CHAPTER 3

3.0 AFFECTED ENVIRONMENT

This chapter describes the existing condition of the environmental resources and characteristics of the proposed project area that would affect or be affected by implementing the proposed action. The affected environment descriptions below are based on field surveys conducted from 2006 through 2007, on published and unpublished reports, and on personal communications with resource experts. This information establishes the baseline conditions against which the decision maker and the public can compare the potential effects of the alternatives under consideration.

3.1. Groundwater

The entire project area is underlain by Ordovician-aged aquifers in the Interior Low Plateaus Physiographic Province. These carbonate rocks are the principal aquifers in large areas of Central Tennessee and are part of the Central Basin aquifer system. The carbonate rock aquifers consist of almost pure limestone and minor dolostone and are interlayered with confining units of shale and shaly limestone. Limestone is susceptible to erosion and dissolution, which produces fissures, sinkholes, underground streams, and caverns forming vast karst areas.

The Ordovician aquifers are made up of rocks from the Stones River Group and the Nashville Group. The Stones River Group contains the most important carbonate-rock aquifers in the project area. Locally, the Stones River Group contains the Carters Limestone, the Lebanon Limestone, and the Ridley Limestone. The Nashville Group consists of the Bigby-Cannon Limestone and the Hermitage Formation. The calcareous siltstones of the Nashville Group yield small volumes of water, but these units are not considered principal aquifers (Lloyd and Lyke 1995; Hardeman 1966).

The project area is located within mature karst terrain. Karst terrain is formed in areas underlain by limestone. Karst landforms result from mildly acidic rainwater dissolving bedrock such as limestone or dolostone. Over time, these fractures enlarge as the bedrock continues to dissolve. Openings in the rock increase in size, and an underground drainage system begins to develop, allowing more water to pass through and accelerating the formation of underground karst features.

The groundwater system in the project vicinity is typical of many karst areas with little groundwater stored in or transported through the matrix of the limestone bedrock; rather, most of the groundwater resides in and flows through fractures, bedding planes, small solution openings, and large open conduits. Water enters the groundwater system as dispersed recharge from rainfall that infiltrates over wide areas or as concentrated recharge from sinkholes and losing streams that infiltrates to localized parts of the groundwater system. Groundwater flows from the recharge areas through fractures and conduits and eventually discharges to springs and gaining streams. Large conduits or interconnected conduit systems may consolidate groundwater flow similar to the way surface water flows from small tributaries to larger streams. These interconnected, open conduits (the groundwater conduit system) can transmit water rapidly and can act as important local and regional drains of the groundwater system (Bradley and Hileman 2006).

The quality of the water in the carbonate aquifers in the Ordovician rocks is considered hard and contains high concentrations of dissolved solids, chlorine, and iron. These concentrations, however, are equal to or less than USEPA's secondary maximum

contaminant levels for drinking water. The quality of the water generally is adequate for domestic use, or it can be treated and made adequate for most uses. Contaminated and turbid waters are common problems for the users of water from the carbonate aquifers in Ordovician rocks. The thin soil and residuum and the presence of solution-karst features allow water from the land surface to recharge the aquifer directly and rapidly. Contaminated and sediment-laden waters can then spread through a system of interconnected solution openings, which can eventually cause the waters to reach wells and springs (Lloyd and Lyke 1995).

Groundwater in karst terrains is readily susceptible to contamination, as the water can travel long distances through conduits with no chance for the natural filtering processes of soil or bacterial action to diminish the contamination. In unconfined conditions, karst aquifers have very high flow and contaminant transport rates under rapid recharge conditions such as storm events (Tennessee Department of Environment and Conservation [TDEC] 2002a). Consequently, the groundwater sources in karst aquifers considered most vulnerable to contamination are those that are under the direct influence of surface water.

Karst springs support the base flow of the streams to which they discharge. This means that most public systems in karst areas use water from a karst aquifer when they withdraw from a surface stream or reservoir.

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

Several karst features occur along the proposed ROWs. Karst features in the project area include sinkholes, disappearing streams, reappearing streams (springs), and caves.

3.1.1. Rutherford 500-kV Substation

The 53.1-acre substation site is located within Rutherford County. Public drinking water for Rutherford County is not supplied by groundwater sources (TDEC 2002b). The substation is not within a State Designated Source Water Protection Area. However, privately owned wells supply water to area restaurants, schools, and marinas in the county (USEPA 2007). Residential wells may also occur near the project area. No karst features were found in the substation area.

3.1.2. Maury Transmission Line

During field surveys and map reviews of the Maury Transmission Line ROW, 24 karst features were identified. These features include 21 small to very large sinkholes, two caves (one with a spring flowing from it), and a disappearing stream.

The Maury Transmission Line spans parts of Rutherford, Williamson, and Maury counties. Public drinking water for Williamson and Maury counties is supplied by both surface water and groundwater sources (TDEC 2002b). Approximately 5 miles of the proposed ROW at the Rutherford and Williamson County line located between Windrow Road and Allisonna Road is within a State Designated Source Water Protection Area. Privately owned wells supply water to area restaurants, schools, and marinas in the county (USEPA 2007). Residential wells may occur near the project area.

3.1.3. Almaville Transmission Line

Sixteen karst features, all sinkholes of various sizes, were identified along the Almaville Transmission Line. Three of these sinkholes are filled with refuse: two are filled with tires, and one is filled with household trash and debris from land clearing.

The Almaville Transmission Line ROW is entirely in Rutherford County and is not within a State Designated Source Water Protection Area. However, privately owned wells supply water to area restaurants, schools, and marinas in the county (USEPA 2007). Residential wells may occur near the project area.

3.1.4. Christiana Transmission Line

Thirty-one karst features were identified along the Christiana Transmission Line. Seven of these, all sinkholes, are shared with the Maury Transmission Line. This ROW spans 29 small to very large sinkholes and two caves entrances. Both cave entrances and many of the karst features along the proposed ROW, especially those clustered between SR 99 and Windrow Road, may have interconnections to the Snail Shell Cave System.

This section of the ROW is entirely in Rutherford County and is not within a State Designated Source Water Protection Area. However, privately owned wells supply water to area restaurants, schools, and marinas in the county, and residential wells may occur near the project area.

3.2. Surface Water

Precipitation in the project area averages about 55 inches per year with March being the wettest month at 5.8 inches and October the driest at 3.5 inches of rainfall. The average annual air temperature is 58°F, ranging from a monthly average of 35°F in January to 78°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. Precipitation, annual temperature, stream flow and runoff data are similar across all project areas. Drainage areas for each major project component are described below.

3.2.1. Rutherford 500-kV Substation

The Rutherford Substation area drains to Nelson Creek, a tributary of the Harpeth River in the Cumberland River Basin. As defined by TDEC, Nelson Creek is classified for uses for fish and aquatic life, recreation, livestock watering and wildlife, and irrigation. The Harpeth River is classified for uses for domestic water supply, industrial water supply, fish and aquatic life, recreation, livestock watering and wildlife, and irrigation. TDEC lists the Harpeth River on the 2006 303(d) list as impaired (i.e., not fully supporting its designated uses) due to low dissolved oxygen, siltation, and lead. Two intermittent streams and a small farm pond are located on the proposed substation site.

An intermittent stream crosses 91 feet of the proposed substation site on the northwest corner of the site. A second intermittent stream begins on the site and flows south 82 feet before leaving the property boundary. The perimeter of the pond is 520 feet with the area of 19,834 square feet.

3.2.2. Maury Transmission Line

The Maury Transmission Line area drains to tributaries of Kentucky Reservoir on the Tennessee River and to tributaries of Cheatham Reservoir on the Cumberland River. Streams along the proposed Maury Transmission Line and their use classifications as defined by TDEC are listed in Table 3-1. This transmission line would cross a Nationwide

Rivers Inventory (NRI) stream (Harpeth River) and is within 3 miles of another NRI stream (Overall Creek in the Stones River drainage). See Section 3.9.2 for additional details.

Within the Maury Transmission Line project area, five streams were listed as impaired (i.e., not fully supporting its designated uses) in the 2006 TDEC 303(d) assessment (Table 3-2).

Table 3-1. Stream Use Classifications - Maury Transmission Line

Stream	Use Classification[1]						
	DWS	IWS	FAL	REC	LWW	IRR	NAV
Tennessee River (Kentucky Reservoir)	X	X	X	X	X	X	X
Duck River		X	X	X	X	X	
Rutherford Creek	X	X	X	X	X	X	
Double Branch			X	X	X	X	
Crooked Creek			X	X	X	X	
Flat Creek			X	X	X	X	
Little Flat Creek			X	X	X	X	
Carlton Branch			X	X	X	X	
Comstock Creek			X	X	X	X	
Wallace Branch			X	X	X	X	
Boone Creek			X	X	X	X	
Cumberland River (Cheatham Reservoir)	X	X	X	X	X	X	X
Harpeth River	X	X	X	X	X	X	
Overall Creek			X	X	X	X	
Cove Branch			X	X	X	X	
Nelson Creek			X	X	X	X	
Windrow Branch			X	X	X	X	

Source: TDEC 2004
[1] DWS = domestic water supply; IWS = industrial water supply; FAL = fish and aquatic life; REC = recreation; LWW = livestock watering and wildlife; IRR = irrigation; NAV = navigation

Table 3-2. Impaired Stream Classifications - Maury Transmission Line

Stream	303(d) Impaired Stream			High Quality
	Use Support	Cause	Source	
Tennessee River (Kentucky Reservoir)	Yes			Yes
Duck River	Impaired	Phosphorus, Low Dissolved Oxygen	Major Municipal Point Source, Discharges from MS4 Area	Yes
Rutherford Creek	Impaired	Siltation, Nitrates, Phosphorus	Minor Municipal Point Source, Land Development	No
Double Branch	Yes			No
Crooked Creek	Impaired	Siltation, Physical Substrate Habitat Alteration	Pasture Grazing	No
Flat Creek	Yes			Yes
Little Flat Creek	Yes			Yes
Carlton Branch	Yes			No
Comstock Creek	Yes			No
Wallace Branch	Impaired	E. Coli	Pasture Grazing	No
Boone Creek	Yes			No
Cumberland River (Cheatham Reservoir)	Yes			No
Harpeth River	Impaired	Low Dissolved Oxygen, Siltation, Lead	Pasture Grazing, Removal of Riparian Vegetation, Industrial Point Source Discharge, Contaminated Sediment	Yes
Overall Creek	Yes			Yes
Cove Branch	Yes			No
Nelson Creek	Yes			No
Windrow Branch	Yes			No

Source: TDEC 2006
E. coli = Escherichia coli
MS4 = Municipal Separate Storm Sewer Systems

3.2.3. Almaville Transmission Line

The Almaville Transmission Line project area drains to Stewart Creek, a tributary of J. Percy Priest Reservoir on the Stones River, and to Nelson Creek, a tributary of the Harpeth River, all in the Cumberland River Basin. NRI-listed Overall Creek (in the Stones River drainage) at its headwaters is approximately 2.4 miles southeast of the proposed transmission line.

As defined by TDEC, Stewart Creek is classified for uses for fish and aquatic life, recreation, livestock watering and wildlife, and irrigation. The Stones River is classified for uses for domestic water supply, industrial water supply, fish and aquatic life, recreation, livestock watering and wildlife, and irrigation. Nelson Creek is classified for uses for fish and aquatic life, recreation, livestock watering and wildlife, and irrigation. Harpeth River is classified for uses for domestic water supply, industrial water supply, fish and aquatic life, recreation, livestock watering and wildlife, and irrigation. TDEC assessed Stewart Creek on the 2006 303(d) list as impaired (i.e., not fully supporting its designated uses) due to siltation and nitrates. In addition, TDEC assessed the Harpeth River on the 2006 303(d) list as impaired due to low dissolved oxygen, siltation, and lead.

3.2.4. Christiana Transmission Line

The Christiana Transmission Line project area drains to tributaries of J. Percy Priest Reservoir on the Stones River and to tributaries of the Harpeth River, all in the Cumberland River Basin. The proposed transmission line is a mile southwest of the headwaters of Overall Creek (in the Stones River drainage), 2.5 miles northeast of Harpeth River, both NRI streams. Table 3-3 identifies streams in the project area and their use classification as defined by TDEC. Table 3-4 lists five streams in the project area that are assessed on the 2006 TDEC 303(d) list as impaired (i.e., not fully supporting its designated uses).

Table 3-3. Stream Use Classifications - Christiana Transmission Line

Stream	Use Classification[1]						
	DWS	IWS	FAL	REC	LWW	IRR	NAV
Cumberland River (Cheatham Reservoir)	X	X	X	X	X	X	X
Harpeth River	X	X	X	X	X	X	
Nelson Creek			X	X	X	X	
Windrow Branch			X	X	X	X	
Concord Creek			X	X	X	X	
Stones River (J. Percy Priest Reservoir)	X	X	X	X	X	X	
West Fork of the Stones River	X	X	X	X	X	X	
Overall Creek			X	X	X	X	
Puckett Creek			X	X	X	X	
Armstrong Branch			X	X	X	X	
Panther Creek			X	X	X	X	
Lytle Creek			X	X	X	X	
Christmas Creek			X	X	X	X	

Source: TDEC 2004

[1] DWS = domestic water supply; IWS = industrial water supply; FAL = fish and aquatic life; REC = recreation; LWW = livestock watering and wildlife; IRR = irrigation; NAV = navigation

Table 3-4. Impaired Stream Classifications - Christiana Transmission Line

Stream	303 (d) Impaired Stream			High Quality
	Use Support	Cause	Source	
Cumberland River (Cheatham Reservoir)	Yes			No
Harpeth River	Impaired	Lead, Low DO, Siltation	Industrial Point Source Discharge, Contaminated Sediment, Pasture Grazing, Removal of Riparian Vegetation	Yes
Nelson Creek	Yes			No
Windrow Branch	Yes			No
Concord Creek	Impaired	Habitat Loss Due to Alteration in Streamside or Littoral Vegetative Cover, Siltation	Pasture Grazing, Removal of Riparian Vegetation	No
Stones River (J. Percy Priest Reservoir)	Yes			No
West Fork of the Stones River	Impaired	Siltation	Land Development, Pasture Grazing	Yes
Overall Creek	Yes			No
Puckett Creek	Yes			No
Armstrong Branch	Yes			No
Panther Creek	Yes			No
Lytle Creek	Impaired	Siltation, E. coli	Pasture Grazing	No
Christmas Creek	Impaired	Siltation, E. coli	Pasture Grazing	No

Source: TDEC 2006
E. coli = Escherichia coli

3.3. Aquatic Ecology

The proposed substation and transmission lines are within drainages of the Stones, Harpeth, and Duck rivers in Rutherford, Williamson, and Maury counties in the Nashville Basin of Tennessee. Streams of the Nashville Basin are characterized by low to moderate gradient and virtually paved in some areas with expanses of limestone bedrock interspersed with rock rubble riffle areas, silty basins, and some sand and gravel reaches (Etnier and Starnes 1993). Many streams are dry, reduced to isolated pools, or are subterranean during the late summer and fall (TDEC 2003). The limestones freely leach nutrients and, consequently, waters are very productive, and algae and rooted vegetation are abundant in streams.

