sacred ground. The town of Charleston is significant because it was the home for the Cherokee Agency and the U.S. Agents of the Cherokee Affairs. During the Civil War, soldiers from Bradley County fought on both sides. Today, Charleston supplies employment for the county through industries such as Bowater, a large paper mill plant. The county has over 190 industries and is known for its production of Maytag stoves. Maytag is the county's largest employer (Bowman, 1998).

The Area of Potential Effect (APE) for this project was determined to be all areas in which land-disturbing activities would take place, including the existing and proposed transmission line rights-of-way, substation, laydown area, and access roads, as well as any historic structures located within a 0.5-mile radius from which the transmission lines would be visible. A cultural resources survey was conducted between January and February 2005 (Deter-Wolf and Karpynec, 2005). Prior to the survey, a records search was conducted to identify previously recorded historic properties that may be located within the APE. One previously recorded historic structure was identified (BY-92).

The archaeological survey identified one archaeological site (40BY180). Site 40BY180 is a historic homestead located within the APE of the proposed Sequoyah-Conasauga 500-kV transmission line connection to the Bradley 500-kV Substation. The current landowner says that the house was originally a two-story residence constructed in 1910. No intact archaeological deposits or features were identified during the investigations. Therefore,

40BY180 is considered ineligible for listing on the NRHP due to its lack of integrity. The historic/architectural survey yielded no new architectural resources. The previously recorded property BY-92 has been destroyed since its original recordation.

CHAPTER 4

4. ENVIRONMENTAL CONSEQUENCES

4.1. Introduction

Chapter 4: Environmental Consequences and Chapter 3: Affected Environment form the detailed scientific and analytic basis for the summary comparisons presented in Chapter 2, Section 2.2 Description of Alternatives.

Section 2.2 contains by option the predicted attainment and nonattainment of the purpose and need defined in Chapter 1. This chapter presents the detailed predicted effects of implementing Alternative 1: Do Not Upgrade the TVA Transmission System (No Action) and Alternative 2: Construct 500-kV Substation and Transmission Line Connections and Perform Upgrades to the TVA Transmission System (Action).

4.2. Effects of Alternative 1: Do Not Upgrade the TVA Transmission System (No Action)

Should the proposed TVA transmission system upgrades not be implemented, TVA would not be able to meet the current and projected increased power demands on its system without the potential for overloading or stability problems in the project area that could cause damage to generating facilities in the Chattanooga area.

4.3. Effects of Alternative 2: Construct 500-kV Substation and Transmission Line Connections and Perform Upgrades to the TVA Transmission System (Action)

4.3.1. Terrestrial Ecology

4.3.1.1. Terrestrial Plants

No Action Alternative
Adoption of the No Action Alternative would not result in any project-related impacts to the terrestrial plant ecology of the region.

Action Alternative
No uncommon plant communities were encountered at the proposed Bradley 500-kV Substation site or along the associated 161-kV transmission line connections, existing transmission line routes, or Concord Substation. Because the vegetation occurring in these areas is common and representative of the region, project-related impacts to the terrestrial plant ecology of the region are expected to be insignificant as a result of the proposed Action Alternative.

The construction of the 500-kV transmission line connection to the Bradley 500-kV Substation could potentially impact a portion of the palustrine forest community, especially in the low wet areas where habitat for the federally listed candidate monkey-face orchid occurs. Construction and clearing of the right-of-way in the wetland area for the 500-kV

transmission line would utilize BMPs as described in Muncy (1999) and Appendix II - Tennessee Valley Authority Right-of-Way Clearing Specifications. These measures include the use of hand-held equipment and low ground-pressure feller-bunchers to limit ground disturbance. In addition, vegetation removal would be restricted to trees tall enough, or with the potential soon to grow tall enough, to interfere with conductors. With implementation of these standard measures and protection measures outlined in Section 4.3.2.1, no significant impacts to the terrestrial plant community are anticipated as a result of the proposed project.

4.3.1.2. Terrestrial Animals

No Action Alternative
Adoption of the No Action Alternative would not result in any project-related impacts to the terrestrial animal ecology of the region.

Action Alternative

Bradley 500-kV Substation
The Bradley 500-kV Substation would consist of two switchyards and a switch house, a retention pond, a 250-foot-tall microwave tower with strobe lighting, and a gravel access road. However, the majority of the proposed site has been previously and heavily disturbed. Species of wildlife that occur in the vicinity are considered regionally and locally common. Although terrestrial animal species currently inhabiting this area would be displaced by the Bradley 500-kV Substation, the surrounding landscape consists of a similar matrix of disturbed and semi-disturbed habitats, and displaced animals would most likely reestablish nearby.

Communication towers with lighting similar to the microwave tower proposed for the Bradley 500-kV Substation have been implicated as a hazard to migrating songbirds during inclement weather. Decreased height, decreased number of supporting guy wires, and strobe lighting (as opposed to a constant light projection) have been recommended for decreasing the potential risk of avian fatalities at these structures. The relatively short height (250 feet) and use of strobe lighting presents a low risk to migrating songbirds, while still satisfying safety and security regulations.

Bradley 500-kV Substation Connections to Sequoyah-Conasauga 500-kV Transmission Line and East Cleveland-Apison Tap-Catoosa 161-kV Transmission Line
The 161-kV transmission line connections to the Bradley 500-kV Substation would eliminate portions of a young loblolly pine plantation and a small wetland. The area that would be eliminated lacks any substantial habitat for terrestrial animals because of the monotypic nature of the pine plantation and the small size of the wetland. The 500-kV connection would cross 2.85 acres that include mostly pastureland and a bottomland hardwood forested wetland with a nearby spring and stream. The forested wetland is approximately 3 acres in size, of which 0.27 acre at the wetland edge would be converted by the construction of the 500-kV transmission line connection. Amphibian communities using the bottomland hardwood forest would be disturbed, but because a relatively small portion of the wetland and stream would be affected and the nearby spring would remain intact, only minimal displacement of these amphibians and moderate degradation of habitat would

occur. No overall significant impacts to terrestrial animals or their habitats are expected from the construction of the Bradley 500-kV Substation and transmission line connections.

Concord Substation Expansion
The Concord Substation would be expanded 1.8 acres to the southwest of the existing substation. Although a small, isolated red cedar and Bradford pear forest fragment would be eliminated, this area does not provide any significant habitat for terrestrial animals, and no adverse impacts are expected.

Existing TVA Transmission Lines
No right-of-way clearing is proposed and existing roads would be used along the existing transmission line project areas. Therefore, the proposed actions would cause only temporary disturbance to terrestrial animals using the predominantly early successional, grassy, and disturbed right-of-way habitats, and no significant adverse impacts are expected. A cave with eastern pipistrelles and cave salamanders exists within 200 feet of the East Cleveland-Apison Tap 161-kV Transmission Line. This cave was explored during a January field survey and was found to be almost directly under the transmission line right-of-way. Construction and maintenance activities should not cause any erosion or runoff into this cave, any destabilization of the surrounding rock, or disturbance of vegetation immediately around the cave entrance. No noise restrictions are needed during the months of May through August.

Overall, the implementation of the Action Alternative would displace or disrupt very little wildlife, and impacts to terrestrial animals and their habitats would not be significant.

4.3.2. Threatened and Endangered Species

4.3.2.1. Terrestrial Plants

No Action Alternative
No project-related impacts to rare plant species would result from the adoption of the No Action Alternative.

Action Alternative
Several federally and/or state-listed plant species have been reported within a 5-mile radius of the proposed project areas. No occurrences of these or other rare species were observed on or immediately adjacent to the proposed project area during field surveys in April 2004 or January and February 2005. In addition, with the exception of one location, no habitat suitable for any of the listed plants was observed in the project area.

Suitable habitat for the federally listed candidate monkey-face orchid occurs in the open wet areas within and adjacent to the mature palustrine forest that occurs near the proposed 500-kV transmission line connection site to the Bradley 500-kV Substation. Should this species occur within this habitat, construction of this section of transmission line could potentially impact the plant population. Before construction of the 500-kV transmission line connection, TVA would conduct additional field surveys for this species during the flowering season (late July-August). Should the monkey-face orchid be found to occur along the area proposed for transmission line right-of-way clearing, construction would be completed in this section during the late fall and winter. Clearing of the forested wetland would be limited

to 0.27 acre that is located within the proposed 500-kV transmission line connection right-of-way and includes the adjacent danger trees. Low-ground pressure feller bunchers would be used for clearing in all areas of wetland habitat, and because the plants would be dormant (underground), they would not be disturbed. With this commitment, impacts to this species as a result of the proposed project would be insignificant.

4.3.2.2. Terrestrial Animals

No Action Alternative
Adoption of the No Action Alternative would not result in any project-related impacts to rare terrestrial animal species of the region.

Action Alternative

Bradley 500-kV Substation Associated Connections to Sequoyah-Conasauga 500-kV Transmission Line and East Cleveland-Apison Tap-Catoosa 161-kV Transmission Line
Listed terrestrial animal species have not been reported from Bradley County, Tennessee. Records of listed terrestrial animal species in adjacent Hamilton County, Tennessee, and Catoosa County, Georgia, were used when considering potential habitat of listed species in the Bradley 500-kV Substation and connections project area.

Suitable habitat does not exist at the Bradley 500-kV Substation and associated connections for the following listed species: eastern hellbender, Tennessee cave salamander, Allegheny woodrat, Bachman's sparrow, peregrine falcon, bald eagle, least bittern, Virginia rail, king rail, and Bewick's wren.

The forested wetland and associated stream adjacent to the 500-kV transmission line connection provides some marginal habitat for Swainson's Warbler and poor quality habitat for the great egret. Alteration of this habitat is not expected to impact the populations of either species.

The sharp-shinned hawk likely uses the mixed hardwood forest and pine plantation in this project area during spring and fall migration. A relatively small amount of habitat would be displaced by the proposed project, and similar mixtures of habitat occur in the surrounding area. Therefore, no adverse impacts to this species are expected.

Habitat for southeastern shrew exists in the mixed Mesophytic and bottomland wetland forest. Temporary disturbance to individuals of this species in a relatively small area could occur during construction of the proposed transmission line connection. However, adverse impacts are not expected due to the mobility and wide range of habitat preferences of this species and the abundance of suitable habitat in the surrounding area.

The open pastureland in both the Bradley 500-kV Substation proposed site and the transmission line connections provide potential foraging habitat for the barn owl. Individuals of this species forage from much larger areas than would be disturbed by this project, and sufficient similar habitat exists in the surrounding landscape. Therefore, no adverse impacts to this species are expected.

Concord Substation Expansion
No suitable habitat exists for any of the federally or state-listed terrestrial animal species occurring in Hamilton County, Tennessee, and no impacts to listed terrestrial animals or their habitats is expected.

Existing TVA Transmission Lines
Suitable habitat for Bachman's sparrow, peregrine falcon, Swainson's warbler, and Tennessee cave salamander do not exist within the existing transmission line rights-of-way. Therefore, these species would not be affected by the proposed project.

Brushy, disturbed areas and brush piles within the Falling Water-Sequoyah 161-kV Transmission Line right-of-way provide possible habitat for the Allegheny woodrat, and all the existing transmission line rights-of-way provide possible habitat for Bewick's wren. The wooded edges of mixed Mesophytic forests surrounding the rights-of-way offer habitat for sharp-shinned hawks during migration. The open, grassy areas within these rights-of-way provide southeastern shrews with foraging and nesting habitat and barn owls with limited foraging habitat. Individuals of all these species may experience some disturbance from the proposed actions, but the disturbances would be temporary and relatively isolated, and no adverse impacts are expected.

Some marginal wetland habitat is available for least bittern, Virginia rail, and king rail within or adjacent to the transmission lines, but no large, high quality habitat with lots of emergent vegetation was observed. The isolated, temporary nature of the upgrade and rebuild actions would not significantly impact these marsh birds.

Suitable foraging habitat exists for the bald eagle on Chickamauga Reservoir, Wolftever Creek, and South Chickamauga Creek. Although the existing transmission lines cross these waterways, the proposed actions would not impact this habitat, and bald eagles would not be adversely impacted.

Habitat for the eastern hellbender exists in South Chickamauga Creek. The existing East Cleveland-Apison Tap-Catoosa 161-kV Transmission Line crosses this creek in Catoosa County, Georgia, but the proposed actions would not impact the waterway, and this species would not be affected.

The proposed upgrade and rebuild actions on the existing transmission lines may temporarily disturb some listed terrestrial animal species but would not cause any significant adverse effects to any protected species.

4.3.2.3. Aquatic Animals

No Action Alternative
Under the No Action Alternative, the proposed project would not be constructed, and the project area would likely remain in its current state. Therefore, aquatic animals and their habitats would not be affected.

Action Alternative
No federally or state-listed aquatic species would be directly affected by the required improvements on the existing transmission lines or operation of the proposed transmission line. This proposed action could indirectly affect local populations of aquatic animals in

streams along this transmission line right-of-way if it resulted in an increased sediment load or other changes in physical habitat of affected streams. Increased sediment loading, extensive disruption of the canopy cover, or changes in the water temperature could disrupt or eliminate nearby populations of these species. Because the transmission line upgrade and rebuild activities would occur within existing rights-of-way and would not require ground disturbance, no direct, indirect, or cumulative adverse impacts to protected aquatic animals are likely to occur as a result of this activity.

New construction would be required at the proposed Bradley 500-kV Substation site and along the 161-kV and 500-kV transmission line connections to the substation. A population of the state-listed Tennessee dace inhabits the spring/stream complex that flows in and adjacent to the proposed right-of-way for the 500-kV transmission line connection. This area would qualify for Important Permanent Stream Protection (Category B) and the springs would qualify for Protection of Unique Habitats (Category C). With these protection measures, no additional impacts to the Tennessee Dace or any other listed species is anticipated as a result of the construction of the proposed project.

All construction work, especially near streams, would be conducted following the requirements and guidelines presented in TVA's environmental protection and BMP guidelines (Muncy, 1999). Maintenance of this transmission line would not result in any significant adverse effect on listed aquatic species. Maintenance techniques would be employed that avoid or minimize adverse effects to streams. Any herbicides used as part of the maintenance program would be registered for that use by USEPA, and would be applied according to label directions. Particular care would be given to the selection of herbicides to be used near streams as a further safeguard for the protection of aquatic species, including those protected under Federal and state law.

The clearing of the mature canopy around the spring would increase the likelihood that cattle would be attracted to the spring, and as a result of the possible habitat alteration in the spring, the more sensitive fish species (the state-listed fish) would likely move to other, more suitable areas. To protect the habitat and to allow the establishment of native low-growing deciduous vegetation and shrubs that would be replanted along the stream banks, TVA would coordinate with the landowner to fence the cattle out of the width of the SMZ within the right-of-way. With the protection measures described above, there would not be direct, immediate impacts to the spring habitat.

Due to the nature of this action, there would likely be no potential impacts from invasive aquatic animal species.

4.3.3. Wetlands

No Action Alternative
Adoption of the No Action Alternative would not result in any project-related impacts to wetlands. All wetlands in the existing transmission line rights-of-way would continue to be periodically cleared by mowing and other methods to keep the rights-of-way free from tall, woody vegetation that could interfere with the transmission lines.

Action Alternative

There are approximately 25.1 acres of wetlands in the proposed project area that meet USACE parameters for wetlands that may be Federal jurisdictional wetlands under the Clean Water Act.

No wetlands would be disturbed at the proposed Bradley 500-kV Substation site or the existing Concord Substation expansion area because there are no wetlands at these locations.

Existing transmission line structures are located within seven of the wetlands found along the existing transmission line rights-of-way (Table 3-4). All of the wetlands along the existing transmission lines are already periodically cleared by mowing and other methods for right-of-way maintenance using BMPs (Muncy, 1999) and procedures described in Section 2.7.2.2. Established BMPs for these wetlands would be used during the upgrades and rebuild to these transmission lines, and, therefore, no significant impacts are anticipated.

Located in the proposed right-of-way for the 161-kV transmission line connection to the Bradley 500-kV Substation, Wetland JW10 has developed in a seepage area near an intermittent stream in a loblolly pine plantation. The area in and around the wetland has been disturbed by silvicultural activities associated with the planting of the pine plantation. It is possible that the wetland existed in an undisturbed condition prior to silvicultural activities, or alternatively, that it developed following these activities as a result of alterations in contours and hydrology.

Impacts to Wetland JW10 and to the right-of-way emergent wetlands and emergent/scrub-shrub wetlands are expected to be minor and insignificant with implementation of BMPs (Muncy, 1999), TVA Environmental Quality Specifications, minimization of vehicle or equipment entry into the wetlands, and compliance with any applicable Federal and state permits.

Clearing for the proposed right-of-way for the 500-kV transmission line connection to the Bradley 500-kV Substation would convert 0.27 acre of jurisdictional forested wetland in Wetland JW9 to PEM1 or PSS1 habitat. Forested wetland clearing may be conducted under Nationwide Permit #12 under the condition that no mechanical clearing occurs in the wetland. The TVARAM resulted in the classification of JW9 as a Category 3 wetland.

To aid in the enhancement and preservation of wetland structure and functions in the cleared section of JW9, a planting plan would be developed and implemented in the wetland portion of the 500-kV transmission line connection right-of-way. The planting plan would establish a shrub wetland dominated by silky dogwood (*Cornus amomum*), smooth alder (*Alnus serrulata*), and other soft-mast-producing shrubs. Wetland functions that would be partly or fully restored include water storage, maintenance of stream base flow, storm water velocity and volume reductions, shading and cooling of substrates and streams, provision of soft-mast for wildlife, and provision of nesting sites for shrub-nesting bird species. The planting of shrubs may also delay or inhibit the growth and dominance of invasive exotic species such as multiflora rose, Japanese honeysuckle, and microstegium.

Impacts to Wetland JW9 are expected to be insignificant with the implementation of the planting plan, BMPs (Muncy, 1999), TVA Environmental Quality Specifications,

minimization of vehicle or equipment entry into the wetlands, and compliance with any applicable Federal and state permits

4.3.4. Aquatic Ecology

No Action Alternative
Under the No Action Alternative, the proposed project would not be constructed, and the project area would likely remain in its current state. Therefore, aquatic ecology would not be affected.

Action Alternative
Watercourses in the project area considered to convey only surface water during storm events (i.e., WWCs or ephemeral streams) would be protected by standard BMPs as identified in Muncy (1999). These BMPs are designed to minimize erosion and subsequent sedimentation in streams. Appendix VI lists the approximate locations of these watercourses. Standard Stream Protection (Category A), as designated by TVA Transmission Construction Guidelines near Streams (Muncy, 1999), would apply to all perennial and intermittent streams. Due to the orientation of Ryall's Branch and its many tributaries located under the existing Concord-Sequoyah 161-kV Transmission Line segment, the potential for impacts exists; however, with the use of BMPs under Category A protections as outlined in Muncy (1999) impacts would be insignificant.

Within the right-of-way for the proposed 500-kV transmission line connection to the Bradley 500-kV Substation, the unnamed tributary to Taylor Branch forms a spring/stream complex. Potential project-related impacts to the aquatic life within this area could occur as a result of sedimentation caused by erosion or increased cattle access, as well as water temperature increases related to canopy removal. BMPs would minimize the potential for erosion-related impacts, and although cattle currently have access to the spring/stream complex, other areas of the property also provide shade and water so the animals do not frequent only this area.

In addition to BMPs, the complex area of the unnamed tributary would qualify for Important Permanent Stream Protection (Category B) and the associated springs would qualify for Protection of Unique Habitats (Category C) with the SMZ extending 150 feet from each stream bank (Appendix VI).

Vegetation removal in the SMZs would be restricted to trees tall enough, or with the potential soon to grow tall enough, to interfere with conductors (Section 2.7.1.1). In accordance with the Category C protection level, trees in the vicinity of the springs would be hand cut and the stumps would not be removed. Other vegetation near the springs and stream would be disturbed as little as possible during construction and would be stabilized as soon as possible and revegetated as soon as feasible.

To provide bank stabilization and a certain degree of canopy cover, stream banks along the tributary watercourses and springs would be planted using native, low-growing, deciduous, and/or scrub-shrub vegetation. The growth of a vegetative cover on the stream banks could potentially be delayed due to the current accessibility of cattle to the stream and springs in the area. The initial clearing of the mature canopy around the spring would increase the likelihood that cattle would be attracted to the spring, and as a result of habitat alteration in the spring, the more sensitive fish species (the state-listed fish) would likely

move to other, more suitable areas. TVA would coordinate with the landowner to fence the width of the SMZ within the right-of way to facilitate the establishment of vegetation along the stream banks of the spring and unnamed tributary of Taylor Branch. Since the landowner's cattle have access to other areas that provide shade and water, once the vegetative cover along the banks is established, it should discourage cattle access from using the area.