The upper Duck, Stones, and Harpeth rivers support diverse aquatic communities. These rivers support 102, 72, and 64 native fish species, respectively (NatureServe 2006). Aquatic insects, mussels, snails, and other aquatic organisms are expected to be similarly diverse in these drainages. Representative fish and mussels occupying streams in the

drainages are described in Etnier and Starnes (1993) and Parmalee and Bogan (1998), respectively. Of the known aquatic animal species that occur in these watersheds, a few have been federally and/or state-listed as endangered, threatened, or other conservation status because of concerns for their survival (Section 3.6).

The majority of perennial and intermittent streams in the study area have substrates consisting of bedrock with some gravel, cobble, rubble, and sand. Larger named streams whose watersheds occur within portions of the study area, streams that contain unique resources (i.e., trout streams), and streams currently listed as "impaired" for one or more uses by TDEC are described below for the major project components. Because transmission line construction and maintenance activities mainly affect riparian conditions, instream and riparian habitat conditions are evaluated at each stream crossing and assigned to one of three riparian condition classes (Table 3-5). Appropriate SMZ widths and best management practices (BMPs) are then assigned based upon these evaluations and other considerations (i.e., 303(d) listing, unique habitats, and endangered or threatened species). These BMPs minimize impacts to water quality and instream habitat for aquatic organisms. Riparian habitat condition classes are:

- "Forested" - Riparian area is fully vegetated with trees, shrubs, and herbaceous plants. Vegetative disruption from mowing or grazing is minimal or not evident. Riparian width extends more than 60 feet on either side of the stream.
- "Partially forested" - Although not forested, sparse trees and/or shrub/scrub vegetation is present within a wider band of riparian vegetation (20-60 feet). Disturbance of the riparian zone is apparent.
- "Nonforested" - No or few trees are present within the riparian zone. Significant clearing has occurred, usually associated with pasture or cropland.

Table 3-5. Stream Riparian Condition Summary for Perennial and Intermittent Stream Crossings Within the Rutherford Project Area

Project Area	Perennial Streams				Intermittent Streams			
Riparian Zone	**Forested**	**Partially Forested**	**Non-Forested**	**Total**	**Forested**	**Partially Forested**	**Non-Forested**	**Total**
Rutherford Substation Site	0	0	0	0	1	0	1	2
Maury Transmission Line	2	25	15	42	4	5	5	14
Almaville Transmission Line	3	1	0	4	10	2	2	14
Christiana Transmission Line	1	3	2	6	11	5	7	23
Total	**6**	**29**	**17**	**52**	**26**	**12**	**15**	**3**

3.3.1. Rutherford 500-kV Substation

Five watercourses, all tributaries of Nelson Creek, were identified during a field survey in April 2007 on the proposed substation site. These include two intermittent streams, two wet-weather conveyances (WWCs), and one pond.

One intermittent stream crosses 91 feet of the northwest corner of the site. The second intermittent stream begins on the site and flows south 82 feet before leaving the property boundary. The perimeter of the pond is 520 feet with the area of 19,834 square feet. See Appendix J - Table J-1.

The TVA Natural Heritage database indicated that one federally and nine state-listed aquatic species are known to occur in Rutherford County and within 10 miles of the proposed substation site (Section 3.6). However, because none of these intermittent streams and WWCs located on the Rutherford Substation site support persistent aquatic communities or contain any unique or important aquatic habitat, none of these species would occur within the area affected by substation construction and operation. Additionally, the one small farm pond located on the site does not contain any notable aquatic community or habitat.

3.3.2. Maury Transmission Line

The proposed Maury Transmission Line would be located in the Harpeth and Duck River watersheds. A total of 105 watercourses were identified during a field survey conducted in February 2007. These include 42 perennial streams, 15 intermittent streams, 37 WWCs, and 11 ponds (Appendix J - Table J-2). Few of the riparian zones of these streams are forested, and most show signs of agricultural or other clearing (Table 3-5). The most intact and mature riparian forests are at the crossings of Rutherford Creek and the Harpeth River. Some of the larger named streams crossed by the proposed Maury Transmission Line in the Duck River drainage include Rutherford Creek, Double Branch, Crooked Creek, and Little Flat Creek.

Crooked Creek and Rutherford Creek are listed by TDEC (Section 3.2) as impaired due to siltation and other causes. Land use practices including development, row crops, cattle grazing, and riparian clearing contribute to the siltation problems in the streams. Transmission line construction and maintenance activities could contribute to additional siltation in these streams.

Larger named streams in the Harpeth River drainage include Overall Creek, Harpeth River, and Nelson Creek. Numerous other unnamed watercourses are also located along the proposed transmission line. The Tennessee Wildlife Resources Agency (TWRA) stocks a “put-and-take” trout fishery in the Duck River near the southern end of the proposed transmission line; however, the portion of the river with the trout fishery would not be crossed by the line.

The TVA Natural Heritage database indicated that nine federally and 21 state-listed aquatic species are known to occur within Rutherford, Williamson, and Maury counties and within 10 miles of the proposed Maury Transmission Line. Of these, the Nashville crayfish (federally listed), and four state-listed fish are not found within watersheds affected by the project (Section 3.6).

Located downstream and within 10 miles downstream of the proposed Maury Transmission Line is federally designated critical habitat (DCH) for the oyster mussel and Cumberlandian combshell (both federally listed).

3.3.3. Almaville Transmission Line

The proposed Almaville Transmission Line would be located in the Harpeth and Stones river watersheds. A field survey conducted in April 2007 documented 43 watercourses including four perennial streams, 14 intermittent streams, 22 WWCs, and four ponds (see Appendix J - Table J-3). The riparian zone of most of these streams is forested (Table 3-5).

The TVA Natural Heritage database indicated two federally and nine state-listed aquatic species are known to occur within Rutherford County and within 10 miles of the proposed Almaville Transmission Line. Of these, the Nashville crayfish and redband darter are not found within affected watersheds (Section 3.6).

3.3.4. Christiana Transmission Line

The proposed Christiana Transmission Line would be located in the Harpeth and West Fork of the Stones River watersheds. A total of 56 watercourses were documented during a field survey conducted in April of 2007. These include five perennial streams, 24 intermittent streams, 20 WWCs, and seven ponds (see Appendix J - Table J-4). Most of the stream riparian zones are forested or partially forested (Table 3-5). Some of the larger named streams crossed by the proposed transmission line include Panther Creek, West Fork of the Stones River, and tributaries of Overall Creek in the Stones River watershed and Nelson Creek in the Harpeth River watershed. Numerous other unnamed watercourses are also located along the proposed transmission line. The West Fork of the Stones River downstream of the proposed transmission line crossing is listed by TDEC as impaired because of loss of biological integrity due to siltation. Land uses along this transmission line segment are similar to conditions described for the Maury segment.

The TVA Natural Heritage Database indicated that two federally and 10 state-listed aquatic species are known to occur within Rutherford County and within 10 miles of the proposed Christiana Transmission Line. Of these, the Nashville crayfish, and two state-listed fish are not found within affected watersheds (Section 3.6).

3.4. Vegetation

The project area is in the Outer Nashville Basin and Inner Nashville Basin level IV Ecoregions (Chapman et al. 2004). The Outer Nashville Basin rings the Inner Nashville Basin and is typified by rolling hills with Ordovician Age limestone at lower elevations and Mississippian Age formations at higher elevations. The Inner Nashville Basin is flatter and at a lower elevation than the Outer Nashville Basin. Forest, pasture, and croplands are the dominant vegetation cover types in this region.

Ten rare plant communities, as classified by NatureServe (2007), are known from Rutherford, Williamson, and Maury counties (Appendix K). Each of these plant communities is defined by the presence of specific plant species. Besides plant species composition, the very nature of these rare communities tends to make it more likely that federally or state-listed species are present. Four of these communities occur in the vicinity of the proposed substation and transmission lines; these communities are restricted to the Nashville Basin, the Moulton Valley of Alabama, and limited areas of Kentucky. The four communities are:

- *Central Basin Limestone Glade Margin Shrubland*
  This community is restricted to dry limestone substrates and occurs along the edges of limestone cedar glades. Characteristic shrubs include eastern red cedar, glade privet, fragrant sumac, and golden St. John's wort. Endangered or threatened species known to occur in this habitat include Tennessee coneflower and Pyne's

ground-plum (NatureServe 2007). This community was found along the periphery of several glades within the proposed Maury, Almaville, and Christiana transmission line routes; no listed species were observed.

- *Interior Low Plateau Limestone Glade Ephemeral Pool*
  This herbaceous community occupies depressions in limestone glades that hold water in the winter and spring and are dry in the summer. Characteristic plants include widowscross, cedar glade-cress, necklace glade-cress, and the state-listed Tennessee glade-cress and limestone fameflower. This community may cover large parts of glade sites; however, its overall coverage is limited (ibid). This community was observed within the proposed Maury and Christiana transmission line routes. Several occurrences of Tennessee glade-cress and limestone fameflower were observed in this glade type.
- *Limestone Seep Glade*
  This annual herbaceous community is restricted to the Inner Nashville Basin and areas of Alabama and Kentucky and may cover large parts of glades (ibid). This community type occurs in very thin soil areas over limestone where there is not sufficient soil to support a dominant cover of perennial grasses or woody plants. These areas are seasonally wet, but dry out quickly in the summer. Much of the vegetation is a mixture of annual grasses and perennial forbs. Characteristic species include barrens drop seed, poverty drop seed, slim spike three-awn, wiry panic grass, and common panic grass. Though endangered or threatened plants such as Tennessee milk-vetch and Tennessee coneflower are known to occur in this habitat (ibid), no listed species were observed in this community in the project area. This community was observed within the proposed Maury, Almaville, and Christiana transmission line routes.
- *Limestone Annual Grass Glade*
  This fragile herbaceous community is only known from seasonal seepage areas in limestone glades found in the Nashville Basin and the Moulton Valley of Alabama. It is supported by seepage of groundwater from unconfined aquifers during winter and spring (ibid). This community is dominated by flat-stem spike rush, yellow sunnybell, Crawe's sedge, and nodding onion. Other characteristic species include false garlic, limestone quillwort, and star-grass. This vegetation type was observed within the proposed Maury and Almaville transmission line routes. Several occurrences of the threatened yellow sunnybell were observed within this glade community.

Limestone glades are a unique mixed grassland/forest vegetation type found in Central Tennessee and a few other areas. Distinctive in appearance, these areas are characterized by a mosaic of limestone outcroppings. Limestone glades occur within these outcrops and are surrounded by gravel and/or very thin soil (Baskin and Baskin 1994). Some limestone glades have a dominant eastern red cedar component and hardwood trees in deeper soils and are called limestone cedar glades. Most glades are wet in the winter and very dry in the summer. Glade communities are rich in endemic plant species (plants that grow in no other habitat). There are at least 22 plant species endemic to limestone glades and four of these species occur only in Central Tennessee (Baskin and Baskin 1989; 2002) (Appendix K). Limestone glades and other natural plant communities in the Nashville Basin are under threat from increasing urban, suburban, and industrial land use.

Nonnative, invasive species are also a threat to biodiversity and natural plant communities. Unchecked, invasives lead to the degradation of natural areas and displace native species.

Nonnative, invasive species occur in and around the proposed substation and transmission line ROWs. Species that are of particular concern because of their potential to spread rapidly and displace native vegetation have been compiled and are listed in the *Invasive Species of High Priority to TVA* (Appendix L).

During field surveys conducted in spring and summer 2007, TVA botanists identified invasive plants and plants that may become invasive and cause damage to native plant communities. To evaluate the invasive species within the proposed substation and transmission line ROWs, TVA used ranking designations determined by the Tennessee Exotic Plant Pest Council. These rankings are as follows:

- Rank 1 (R1) - "Severe Threat" - Exotic plant species that possess characteristics of invasive species and spread easily into native plant communities and displace native vegetation; includes species that are or could become widespread in Tennessee.
- Rank 2 (R2) - "Significant Threat" - Exotic plant species that possess characteristics of invasive species but are not presently considered to spread as easily into native plant communities as those species listed as Rank 1.
- Rank 3 (R3) - "Lesser Threat" - Exotic plant species that spread in or near disturbed areas and are not presently considered a threat to native plant communities.

3.4.1. Rutherford 500-kV Substation

The proposed Rutherford 500-kV Substation site is characterized by two main vegetation types: herbaceous vegetation (95 percent) and forest (5 percent). No rare plant communities occur on the site.

The proposed substation site was primarily active pasture in 2007. Common grasses observed included broomsedge, Kentucky blue grass, orchard grass, and tall fescue. Common forbs included beaked corn salad, goldenrod, ox-eye daisy, ragweed, sheep sorrel, and yarrow. Species composition was typical of heavily disturbed, grazed areas.

Though dry and rocky areas supported species commonly found in limestone glades, no distinct glade communities were found at the proposed substation site. Glade species observed include prickly pear, necklace glade-cress, pitcher's sandwort, and widowscross.

A small area (less than 1 percent) of the proposed substation site was identified as wetland. This wetland is dominated by weeds tolerant of seasonally wet areas such as hairy bittercress, Kentucky bluegrass, joe pye weed, rough cocklebur, seedbox, spike rush, and tall fescue. A previously unreported occurrence of the state-listed water stitchwort was identified in this area.

The 2.7-acre forested portion of the proposed substation site is deciduous with pole-sized (5-12 inches diameter at breast height) trees. The forested areas have been impacted by past clearing and agricultural practices. Winged elm, chinquapin oak, shingle oak, and black cherry were the dominant canopy species. Carolina buckthorn, coralberry, poison ivy, Virginia creeper, and Japanese honeysuckle occurred in the shrub layer. The herbaceous plants observed include bluntlobe cliff fern, ebony spleenwort, hairy wild rye, and spreading chervil in the ground layer.

Invasive species inhabiting the proposed substation site include Japanese honeysuckle (R1), Queen Anne's-lace (R2), sericea lespedeza (R1), and tall fescue (R2). Invasive

species populations observed at the proposed substation site were typically well established. All of these species are listed in *Invasive Species of High Priority to TVA* (Appendix L) and have the potential to spread rapidly and displace native vegetation.

3.4.2. Maury Transmission Line

The proposed Maury Transmission Line extends over 27 miles through Rutherford, Williamson, and Maury counties. Approximately 8 miles of the proposed Maury Transmission Line route occurs within maintained ROW; the remaining 19 miles are a mixture of forest and herbaceous vegetation types that have been modified by agriculture, forestry, and other development. The vegetation types observed along the proposed transmission line route include herbaceous vegetation (approximately 70 percent), forest (approximately 30 percent), and shrubland (less than 1 percent). About 190 acres of the Maury route is forested.

Herbaceous vegetation is dominated by forbs and other species having less than 25 percent cover. The proposed transmission line ROW is composed of herbaceous vegetation including managed pastures, row crops, residential lawns, and scattered small limestone glades. Common pasture and ROW species observed include bluegrass, broomsedge, coralberry, eastern red cedar, fescue, goldenrod, and orchard grass.