Additionally, although temperature increases are likely to occur with the initial removal of the mature canopy, impacts to the aquatic life are expected to be temporary and insignificant. This is partially because springs typically provide a water source to streams that is cooler, in effect reducing the impact of solar heating for some distance downstream. Also, because the vegetation that would be replanted within the SMZ would be allowed to reach a mature height of 20 feet before it would be considered tall enough to pose a danger to the conductors or structures, it is anticipated that shading would again be provided to the spring/stream complex. With the protection measures described above, there would not be direct, immediate impacts to the spring habitat.

By following the appropriate stream protection requirements on streams identified in Appendix VI, construction, operation, and maintenance of the proposed substation and associated transmission lines would not result in significant direct impacts to aquatic life. All construction and maintenance work, especially near streams, would be conducted following the requirements and recommendations presented in TVA's guidelines for environmental protection during transmission line construction and maintenance (Muncy, 1999). Road access to transmission line and substation construction sites would be planned and constructed to minimize erosion and sedimentation effects. Use of existing access points on the existing rights-of-way would reduce access-related impacts.

4.3.5. Managed Areas

No Action Alternative
Under the No Action Alternative, TVA would not implement the proposed project. Therefore, no impacts would occur to the managed areas in the project area.

Action Alternative
Under the Action Alternative, the activities outlined in the proposed project would be implemented.

The Concord-Sequoyah 161-kV Transmission Line spans a small portion of Harrison Bay State Park between Structures 27 and 28. Because these structures are located outside of the state park boundary and due to the nature of the proposed work to be conducted on the Concord-Sequoyah 161-kV Transmission Line, impacts to Harrison Bay State Park are not anticipated. However, notification of state park officials before work begins would help ensure that no impacts occur.

Because the distance is sufficient for all managed areas and/or ecologically significant sites identified within a 3-mile radius of proposed activities along the existing transmission lines, with the exception of Harrison Bay State Park above, no impacts would occur.

No impacts to the NRI-listed stream, South Chickamauga Creek, are anticipated due to the nature of the proposed work on the transmission lines that cross the stream in two

locations. Proposed activities over and near South Chickamauga Creek on the Concord-Catoosa 161-kV Transmission Line, that would involve replacing the existing overhead ground wire, and the proposed activities on the Catoosa-Apison Tap 161-kV Transmission Line, that would involve reconductoring and adding an overhead ground wire, would be done using TVA BMPs to ensure the protection of the stream.

No impacts to the NRI-listed stream, North Chickamauga Creek are anticipated because the distance from the proposed activities is sufficient.

No impacts would occur to natural areas from the proposed construction of the Bradley 500-kV Substation and its connections nor from the proposed expansion of the existing TVA Concord Substation because the distance from Natural Areas identified within a 3-mile radius of these substations is sufficient and because the proposed work would be done on newly purchased or existing TVA property.

Access roads identified for use in conducting the proposed project activities would not cross or be near any natural areas and therefore would have no impact.

4.3.6. Recreation

No Action Alternative
Under the No Action Alternative, the proposed project would not be constructed, and the project area would likely remain in its current state. Therefore, recreation would not be affected.

Action Alternative
The Bradley 500-kV Substation, access road, and associated transmission line connections would not impact any recreational resources. This is also true of the Concord Substation expansion. Therefore, no impacts would occur to recreation.

Some of the existing transmission lines cross or run close to recreational resources, but overall the preponderance of the transmissions lines run over private property with little to no public, commercial, or private recreation facilities involved. Some level of hunting and off-road vehicle use probably occurs under or adjacent to these transmission lines. However, the nature of the action, i.e., occurring on existing rights-of-way, replacing existing structures, using existing access, and not clearing entire right-of-way, and the fact that any potential impact would be intermittent and temporary indicate there would be no significant recreation impacts.

4.3.7. Floodplains

No Action Alternative
Under the No Action Alternative, the proposed project would not be constructed. Therefore, no floodplains would be affected.

Action Alternative
Construction of the proposed Bradley 500-kV Substation and the Concord Substation expansion would not involve work within the 100-year floodplain. The proposed 161-kV and 500-kV transmission line rights-of-way into the Bradley 500-kV Substation would cross a

small stream. The support structures for these transmission lines would be located outside the limits of the 100-year floodplain. Rebuilding the 4.7-mile section of the East Cleveland-Apison Tap-Catoosa 161-kV Transmission Line could involve the replacement of existing structures or construction of new structures in the 100-year floodplain. Construction of the support structures would not result in any increase in flood hazard, and the proposed action is consistent with the Executive Order on Floodplains. For the existing transmission lines where conductors would be added, replaced, or the transmission line would be reconductored, some of the existing structures are likely located within the limits of the 100-year floodplain; however, the work would take place well above the 100-year flood elevation. Therefore, the project would comply with EO 11988.

Some of the construction access roads cross small streams. Any necessary improvements to the road crossings would be done in such a manner that upstream flood elevations would not be increased.

4.3.8. Navigation

No Action Alternative
Under the No Action Alternative, the proposed project would not be implemented and the existing transmission line across Chickamauga Reservoir would not be altered. Therefore, no effects to navigation would be anticipated.

Action Alternative
Under the Action Alternative, the existing Concord-Sequoyah 161-kV Transmission Line would have an additional conductor added to the vacant side of the existing transmission line structures. For navigation purposes, the minimum clearing allowance for transmission lines is 82 feet above a normal pool elevation of 682.5 feet mean sea level and 72 feet at regulated high water. The Concord-Sequoyah 161-kV Transmission Line currently meets these clearance requirements. In addition, since the new conductor would be placed on the existing structures, the proposed project would meet the minimum clearance requirements at this transmission line crossing of Chickamauga Reservoir.

4.3.9. Groundwater

No Action Alternative
Under the No Action Alternative, the proposed project would not be implemented, and the project area would likely remain in its current state. Therefore, groundwater would not be affected.

Action Alternative
To avoid contamination of groundwater in the project area, BMPs as described in Muncy (1999) would be used. Only minimal construction activity would occur within the groundwater protection zones within the project area. During construction, BMPs would be used to control sediment infiltration to groundwater sources. Any structures that are located on or next to sinkholes may be subject to a Class V Underground Injection Control Permit. However, because no sinkholes were identified where construction would occur, a Class V permit would not be necessary.

The proposed Bradley 500-kV Substation would have an oil-containment facility and a retention pond. These measures would prevent oil or other pollutants from entering groundwater.

Contaminants such as herbicides and fertilizers could easily be transported to groundwater by storm water runoff. During revegetation and maintenance activities, fertilizers and herbicides should be avoided or used sparingly to avoid contamination of groundwater. As stated in the BMPs, fertilizers and herbicides would not be applied in areas that flow to groundwater infiltration zones (i.e., springs, wells, and sinkholes). Fertilizers and herbicides would be applied neither within the area that drains to the springs located at the proposed 500-kV transmission line connection to the substation nor within the groundwater protection zones previously described. With the use of these BMPs, potential impacts on groundwater from these actions would be insignificant.

4.3.10. Surface Water

No Action Alternative
Under the No Action Alternative, the proposed project would not be constructed. Therefore, no surface waters would be affected.

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

However, TVA routinely includes precautions in the design, construction, and maintenance of its transmission line projects to minimize these potential impacts. Permanent stream crossings would be designed not to impede runoff patterns and the natural movement of aquatic fauna. Temporary stream crossings and other construction and maintenance activities would comply with appropriate state permit requirements and TVA requirements as described in Muncy (1999). During the initial clearing of the new transmission line connections, trees in the SMZ that could interfere with the conductors or structures would be removed with a low-ground pressure feller buncher. Small trees and shrubs would be left in place, if possible. During maintenance operations, canopies in all SMZs of the existing and new transmission lines would be left undisturbed unless there were no practicable alternative. Danger trees in these areas would be removed using a low-ground pressure feller buncher to minimize disturbance in the SMZ. 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.

The Bradley 500-kV Substation and transmission line connection sites would encompass approximately 58 acres and would be the area most affected by the proposed project. In addition to the routine design, construction, and maintenance measures to prevent adverse stream impacts, TVA would also obtain and comply with the provisions of a state storm water construction permit. The state provisions are also designed to prevent adverse

surface water impacts. The expansion at the existing Concord Substation would involve the addition of new equipment on a small area covering approximately 2 acres. The remainder of the proposed project would involve upgrades to existing transmission lines on existing right-of-way. All of the upgrades would involve additions to existing structures, except for a 4.7-mile segment of the East Cleveland-Apison Tap-Catoosa 161-kV Transmission Line that would be rebuilt. Stream protection measures and SMZs are already established for all of the existing transmission lines and structures. These would be maintained, and similar measures would be established and maintained on the transmission line segment that would be rebuilt. Based on the proposed work and protection measures to be implemented, potential surface water impacts are expected to be minor and temporary. No cumulative surface water impacts are anticipated.

4.3.11. Visual

No Action Alternative
Under the No Action Alternative, the proposed project would not be constructed. Therefore, no visual impacts would occur.

Action Alternative
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 previously described Section 3.3.11.

Expanding the existing Concord Substation would likely have no visual impacts for residents or motorists due to existing dense vegetation that currently obscures views of the substation. Area residents may notice an increase in personnel and equipment along the access road to the substation during the construction period. This would be temporary until all activities are complete.

The existing Concord-Catoosa 161-kV Transmission Line route from the Concord Substation to the Catoosa Substation is characterized by mainly open land over relatively flat topography. Views of the existing line are mainly in the middleground for local residents. These views are of existing double-steel poles, generally obscured by moderate to dense vegetation. Replacing structures, adding new structures, and replacing overhead wires would be visually similar.

From the Catoosa Substation to the proposed Bradley 500-kV Substation to the northeast, the existing East Cleveland-Apison Tap-Catoosa 161-kV Transmission Line section traverses a variety of north Georgia and southeast Tennessee countryside. Rebuilding this section of transmission line would not alter the scenic quality of the rural countryside. New structures would be visually similar to existing structures. Residents and motorists would not perceive a change in landscape character along the route with additional transmission lines added to the structures.

The CEPB Transmission Line turns north toward the existing Apison Substation, located just east of Collegedale. New structures and conductors would provide similar visual

contrast in the landscape as those now in the right-of-way. Minor visual discordant contrast may occur during the construction process as residents notice an increase in personnel and equipment. This would be temporary until all work has been completed and the disturbed areas have been restored through the use of BMPs.

The proposed Bradley 500-kV Substation would be constructed approximately 4.25 miles east of the existing Apison Substation along Tunnel Hill Road on approximately 58 acres. The new substation and associated infrastructure would be seen in the foreground by motorists along Tunnel Hill Road and area residents. Views for residents of existing, open countryside would be severely altered, replaced by views of broadly horizontal transmission structures and industrial equipment. Residents closest to the substation would be negatively impacted by a loss of scale in the landscape. The views would be disrupted by elements of discordant contrast, which would substantially reduce scenic harmony in the rural countryside. These impacts would be reduced, however, by screening the substation and disturbed areas with appropriate plantings. Views for residents in middleground and background distances to the east and west would be obscured by Pine Hill Ridge and to the east by Lebanon Ridge. Therefore, there would be no visual impacts for these residents.

Lighting for the substation would be visually insignificant if “dark sky” lighting techniques and limiting light use were implemented. All lights used (including headlights and pole-mounted, equipment-mounted or structure-mounted floodlights) would be fully shielded or would have internal low-glare optics, such that no light is emitted from the fixture at angles above the horizontal plane. For construction, this may require temporarily retrofitting headlights, floodlights, and other fixtures with external visors and side shields. Shielded low pressure sodium would be used during the construction and operational phases. Area lighting and parking lot poles would be no taller than 40 feet, unless they are lighting objects taller than 40 feet. In such cases, pole heights would be minimized.

The height and vertical form of the proposed 250-foot-tall microwave tower would be visually dominant in the landscape, but would be visually similar to other towers currently seen in the region by motorists and residents. The linear structure would add discordant contrast and adverse variety to the existing landscape character. One or more flashing strobe lights would provide a pulsating disruptive contrast in the night sky. The microwave tower could be seen at distances of 3 miles or more, depending upon atmospheric conditions.

From the Concord Substation, the existing Concord-Sequoyah 161-kV Transmission Line crosses East Brainerd Road and turns north toward Sequoyah Nuclear Plant. On this section of transmission line, TVA would add a conductor to the vacant side of the transmission line and potentially add 12-foot extensions to six existing structures. One new structure would be required near the Apison Tap structure. New transmission lines and associated accessories would add to the number of discordantly contrasting elements seen in the landscape. However, they would not be individually significant. The new structure near the Apison Tap would be visually similar to other structures currently seen in the area.

From the proposed Bradley 500-kV Substation, the existing East Cleveland-Apison Tap-Catoosa 161-kV Transmission Line crosses Lead Mine Valley Road to the northeast toward the East Cleveland Substation. Work to be performed on this section of transmission line would include the replacement of transmission line conductor and associated equipment.

Visual impacts would be similar to those described for the Concord-Sequoyah 161-kV Transmission Line.

The Falling Water-Sequoyah 161-kV Transmission Line section of the existing Widows Creek-Sequoyah Transmission Line runs from Falling Water Substation to Sequoyah Nuclear Plant. The existing towers are prominent focal points in the landscape, particularly at road crossings and sections of the route that parallel the road right-of-way. Work along this transmission line route would include the reconductoring of 7.7 miles of 500-kV transmission line and adding 8-foot extensions on six structures. Visual impacts would be similar to those described for the Concord-Sequoyah 161-kV Transmission Line.

Operation, construction, and maintenance of the proposed transmission lines, rights-of-way, access roads, and Bradley 500-kV Substation would be visually insignificant if the commitments provided are implemented during construction. 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 all disturbed areas have been restored through the use of TVA standard BMPs (Muncy, 1999). Therefore, no significant visual impacts are anticipated as a result of this project.

4.3.12. Prime Farmland

No Action Alternative
Under the No Action Alternative, the proposed project would not be constructed. Therefore, no impacts to prime farmlands would occur.

Action Alternative
Form AD 1006 was completed with assistance from the NRCS office in Clinton, Tennessee. A score of 78 was assigned for the relative farmland value (Appendix VII). The site assessment score is 48 for a total rating of 126. This score is below the 160 threshold. Protection of this land is not required and any impacts to farmland would be insignificant.

4.3.13. Cultural Resources

No Action Alternative
Under the No Action Alternative, the proposed project would not be constructed. Therefore, no impacts to cultural resources would occur.

Action Alternative
The cultural resources survey identified one new archaeological site (40BY180) and one previously recorded historic structure (BY-92) within the APE of the proposed improvements to the Bradley 500-kV Substation. These historic properties were recommended ineligible for listing on the NRHP. The Tennessee State Historic Preservation Officer has concurred with TVA's determination that the proposed undertaking does not have the potential to affect any historic properties that are eligible for listing or are currently listed on the NRHP.

4.4. Post Construction Impacts

4.4.1. Electric and Magnetic Fields

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 place a 300-foot radius buffer around occupied buildings, except schools, for which a 1200-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, influencing 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.

4.4.2. Other Impacts

No significant impacts are expected to result from the relatively short-term activities of construction, such as noise, air quality, solid waste, etc. Appendixes II and III contain procedures for dealing with these issues.

Additionally, no significant long-term impacts related to noise are expected as a result of the operation of the substation or transmission lines (Appendix VIII). It is expected that circuit breakers at the substation could occasionally open to disconnect part of the transmission system during incidents such as excessive current or voltage fluctuations. The resulting noise could startle people nearby; however, because of the infrequent occurrences, it would not result in a significant impact (Appendix VIII).

4.5. Irreversible and Irretrievable Commitment of Resources

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

The rights-of-way used for the transmission lines would not be irreversibly committed and could be returned to other uses upon retirement of the line. In the interim, compatible uses of the right-of-way could continue.

Forest products and related wildlife that might have grown on the presently forested portions of the right-of-way would be lost for the life of the project. No locally or regionally significant lost forest or agricultural production would be expected.

4.6. Unavoidable Adverse Effects

As previously stated, clearing for the 500-kV substation and the associated transmission line connections would result in the removal of approximately 30 acres of forest. After completion of the substation and transmission line:

- The substation location would be graveled. Trees would not be permitted to grow within the transmission line right-of-way or to a determined height adjacent to the right-of-way that would endanger the transmission line. The exception to this would be within the SMZ of the 500-kV transmission line loop connection right-of-way into the Bradley 500-kV Substation. Trees and shrubs would be allowed to reach a mature height of 20 feet before they would be considered tall enough to pose a danger to the conductors or structures.

- Clearing and construction would result in the disruption of some wildlife, but no permanent habitat changes would occur except in the wooded areas previously described.

- Any burning of cleared material would result in some short-term air pollution.

- Clearing, tree removal, and excavation for pole erection would result in a small amount of localized siltation.

- Transmission line and substation visibility would be minimized through the location; however, there would be some degree of visual effect on the landscape in the project area.

4.7. Relationship Between Local Short-Term Uses of the Environment and Long-Term Productivity

The construction and operation of the proposed substation and associated transmission line connections, Concord Substation expansion, and existing transmission line upgrades would supply electricity to meet the present and foreseeable expected loads in the TVA's southeastern power service region. This would be accomplished by a localized shift of a small amount of land to use for electric power transmission. If, during the useful life of the transmission line, it is no longer needed or technology renders it obsolete, it can be removed with relatively little difficulty. The land encumbered by the right-of-way could be returned to its previous use or used for other purposes.

The principal change in short-term use of the right-of-way would be the exclusion of trees and permanent structures. The amount of forest being lost is approximately 30 acres within the Bowater pine plantation section of the substation and transmission line right-of-way area connecting to the Bradley 500-kV Substation. The right-of-way cannot support building construction for the life of the project, but the social and economic benefits of the project should outweigh this small loss.

The substation site would be committed to use for electrical system needs for the foreseeable future. The land occupied by substation facilities would be converted from its present use as pasture and a pine plantation. Any agricultural production or wildlife uses would be foregone for the life of the substation.

It is expected that these diminutions of long-term productivity would be relatively small both locally and regionally and would therefore be insignificant.

It is possible that the site could be returned to other uses if it is no longer needed for electric power purposes.

4.8. Summary of TVA Commitments and Proposed Mitigation Measures

To support the preceding conclusions, TVA would commit to the following additional actions to avoid or mitigate possible environmental impacts:

<u>Protection of Wetland Habitat</u>

- Additional surveys for the monkey-face orchid would be conducted during the flowering season (late July-August). Should specimens be located, the construction of the section of 500-kV transmission line connection to the Bradley 500-kV Substation that lies within the 150-foot SMZ for the spring/stream complex would be scheduled to occur in late fall or winter. This would be coordinated with the U.S. Fish and Wildlife Service.

- Forested wetland clearing within the right-of-way section of the 500-kV transmission line connection to the Bradley 500-kV Substation would be limited to 0.27 acre.

Protection of Aquatic Resources

- With the exception of the unnamed tributary to Taylor Branch spring and stream complex located within the right-of-way of the 500-kV transmission line connection to the Bradley 500-kV Substation, all intermittent and perennial watercourse crossings would be designated as Category A, Standard Stream Protection, as outlined in Muncy (1999).

- The spring/stream complex would be designated as Category C, Protection of Unique Habitats. To provide bank stabilization and a certain degree of canopy cover, stream banks along the tributary watercourses and springs along the 500-kV transmission line connection would be planted using native, low-growing, deciduous, and/or scrub-shrub vegetation. To facilitate the establishment of the vegetation, TVA would coordinate with the landowner to fence the width of the SMZ. Vegetation in the SMZ would be allowed to reach a mature height of 20 feet.

- Watercourses that convey only surface water during storm events (i.e., WWCs or ephemeral streams) and that could be affected by the proposed transmission line route would be protected by standard BMPs as identified in Muncy (1999). These BMPs are designed to minimize erosion and subsequent sedimentation in streams.

Visual Commitments

- A vegetative screen would be planted with a mixed tree and evergreen shrub species, 10-foot-minimum width, around three sides of the Bradley 500-kV Substation. Shrubs would have a mature height of 10 to 12 feet, and be 4.5 to 5 feet tall when planted, with a maximum spacing of 5 feet. Trees would have a mature height of 30 to 35 feet, or greater, would be a minimum of 9 to 10 feet in height, and would be planted a maximum of 20 feet apart. Screening (trees or shrubs) would not be planted within 20 feet of proposed gates.

- All lights used (including headlights and pole-mounted, equipment-mounted or structure-mounted floodlights) would be fully shielded or would have internal low-glare optics, such that no light is emitted from the fixture at angles above the horizontal. Area lighting and parking lot poles would be no taller than 40 feet unless they are lighting objects taller than 40 feet. In such cases, pole heights would be minimized.

General Best Management Practices for Clearing, Construction, and Maintenance

- TVA practices detailed in Appendixes II, III, IV, and V would be used during clearing, construction, and maintenance. EO 13112 directs all Federal agencies to prevent and control the introduction and spread of invasive species resulting from their activities. TVA would use reseeding mixes that are certified free of invasive, exotic plant seeds when replanting disturbed areas.