Although many areas with shallow soils occur within the ROW, limestone glades cover just over 5 acres. Herbaceous species present and characteristic of limestone glades include prickly pear, pitcher's sandwort, Indian breadroot, glade violet, cedar glade-cress, widowscross, purpletassels, and rose mock vervain. As described in Section 3.6, a few occurrences of state-listed plants occur in these glades or gladelike areas.

Each of the four rare plant communities identified in the project area occur within the proposed Maury ROW and they total 2.7 acres in size. Most of the rare glade communities observed were not confined to the ROW and were part of larger glade complexes scattered throughout the area.

Forests in the proposed transmission line ROW include deciduous, evergreen, and mixed forest types. Deciduous forest is characterized by trees with overlapping crowns where deciduous species account for more than 75 percent of the canopy cover. Deciduous forests occurring along the proposed transmission line route are subdivided into oak-hickory forest, mesic maple forest, and riparian forest.

Oak-hickory forest is the most common deciduous forest type along the proposed route and most of the stands are a mix of pole and sawtimber (> 12 inches diameter at breast height) size classes. Common overstory species observed in oak-hickory forests include black oak, chinquapin oak, pignut hickory, scarlet oak, shagbark hickory, Shumard's oak, white ash, and white oak. The smaller trees and shrubs in these areas include blue ash, Carolina buckthorn, coralberry, crossvine, fragrant sumac, hophornbeam, poison ivy, upland swamp privet, and Virginia creeper. Although the herbaceous layer was not well developed during the early spring field survey, cutleaf toothwort, whiteflower leafcup, ebony spleenwort, and hairy wild rye were present. A previously unrecorded population of several hundred toothache trees, state-listed as special concern, was found in the shrub layer of an oak-hickory forest.

Mesic maple forest is present in two areas, one near Columbia and one just west of US 31. Both stands are in the sawtimber size class. Species observed include bitternut hickory, black walnut, Ohio buckeye, sugar maple, and tulip poplar. The invasive tree-of-heaven

was prevalent in some of the larger mesic maple forested areas. Ramps, state-listed as special concern, were observed in a small patch of mesic forest on a rich east-facing slope.

Riparian forested areas are associated with watercourses. This forest type was most mature where the proposed transmission line would cross Rutherford Creek and the Harpeth River. Sycamore, sugarberry, boxelder, and ash were common woody species found in these areas. Herbaceous plants observed include purple phacelia, purple rocket, Virginia wild rye, white wingstem, and yellow wingstem.

Mixed evergreen-deciduous and evergreen forest occurs throughout the proposed transmission line route. These forest stands are a mix of sapling, pole and sawtimber size classes. In areas of thin soil that naturally support a mixed forest, eastern red cedar, chinquapin oak, post oak, and Shumard's oak dominate the canopy. Early successional mixed forests tended to have a greater proportion of black cherry, black locust, hackberry, honey locust, and sweetgum. Eastern red cedar comprises more than 75 percent of the canopy in the evergreen forest and between 25 percent to 75 percent in the mixed forest.

Shrubland exists in the proposed transmission line route in association with limestone cedar glades. Areas where shrubland occurs have shallower soils than the surrounding forests, but deeper soils than the herb-dominated glades. Dominant species in the shrublands included cedar glade St. John's wort, chinquapin oak, eastern red cedar, fragrant sumac, Shumard's oak, upland swamp privet, and winged elm.

Some disturbed areas of existing ROW, pasture, and forest along the proposed Maury route possess a large component of invasive exotic plant species. Plants observed include Chinese privet (R1), field garlic (R3), garlic mustard (R1), Japanese honeysuckle (R1), Japanese stilt grass (R1), Johnson grass (R1), multiflora rose (R1), ox-eye daisy (R3), sericea lespedeza (R1), tall fescue (R2), tree-of-heaven (R1), and winter creeper (R1). The invasive plant species observed along this route are considered common in the region and were typically well established.

3.4.3. Almaville Transmission Line

The proposed Almaville Transmission Line is approximately 9 miles long and occurs within Rutherford County. Of this, 6 miles would be on vacant, TVA-owned ROW and 3 miles would be on new ROW. Vegetation types observed along this route section include forest (approximately 80 percent), herbaceous vegetation (approximately 20 percent), and shrubland (less than 1 percent).

Forests located along the proposed Almaville Transmission Line ROW are divided into deciduous (65 percent), evergreen (5 percent), and mixed evergreen-deciduous (10 percent) forest types. Approximately 68 acres of the proposed route is forested.

The dominant deciduous forest type on the Almaville Transmission Line is maple-oak-hickory, an intermediate type between the oak-hickory forest and the mesic maple forest types found on the Maury Transmission Line. Most of the maple-oak-hickory forest, which comprises about two-thirds of the forest along the Almaville line, is mature sawtimber. Much of this type is located on knobby areas of rugged terrain near and on Indian and Scales mountains. Areas of exposed limestone are common. The limestone outcrops take many forms including ledges, fissures, flagstone, and boulders. Common overstory species in this vegetation type include black walnut, sugar maple, chinquapin oak, shagbark hickory, Shumard's oak, and white ash. Kentucky coffee tree, uncommon in this area, occurs in the transmission line ROW on Scales Mountain. The midstory contains American

elm, eastern red cedar, hackberry, hophornbeam, Ohio buckeye, sassafras, and sugar maple.

The herbaceous layer in the maple-oak-hickory forest type contains numerous species such as American hog peanut, Canada black snakeroot, Carolina spider lily, devil's darning needles, heartleaf nettle, Illinois woodsorrel, Jack in the pulpit, may apple, nodding fescue, purple rocket, rue anemone, roundleaf ragwort, smooth rock-cress, whiteflower leafcup, wild columbine, wild ginger, woodland bluegrass, and others. The federally listed as endangered Braun's rock-cress occurs in this forest type; it is described in more detail in Section 3.6.

Evergreen forest occurs in one section of the proposed transmission line route just south of Indian Mountain. This area is currently dominated by an early successional stand of eastern red cedar. The shrub layer is comprised primarily of Carolina buckthorn, coralberry, fragrant sumac, spicebush, and upland swamp privet. The area is relatively species poor and has a large population of the invasive plant species sericea lespedeza.

Mixed evergreen-deciduous forest occurs mostly on drier sites along the northern portion of the proposed transmission line. The overstory is made up of blue ash, eastern red cedar, shagbark oak, Shumard's oak, white ash, and winged elm. The relative abundance of these species changes according to site conditions (disturbance history, moisture, soil type, aspect, etc.). Some areas have a very thick growth of upland swamp privet and fragrant sumac in the shrub layer. American columbo, cinquefoil, comfrey, green violet, little sweet Betsy, and trumpet honeysuckle were observed in the herb layer.

Herbaceous vegetation observed along the proposed Almaville Transmission Line route is categorized as pasture or limestone glades. Pasture accounts for approximately 20 percent of the proposed route. These areas have few woody species and are dominated by nonnative plants. Typical species observed include bluegrass, broomsedge, clovers, dandelion, docks, English plantain, fescue, ironweed, lyreleaf sage, and orchard grass. The herbaceous vegetation in these areas was grazed by livestock or harvested for hay throughout the growing season.

Limestone glades are scattered throughout the length of the proposed transmission line route. These glades range from small openings among closed canopy forest to large glade complexes that covered several acres. Most of the limestone glades are relatively intact and exhibited few signs of recent disturbance such as invasive species or off-road vehicle traffic. Dominant species observed include bastard toadflax, false garlic, Gattinger's lobelia, limestone adder's tongue, Michaux's glade-cress, pitcher's sandwort, prickly pear, St. John's wort, shooting star, small skullcap, Tennessee glade-cress, yellow star-grass, and others. Two previously unrecorded occurrences of the state-listed yellow sunnybell were observed in seasonally wet glades. Small portions of the limestone glades within the proposed ROW, totaling about 0.20 acres in size, are classified as Limestone Seep Glade and Limestone Annual Grass Glade communities.

Shrublands occur along less than 1 percent of the proposed Almaville Transmission Line ROW, primarily in the periphery of limestone cedar glades where soils are deeper. Species observed include cedar glade St. John's wort, chinquapin oak, eastern red cedar, fragrant sumac, Shumard's oak, upland swamp privet, and winged elm.

Some disturbed areas of pasture and forest along the Almaville Transmission Line possess a large component of invasive plant species. These include Japanese honeysuckle (R1),

Japanese stilt grass (R1), ox-eye daisy (R3), sericea lespedeza (R1), tall fescue (R2), and tree-of-heaven (R1). A population of tree-of-heaven occurs along the Scales Mountain portion of the proposed Almaville Transmission Line within the DCH for Braun's rock-cress; see Section 3.6 for more on this area.

3.4.4. Christiana Transmission Line

The proposed Christiana Transmission Line route is approximately 15 miles long and is located in Rutherford County. Vegetation types observed include forest (approximately 60 percent), herbaceous vegetation (approximately 40 percent), and shrubland (less than 1 percent).

Forests located in the proposed Christiana Transmission Line ROW are divided into deciduous and mixed evergreen-deciduous forest types. The deciduous forest vegetation type can be further divided into oak-hickory, maple-oak-hickory, and wetland forest. About 109 acres of the Christiana Transmission Line route are forested.

The oak-hickory forest along the Christiana Transmission Line ROW is similar in composition and structure to that found along the Maury Transmission Line (Section 3.4.2) and makes up about 40 percent of the forest area. Most oak-hickory stands are sawtimber. Herbaceous species include fire pink, nettleleaf sage, sedges, sessile leaf bellwort, two flowered melic grass, Virginia snakeroot, and wild yam. More herbaceous species were encountered in this forest type along the proposed Christiana Transmission Line than the Maury Transmission Line because the field survey was conducted further into the growing season.

Maple-oak-hickory forest occurring along the proposed Christiana Transmission Line ROW is similar in composition and structure to that found along the proposed Almaville Transmission Line (Section 3.4.2). It makes up about 40 percent of the forest area and is mostly sawtimber. Three occurrences of the state-listed Canada lily and one of the state-listed Alabama snow-wreath, all four occurrences previously unreported, were observed in a maple-oak-hickory forest. Other herbaceous species observed include fire pink, nettleleaf sage, sedges, sessile leaf bellwort, Virginia snakeroot, and wild yam.

Wetland forest occurs in one area along the route near the Stones River. The primary overstory species observed are green ash, sweetgum, water oak, and willow oak. These species are well adapted to the poorly drained conditions found on the site. Bulbous bittercress, Frank's sedge, and straw colored flat sedge are the prevalent herbaceous species.

Mixed evergreen-deciduous forest occurs on about 10 percent of the proposed Christiana Transmission Line. It is primarily pole-sized and similar in composition and structure to mixed forest identified on the proposed Maury and Almaville transmission lines (Sections 3.4.2 and 3.4.3).

Herbaceous vegetation along the proposed Christiana Transmission Line is characterized as pasture or limestone glades. Pasture accounts for the vast majority of herbaceous vegetation and is similar in composition and structure to pasture occurring on the Almaville Transmission Line (Section 3.4.3).

Limestone glades observed were similar in composition and structure to those found on the Maury and Almaville transmission line segments (Sections 3.4.2 and 3.4.3). A previously unreported population of the federally listed as endangered Pyne's ground-plum was

observed near the proposed ROW, and occurrences of the state-listed Tennessee milk-vetch, limestone fameflower, and Tennessee glade-cress were observed within other areas of the proposed ROW. These are described in more detail in Section 3.6. The Glade Margin Shrubland, Limestone Glade Ephemeral Pool, and Limestone Annual Grass Glade vegetation types occur within the proposed Christiana Transmission Line ROW and total about 0.20 acres.

3.5. Wildlife

The project area occurs in a landscape heavily disturbed and shaped by previous agricultural, forestry, and development activities. Just over half of the substation site and transmission line ROWs (52 percent) consist of early successional habitats, with the remaining area composed of forested habitats (48 percent). The forested habitat occurs mostly in fragments, but approximately 15 acres of over 500 acre contiguous forest associated with the periphery of Indian and Scales mountains would be crossed by the Almaville Transmission Line ROW.

The composition and abundance of wildlife species in the project area varies with habitat type and size, food availability, surrounding land use, and other limiting factors. Similar species of wildlife occur in each section of this project, but some differences were observed. Features occurring within the proposed project area included a variety of karst features, such as caves, sinkholes, and outcrops. Aquatic features include vernal pools, farm ponds, and streams.

Eight caves have been reported from within 3 miles of the proposed project area. Multiple entrances of the Snail Shell Cave System occur in the vicinity of the proposed Christiana Transmission Line (Section 3.5.4). No heron colonies or DCH for terrestrial animals occur in the project area.

3.5.1. Rutherford 500-kV Substation

The proposed 53.1-acre substation site is mostly early successional habitat (95 percent) with 5 percent consisting of forested fragments. Active pasture and herbaceous vegetation with shrubs are scattered throughout. A wetland and an associated pond containing emergent vegetation occur on the proposed substation site. The close proximity of herb, shrub, wetland, and a few trees creates a diverse environment that hosts numerous wildlife species. Many species of birds were observed within the proposed substation site including Canada goose, Cooper's hawk, eastern phoebe, barn swallow, American crow, blue-gray gnatcatcher, white-eyed vireo, yellow-breasted chat, eastern meadowlark, red-winged blackbird, blue-winged warbler, yellow warbler, Kentucky warbler, common yellowthroat, indigo bunting, field sparrow, eastern towhee, and orchard oriole. The site provides habitat for various mammals and reptiles, such as white-tailed deer, eastern cottontail, black ratsnake, and eastern fence lizard. Amphibians are mostly restricted to the wetlands on site and include green frog, bullfrog, northern cricket frog, red-eared slider, and midland watersnake.

No caves or other unique terrestrial animal habitats occur on the property. The nearest known cave is approximately 0.5 mile from the proposed substation site. A railroad car on the site and several abandoned farm buildings are being used by nesting barn swallows; no bats were found using these structures.

3.5.2. Maury Transmission Line

The proposed Maury Transmission Line route crosses a landscape heavily affected by agriculture, forestry, and development practices. Eight miles of the route occur on an

existing ROW, and the remainder of the proposed route crosses a mixture of early successional habitats (70 percent) and several forest types (30 percent). Early successional habitats include mostly pastures and herbaceous vegetation (particularly in the existing ROW), with small areas of shrubland, limestone glades, cropland, and developed areas.

Pastures and other herbaceous vegetation provide habitat for early successional bird species such as Carolina wren, eastern bluebird, American robin, brown thrasher, white-eyed vireo, yellow-breasted chat, prairie warbler, indigo bunting, northern cardinal, blue grosbeak, field sparrow, song sparrow, and orchard oriole. Birds found in early successional habitats with a dominant grass component include field sparrow, northern bobwhite, and eastern meadowlark. Small mammals such as eastern mole, white-footed mouse, prairie vole, and larger mammals such as eastern cottontail, woodchuck, and white-tailed deer can be abundant in early successional habitats. Predators that hunt small mammals in these areas include red fox, coyote, snakes, and raptors such as American kestrel and red-tailed hawk.