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CHAPTER 5

5. SUPPORTING INFORMATION

5.1. List of Preparers

John T. Baxter
Position: Biologist - Aquatic
Involvement: Threatened and Endangered Species - Aquatic Animals

W. Nannette Brodie
Position: Environmental Specialist, Professional Geologist
Involvement: Groundwater

Kimberly D. Choate
Position: Environmental Engineer - Siting and Environmental Design
Involvement: Purpose of and Need for Action; Alternatives Including Proposed Action

J. Leo Collins
Position: Senior Botanist
Involvement: Terrestrial Ecology - Terrestrial Plants; Threatened and Endangered Species - Terrestrial Plants

Jenny K. Fiedler
Position: Contract Zoologist
Involvement: Terrestrial Ecology - Terrestrial Animals; Threatened and Endangered Species - Animals

T. Hill Henry
Position: Senior Zoologist
Involvement: Terrestrial Ecology - Terrestrial Animals; Threatened and Endangered Species - Animals

John M. Higgins
Position: Water Quality Specialist
Involvement: Surface Water

George M. Humphrey
Position: Land Use and Recreation Specialist
Involvement: Recreation

Marianne M. Jacobs
Position: Archaeologist Technician
Involvement: Cultural Resources

Anita E. Masters
Position: Senior NEPA Specialist
Involvement: NEPA Compliance and Document Preparation

Roger A. Milstead
Position: Floodplain Specialist
Involvement: Floodplains

David T. Nestor
Position: Contract Biologist
Involvement: Terrestrial Ecology - Terrestrial Plants; Threatened and Endangered Species - Terrestrial Plants

Kim Pilarski
Position: Senior Wetlands Biologist
Involvement: Wetlands

Jon C. Riley
Position: Landscape Architect
Involvement: Visual

Eric D. Romaniszyn
Position: Contract Aquatic Biologist
Involvement: Aquatic Ecology

Ed Scott
Position: Biologist - Aquatic
Involvement: Aquatic Ecology

Jan K. Thomas
Position: Contract Natural Areas Specialist
Involvement: Managed Areas

W. Richard Yarnell
Position: Archaeologist
Involvement: Cultural Resources

5.2. List of Agencies Consulted

Federal Agencies

U.S. Army Corp of Engineers
U.S. Fish and Wildlife Service
Natural Resource Conservation Service

State Agencies

Tennessee Conservation League, Nashville
Tennessee Department of Agriculture, Nashville
Tennessee Department of Economic and Community Development, Nashville
Tennessee Department of Environment and Conservation, Nashville
Tennessee Department of Transportation, Nashville
Tennessee Division of Natural Heritage, Nashville
Tennessee Historical Commission (State Historic Preservation Officer), Nashville
Tennessee Wildlife Resources Agency, Nashville

5.3. Literature Cited

Bowman, J. C. 1998. Bradley County. The Tennessee Encyclopedia of History and Culture, edited by Carroll Van West. The Rutledge Hill Press, Nashville, Tennessee, pages 84-85.

Braun, E. L. 1950. Deciduous Forests of Eastern North America. The Blakiston Company, Philadelphia, Pennsylvania, 596 pages.

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

Deter-Wolf, A., and T. Karpynec. 2005. Phase I Cultural Resource Survey of Proposed Improvements to the TVA Bradley 500-kV Transmission Line, Bradley and Hamilton Counties, Tennessee. Report Submitted to Tennessee Valley Authority, Cultural Resources, Knoxville, Tennessee.

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

Etnier, D. A. 1997. Jeopardized Southeastern Freshwater Fishes: A Search for Causes. Pages 87-104 IN Aquatic Fauna in Peril: The Southeastern Perspective, edited by George W. Benz and David E. Collins. Special Publication 1, Southeastern Aquatic Research Institute. Lenz Design & Communications, Decatur, Georgia, 554 pages.

Etnier, D. A., and W. C. Starnes. 1993. The Fishes of Tennessee. The University of Tennessee Press, Knoxville, Tennessee, 681 pages.

Fenneman, N. M. 1938. Physiography of Eastern United States. McGraw-Hill Book Company, Inc., New York, 714 pages.

Georgia Department of Natural Resources, Environmental Protection Division. 2004a. Rules and Regulations for Water Quality Control., Chapter 391-3-6, Water Quality Control. Revised - November 2004.

Georgia Department of Natural Resources, Environmental Protection Division. 2004b. Draft Georgia 2004 303(d) List Documents. Updated December 16, 2004.

Kuchler, A. W. 1964. The Potential Natural Vegetation of the Conterminous United States. American Geographic Society, Special Publication No. 36.

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

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

Muncy, J. A. 1999. A Guide for Environmental Protection and Best Management Practices for Tennessee Valley Authority Transmission Construction and Maintenance Activities (revised). Technical Note TVA/LR/NRM 92/1. Tennessee Valley Authority, Norris, Tennessee. Chris Austin, Chris Brewster, Alicia Lewis, Kenton Smithson, Tina Broyles, Tom Wojtalik, editors.

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

Tennessee Department of Environment and Conservation. 2002. Division of Water Supply. Tennessee Ground Water 305b Water Quality Report, November 2002.

Tennessee Department of Environment and Conservation. 2003. Division of Water Supply. Tennessee Source Water Assessment Report, August 2003.

Tennessee Department of Environment and Conservation. 2004a. Draft Version Year 2004 303(d) List. June 2004.

Tennessee Department of Environment and Conservation. 2004b. Rules of the Tennessee Department of Environment and Conservation Division of Water Pollution Control Amendments. Chapter 1200-4-4, Use Classifications for Surface Waters. Revised January 2004.

Tennessee Valley Authority. 1983. Instruction IX Environmental Review http://www.tva.gov/environment/reports/pdf/tvanepa_procedures.pdf

United States Geological Survey and Tennessee Department of Environment and Conservation. 1995. Water Use in Tennessee. http://tn.water.usgs.gov/wustates/tn/mapdatagw95.html

White House Office on Environmental Policy. 1993. http://www.epa.gov/owow/wetlands/guidance

Wilson, J. 1998. Hamilton County. The Tennessee Encyclopedia of History and Culture, edited by Carroll Van West. The Rutledge Hill Press, Nashville, Tennessee, pages 397-399.

APPENDIX I – CORRESPONDENCE

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March 16, 2005, Correspondence From Herbert L. Harper, Deputy State Historic Preservation Officer, Tennessee Historical Commission

TENNESSEE HISTORICAL COMMISSION
DEPARTMENT OF ENVIRONMENT AND CONSERVATION
2941 LEBANON ROAD
NASHVILLE, TN 37243-0442
(615) 532-1550

March 16, 2005

Mr. J. Bennett Graham
Tennessee Valley Authority
400 W. Summit Hill Drive
WT 11D - Cultural Resources
Knoxville, Tennessee 37902

RE: TVA, ARCHAEOLOGICAL ASSESSMENT, BRADLEY 500-KV LINE IMPROVEMENTS, UNINCORPORATED, BRADLEY COUNTY, TN

Dear Mr. Kline:

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

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

Your cooperation is appreciated.

Sincerely,

Herbert L. Harper
Executive Director and
Deputy State Historic
Preservation Officer

HLH/jmb

Undated Correspondence From Wilton Burnett, Jr., Director of Special Projects, Tennessee Economic and Community Development

Kimberly D. Choate, P.E.
Tennessee Valley Authority
Transmission Line Projects
Siting and Environmental Design Department
1101 Market Street, MR 4G-C
Chattanooga, Tennessee 37402-2801

Bradley 500-kV Substation and Transmission Line Connections and Upgrades

Dear Ms. Choate:

This is in reference to Tennessee Valley Authority's project that was mailed to me on April 20, 2005.

The project as described by the project summary creates no incompatibility in our area of planning at this time.

Wilton Burnett Jr.
Signature

DIR. OF SPECIAL PROJECTS
Title

TN ECD
Agency

312 8TH AVE. N., 11 TH FLOOR
Address

NASHVILLE, TN 37243-0405

April 22, 2005, Correspondence From Ralph E. Comer, Assistant Planning Director, Tennessee Department of Transportation

Kimberly D. Choate, P.E.
Tennessee Valley Authority
Transmission Line Projects
Siting and Environmental Design Department
1101 Market Street, MR 4G-C
Chattanooga, Tennessee 37402-2801

Bradley 500-kV Substation and Transmission Line Connections and Upgrades

Dear Ms. Choate:

This is in reference to Tennessee Valley Authority's project that was mailed to me on April 20, 2005.

The project as described by the project summary creates no incompatibility in our area of planning at this time.

Ralph E. Comer 04/22/05
Signature

Title

Agency

Address

TENNESSEE DEPARTMENT OF TRANSPORTATION

RALPH E. COMER
ASSISTANT PLANNING DIRECTOR

TEL. (615) 741-3421
FAX (615) 532-8451
Email. Ralph.Comer@state.tn.us

PLANNING DIVISION
SUITE 900, JAMES K. POLK BLDG.
NASHVILLE, TN 37243-0334

Undated Correspondence From Kristin Condict, Data Manager, Tennessee Division of Natural Heritage

Kimberly D. Choate, P.E.
Tennessee Valley Authority
Transmission Line Projects
Siting and Environmental Design Department
1101 Market Street, MR 4G-C
Chattanooga, Tennessee 37402-2801

Bradley 500-kV Substation and Transmission Line Connections and Upgrades

Dear Ms. Choate:

This is in reference to Tennessee Valley Authority's project that was mailed to me on April 20, 2005.

The project as described by the project summary creates no incompatibility in our area of planning at this time.

Kristin Condict
Signature

Data Manager
Title

Tennessee Division of Natural Heritage
Agency

14th Floor, L&C Tower
Address

401 Church Street
Nashville, TN 37243

May 25, 2005, Correspondence From Robert M. Todd, Fish and Wildlife Environmentalist, Tennessee Wildlife Resources Agency, Page 1 of 2

TENNESSEE WILDLIFE RESOURCES AGENCY

ELLINGTON AGRICULTURAL CENTER
P. O. BOX 40747
NASHVILLE, TENNESSEE 37204

May 25, 2005

Kimberly D. Choate, P.E.
Tennessee Valley Authority
Transmission Line Projects
Siting and Environmental Design Department
1101 Market Street, MR 4G-C
Chattanooga, TN 37402-2801

Re: Comments Concerning the Construction of a 500-KV Substation and Transmission Line Connections and Upgrades in Bradley County

Dear Ms. Choate:

Enclosed is the requested form stating that at this time the Tennessee Wildlife Resources Agency sees no incompatibility in our area of planning by the project as described by the summary.

Thank you for the opportunity to comment on this project.

Sincerely,

Robert M. Todd

Robert M. Todd
Fish and Wildlife Environmentalist

The State of Tennessee

AN EQUAL OPPORTUNITY EMPLOYER

Attachment to May 25, 2005, Correspondence From Robert M. Todd, Fish and Wildlife Environmentalist, Tennessee Wildlife Resources Agency, Page 2 of 2

Kimberly D. Choate, P.E.
Tennessee Valley Authority
Transmission Line Projects
Siting and Environmental Design Department
1101 Market Street, MR 4G-C
Chattanooga, Tennessee 37402-2801

Bradley 500-kV Substation and Transmission Line Connections and Upgrades

Dear Ms. Choate:

This is in reference to Tennessee Valley Authority's project that was mailed to me on April 20, 2005.

The project as described by the project summary creates no incompatibility in our area of planning at this time.

Robert M. Todd
Signature

FISH & WILDLIFE ENVIRONMENTALIST
Title

TENNESSEE WILDLIFE RESOURCES AGENCY
Agency

ELLINGTON AGRICULTURAL CENTER
P.O. BOX 40747
Address

NASHVILLE, TN 37204

APPENDIX II – 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 appendixes, conditions in applicable general and/or site-specific permits, the storm water pollution prevention plan, and any Tennessee Valley Authority (TVA) commitments to property owners. The contractor shall then plan and carry out operations using techniques consistent with good engineering and management practices as outlined in TVA's Best Management Practice (BMP) manual (Muncy, 1992, and revisions thereto). The contractor will protect areas that are to be left unaffected by access or clearing work at and adjacent to all work sites. In sensitive areas and their buffers, the contractor will retain as much native ground cover and other vegetation as possible.

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

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

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

plants or grasses to meet the criteria of regulatory agencies or commitments to special program interests.

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

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

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

7. Water Quality Control - The contractor's clearing and disposal activities shall be performed using BMPs that will prevent erosion and entrance of spillage, contaminants, debris, and other pollutants or objectionable materials into drainage ways, surface water, or groundwater. Special care shall be exercised in refueling equipment to prevent spills. Fueling areas shall be remote from any sinkhole, crevice, stream, or other water body.

Open burning debris will be kept away from streams and ditches and shall be incorporated into the soil.

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

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

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

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

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

11. Burning - The contractor shall obtain applicable permits and approvals to conduct controlled burning. The contractor will comply with all provisions of the permit, notification, or authorization including burning site locations, controlled draft, burning hours, and such other conditions as stipulated. If weather conditions such as wind speed or wind direction change rapidly, the contractor's burning operation may be temporarily stopped by TVA's field engineer. The debris to be burned shall be kept as clean and dry as possible and stacked and burned in a manner that produces the minimum amount of smoke. Residue

from burning will be disposed of according to permit stipulations. No fuel starters or enhancements other than kerosene will be allowed.

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

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

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

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

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

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

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

19. Brush and Timber Disposal (Reclearing) - The reclearing contractor shall place felled tree boles in neat stacks at the edge of the right-of-way, with crossing breaks at least every 100 feet. Property owner requests shall be reviewed with the project manager or right-of-way

specialist before accepting them. Lop and drop activities must be specified in the contract and on plan and profile drawings with verification with the right-of-way specialist before conducting such work. When tree trimming and chipping is necessary, disposal of the chips on the easement or other locations on the property must be with the consent of the property owner and the approval of the right-of-way specialist. No trees, branches, or chips shall remain in a surface water body or be placed at a location where washing into a surface water or groundwater source might occur.

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

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

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

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

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

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

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APPENDIX III – 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 IV – TENNESSEE VALLEY AUTHORITY TRANSMISSION CONSTRUCTION GUIDELINES NEAR STREAMS

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

Three Levels of Protection

During the preconstruction review of a proposed transmission line, TVA Resource Stewardship staff will have studied each possible stream impact site and will have identified it as falling into one of three categories: (A) standard stream protection, (B) protection of important permanent streams, or C) protection of unique habitats. These category designations are based on the variety of species and habitats that exist in the stream as well as state and Federal requirements to avoid harming certain species. The category designation for each site will be marked on the plan and profile sheets. Construction crews are required to protect streams and other identified water habitats using the following pertinent set(s) of guidelines:

(A) Standard Stream Protection

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

Guidelines:

1. All construction work around streams will be done using pertinent Best Management Practices (BMPs) such as those described in "A Guide for Environmental Protection and Best Management Practices for TVA Construction and Maintenance Activities," especially Chapter 6, Standards and Specifications.

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

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

and impacts to the SMZ and surrounding area. Stumps can be cut close to ground level but must not be removed or uprooted.

4. Other vegetation near streams must be disturbed as little as possible during construction. Soil displacement by the actions of plowing, disking, blading, or other tillage or grading equipment will not be allowed in SMZs; however, a minimal amount of soil disturbance may occur as a result of clearing operations. Shorelines that have to be disturbed must be stabilized as soon as feasible.

(B) Protection of Important Permanent Streams

This category will be used when there is one or more specific reason(s) why a permanent (always-flowing) stream requires protection beyond that provided by standard BMPs. Reasons for requiring this additional protection include the presence of important sports fish (trout, for example) and habitats for Federal endangered species. The purpose of the following guidelines is to minimize the disturbance of the banks and water in the flowing stream(s) where this level of protection is required.

Guidelines:

1. Except as modified by guidelines 2-4 below, all construction work around streams will be done using pertinent BMPs such as those described in "A Guide for Environmental Protection and Best Management Practices for TVA Construction and Maintenance Activities," especially Chapter 6, Standards and Specifications.

2. All equipment crossings of streams must comply with appropriate state (and, at times, Federal) permitting requirements. Crossings of drainage channels and intermittent streams must be done in ways that avoid erosion problems and long-term changes in water flow. Proposed crossings of permanent streams must be discussed in advance with Resource Stewardship staff and may require an on-site planning session before any work begins. The purpose of these discussions will be to minimize the number of crossings and their impact on the important resources in the streams.

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

4. Other vegetation near streams must be disturbed as little as possible during construction. Soil displacement by the actions of plowing, disking, blading, or other tillage or grading equipment will not be allowed in SMZs; however, a minimal amount of soil disturbance may occur as a result of clearing operations. Shorelines that have to be disturbed must be stabilized as soon as possible and revegetated as soon as feasible.

(C) Protection of Unique Habitats

This category will be used when, for one or more specific reasons, a temporary or permanent aquatic habitat requires special protection. This relatively uncommon level of protection will be appropriate and required when a unique habitat (for example, a particular spring run) or protected species (for example, one that breeds in a wet-weather ditch) is known to occur on or adjacent to the construction corridor. The purpose of the following guidelines is to avoid or minimize any disturbance of the unique aquatic habitat.

Guidelines:

1. Except as modified by Guidelines 2-4 below, all construction work around the unique habitat will be done using pertinent BMPs such as those described in "A Guide for Environmental Protection and Best Management Practices for TVA Construction and Maintenance Activities," especially Chapter 6, Standards and Specifications.

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

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

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

Additional Help

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

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

Guidelines	A: Standard	B: Important Permanent Streams	C: Unique Water Habitats
1. Reference	• All TVA construction work around streams will be done using pertinent BMPs such as those described in "A Guide for Environmental Protection and Best Management Practices for TVA Construction and Maintenance Activities," especially Chapter 6, BMP Standards and Specifications.	Except as modified by guidelines 2-4 below, all construction work around streams will be done using pertinent BMPs such as those described in "A Guide for Environmental Protection and Best Management Practices for TVA Construction and Maintenance Activities," especially Chapter 6, BMP Standards and Specifications.	• Except as modified by guidelines 2-4 below, all construction work around the unique habitat will be done using pertinent BMPs such as those described in "A Guide for Environmental Protection and Best Management Practices for TVA Construction and Maintenance Activities," especially Chapter 6, BMP Standards and Specifications.
2. Equipment Crossings	• All crossings of streams must comply with appropriate state and Federal permitting requirements. • Crossings of all drainage channels, intermittent streams, and permanent streams must be done in ways that avoid erosion problems and long-term changes in water flow. • Crossings of any permanent streams must allow for natural movement of fish and other aquatic life.	• All crossings of streams must comply with appropriate state and Federal permitting requirements. • Crossings of drainage channels and intermittent streams must be done in ways that avoid erosion problems and long-term changes in water flow. • Proposed crossings of permanent streams must be discussed in advance with Resource Stewardship staff and may require an on-site planning session before any work begins. The purpose of these discussions will be to minimize the number of crossings and their impact on the important resources in the streams.	• All crossings of streams also must comply with appropriate state and Federal permitting requirements. • All construction activity in and within 30 meters (100 feet) of the unique habitat must be approved in advance by Resource Stewardship staff, preferably as a result of an on-site planning session. The purpose of this review and approval will be to minimize impacts on the unique habitat.

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

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

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APPENDIX V – 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.

Revision July 2003

APPENDIX VI – APPROXIMATE LOCATIONS AND LEVELS OF PROTECTION FOR WATERCOURSES WITHIN THE RIGHT-OF-WAY OF THE PROPOSED AND EXISTING TRANSMISSION LINES

FALLING WATER - SEQUOYAH 161-kV TRANSMISSION LINE

Crossing Number	*Watercourse Station Numbers*	*Watercourse Type*	*Commitments*	*SMZ Widths*
1	2162+00 - 2168+90	WWC	Standard BMPs	N/A
2	2183+93	WWC	Standard BMPs	N/A
3	2203+80 2208+40	Pond	Category A SMZ	50
4	2233+43 - 2234+58	Perennial	Category A SMZ	east 50/west 65
5	2300+04 - 2301+04	Perennial	Category A SMZ	50
6	2306+92 - 2307+92	Perennial	Category A SMZ	50
7	2346+95 - 2347+45	WWC	Standard BMPs	N/A
8	2347+90	WWC	Standard BMPs	N/A
9	2359+79 - 2362+28	WWC	Standard BMPs	N/A
10	2375+39	WWC	Standard BMPs	N/A
11	2396+53 - 2396+85	WWC	Standard BMPs	N/A
12	2407+55	WWC	Standard BMPs	N/A
13	2450+76 - 2451+00	WWC	Standard BMPs	N/A
14	2459+12 - 2461+25	WWC	Standard BMPs	N/A
15	2542+70 -2550+80	Perennial	Category A SMZ	50