Limestone cedar glades are mostly associated with the shrubland component, and in the Maury section some aquatic habitat is included. A study of limestone cedar glades elsewhere in the Nashville Basin found 16 amphibians and 19 reptiles (Jordan 1986). Reptiles occurring in limestone cedar glades include eastern box turtle, northern fence lizard, five-lined skink, southeastern five-lined skinks, broad-headed skink, six-lined racerunner, common garter, eastern hognose snakes, and northern black racer. Amphibians in this habitat would be more common near streams and wetlands, and include red-spotted newt, zigzag salamander, eastern narrow-mouthed toad, American and Fowler's toads, northern cricket frog, upland chorus frog, and Cope's gray treefrog. Birds occurring on glades include several of the species listed above for other early successional habitats, most notably the yellow-breasted chat, prairie warbler, indigo bunting, and field sparrow, as well as the common nighthawk and the lark sparrow. The lark sparrow is listed as threatened in Tennessee.

The monotypic vegetation in croplands has little value to wildlife. Within developed areas, human disturbances deter some animals and attract others. Amphibians and reptiles often occurring in developed areas include common garter snake, American toad, Cope's gray treefrog and five-lined skink. Birds that often nest in developed areas are eastern bluebird, northern mockingbird, American robin, American goldfinch, and northern cardinal. Common mammals in these environments include eastern gray squirrel, eastern chipmunk, raccoon, Virginia opossum, and striped skunk. Nonnative terrestrial animals occurring in developed areas include rock pigeon, European starling, house sparrow, Norway rat, and house mouse.

Half of the portion containing forested habitat is deciduous forest consisting primarily of oak-hickory along with portions of mesic and riparian forest. The other forests consist of both mixed evergreen-deciduous and evergreen forest types.

The oak-hickory forest is dryer than the mesic forest type, but many of the same wildlife species are found in both forests types. Common birds in the oak-hickory forests are scarlet tanager, summer tanager, blue jay, American crow, red-bellied woodpecker, pileated woodpecker, downy woodpecker, blue-gray gnatcatcher, Carolina chickadee, tufted titmouse, white-breasted nuthatch, wild turkey, and broad-winged hawk. Mammals frequently found are eastern gray squirrel, white-footed mouse, and eastern chipmunk. Fewer amphibians and reptiles are common in these dryer forests, but slimy salamander,

eastern zigzag salamander, black rat snake, ring-necked snake, and eastern box turtle can be found. Within mesic forests, many of these same species also occur, as do the worm snake, brown snake, spotted dusky salamander, southern two-lined salamander, Fowler's toad, northern cricket frog, and green frog. Common nesting birds are Acadian flycatcher, wood thrush, and Kentucky warbler, and mammals include cotton mouse, woodland voles, eastern pipistrelle, red bat, gray fox, and short-tailed shrew.

Riparian forests and other terrestrial habitats adjacent to streams, ponds, and wetlands are often productive habitats. This forest type was most mature where the proposed transmission line would cross Rutherford Creek and the Harpeth River. These areas are breeding habitats for toads, frogs, and salamanders, and support a variety of other animal life such as turtles, snakes, and mammals. Amphibians and reptiles found in forested areas near water include northern cricket frog, green frog, snapping turtle, southern two-lined salamander, queen snake, and midland water snake. Birds that nest in riparian forests include wood duck, belted kingfisher, barred owl, Acadian flycatcher, and eastern phoebe. Mammals frequently found are muskrat, mink, beaver, and raccoon.

Mixed evergreen-deciduous forest and evergreen forest make up the other half of the forested habitat on this proposed route. Eastern red cedar is prevalent in the project area, forming dense thickets that provide cover, roosts, and food for wildlife. Common birds known to nest in cedars include American robin, northern mockingbird, chipping sparrow, and song sparrows. Many birds eat the berrylike fruit, especially the cedar waxwing. The twigs and foliage are browsed by white-tailed deer. Amphibians are typically absent from dry cedar thickets but can be common in areas near water and areas with woody debris and rocks for refuge. Northern zigzag salamanders were found in areas with heavy cedar cover. Reptiles such as black racer are also found in these habitats.

This portion of the project area occurs in a karst-rich region of the country. Numerous sinkholes, limestone rock outcrops, and other karst features are scattered along the proposed route. Allegheny woodrats, timber rattlesnake, and the crevice-roosting eastern pipistrelle occur in karst features such as these. Caves capable of supporting cave roosting bats, such as gray bat, small-footed bat, and big brown bat were not observed. Four caves exist within 3 miles of the proposed Maury route. All these caves are at least a mile away from the proposed route. During field investigations, a previously unreported cave with a stream flowing from its entrance was located within the proposed transmission line ROW. This cave is considered unsuitable for bats or other terrestrial cave-obligate species due to the small size of the cave and the fact that it likely floods during rain events, flushing out any possible inhabitants. However, amphibians including cave salamander, slimy salamander, northern zigzag salamander, and pickerel frog were observed in or near the cave entrance.

3.5.3. Almaville Transmission Line

This section of proposed transmission line route was 80 percent forested and 20 percent early successional habitats. The forested habitat can be further divided into deciduous (65 percent), mixed evergreen-deciduous (10 percent), and evergreen (5 percent) forest types. Similar to other sections of the proposed project, eastern red cedar is either dominant in the evergreen forest types or a major component in the mixed forest types.

The deciduous forest type is dominated by oak and hickory tree species and has numerous areas of exposed limestone and karst features. Some of the largest continuous sections of forested habitat (over 500 acres) occur on Indian and Scales mountains. Approximately 15 acres of the forest associated with the periphery of Indian and Scales mountains would be

crossed by the Almaville portion of the proposed transmission line. Species observed in this habitat would be similar to those described in the Maury Transmission Line section.

The mixed evergreen-deciduous forest type is dominated by eastern red cedar. Species observed in this habitat would be similar to those described for the Maury Transmission Line ROW (Section 3.5.2).

The early successional habitats on this section of ROW are either pasture or limestone cedar glades, with some shrubland associated with the latter. Species common in limestone cedar glades are similar to those occurring in the Maury Transmission Line ROW, although there were fewer aquatic features in the glades on this section of transmission line and thus likely fewer amphibians.

The closest known caves are 2 and 2.5 miles from the proposed transmission line route. Limestone outcrops, sinkholes, and other karst features were common, but no caves were located within the proposed transmission line route during field investigations.

3.5.4. Christiana Transmission Line

The proposed Christiana Transmission Line route is composed of forested habitats and early successional habitat. Fifty percent of the forested habitats were deciduous forest and 10 percent were mixed evergreen-deciduous (with the evergreen component of the forest dominated by eastern red cedar). Karst features and several aquatic features were scattered among habitats along this transmission line ROW.

The deciduous forest type of this transmission line ROW can be further divided into oak-hickory, maple-oak-hickory, and one small area of wetland forest. Species occurring in this habitat are similar to those occurring along the Maury Transmission Line (Section 3.5.2).

The mixed evergreen-deciduous forests still contain dominant hardwood species and so contain similar species as the deciduous forests.

Early successional habitats on this portion of the project are categorized as either pasture or limestone cedar glades. Species occurring in these habitats would be similar to those described in the Maury Transmission Line ROW (Section 3.5.2).

Ponds and vernal pools along the proposed Christiana Transmission Line route provide habitat for numerous species not found in drier environments. A 6-acre pond and a 1-acre pond containing emergent wetlands exist outside of the proposed route near the southeast end. Amphibians and reptiles observed at these ponds include upland chorus frog, northern cricket frog, and green frog; northern water snake and spiny softshell and snapping turtles. The shallow wetlands provide foraging habitat for herons and egrets. Waterfowl species likely to use these aquatic features include Canada geese, blue-winged teal, and ring-necked duck. Vernal pools in forested areas near Panther Creek provide breeding habitat for woodland amphibians including the mole salamander.

Six caves occur within 3 miles of the proposed Christiana Transmission Line route. Three of these caves are entrances of the extensive Snail Shell Cave System located near this proposed route including Nanna Cave, located approximately 150 feet from the proposed transmission line ROW. Three additional caves are recorded approximately 0.1, 0.9, and 1.0 mile from the proposed Christiana Transmission Line. No additional caves were found during field investigations, although several sinkholes and other karst features occur throughout the route.

Caves provide habitat for a variety of wildlife. Many common and rare species occur in caves. Common species include slimy salamander, cave salamander, big brown bat, and small-footed bat. Eastern phoebes frequently nest on the outside ledge of a cave. Many endangered and threatened species also occur in caves. The federally listed gray bat and the state-listed Tennessee cave salamander and Allegheny woodrat inhabit caves within the three county area. Caves are important ecosystems and often contain many rare organisms that have adapted to the unique cave ecosystem.

The Snail Shell Cave System, a prominent karst feature within the area, is the longest continuous cave in the Tennessee Central Basin region. It is considered one of the most biologically significant caves sites in the Southeastern United States (Southeastern Cave Conservancy Inc. 2002). Many species of cave millipedes, snails, beetles, and other cave-obligate invertebrates have been recorded within the Snail Shell Cave System. It was also named one of the Top Ten Most Endangered Karst Communities by the Karst Waters Institute based upon "threats from trespassing, vandalism, logging, and factors related to encroaching sprawl and development from the nearby city of Murfreesboro" (Southeastern Cave Conservancy Inc. 2002). Initial project scoping considered this cave system when planning transmission line routes, and preliminary line routes were adjusted to move them farther from the cave entrances.

3.6. Endangered and Threatened Species

3.6.1. Aquatic Animals

According to available information sources, including the TVA Natural Heritage database, nine federally and 21 state-listed aquatic species are known to occur in Rutherford, Williamson, and Maury counties (Table 3-6). An area of designated critical habitat (DCH) for five mussel species (purple bean, Cumberlandian combshell, Cumberland elktoe, oyster mussel, and rough rabbitsfoot) is located downstream of the project area in the Duck River. This DCH unit is occupied by only two of these species: oyster mussel and Cumberlandian combshell.

Species occurring in affected watersheds along each segment of proposed transmission line are identified in Table 3-6. No species occur within areas affected by the proposed substation construction or maintenance. The Nashville crayfish does not occur in potentially affected watersheds. The following are descriptions of the listed species that occur within the watersheds affected by the proposed project.

The ashy darter inhabits small to medium upland rivers of the Tennessee River and Cumberland River drainages. It prefers bedrock or gravel substrate with boulders, water willow, or other cover with minimal silt deposits. The water quality necessary to maintain silt-free pool areas is now rare in these regions, and it is likely that populations of this species were extirpated before their discovery (Etnier and Starnes 1993).

The bedrock shiner inhabits bedrock pools of low-gradient streams in the Stones and lower Caney Fork river systems and direct Cumberland River tributaries between these systems in Cannon, Rutherford, Smith, and Wilson counties, Tennessee (ibid). There are also some records of the bedrock shiner in the Duck River in Bedford County (NatureServe 2006). Sedimentation and habitat loss are threats to the bedrock shiner, and the species is ranked as imperiled in Tennessee due to its very restricted range in the Nashville basin (ibid).

Table 3-6. Federally and State-listed Aquatic Species Known From Rutherford, Williamson, and Maury Counties, Tennessee, and/or Within a 10-Mile Radius of the Project Area

Common Name	Scientific Name	Status[1]		Maury Transmission Line[2]	Almaville Transmission Line[3]	Christiana Transmission Line[3]
		Federal	State			
Fish						
Ashy Darter	*Etheostoma cinereum*	--	THR (S2S3)	X	X	X
Bedrock Shiner	*Notropis rupestris*	--	NMGT (S2)	X[5]	X	X
Coppercheek Darter	*Etheostoma aquali*	--	THR (S2S3)	X		
Saddled Madtom	*Noturus fasciatus*	--	THR(S2)	X		
Flame Chub	*Hemitremia flammea*	--	NMGT(S3)	X		
Golden Darter	*Etheostoma denoncourti*	--	NMGT (S2)	X		
Redband Darter	*Etheostoma luteovinctum*	--	NMGT (S4)	X	X[5]	X[5]
Slenderhead Darter	*Percina phoxocephala*	--	NMGT (S3)	X	X	X
Smallscale Darter	*Etheostoma microlepidum*	--	NMGT (S2)	X[5]	X	X
Southern Cavefish	*Typhlichthys subterraneus*	--	NMGT(S3)	X[5]	X	X
Striated Darter	*Etheostoma striatulum*	--	THR (S1)	X		X[5]
Tippecanoe Darter	*Etheostoma tippecanoe*	--	NMGT (S1S2)	X[5]	X	X
Mussels						
Birdwing Pearlymussel	*Lemiox rimosus*	END	END (S1)	X		
Cumberland Monkeyface	*Quadrula intermedia*	END	END (S1)	X		
Cumberlandian Combshell	*Epioblasma brevidens*	END	END (S1)	X		
Orange-foot Pimpleback	*Plethobasus cooperianus*	END	END (S1)	X		
Oyster Mussel	*Epioblasma capsaeformis*	END	END (S1)	X		
Purple Lilliput	*Toxolasma lividus*	--	NOST (S1S2)	X		
Pyramid Pigtoe	*Pleurobema rubrum*	--	NOST (S2S3)	X		
Rabbitsfoot	*Quadrula cylindrica cylindrica*	--	NOST (S3)	X	X	X
Rayed Bean	*Villosa fabalis*	CAND	NOST (S1)	X		
Round Hickorynut	*Obovaria subrotunda*	--	NOST (S3)	X		
Salamander Mussel	*Simpsonaias ambigua*	--	NOST(S1)	X[5]	X	X
Slabside Pearlymussel	*Lexingtonia dolabelloides*	CAND	NOST (S2)	X		
Tan Riffleshell	*Epioblasma florentina walkeri*	END	END (S1)	X	X	X
Tennessee Clubshell	*Pleurobema oviforme*	--	NOST (S2S3)	X		

Common Name	Scientific Name	Status[1]		Maury Transmission Line[2]	Almaville Transmission Line[3]	Christiana Transmission Line[3]
		Federal	State			
Snails						
Helmet Rock Snail	*Lithasia duttoniana*	--	NOST (S2)	X		
Muddy Rocksnail	*Lithasia salebrosa*	--	NOST (S2)	X		
Rugose Rocksnail	*Lithasia jayana*	--	NOST (S2)	X		
Crayfish						
Nashville Crayfish	*Orconectes shoupi*	END	END (S1)	X[5]	X[5]	X[5]

-- = Not applicable

[1] Status codes: **CAND** = Candidate; **END** = Endangered; **NMGT** = In Need of Management; **NOST** = No Legal Status, but tracked by the Tennessee Natural Heritage Program; **THR** = Threatened; **S1** = Extremely rare and critically imperiled in the state with 5 or fewer occurrences; or very few remaining individuals; or because of some special condition, where the species of some factor(s) making it vulnerable to extinction; **S2** = Very rare and imperiled within the state, 6 to 20 occurrences; **S3** = rare or uncommon with 21 to 100 occurrences; **S4** = widespread, abundant, and apparently secure in the state, but with cause for long-term concern (more than 101 occurrences); **S#S#** = denotes a range of ranks because the exact rarity of the element is uncertain (e.g., S1S2)

[2] Species known from the Rutherford, Williamson, and Maury counties project area and the Harpeth and Duck River watersheds

[3] Species known from the Rutherford County project area and the Harpeth and Stones River watersheds

[4] Species does not occur within the watersheds affected by the project area

The coppercheek darter is considered threatened in Tennessee due to its limited range in the Duck and Buffalo rivers and their larger tributaries. It prefers deep riffles, runs, and pools with large rubble or boulder substrates and is threatened by impoundments (Etnier and Starnes 1993).