CONCORD - SEQUOYAH 161-kV TRANSMISSION LINE

Crossing Number	*Watercourse Station Numbers*	*Watercourse Type*	*Commitments*	*SMZ Widths*
1	22+60 - 24+60	Intermittent	Category A SMZ	50
2	51+00 - 94+20	Perennial	Category A SMZ	50
3	98+97	WWC	Standard BMPs	N/A
4	131+49 - 136+50	Perennial	Category A SMZ	50
5	144+00 - 149+70	Perennial	Category A SMZ	50
6	151+00	WWC	Standard BMPs	N/A
7	152+00	WWC	Standard BMPs	N/A
8	160+25	WWC	Standard BMPs	N/A
9	167+11 - 168+61	Perennial	Category A SMZ	50
10	209+14	WWC	Standard BMPs	N/A
11	224+30	WWC	Standard BMPs	
12	237+07 - 238+07	Perennial	Category A SMZ	50
13	258+15 - 261+10	Intermittent	Category A SMZ	50
14	394+03 - 395+03	Perennial	Category A SMZ	50
15	434+30 - 438+60	Perennial	Category A SMZ	50
16	440+90 - 441+90	Perennial	Category A SMZ	50
17	451+10 - 453+80	Perennial	Category A SMZ	50
18	479+92	WWC	Standard BMPs	
19	486+30	WWC	Standard BMPs	N/A
20	490+85 - 493+35	Perennial	Category A SMZ	south 100/north50

CONCORD - SEQUOYAH 161-kV TRANSMISSION LINE (Continued)

Crossing Number	*Watercourse Station Numbers*	*Watercourse Type*	*Commitments*	*SMZ Widths*
21	508+61 - 509+86	Perennial	Category A SMZ	south 75/north 50
22	520+11	WWC	Standard BMPs	N/A
23	532+60	WWC	Standard BMPs	N/A
24	553+56	WWC	Standard BMPs	N/A
25	557+42 - 559+03	Intermittent	Category A SMZ	65
26	577+67 - 578+55	WWC	Standard BMPs	N/A
27	611+50 - 621+09	WWC	Standard BMPs	N/A
28	624+52 - 625+52	Intermittent	Category A SMZ	50
29	656+93 - 671+00	Perennial	Category A SMZ	50
30	691+42 - 700+96	Perennial	Category A SMZ	100
31	726+90 to 730+05	Perennial	Category A SMZ	50
32	773+05	WWC	Standard BMPs	N/A
33	776+01	WWC	Standard BMPs	N/A
34	782+42	WWC	Standard BMPs	N/A
35	785+90	WWC	Standard BMPs	N/A
36	801+06	WWC	Standard BMPs	N/A
37	808+18	WWC	Standard BMPs	N/A
38	825+08	WWC	Standard BMPs	N/A
39	830+00	WWC	Standard BMPs	N/A
40	837+35 to 838+65	Intermittent	Category A SMZ	65
41	840+00	WWC	Standard BMPs	N/A
42	842+50	WWC	Standard BMPs	N/A
43	851+50 to 852+50	Intermittent	Category A SMZ	50
44	896+50	WWC	Standard BMPs	N/A
45	918+64 to 942+00	Perennial	Category A SMZ	50

CONCORD - CATOOSA 161-kV TRANSMISSION LINE

Crossing Number	*Watercourse Station Numbers*	*Watercourse Type*	*Commitments*	*SMZ Widths*
1	23+03 - 29+93	Perennial	Category A SMZ	50
2	55+80 - 65+00	Perennial Intermittent	Category A SMZ	50
3	66+53 - 68+95	Perennial	Category A SMZ	50
4	69+40 - 74+40	Intermittent	Category A SMZ	50
5	94+50 - 96+30	Perennial	Category A SMZ	50
6	106+80 - 112+20	Intermittent	Category A SMZ	50
7	133+60 - 137+00	Perennial	Category A SMZ	50
8	137+50 - 151+90	Perennial	Category A SMZ	50
9	157+00	WWC	Standard BMPs	N/A
10	157+60 - 161+25	Intermittent	Category A SMZ	50
11	163+57	WWC	Standard BMPs	N/A
12	163+76	WWC	Standard BMPs	N/A
13	171+00	WWC	Standard BMPs	N/A
14	293+80	WWC	Standard BMPs	N/A
15	297+86	WWC	Standard BMPs	N/A
16	304+53	WWC	Standard BMPs	N/A

EAST CLEVELAND - APISON TAP - CATOOSA 161-kV TRANSMISSION LINE

Crossing Number	*Watercourse Station Numbers*	*Watercourse Type*	*Commitments*	*SMZ Widths*
1	318+80 - 320+00	Perennial	Category A SMZ	50
2	330+70 - 334+90	Perennial	Category A SMZ	50
3	353+09	WWC	Standard BMPs	N/A
4	365+30	WWC	Standard BMPs	N/A
5	395+00	WWC	Standard BMPs	N/A
6	404+20 - 410+40	Intermittent	Category A SMZ	50
7	450+70 - 455+70	Perennial	Category A SMZ	south 50/north 100
8	473+84	WWC	Standard BMPs	N/A
9	474+50*	WWC	Standard BMPs	N/A
10	493+77	WWC	Standard BMPs	N/A
11	501+50 - 504+20	Perennial WWC	Category A SMZ	east 75/west 65
12	510+35 - 512+90	Perennial Intermittent WWC	Category A SMZ	east 50/west 75
13	517+00 - 526+47	WWC	Standard BMPs	N/A
14	549+76 - 550+76	Intermittent	Category A SMZ	50
15	556+68	WWC	Standard BMPs	N/A
16	564+37 - 565+37	WWC	Standard BMPs	N/A
17	573+79	WWC	Standard BMPs	N/A
18	580+75 - 582+90	WWC	Standard BMPs	N/A
19	585+21	WWC	Standard BMPs	N/A
20	589+00	WWC	Standard BMPs	N/A
21	593+20	WWC	Standard BMPs	N/A
22	598+20 - 610+20	Perennial	Category A SMZ	50
23	609+63 - 611+13	Perennial	Category A SMZ	75
24	627+20 - 629+50	Perennial	Category A SMZ	75
25	637+85 - 639+65	Perennial	Category A SMZ	75
26	646+29 - 647+29	Perennial	Category A SMZ	50
27	658+40 - 600+80	Perennial	Category A SMZ	50
28	670+00 - 673+05	Perennial	Category A SMZ	50
29	698+00 - 699+85	Intermittent	Category A SMZ	50
30	748+26 - 749+26	Perennial	Category A SMZ	50
31	760+30 - 762+18	Intermittent	Category A SMZ	50
32	773+35 - 778+50	Perennial	Category A SMZ	100
33	790+04	WWC	Standard BMPs	N/A
34	799+70 - 802+40	Perennial	Category A SMZ	75
35	806+60 - 809+80	Perennial	Category A SMZ	75
36	819+39 - 820+89	Perennial	Category A SMZ	75
37	829+67	WWC	Standard BMPs	N/A
38	835+60 - 838+35	Perennial	Category A SMZ	75
39	850+43	WWC	Standard BMPs	N/A
40	884+50 - 888+50	Perennial	Category A SMZ	50
41	891+01 - 892+26	Perennial	Category A SMZ	50
42	893+40 - 895+50	Perennial	Category A SMZ	50
43	898+45 - 900+50	Perennial	Category A SMZ	50
44	913+35	WWC	Standard BMPs	N/A
45	925+00 - 928+20	Perennial	Category A SMZ	50
46	928+86	WWC	Standard BMPs	N/A

EAST CLEVELAND - APISON TAP - CATOOSA 161-kV TRANSMISSION LINE (Continued)

Crossing Number	*Watercourse Station Numbers*	*Watercourse Type*	*Commitments*	*SMZ Widths*
47	933+41	WWC	Standard BMPs	N/A
48	934+39 - 935+89	Perennial	Category A SMZ	75
49	949+48*	WWC	Standard BMPs	N/A
50	954+30 - 957+40	Perennial	Category A SMZ	50
51	971+26	WWC	Standard BMPs	N/A
52	979+22	WWC	Standard BMPs	N/A
53	985+21	WWC	Standard BMPs	N/A
54	989+90	WWC	Standard BMPs	N/A
55	1004+55 - 1007+10	Perennial	Category A SMZ	75
56	1015+53	WWC	Standard BMPs	N/A
57	1024+25	WWC	Standard BMPs	N/A
58	1050+90 - 1054+45	Perennial	Category A SMZ	50
59	1071+69*	WWC	Standard BMPs	N/A
60	1080+00*	Perennial	Category A SMZ	50
61	1108+40 - 1111+00	Perennial	Category A SMZ	50
62	1120+70 - 1123+45	Perennial	Category A SMZ	50
63	1137+80	WWC	Standard BMPs	N/A
64	1221+50 - 1222+50	Intermittent	Category A SMZ	50
65	1235+20	WWC	Standard BMPs	N/A
66	1249+80 - 1259+40	Perennial	Category A SMZ	50
67	1275+00 - 1276+10	Perennial	Category A SMZ	50
68	1276+71 - 1277+71	Perennial	Category A SMZ	50
69	1324+63 - 1326+36	Perennial	Category A SMZ	50
70	1335+00 - 1338+90	Intermittent	Standard BMPs	50
71	1370+00 - 1373+90	Perennial	Category A SMZ	50
72	1376+50 - 1379+32	Intermittent Perennial	Category A SMZ	50
73	1397+51	WWC	Standard BMPs	N/A
74	1398+04 - 1399+04	Perennial	Category A SMZ	50
75	1466+00 - 1471+50	Perennial	Category A SMZ	50
76	1489+50 - 1493+80	Perennial	Category A SMZ	50
77	1501+00	WWC	Standard BMPs	N/A
78	1501+50 - 1502+50	Perennial	Category A SMZ	50
79	1581+00 - 1582+00	Perennial	Category A SMZ	50
80	1591+06	WWC	Standard BMPs	N/A
81	1600+50 - 1602+50	Perennial	Category A SMZ	50
82	1641+50 - 1643+10	Perennial	Category A SMZ	50
83	1760+50 - 1761+50	Perennial	Category A SMZ	50
84	1778+47 - 1779+47	Perennial	Category A SMZ	50
85	1790+80 - 1791+80	Perennial	Category A SMZ	50

BRADLEY SUBSTATION AND ASSOCIATED 500-kV AND 161-kV TRANSMISSION LINE CONNECTIONS

Crossing Number	*Watercourse Station Numbers*	*Watercourse Type*	*Commitments*	*SMZ Widths*
1	5+85 - 12+18 and 909+35 - 915+70	Perennial Intermittent WWC	Category C SMZ	150
2	1019+43 - 1020+44	Perennial	Category A SMZ	50
3	3+40 - 4+81	Perennial	Category A SMZ	50
4	7+10 - 10+00	Perennial Intermittent	Category A SMZ	50
5	1020+30 - 1021+50	Perennial	Category A SMZ	50
6	11+60 - 13+45	Perennial	Category A SMZ	50