The saddled madtom is a recently described species reported to occur in riffle habitats with gravel, cobble, rubble, or slate substrate during daylight hours and occupying pools at night. It inhabits streams ranging from 25-80 feet wide in the Duck River system and adjacent western tributaries (Burr et al. 2005).

The flame chub is an inhabitant of springs and spring runs, usually occurring in areas of lush aquatic vegetation (Etnier and Starnes 1993). Although it is reported from several river systems in Tennessee, in the proposed project area the species in known to occur in the upper Duck River drainage. Because of its fragile habitat, this species has certainly decreased in abundance and range within the past 50 years and has nearly disappeared from east Tennessee. Continued alteration of spring habitats is expected and will result in continued extirpation of populations (ibid).

The golden darter, formerly considered synonymous with the Tippecanoe darter, was recently described as a separate species. It occurs in the Tennessee River drainages while the Tippecanoe darter occurs in the Cumberland River drainages (NatureServe 2006).

The redband darter has been described as occurring only within the Duck River drainage, the Caney Fork River drainage, and Stones Creek (Etnier and Starnes 1993); however, TWRA reports collections from the headwaters of the Mill Creek drainage. This darter prefers pools and sluggish runs in spring-fed streams of moderate gradient over limestone bedrock, gravel, and cobble substrates (ibid). This species is apparently secure; however, its preferred habitat is particularly vulnerable to man-made disturbances.

In recent years, the slenderhead darter was collected primarily from the Duck, Stones, Harpeth, and Red river drainages, with sporadic samples taken from mainstem of the Tennessee and Cumberland rivers. The slenderhead darter commonly inhabits gravel shoal areas of medium to large rivers with moderate to swift current (Etnier and Starnes 1993). NatureServe (2006) ranks the species as vulnerable in Tennessee because only the southeastern edge of the known range occurs in the state. The most likely threats to the species are siltation, impoundment, and channelization (NatureServe 2006).

The smallscale darter inhabits deep riffles with boulder and coarse rubble substrate. It occurs in large streams and rivers in the Stones, Harpeth, Red, and Little river systems within the Cumberland River system (Etnier and Starnes 1993). The species is considered imperiled in Tennessee. Threats include impoundments and habitat alteration.

The southern cavefish occurs within subterranean environments and has a discontinuous range in Missouri, Arkansas, Indiana, Tennessee, Alabama, and Georgia. Although apparently stable, small populations are susceptible to groundwater pollution (NatureServe 2006).

The striated darter is limited to tributaries of the Duck River and prefers slabrock pools in small to medium, low-gradient streams. It is confined to only four counties in Tennessee (Bedford, Lewis, Marshall, and Maury), which makes this species' populations very vulnerable to depletion (Etnier and Starnes 1993).

The Tippecanoe darter inhabits shallow riffles in medium to large rivers with fine cherty gravel in the Ohio River and Cumberland River drainages. Previous species' accounts within the Tennessee River drainage are now recognized as the golden darter. Its populations are widespread and locally abundant, yet with a spotty distribution. Because of its very restricted riverine habitat, the Tippecanoe darter has been eliminated from many areas affected by siltation and impoundment (Etnier and Starnes 1993).

The birdwing pearlymussel occurs in riffle areas of small to medium-sized rivers, embedded in a sand and gravel substrate in moderate to fast currents (Parmalee and Bogan 1998). Currently, this species is restricted to several small populations in the upper Powell and Clinch rivers, and in the Duck River in Maury County (ibid). Threats include pollution and habitat alteration (NatureServe 2006).

The Cumberland monkeyface inhabits shoals and riffles of the Tennessee River from the confluence of the French Broad and Holston rivers downstream to Muscle Shoals, Alabama. Additional scattered populations occur in the Powell, Clinch, and Duck rivers (Parmalee and Bogan 1998). Habitat alteration from pollution, siltation, impoundment, and channelization threatens this species (NatureServe 2006).

The Cumberlandian combshell prefers clean gravel shoals and riffles of medium-sized streams; it is not associated with small stream habitat (Terwilliger 1991). Parmalee and Bogan (1998) reports that this species occurs in the Powell, Clinch, and Holston rivers and has been collected in the Elk River and the Duck River in Marshall and Maury counties. This species is in decline due to pollution and the inundation of habitat by reservoirs (NatureServe 2006).

The orange-foot pimpleback mussel is primarily a big river species. Populations of this species have been greatly reduced or extirpated in much of its former range (Parmalee and Bogan 1998).

The oyster mussel inhabits small to medium-sized streams with clean gravel substrate and sometimes quieter shoals with gravel and mud substrates (Terwilliger 1991). This species is formerly known from the Tennessee River and tributaries including the Elk and Duck rivers. It also occurs in the Cumberland River and several tributaries. NatureServe (2006) reports the biggest threat to the oyster mussel is habitat alteration.

The purple lilliput occurs sporadically in less than 10 tributaries of the Cumberland River and in small disjunct populations in the Duck, Elk, Paint Rock, and North Fork Holston rivers (Parmalee and Bogan 1998). It inhabits small to medium-sized rivers in mud, sand, and gravel substrates.

Pyramid pigtoe inhabits rivers with strong current and a substrate composed of firm sand and gravel. Currently, this species occurs in stretches of the Clinch, Tennessee, Cumberland, Duck, and Stones rivers (ibid).

The rabbitsfoot inhabits small to medium-sized rivers in clear, shallow water in sand and gravel substrate and has been found in the Duck and East Fork of the Stones rivers (ibid).

The rayed bean is found in and near riffles deeply buried in sand and gravel bounded by roots. This species is possibly extirpated from Tennessee except possibly in the Duck River (ibid).

The round hickorynut prefers medium-sized to large rivers with sand and gravel substrates at depths less than 6 feet. This species has disappeared from most of its Tennessee River range. In the Cumberland River system, it occurs in the Obey, Stones, Harpeth, and Red rivers, and in the mainstem of the Cumberland (ibid).

The salamander mussel occurs in sand substrates under flat rocks as well as on mud and in gravel. Records in Tennessee come from the Tennessee River, but Parmalee and Bogan (1998) state that this species is probably extirpated from the state.

The slabside pearlymussel occurs in shoal areas of small to medium-sized streams with moderately strong current and sand, fine gravel, and cobbles substrates (ibid). The species is restricted to thinly scattered populations in the Clinch, Powell, Elk, Duck, Hiawassee, North and Middle Fork Holston, and Paint Rock rivers.

The tan riffleshell occurs in varying habitats from headwaters of small rivers to large rivers such as the Tennessee River in riffles and shoals with sand and gravel substrates (ibid). This species was once widespread throughout the Tennessee River and found in some Cumberland River drainages. However, it is now confined to a few surviving populations. A fresh dead specimen was discovered in the Duck River in 1988 (NatureServe 2006).

The Tennessee clubshell typically occurs in small, shallow streams and rivers with good current and course gravel and sand substrates. Prior to 1960, the Tennessee clubshell was widespread in Middle and East Tennessee. It can still be found inhabiting stretches of the Clinch, Powell, Tellico, Elk, Hiwassee, Duck, Little Pigeon, Big South Fork Cumberland, and Stones rivers.

The helmet rocksnail inhabits rocky substrates in riffle systems (NatureServe 2006). This species occurs in the Duck, Harpeth, and lower Caney Fork rivers (Parmalee and Bogan 1983).

The muddy rocksnail occurs in dam tailwaters of the Elk, Duck, lower Stones, lower Caney Fork, and Cumberland rivers (ibid).

Bogan and Parmalee (1983) reported that the only extant population of the rugose rocksnail occurs in the Duck River. However, this species is probably extinct.

3.6.2. Terrestrial Plants

Six federally listed plant species are known from Rutherford, Williamson, and Maury counties and an additional 25 state-listed plant species are known from within 5 miles of the proposed project components (Table 3-7). Field surveys of the proposed substation site, transmission line ROWs, access roads, and some adjacent areas were conducted between February 2007 and August 2007. One federally listed plant, DCH for one federally listed plant, and nine state-listed plants were observed during these surveys. Some of these occurrences of listed species were previously unreported. The listed species occurrences are described in more detail below.

Table 3-7. Federally Listed Plant Species Known From Rutherford, Williamson, and Maury Counties and Tennessee State-Listed Plant Species Known From Within 5 Miles of the Proposed Project Area.

Common Name	Scientific Name	Federal Status	State Status (Rank)
Alabama snow-wreath*	*Neviusia alabamensis*	-	THR (S2)
Boykin's milkwort	*Polygala boykinii*	-	SPCO (S2)
Braun's rock-cress*	*Arabis perstellata*	END	END (S1)
Canada lily*	*Lilium canadense*	-	THR (S3)
Carolina anemone	*Anemone caroliniana*	-	END (S1S2)
Cleft phlox	*Phlox bifida ssp. stellaria*	-	THR (S3)
Davis' sedge	*Carex davisii*	-	SPCO (S1)
Duck River bladderpod	*Lesquerella densipila*	-	THR (S3)
Evolvulus	*Evolvulus nuttallianus*	-	SPCO (S3)
False gromwell	*Onosmodium molle* ssp. *subsetosum*	-	END (S1)
Fen Indian-plantain	*Arnoglossum plantagineum*	-	SPCO (S2)
Flat-stemmed spike-rush	*Eleocharis compressa*	-	SPCO (S1)
Hairy rock-cress	*Arabis hirsuta var. adpressipilis*	-	S-CE (S1S2)
Leafy prairie-clover	*Dalea foliosa*	END	END (S2S3)
Leo's trifolium	*Trifolium calcaricum*	-	END (S1)
Limestone blue-star	*Amsonia tabernaemontana* var. *gattingeri*	-	SPCO (S3)
Limestone fameflower*	*Talinum calcaricum*	-	SPCO (S3)
Pope sand-parsley	*Ammoselinum popei*	-	THR (S2)
Price's potato-bean	*Apios priceana*	THR	END (S2)
Pyne's ground-plum*	*Astragalus bibullatus*	END	END (S1)
Ramps*	*Allium tricoccum*	-	S-CE (S1S2)
Sand grape	*Vitis rupestris*	-	END (S1)
Tennessee coneflower	*Echinacea tennesseensis*	END	END (S2)
Tennessee glade-cress*	*Leavenworthia exigua* var. *exigua*	-	SPCO (S3)
Tennessee milk-vetch*	*Astragalus tennesseensis*	-	SPCO (S3)
Tennessee yellow eyed-grass	*Xyris tennesseensis*	END	END (S1)
Toothache tree*	*Zanthoxylum americanum*	-	SPCO (S2)
Tower-mustard	*Arabis glabra*	-	THR (S1)
Water stitchwort*	*Arenaria fontinalis*	-	THR (S3)
Willow aster	*Aster praealtus*	-	END (S1)
Yellow sunnybell*	*Schoenolirion croceum*	-	THR (S3)

Status codes: **END** = Endangered; **SPCO** = Special Concern; **S-CE** =Special Concern-Commercially Exploited; **THR** = Threatened; **S1** = Extremely rare and critically imperiled in the state with 5 or fewer occurrences; or very few remaining individuals; or because of some special condition, where the species of some factor(s) make it vulnerable to extinction; **S2** = Very rare and imperiled within the state, 6 to 20 occurrences; **S3** = Rare or uncommon with 21 to 100 occurrences; **S#S#** = Denotes a range of ranks because the exact rarity of the element is uncertain (e.g., S1S2)

*An asterisk denotes occurrences of federally listed and state-listed plant species observed during botanical field surveys of the proposed project area.

Four federally listed plants previously known from the project area counties were not observed during the surveys. Leafy prairie clover has been previously reported from all

three project area counties and is usually associated with seasonally wet limestone glades and calcareous barrens, typically in the deeper soil along glade margins. Although appropriate habitat for this species was observed, no occurrences of leafy prairie-clover were identified during surveys of the proposed project area. Tennessee coneflower also occurs on limestone glades, typically in sunny gravel crevices or thin soils along the glade margins. Several populations occur in Rutherford County, but it has not been observed in Maury or Williamson counties. Although appropriate habitat for this species was observed, no occurrences of Tennessee coneflower were identified during surveys of the proposed project area. In Tennessee, Price's potato-bean is restricted to the Highland Rim ecoregion and is associated with streams and soils derived from limestone. Neither this species nor suitable habitat for it was observed. Tennessee yellow-eyed grass occurs in wetlands with a calcareous substrate in forest seeps or in rocky margins of small streams and ditches. It is known from two calcareous fens in Rutherford County and a few other counties outside the project area. No populations or habitats suitable for this species were identified during surveys of the proposed project area. The federally listed Pyne's ground-plum and Braun's rock-cress do occur in the project area and are described in more detail below.

3.6.2.1. Rutherford 500-kV Substation

Water stitchwort, an endemic to the Interior Low Plateau in Kentucky and Tennessee, occurs in a wetland situated in a horse pasture on the proposed Rutherford Substation site. It is typically found in wet areas of shallow soil over limestone. Water stitchwort often forms mats making estimates of the size of individual populations difficult; the population on the substation site covers approximately 600 square feet. There are at least 59 occurrences of this state-listed species in Tennessee.

3.6.2.2. Maury Transmission Line

Six state-listed plants were observed within or immediately adjacent to the proposed Maury Transmission Line ROW. Three occurrences of Tennessee glade-cress were found; this species is restricted to limestone glades and is found in areas of middle Tennessee and north Georgia. This winter annual requires thin soils and completes its lifecycle early in the growing season. Two of the occurrences are entirely restricted to the ROW. The third occurrence extends from within the ROW to a few hundred yards off the ROW along a gravelly road shoulder. Each occurrence contains hundreds to thousands of individual plants. There are at least 176 known occurrences of Tennessee glade-cress in Tennessee.

Two occurrences of limestone fameflower were observed. One occurrence with several hundred individuals is in a degraded limestone glade within a portion of the ROW presently occupied by a transmission line. A second occurrence is on a high-quality limestone glade within the proposed ROW and consists of approximately 150 individual plants. Limestone fameflower is endemic to the Nashville Basin and other calcareous areas in southern Kentucky and northern Alabama. There are about 135 reported occurrences of this plant in Tennessee. The succulent nature of the plant allows it to grow in the driest areas of limestone glades in very thin soils.

Two populations of yellow sunnybell were found in wet areas of high-quality limestone glades along the proposed ROW. One of these populations contains many thousands of individuals, and the other contains less than 50. This species occurs in seasonally wet areas on thin soils over limestone in seven southern states, but is restricted to the Nashville Basin in Tennessee. Over 70 occurrences are known from Tennessee.