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APPENDIX VII – LOCATION OF PRIME FARMLAND SOILS IN THE BRADLEY 500-kV SUBSTATION SITE

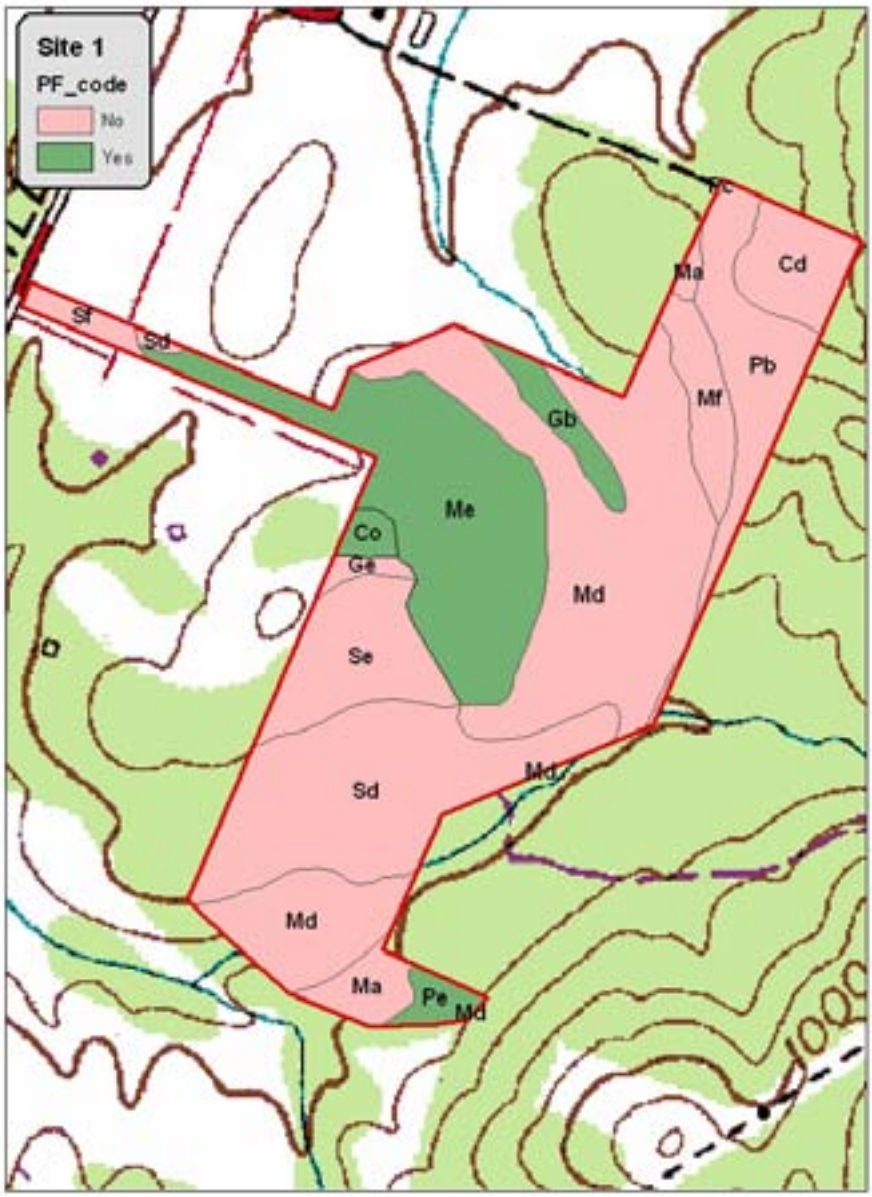

Figure 1. Location of Prime Farmland Soils in the Bradley 500-kV Substation Site

APPENDIX VII (CONTINUED) – DESCRIPTION OF SOILS IN THE PROPOSED SITE FOR THE BRADLEY 500-kV SUBSTATION

Table 1. Description of Soils in the Proposed Site for the Bradley 500-kV Substation

SMU	Description	Prime Farmland	Acres
Cd	CLARKSVILLE CHERTY SILT LOAM, HILLY PHASE	no	2.4
Ge	GULLIED LAND, SHALE SOIL MATERIALS	no	0.4
Ma	MELVIN SILT LOAM	no	1.6
Md	MINVALE SILT LOAM, ERODED ROLLING PHASE	no	18.0
Mf	MINVALE SILT LOAM, ROLLING PHASE	no	2.0
Pb	PACE CHERTY SILT LOAM, ROLLING PHASE	no	4.5
Sd	SEQUOIA SILTY CLAY, SEVERELY ERODED ROLLING PHASE	no	10.3
Se	SEQUOIA SILTY CLAY LOAM, ERODED ROLLING PHASE	no	4.1
Sf	SEQUOIA SILTY CLAY LOAM, ERODED UNDULATING PHASE	no	0.8
Co	*COTACO SILT LOAM*	yes	0.5
Gb	*GREENDALE SILT LOAM*	yes	1.3
Me	*MINVALE SILT LOAM, ERODED UNDULATING PHASE*	yes	11.1
Pe	*PACE SILT LOAM, UNDULATING PHASE*	yes	0.8
	Total acreage		57.8

Source: Soil Survey of Bradley County, Tennessee, U.S. Department of Agriculture, Soil Conservation Service, in cooperation with Tennessee Agricultural Experiment Station and TVA, July 1958

SMU = Soil Map Units

U.S. Department of Agriculture

FARMLAND CONVERSION IMPACT RATING

PART I *(To be completed by Federal Agency)*	Date Of Land Evaluation Request 2/1/05
Name Of Project Bradley 500 kV Substation Project	Federal Agency Involved Tennessee Valley Authority
Proposed Land Use Sub-station	County And State Bradley Co, TN
PART II *(To be completed by NRCS)*	Date Request Received By NRCS

Does the site contain prime, unique, statewide or local important farmland? *(If no, the FPPA does not apply – do not complete additional parts of this form).* Yes ☑ No ☐		Acres Irrigated 0	Average Farm Size 115
Major Crop(s) Corn	Farmable Land In Govt. Jurisdiction Acres: 160282 %		Amount Of Farmland As Defined in FPPA Acres: 89028 %
Name Of Land Evaluation System Used Bradley Co. Land Evaluation	Name Of Local Site Assessment System None		Date Land Evaluation Returned By NRCS

PART III *(To be completed by Federal Agency)*	Alternative Site Rating Site A	Site B	Site C	Site D
A. Total Acres To Be Converted Directly	57.8			
B. Total Acres To Be Converted Indirectly				
C. Total Acres In Site	57.8	0.0	0.0	0.0
PART IV *(To be completed by NRCS)* Land Evaluation Information				
A. Total Acres Prime And Unique Farmland	13.7			
B. Total Acres Statewide And Local Important Farmland	0.0			
C. Percentage Of Farmland In County Or Local Govt. Unit To Be Converted	0.0			
D. Percentage Of Farmland In Govt. Jurisdiction With Same Or Higher Relative Value	18.0			
PART V *(To be completed by NRCS)* Land Evaluation Criterion Relative Value Of Farmland To Be Converted *(Scale of 0 to 100 Points)*	78	0	0	0

PART VI *(To be completed by Federal Agency)* Site Assessment Criteria *(These criteria are explained in 7 CFR 658.5(b)*	Maximum Points				
1. Area In Nonurban Use	15	12			
2. Perimeter In Nonurban Use	10	10			
3. Percent Of Site Being Farmed	20	0			
4. Protection Provided By State And Local Government	20	0			
5. Distance From Urban Builtup Area	15	15			
6. Distance To Urban Support Services	15	5			
7. Size Of Present Farm Unit Compared To Average	10	1			
8. Creation Of Nonfarmable Farmland	10	0			
9. Availability Of Farm Support Services	5	5			
10. On-Farm Investments	20	0			
11. Effects Of Conversion On Farm Support Services	10	0			
12. Compatibility With Existing Agricultural Use	10	0			
TOTAL SITE ASSESSMENT POINTS	160	48	0	0	0
PART VII *(To be completed by Federal Agency)*					
Relative Value Of Farmland *(From Part V)*	100	78	0	0	0
Total Site Assessment *(From Part VI above or a local site assessment)*	160	48	0	0	0
TOTAL POINTS *(Total of above 2 lines)*	260	126	0	0	0

Site Selected:	Date Of Selection	Was A Local Site Assessment Used? Yes ☐ No ☒

Reason For Selection:

(See Instructions on reverse side)
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Clear Form

Form AD-1006 (10-83)

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APPENDIX VIII – NOISE DURING TRANSMISSION LINE CONSTRUCTION AND OPERATION

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

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

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

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

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

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

Construction Noise

Construction noise impacts would vary with the number and specific types of equipment on the job, the construction methods, the scheduling of the work, and the distance to sensitive noise receptors such as houses. Typical construction activities are described in Section 2.4 for a substation and in Section 2.7 for a transmission line. Maximum noise levels generated by the various pieces of construction equipment typically range from about 70 to 85 dBA at 50 feet (Bolt, Beranek, and Newman, 1971). An exception would be the use of track drills for building roads and installing foundations in rocky areas; track drills have a typical maximum noise level of 98 dBA at 50 feet. Use of track drills is not expected to be widespread.

Project-related construction noise levels would likely exceed background noise levels by more than 10 dBA at distances from within 500 feet in developed areas to over 1000 feet in rural areas with little development. These distances are without the use of track drills; drilling activities could increase the distances by an additional 500 feet. A 10-dBA increase would be perceived as a large increase over the existing noise level and could result in annoyance to adjacent residents. The residential noise level guideline of 55 dBA could also be temporarily exceeded for residences near construction activities.

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

Operational Noise

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

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

Transformers at the substation would generally operate in self-cooled mode, though a few days a year during extreme temperatures, transformers would operate in fan-cooled mode. When fans are used, they would generate approximately 85 dB at 3 feet. This would be approximately 41 dB at the nearest residence 500 feet away, and it would not cause annoyance.

The substation would produce a loud impulse noise when a breaker is tripped due to excessive current, high voltage, low voltage, low frequency or other less common problems. When such problems occur, the circuit breaker opens to disconnect part of the system, and the flow of current is interrupted. The noise from the breaker is expected to last 1/20 of a second and range from 96 to 105 dB at 50 feet. Breaker noise would be quite loud, though it is only expected to occur about 18 times each year. Breaker noise may startle people in the nearest residence 500 feet away; though, because of the infrequent occurrence, it would not result in a significant impact.

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

Literature Cited

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

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

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