A population of ramps consisting of at least 69 plants was observed in a mesic, forested area of the proposed ROW near the southern end. Ramps typically occur on mesic slopes under forest canopy and were not previously known from Maury County. This species, which has a large range and occurs in at least 14 Tennessee counties, is commercially exploited because of its value as a wild vegetable.

An unrecorded population of a few hundred toothache trees was observed in thin-canopied oak-hickory woods along the proposed ROW. This large shrub or small tree, also known as prickly ash, occurs across the central and eastern United States but is only known from four Tennessee counties, all in the Nashville Basin. There are eight recorded populations of this species in Tennessee.

One population of water stitchwort occurs in a calcareous seep surrounded by a dense growth of tall fescue within the proposed ROW.

3.6.2.3. Almaville Transmission Line

Two occurrences of yellow sunnybell were found on the proposed Almaville Transmission Line route in wet areas of high-quality limestone glades; each contains less than 50 plants.

Braun's rock-cress typically occurs on slopes composed of calcium carbonate, calcium, or limestone in moderately moist to almost dry forests on shaded, moist outcrops. It is currently known from 43 populations in Kentucky and Tennessee. Of the five populations in Tennessee, four are in Rutherford County, and one is in Wilson County (USFWS 2004). Several occurrences of Braun's rock-cress are known from within a few miles of the proposed project area and one occurrence is less than 300 feet from the edge of the proposed Almaville Transmission Line ROW on Scales Mountain. No individuals of this species or its appropriate habitat were identified during surveys along the proposed Almaville route in June 2007. The habitat located within this ROW is too dry to support populations of Braun's rock-cress. Although no plants are present, a portion of the proposed Almaville Transmission Line route passes through two areas of DCH for the federally listed Braun's rock-cress.

The proposed ROW would occupy approximately 4 acres of the 255-acres DCH on Scales Mountain and less than 0.05 acre of the 214-acre DCH on Indian Mountain. Critical habitats are geographic areas identified under the authority of the ESA as essential for the conservation of a threatened or endangered species. Federal agencies are prohibited from adversely modifying critical habitat, which may also require special management considerations (ibid). The physical and biological habitat features essential for the conservation of Braun's rock-cress, known as primary constituent elements of the critical habitat, are:

(a) The slopes of calcareous mesophytic and sub-xeric forest that are relatively undisturbed, with few openings in the canopy and several large, mature trees (such as sugar maple, chinquapin oak, hackberry, or Ohio buckeye).

(b) An area with few introduced weedy plant species, such as the invasive biennial garlic mustard, that is able to support self-sustaining populations of 50 or more individuals.

(c) A mesic habitat with open forest floors containing rock outcrops on moderate to steep slopes with little herbaceous cover and leaf litter accumulation with natural disturbance to allow for Braun's rock-cress germination and seedling germination.

(d) Ordovician limestone, in particular the Lebanon, Carters, Leipers, Catheys, and Bigby-Cannon limestones in Tennessee.

(e) Limestone soils such as the Mimosa Rock outcrop complexes in Tennessee.

3.6.2.4. Christiana Transmission Line

One federally and four state-listed plants were found in or near the proposed Christiana Transmission Line ROW. The federally listed Pyne's ground-plum was found about 30 feet outside the proposed ROW in a small glade opening surrounded by close canopy forest. This previously unreported population consists of about 300 individual plants and is one of three known populations of the species.

A population of Alabama snow-wreath was observed in a closed canopy forest and around the edge of a grazed field on the proposed Christiana Transmission Line ROW and is among the largest currently known. This shrub typically forms large colonies, is across its entire range, and is known from 10 sites in Tennessee.

Three occurrences of Canada lily were found in a maple-oak-hickory forest along the proposed line route. Canada lily is typically found in open moist woods and open grassy areas and is known from 70 localities in eastern and middle Tennessee.

Three populations of limestone fameflower were observed along the proposed line route. One of these consists of less than five plants and the other two consist of over 100 plants each and occur in Interior Low Plateau Limestone Glade Ephemeral Pool communities.

Two occurrences of Tennessee milk-vetch were found along the proposed line route. One occurrence within the proposed ROW consists of several hundred plants and occurs on the edge of a cedar glade. The second occurrence consists of less than five plants in open, rocky woods. This species is typically found in transitional zones between eastern red cedar woods and rocky open glades. There are at least 247 occurrences known from Tennessee. Nearly all known populations occur in the central Tennessee area; a few populations are known from northern Alabama and Illinois.

3.6.3. Terrestrial Animals

Two federally listed terrestrial animal species have been previously reported from Rutherford, Williamson, and Maury counties (Table 3-8). At least one state-listed terrestrial animal and one species considered rare by the Tennessee Natural Heritage Program have also been reported from within 3 miles of the major project components. No federally listed or state-listed terrestrial animals were observed in the proposed project areas during field investigations conducted in spring and summer 2007. Listed species potentially occurring in the project area are described below.

Table 3-8. Federally Listed Terrestrial Animal Species Reported From Rutherford, Williamson, and Maury Counties, and State Protected Terrestrial Animal Species Reported From Within 3 Miles of the Project Site

Common Name	Scientific Name	Federal Status	State Status
Amphibians			
Tennessee cave salamander	*Gyrinophilus palleucus*	-	THR (S2)
Mammals			
Gray bat	*Myotis grisescens*	END	END (S2)
Indiana bat	*Myotis sodalis*	END	END (S1)
Invertebrates			
Echo Cave beetle	*Pseudanophthalmus acherontis*	-	NOST (S1S2)

Federal and State Status: END = Endangered, THR = Threatened, NOST – No Status; State ranks: S1 = critically imperiled, S2 = very rare or imperiled, S#S# = denotes a range of ranks because the exact rarity of the element is uncertain

Tennessee cave salamanders inhabit cave systems with clear, sediment-free streams containing abundant forage in the form of aquatic invertebrates. Local populations in Tennessee are usually found in sinkhole-type caves or in wet cave systems in the vicinity of sinkholes (Petranka 1998). The big mouth subspecies (*Gyrinophilus palleucus necturoides*) is known within the project area from both Echo and Snail Shell caves. Nanna Cave, which is part of the Echo and Snail Shell Cave System, is approximately 150 feet from the proposed Christiana Transmission Line ROW. A stream in this cave provides suitable habitat for the Tennessee cave salamander. No other caves with entrances close to the proposed substation or transmission lines are known to offer suitable habitat for this salamander.

Gray bats roost in caves year-round and typically forage over the open water of streams, rivers, and reservoirs. Gray bats are known from two caves in Maury County and one cave in Rutherford County. No caves used by gray bats occur near the proposed substation or transmission line, but numerous stream crossings along the proposed transmission line routes provide foraging habitats for gray bats.

Indiana bats hibernate in caves during the winter and typically form summer roosts under the bark of dead or dying trees (Menzel et al. 2001). Their summer roosts are found in mature forests with an open subcanopy, usually near water (Romme et al. 1995), and they primarily forage in forested areas along streams or other corridors. One record of the Indiana bat is recorded from Benderman Cave in Maury County, approximately 14 miles southwest of the proposed Maury Transmission Line. The record noted a maternity colony in this cave. This species uses forests, not caves, for maternity habitat, which makes this record questionable. Surveys by Harvey and Britzke (2002) did not find Indiana bats in this cave.

Although there are no other records of Indiana bats from the three-county area, other caves may provide suitable hibernating sites, and mature forests habitat in the area could provide summer habitat for this species. Indiana bats have not been reported from any of the recorded caves in the project area. Numerous karst features occur in the project area, and on previously unrecorded cave was found during project field studies. This previously unrecorded cave is a small tunnel with a stream emerging from it and likely floods during rain events, making it unsuitable for roosting or hibernating bats.

In order to assess the suitability of forested habitat for Indiana bats, sampling was conducted using a protocol on Romme et al. (1995). Five variables were estimated at sites containing primarily deciduous forest and some mature trees. Forests with a strong or dominant eastern red cedar component, as well as forests with no mature trees, do not offer suitable habitat and were not sampled. Average canopy cover, average height to bottom of canopy, and average diameter at breast height of overstory trees were used to indicate forest maturity. Subcanopy density was categorized as open (less than 5 percent), moderately dense (5 percent to 20 percent), dense (20 percent to 60 percent), and very dense (greater than 60 percent). Potential roost trees included snags less than 9 feet in height, hollow trees or trees with large cavities, and trees with exfoliating bark. Percent exfoliating bark was used to categorize quality of potential roost trees. High-quality trees exhibited greater than 25 percent of the remaining bark exfoliating; moderate quality trees had 11 percent to 25 percent exfoliating; and low-quality trees had less than 10 percent exfoliating bark. High-quality habitat plots contained a mature forest with a relatively open subcanopy and at least one moderate or high-quality potential roost tree. Low-quality habitat plots consisted of young forest or forest with a dense subcanopy or lacked potential roost trees.

No forest meeting the sampling criteria occurred on the proposed substation site and 53 points were sampled in forests along the proposed transmission line routes. Overall, most forested habitat was unsuitable for Indiana bats, with 47 of the 53 rating as low-quality habitat. Six points rated as moderate quality and none rated as high quality for Indiana bats.

The Echo Cave beetle is an eyeless ground beetle that inhabits caves, typically in the twilight zone or deeper in the cave, or on moist soil near streams or drip areas (NatureServe 2006). Suitable habitat likely occurs in parts of the Snail Shell Cave System, including the nearby Nanna Cave entrance near the proposed Christiana Transmission Line.

The lark sparrow (*Chondestes grammacus*), listed as threatened in Tennessee, nests in cedar glades with sparse tree and shrub cover. Although not observed during project field surveys, some of the project area glades do provide suitable habitat for this bird. It is presently known from very few counties in Tennessee.

3.7. Wetlands

Wetlands are areas inundated by surface water or groundwater such that vegetation (hydrophytes) adapted to saturated soil conditions is prevalent. Wetland substrates consist predominantly of undrained hydric soil, soils that are saturated with water and usually deprived of oxygen. Wetland examples include palustrine areas (described as lacking flowing water, including marshes and swamps as well as bogs, fens, wet meadows, and floodplains) and lacustrine areas (described as lake-associated, including freshwater marshes, aquatic beds, and lakeshores). Ground surveys were conducted between February and July 2007 to delineate wetland areas within the existing and proposed transmission line ROWs and substation site that make up the proposed project area.

Wetland determinations were performed according to the USACE standards, which require documentation of hydrophytic (i.e., wet-site) vegetation, hydric soil, and wetland hydrology (Environmental Laboratory 1987; Reed 1997; U.S. Department of Defense and USEPA 2003). Broader classification definitions of wetlands, such as that used by the USFWS (Cowardin et al. 1979), Tennessee (Tennessee Code 11-14-401), and TVA Environmental

Review Procedures (TVA 1983), were also considered in this review. In addition, the TVA Rapid Assessment Method (TVARAM), adapted from the Ohio Rapid Assessment Method (Mack 2001), was used to assess wetland condition and identify wetlands with potential ecological significance.

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

The project area is a landscape that is predominantly forest, pasture, and cropland, although portions of the proposed transmission line would cross residential areas, creeks, and drainage ways. Land use/land cover data indicated wetlands occupy very small percentages of overall total land use (Table 3-9. Twelve wetlands, comprising 3.43 wetland acres, were identified within the proposed project areas (Table 3-10).

Table 3-9. Total Land Use in the Project Area

Watershed	Forested/Scrub-Shrub Wetlands (acres)	Forested/Scrub-Shrub Wetlands (% of watershed)	Emergent Wetlands (acres)	Emergent Wetlands (% of watershed)	Total Wetland Acres	Wetlands as % of Watershed
Harpeth River	2,624	0.5	864	0.2	3,488	.7
Lower Duck River	6,853	0.69	224	0.02	7,077	.071
Stones River	1,152	0.2	8,160	1.35	9,312	1.55
Total	**10,629**	**1.39**	**9,248**	**1.57**	**19,877**	**N/A**

Data are from Multiresolution Land Characterization (MRLC) derived from applying a generalized Anderson Level II system to mosaics of Landsat thematic mapper images collected every five years. Land use/land cover information was provided by USEPA Region 4 and was interpreted from 1992 MRLC satellite imagery.

Table 3-10. Summary of Wetlands on the Rutherford Project Site

Project Area	Total Wetland Acreage	Forested Wetland Acreage
A. Rutherford Substation	0.49	-
B. Maury Transmission Line	1.29	0.64
C. Almaville Transmission Line	0.02	0.02
D. Christiana Transmission Line	1.63	1.63
Total Acres	**3.43**	**2.29**

3.7.1. Rutherford 500-kV Substation

One wetland was identified on the proposed substation site (Table 3-11). Wetland W001S is an emergent wetland, approximately 0.49 acre in size. The wetland is located in a highly

disturbed horse pasture and is hydrologically connected to an intermittent stream draining to Nelson Creek, as well as a pond, on the site. The wetland is dominated by hydrophytic vegetation, including hairy buttercup, cocklebur, hairy bittercress, flat-stem spikerush, and state-listed water stitchwort.

Table 3-11. Wetlands on the Rutherford Substation Site

Wetland ID	Type[a]	Wetland Acreage	Estimated Forested Wetland Acreage	TVARAM Category (score)
W001S	PEM1E	0.49	-	2 (37)
Total Acres		**0.49**	**-**	

[a]Classification codes as defined in Cowardin et al. 1979: PEM1 = palustrine emergent, persistent vegetation; E = seasonally flooded/saturated

3.7.2. Maury Transmission Line

Six wetlands were identified within the proposed transmission line ROW (Table 3-12).

Table 3-12. Wetlands in the Proposed Maury Transmission Line Right-of-Way

Wetland ID	Type[a]	Wetland Acreage	Forested Wetland Acreage	TVARAM Category (score)
W001M	PEM1E	0.02	-	2 (51.5)
W002M	PEM1A	0.09	-	1 (25)
W003M	PEM/PSS1A	0.08	-	2 (50)
W004M	PFO1E	0.05	0.05	3 (62)
W005M	PFO1C	0.54	0.54	2 (48)
W006M	PFO1B	0.51	0.05	2 (44)
Total Acres		**1.29**	**0.64**	

[a]Classification codes as defined in Cowardin et al. 1979: PEM1 = palustrine emergent, persistent vegetation; PSS1 = palustrine scrub-shrub, broadleaf deciduous; PFO1 = palustrine forested, broadleaf deciduous; A = temporarily flooded; B = saturated; C = seasonally flooded; E = seasonally flooded/saturated

Wetland W001M occurs within existing, maintained transmission line ROW and within the floodplain of Rutherford Creek. W001M is dominated by hydrophytic vegetation, including fescue, purple-leaf willow-herb, hairy buttercup, Japanese stilt grass, fox sedge, and curly dock and exhibits hydric soils.

Wetland W002M occurs within existing, maintained transmission line ROW within a topographic drainage. It exhibits hydric soils and is hydrologically connected to Rutherford Creek. W002M is dominated by hydrophytic vegetation, including white heath aster, bulrush, cattail, soft rush, and goldenrod.

Wetland W003M occurs within existing, maintained transmission line ROW, exhibits hydric soils, and is hydrologically connected to Crooked Creek. Dominant hydrophytic vegetation includes red maple, box elder, privet, river oats, and bugleweed.

Wetland W004M occurs on vacant, TVA-owned ROW and is part of a larger forested wetland totaling 0.19 acre that extends north of the ROW and contains a vernal pool.

W004M exhibits hydric soils and is hydrologically connected to Cove Branch. Dominant hydrophytic vegetation includes sycamore, American hornbeam, sweetgum, and red maple.

Wetland W005M is located entirely within vacant, TVA-owned transmission line ROW exhibits hydric soils, and is hydrologically connected to Overall Creek. The wetland is also partially fed by groundwater seepage from an adjacent old-field. W005M is dominated by hydrophytic vegetation, including green ash, American hornbeam, elm, and box elder.

Wetland W006M is associated with a headwater area of an unnamed tributary to the Harpeth River. Located within vacant, TVA-owned ROW, the wetland exhibits hydric soils and is dominated by hydrophytic vegetation, including sycamore, sweetgum, green ash, elm, and privet.

3.7.3. Almaville Transmission Line

One wetland was identified within the Almaville Transmission Line ROW (Table 3-13).

Table 3-13. Wetland in the Proposed Almaville Transmission Line Right-of-Way

Wetland ID	Type[a]	Wetland Acreage	Forested Wetland Acreage	TVARAM Category (score)
W001A	PEM/PFO1E	0.02	0.02	2 (55)
Total Acres		**0.02**	**0.02**	

[a]Classification codes as defined in Cowardin et al. 1979: PEM1 = palustrine emergent, persistent vegetation; PFO1 = palustrine forested, broadleaf deciduous; E = seasonally flooded/saturated

Wetland W001A is located on the proposed ROW, but extends east of the ROW for a total of approximately 0.03 acre. W001A exhibits hydric soils and is hydrologically connected to an unnamed tributary to Steward Creek. Dominant hydrophytic vegetation includes needlerush, Indian woodoats, cypress panic grass and the state-listed yellow sunny bell.

3.7.4. Christiana Transmission Line

Four wetlands were identified within the Christiana Transmission Line ROW (Table 3-14).

Wetland W001C is a forested 0.63-acre wetland located on the proposed ROW. This wetland extends off the ROW for a total of 20 acres. W001C exhibits hydric soils and is hydrologically connected to an unnamed tributary to the West Fork of the Stones River. Dominant hydrophytic vegetation includes green ash, dogwood, and cottonwood saplings.

Wetland W002C is a forested wetland approximately 0.06-acre in size on the proposed ROW. This wetland is part of a larger wetland complex approximately 25 acres in size and is located on the north edge of a pond associated with an unnamed tributary to the West Fork of the Stones River. The wetland is part of a former stream channel that was altered to form the pond, and it contains hydric soils. Dominant vegetation includes black willow, privet, green ash, soft rush, and smartweed.

Table 3-14. Wetlands in the Proposed Christiana Transmission Line ROW

Wetland ID	Type[a]	Wetland Acreage	Forested Wetland Acreage	TVARAM Category (score)
W001C	PFO1E	0.63	0.63	2 (40)
W002C	PFO1E	0.06	0.06	2 (43)
W003C	PSS1/PFO1E/PABH	0.89	0.89	2 (43)
W004C	PFO1E	0.05	0.05	3 (70.5)
Total Acres		**1.63**	**1.63**	

[a]Classification codes as defined in Cowardin et al. 1979: PAB = palustrine aquatic bed, rooted vegetation; PSS1 = palustrine scrub-shrub, broadleaf deciduous; PFO1 = palustrine forested, broadleaf deciduous; E = seasonally flooded/saturated; H = permanently flooded

Wetland W003C is a mix of forested, scrub-shrub, and aquatic bed habitat approximately 15 acres in size, 0.89 acre of which occurs on the proposed ROW. The wetland is associated with a WWC that flows into an embayment of the same pond associated with W002C and an unnamed tributary to the West Fork of the Stones River. A small road separates W002C from W003C. Vegetation includes sycamore, American elm, buttonbush, lizard's tail, water willow, and supplejack. Hydric soils are present.

Wetland W004C is a forested wetland with 0.05 acre located on the existing ROW. W004C exhibits hydric soils and is hydrologically connected to a large pond that has formed in a sinkhole. Dominant hydrophytic vegetation includes black willow, American elm, supplejack, and spring avens.

Summary

All of the potentially affected wetlands function in storm water retention, erosion control, toxicant absorption, flood control, and offer wildlife habitat. Wetland W002M, consisting of 0.09 acre scored as Category 1 wetlands using the TVARAM, indicating this wetland in general is in relatively poor ecological condition providing limited wetland function. Wetlands W001S, W001M, W003M, W005M, W006M, W001A, W001C, W002C, and W003C, with a total area of 3.24 acres, scored in Category 2 using the TVARAM, which indicates these wetlands are of good condition and therefore provide these beneficial wetland functions to a moderate extent. Wetlands W004M and W004C, with a total area of 0.10 acre, scored in Category 3 using the TVARAM, which indicates these wetlands are of high quality and therefore function in providing these beneficial wetland functions at a superior level.

Wetlands W004M, W005M, W006M, W001A, W001C, W002C, W003C, and W004C are forested and total 2.29 acres within the proposed new transmission line routes. All of the identified wetland areas appear to be jurisdictional. Total wetland area identified within the proposed substation site and transmission line routes is 3.48 acres.

3.8. Floodplains

3.8.1. Rutherford 500-kV Substation

The proposed Rutherford Substation would be located east of Rehobeth Road and north of Opossum Trot Road in Rutherford County, outside of the identified 100-year floodplain.

3.8.2. Maury Transmission Line

The proposed Maury Transmission Line route crosses the identified 100-year floodplains of Rutherford Creek and Crooked Creek in Maury County; the identified 100-year floodplains

of Overall Creek and the Harpeth River in Williamson County; and the identified 100-year floodplain of the Harpeth River in Rutherford County.

3.8.3. Almaville Transmission Line

The proposed Almaville Transmission Line route crosses the identified 100-year floodplains of Stewart Creek and Almaville-Rocky Fork in Rutherford County.

3.8.4. Christiana Transmission Line

The proposed Christiana Transmission Line route crosses the identified 100-year floodplains of Panther Creek and the West Fork of the Stones River in Rutherford County.

All of the transmission line routes cross several other minor floodplain areas in these counties.

3.9. Managed Areas

The managed areas and/or ecologically significant sites and NRI streams occurring on or within 3 miles of the proposed Rutherford Substation and its three associated transmission lines (Maury, Almaville, and Christiana) are described below.

3.9.1. Rutherford 500-kV Substation

The proposed 53.1-acre substation in southwest Rutherford County is within a mile of two Registered State Natural Areas (SNAs). Scales Mountain Knobs SNA, an approximate 170-acre forested tract on the eastern and middle knobs of Scales Mountain, is approximately 0.8 mile northeast of the substation. Indian Mountain SNA, another forested, mountainous tract of approximately 134 acres southeast of Scales Mountain, is approximately 1.0 mile east of the substation. Both SNAs are recognized by the TDEC Natural Areas Program as sites of ecological importance for their populations of the federally listed Braun's rock-cress. The state's Natural Areas Registry Program develops nonbinding voluntary agreements with private and public landowners to protect such sites. These SNAs are privately owned and overlap federal DCH for Braun's rock-cress (Section 3.6.2).

3.9.2. Maury Transmission Line

The proposed route for the Maury Transmission Line crosses an NRI stream, comes within 0.5 mile of a wildlife management area (WMA), and is within 3 miles of another NRI stream and four other natural areas.

Harpeth River, from River Mile (RM) 6.0 near Jackie Branch on the Cheatham and Dickson county line to RM 121.0 at the confluence with Puckett Branch and Concord Creek, in Cheatham, Dickson, Davidson, Williamson, and Rutherford counties, is listed on the NRI. The National Park Service (NPS) recognizes this segment for its scenic, recreational, geologic, fish and wildlife, historic, and cultural values. Noted features include carved bluffs, including petroglyphs on Paint Rock, and the Narrows of the Harpeth, a narrow horseshoe bend connected in the early 1880s by an approximate 200-foot man-made tunnel to power an iron forge. The proposed route crosses the Harpeth River at approximately RM 115.0 in Rutherford County. Noted geologic, historic, and cultural features of the Harpeth River are several miles northwest and downstream of this crossing point, primarily in Cheatham County at Harpeth River State Park near Kingston Springs.

Haley-Jaqueth WMA is a 200-acre tract in Williamson County managed by TWRA. The area provides habitat for small game. No hunting is allowed on this WMA. The proposed route is approximately 0.4 mile southeast of this tract.

Middle Tennessee Agricultural Experiment Station is one of 11 experiment stations managed by the University of Tennessee. Research in beef and dairy cattle, commercial crops, fruits trees, and forage crops is conducted on 1,263 acres near Spring Hill. The proposed route is approximately 1.5 miles southeast of the experiment station.

Duck River State Mussel Sanctuary, managed by TWRA, is that section of the Duck River from Kettle Mills Dam in Maury County at RM 105.6 upstream to the river's headwaters, including the section impounded by Normandy Dam. Taking aquatic mollusks by any means, and/or the destruction of their habitat is prohibited within the sanctuary. The proposed route is approximately 2.6 miles north of the mussel sanctuary. This segment of the Duck River also is DCH for endangered mussels in Tennessee and the Cumberland River Basin (Section 3.6.1).

Scales Mountain Knobs SNA is approximately 1.8 miles northwest of the end point of the proposed Maury Transmission Line route, and Indian Mountain SNA is approximately 1.5 miles north of this point.

Overall Creek in Rutherford County, from RM 0 at the confluence with the West Fork of the Stones River to RM 17 at the stream headwaters, is listed on the NRI. The NPS recognizes this stream for its recreational and fish and wildlife values. It is a popular canoe stream in a rural setting. The stream at its headwaters is approximately 2.3 miles southeast of the proposed route.

3.9.3. Almaville Transmission Line

The proposed Almaville Transmission Line would cross small portions of two natural areas and is within 3 miles of an NRI stream.

Approximately 400 feet of the proposed route would cross the southwesternmost tip of Scales Mountain Knobs SNA and would be immediately adjacent or just within the westernmost boundary of Indian Mountain SNA.

Overall Creek at its headwaters is approximately 2.4 miles southeast of the proposed transmission line.

3.9.4. Christiana Transmission Line

The proposed Christiana Transmission Line segments cross an NRI stream, are within 0.5 mile of one managed area, and are within 3 miles of two NRI streams and two additional natural areas.

The West Fork of the Stones River in Rutherford County, from RM 17 southwest of Murfreesboro to RM 27 at the bridge west of the town of Christiana, is listed on the NRI. The NPS recognizes this river segment for its scenic, recreational, geologic, and fish and wildlife values. The proposed route crosses the West Fork at approximately RM 26 near Christiana.

Snail Shell Cave Preserve is owned and managed by the Southeastern Cave Conservancy Inc. Snail Shell Cave is the longest continuous cave in the Tennessee Central Basin and is inhabited by many cave-adapted animals of very limited distribution. The preserve is an

approximately 80-acre, predominantly cedar glade area surrounding the main entrance to Snail Shell Cave near Murfreesboro. The proposed route is approximately 0.5 mile west of the preserve, and parts of the cave extend under some of the project components.

The proposed transmission line is a mile southwest of the headwaters of Overall Creek (in the Stones River drainage), 2.5 miles northeast of Harpeth River, both NRI streams, 1.1 miles southwest of Scales Mountain Knobs SNA, and 1.0 mile southwest of Indian Mountain SNA.

3.10. Recreation

3.10.1. Rutherford 500-kV Substation

Recreation activities in the project vicinity are informal, dispersed, and include hunting and nature viewing. There are no developed public recreational facilities in, adjacent to, or within sight of the proposed substation area. Informal recreation activities in the vicinity primarily occur on privately owned land.

3.10.2. Maury Transmission Line

The proposed transmission line would be located in an existing, undeveloped ROW from the substation site to a location just west of US 31 near Columbia. Public recreation activities along the project route are largely informal, dispersed, and include hunting, walking, horseback riding, off-road vehicle use, and nature viewing. There are no developed public recreational facilities directly in, adjacent to, or within sight of the route. Informal recreation activities primarily occur on privately owned land.

The route crosses the Harpeth River in the community of College Grove near the origins of the river. This crossing occurs at a section of the Harpeth River that can only accommodate small nonmotorized vessels and, therefore, recreational boating is limited. As described in Section 3.9, the Harpeth River is listed on the NRI, in part because of its recreational opportunities.

3.10.3. Almaville Transmission Line

The Almaville Transmission Line is located on an existing, undeveloped ROW from the substation site to a location just north of the Almaville Community. Public recreation activities in the project route are largely informal, dispersed, and include hunting, walking, horseback riding, off-road vehicle use, and nature viewing. There are no developed public recreational facilities directly in, adjacent to, or within sight of the route. Informal recreation activities primarily occur on privately owned land.

3.10.4. Christiana Transmission Line

The Christiana Transmission Line is located on a new ROW from the substation site to a location just east of US 231 south of Murfreesboro. Public recreation activities in the project route are largely informal, dispersed, and include hunting, walking, horseback riding, off-road vehicle use, and nature viewing. There are no developed public recreational facilities directly in, adjacent to, or within sight of the transmission line route. Informal recreation activities primarily occur on privately owned land.

The route crosses the West Fork of the Stones River west of the community of Christiana. As described in Section 3.9, this stream is listed on the NRI, in part because of its recreational opportunities.

3.11. Land Use and Prime Farmland

Prime farmland is land that has the best combination of physical and chemical characteristics for producing food, feed, fiber, forage, livestock, and other agricultural crops with minimum inputs of fuel, fertilizer, pesticides, and/or labor. Prime farmland does not include land that is already in or committed to urban development (through, for example, zoning) or to water storage. The Farmland Protection Policy Act of 1981 directs federal agencies to evaluate land use prior to converting an area permanently to a nonagricultural land use. The act and its implementing regulations require agencies considering such a conversion to complete Form AD 1006, "Farmland Conversion Impact Rating," for areas larger than a 10-acre threshold.

This project involves the construction of about 52 miles of new transmission lines and a 500-kV substation on 53.1 acres of the 57.5-acre tract that was evaluated. The construction of transmission lines and their support structures would not render farmland unusable because transmission line ROWs can still be farmed. Only the land occupied by the substation would be converted to nonfarm use. Consequently, this prime farmland evaluation is restricted to the substation site.

The proposed substation would occupy around 53.1 acres of land. A gravel road about 1,600 feet long, connecting the proposed substation site to Coleman Hill Road, would be purchased to provide access to the site. The road covers about 2.7 acres of land and because the soils beneath this gravel access road have been altered to support vehicle traffic and have not been farmed nor are currently being farmed, this area will not be included in this evaluation. The proposed substation site is in a rural, sparsely populated, area. The Landview® Census 2000 Population Estimator shows only 24 people live within a mile of the site (U.S. Census Bureau 2002). The project site is predominantly unimproved pastureland, a portion of which has occasionally been harvested for hay. It is dispersed with cedar trees and slopes from an elevation of 850 feet above sea level on the northern boundary to an elevation of about 790 feet above sea level on the southern boundary. Rock outcroppings cover nearly 5 acres on the northern and eastern edges of the property. The center and southern edge have about 5 acres of poorly drained, wet soil. A barn and an abandoned house are on the east side of the project area, and the gravel road leading to these structures is also within the project area. For the proposed Rutherford Substation location, Figure 3-1 illustrates the location of the soils and Table 3-15 lists the acreage of all the soils in area.

Soils areas shaded in Table 3-15 are considered prime farmland and cover an area of 29.1 acres, roughly half of the substation site. As indicated by some of their names, the prime farmland soils have less than 5 percent slope and are not eroded. All of the soils are either weathered limestone rock, residuum, or sediments washed from soils derived from limestone rock. The Gladeville, Hampshire, Stiversville, and Talbott soils are weathered limestone. The Gladeville soil is too rocky and thin to be considered prime farmland. The Talbott series soils are too eroded to be considered prime farmland. Only the Hampshire and Stiversville soils with 2 to 5 percent slope are considered prime.

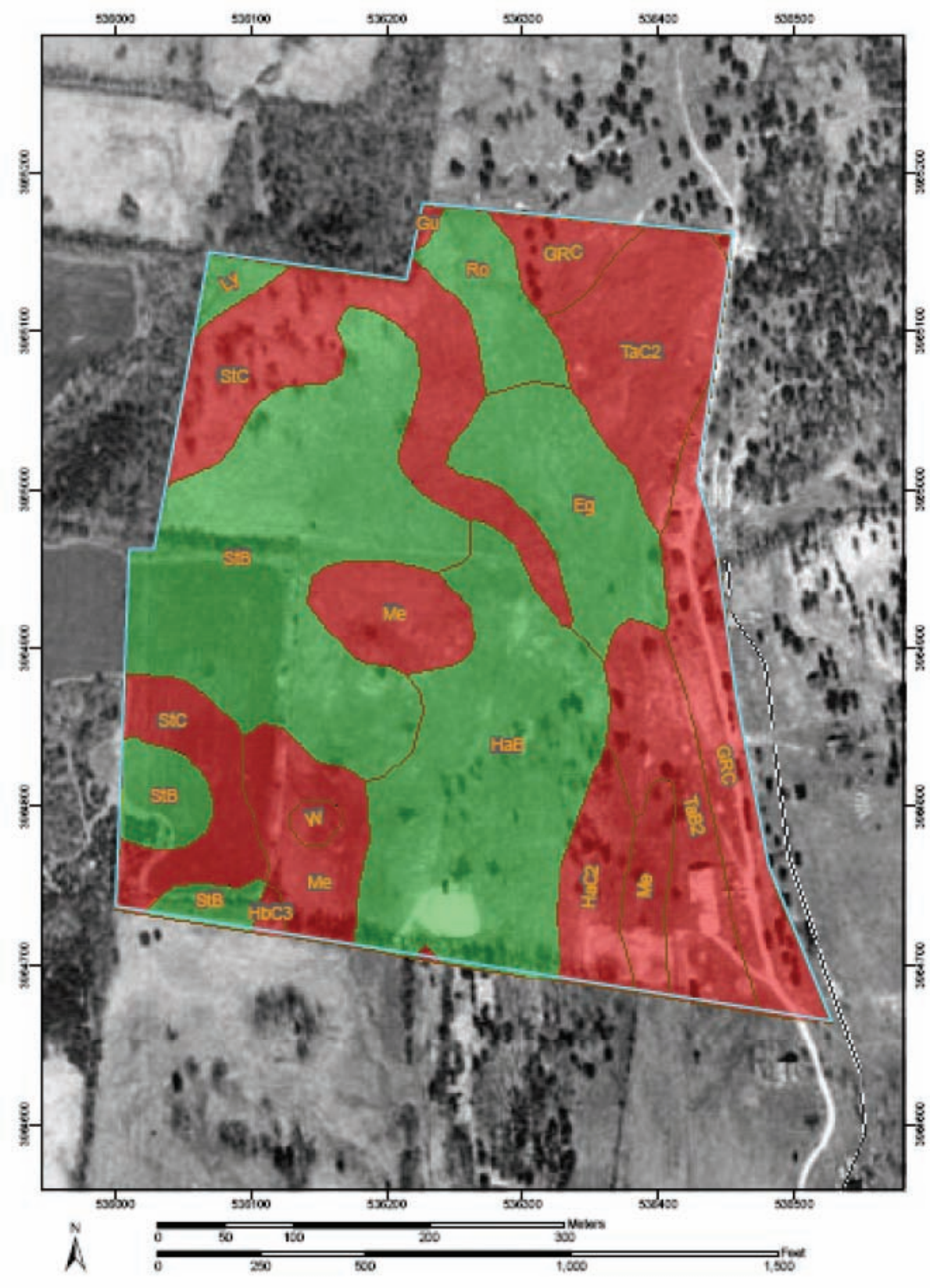

Figure 3-1. Soil Map for the Proposed Rutherford 500-kV Substation Site

Table 3-15. Description, Acreage, and Rating of Soils Located at the Proposed Substation Site

Map Unit Symbol	Map Unit Name	Rating	Acres
Eg	Egam Silt Loam	Prime	4.0
GRC	Gladeville-rock-outcrop-Talbott association, rolling	Not Prime	5.2
Gu	Gullied Land	Not Prime	0.1
HaB	Hampshire Silt Loam, 2 to 5 percent slopes	Prime	9.6
HaC2	Hampshire Silty Clay Loam, 5 to 12 percent slopes, eroded	Not Prime	1.8
HbC3	Hampshire Silty Clay Loam, 5 to 12 percent slopes, severely eroded	Not Prime	0.2
Ly	Lynnville Silt Loam	Prime	0.5
Me	Melvin Silt Loam	Not Prime	5.4
Ro	Roellen Silty Clay Loam	Prime	1.9
StB	Stiversville Silt Loam, 2 to 5 percent slopes	Prime	13.1
StC	Stiversville Silt Loam, 5 to 12 percent slopes	Not Prime	7.9
TaB2	Talbott Silt Loam, 2 to 5 percent slopes, eroded	Not Prime	3.5
TaC2	Talbott Silt Loam, 5 to 12 percent slopes, eroded	Not Prime	4.2
W	Water	Not Prime	0.3
Totals for area of interest			**57.5**

All the other soils are alluvial or colluvial; that is, they were deposited by streams or accumulated at the base of slopes by the action of gravity. Egam and Lynnville silt loams are moderately well drained and are considered prime farmland. Melvin silt loam is not considered prime farmland due to its poor drainage characteristics. It is best suited for moisture-tolerant pasture. Roellen silty clay loam is also poorly drained but is considered prime farmland as it can support crops other than pasture. When these soils were surveyed, moisture levels were such that a small depression (about one-third acre) in the Melvin silt loam in the southwest part of the property was under water.

Before a septic tank system would be installed on the substation site, the location would be determined from results of percolation tests as required by Rutherford County. Some soils at the site are poorly suited for septic tank installation due to poor drainage characteristics or shallow depth. Approximately half of the substation area is moderately suited for septic systems. All the soils in the Hampshire and Stiversville series are suitable for septic systems if depth to rock is sufficient. The Stiversville soils cover about 21 acres on the western side of the site, and Hampshire soils consist of 11.6 acres in the central and southern areas of the site (Table 3-15).

3.12. Visual Resources

The physical, biological, and man-made features seen in the landscape provide any selected geographic area with particular visual qualities and aesthetic character. The varied combinations of natural features and human alterations that shape landscape character also help define their scenic importance. The presence or absence of these features along with aesthetic attributes such as uniqueness, mystery, variety, pattern, vividness, contrast, and harmony make the visual resources of an area identifiable and distinct. The scenic value of these resources is based on human perceptions of intrinsic

beauty as expressed in the forms, colors, textures, and visual composition seen in each landscape.

A visual analysis includes evaluating the extent and magnitude of potential changes in the visual environment that could result from the proposed actions. The objectives are to identify:

- The scenic and aesthetic character of the existing landscape.
- The degree of discernible contrast between the proposed action and the existing landscape.
- The location and sensitivity levels of viewpoints available to the public.
- The visibility of the proposed action from the public viewpoints.
- Any potential cumulative changes to the visual landscape.

The visual attributes of existing scenery, along with the anticipated attributes resulting from the proposed action are reviewed and classified in the visual analysis process. The classification criteria are adapted from a scenic management system developed by the U.S. Forest Service (USFS), and integrated with planning methods used by TVA. The classifications are based on methodology and descriptions from the U.S. Department of Agriculture (1995) and TVA (2003).

Four categories of visual attributes are evaluated individually as described below, and the results help determine an overall scenic value.

- Scenic attractiveness is the measure of outstanding natural features, scenic variety, seasonal change, and strategic location. It is based on the intrinsic beauty of landforms, rock outcrops, water bodies, and vegetation. Attractiveness is ranked in one of three classifications from distinctive to minimal.
- Scenic integrity is the measure of visual unity and wholeness of the natural landscape character. It is based on the degree of disturbance in natural patterns, the presence of disruptive or discordant elements, and the relative harmony of human alterations. Integrity is ranked in one of four classifications from high to very low.
- Human sensitivity is the expressed concern of people for the scenic qualities of the project area. Sensitivity includes considerations such as the type and number of viewers, frequency and duration of views, and viewer context of adjacent scenery. Concerns are also derived or confirmed by public input. Sensitivity is ranked in one of three classifications from high to low.
- Viewing distance is the measure of how far an area can be seen by observers and the degree of visible detail. It is ranked in one of three classifications from foreground to background.
    - Foreground is up to 0.5 mile from the observer where details of objects are clearly seen. Details are most distinct in the immediate foreground of up to 300 feet.
    - Middleground is 0.5 to 4 miles where single objects or groups tend to merge into larger patterns with less distinguishable details. When viewed in this

broader context, alterations may contrast strongly with larger natural patterns and make some middleground views more sensitive than the foreground.

- Background is 4 miles to the horizon where objects are seen as broad outline patterns and forms. Details and colors are not normally discernible unless they are quite large, standing alone, or provide strong contrast.

The term "scenic visibility" is sometime used in visual analyses. Scenic visibility is composed of human sensitivity and viewing distance, which are interrelated, but evaluated and classified separately.

Visual absorption capacity is also considered when determining scenic value of a landscape. Absorption capacity indicates the relative ability of a landscape to accept human alteration with the least loss of scenic quality. It is based on characteristics of the natural features seen in the project area. As an example, alterations on a steep woodland slope with dense evergreen cover would create much greater visual contrast than similar actions on a gentle slope with a cover of mixed woodlands and pastures. Areas of greatest scenic value frequently have the least capacity to absorb visual change without substantial devaluation.

Overall scenic value is determined by evaluating the combined levels of the four attributes, along with absorption capacity. It is ranked in one of four classes ranging from excellent to poor.

The following sections describe the existing environment of each segment of the new transmission lines and substation. Each segment of the proposed transmission line routes traverses a variety of Middle Tennessee landscape. For clarification, each of these segments is described based upon regional aesthetic conditions and landscape character and include unaltered landscapes, human alterations and development in the environment, and evolving landscapes of aesthetic significance.

3.12.1. Rutherford 500-kV Substation

The proposed 53.1-acre, 500-kV Rutherford Substation site is located just east of the Patterson Community and 0.3 mile north of Patterson Road (Opossum Trot Road) in Rutherford County, Tennessee. The site is not visible from Patterson Road and is located on mainly level to gently sloping terrain on pastoral land. There are few homes in the immediate area, and traffic along Patterson Road is very light. Land use in the vicinity is mainly open, grazing lands with views in the foreground and middleground distances in all directions. Scenic attractiveness is common. Scenic integrity is low due to human alterations of naturally evolving landscapes that are now agriculture and grazing lands.

3.12.2. Maury Transmission Line

The proposed Maury 500-kV Transmission Line would begin at the existing TVA Maury Substation on North Point Drive in Maury County, and extend 27 miles to the northeast. The Maury Substation area is mainly industrial to the immediate east and is characterized by numerous laced-steel transmission structures and industrial architecture, i.e., metal buildings and open expanses of asphalt parking. To the west is mainly agricultural and residential land with a few homes bound by open, pastoral landscapes.

Approximately 0.5 mile to the east, the new 500-kV transmission line would cross US 31, a major thoroughfare from Columbia to the south and Nashville to the north. Traffic along US 31 is extremely heavy. Continuing east, the line would cross Rutherford Creek three times.

The creek is a narrow body of water suitable only for small watercraft along this section. Prior to the third creek crossing, the new line would bisect Double Branch Road. This area is mainly residential, characterized by open grasslands and existing utility poles along roadsides.

Farther northeast, the transmission line would cross Greens Mill Road and a subdivision development that is typical of the region. There are several homes in the foreground and middleground of the proposed line route. There are numerous wood utility poles along roadsides, and an existing transmission line route bisects Greens Mill Road from north to south. Residents have foreground views of existing single steel poles within this transmission line route.

Just west of I-65, the line would cross Kedron Road. A new residential development is under construction to the northwest, and there are numerous existing homes in all directions. Residents have foreground views of an existing water treatment plant on the northeast side of Kedron Road, a minor industrial element that provides discordant contrast in this mainly rural setting. Scenic attractiveness is common, with a variety of landforms and textures in the landscape. Scenic integrity is low, a result of residential construction, the water treatment plant, and associated infrastructure development in the area.

Existing transmission lines end just west of I-65, and the route would continue to the northeast on vacant, TVA-owned, 175-foot ROW. Crossing I-65, the line would be located along gently sloping terrain and would traverse dense vegetation outside of existing road ROW. Continuing northeast, the line would traverse US 41, a major thoroughfare from Shelbyville to the south and Nashville to the north. There are numerous homes along this section of US 41 and more under construction. An existing water tower along the east side of US 431 provides vertical contrast in the rural setting and can be seen up to middleground distances north and south on US 431.

Northeast of US 431, the landscape becomes a transition zone to pasture along roadways and an increase in woodland areas in the middleground distances. Residential development becomes sporadic, and topography becomes steeper. Approximately 2 miles east of US 431, the ROW would traverse the 256-acre Smithson-McCall farm, which was listed on the National Register of Historic Places (NRHP) in 2007. This property is further described in Section 3.13. Near Skinner Hill at Keys Flat Creek, open pastures in the foreground provide visual contrast to dense woodland areas in the middleground. There are few homes in the area, and traffic is light along Cross Keys Road.

Near US 31A, two NRHP-listed properties have been identified: the William Allison house to the south and the William Ogilvie house along the proposed route on US 31A. Both houses are located in sparsely developed areas and can be viewed from the roadway. These properties are further described in Section 3.13.

The transmission line route would continue northeast over the Harpeth River and Talieaferro Road over steep terrain. This area is heavily wooded and is mostly inaccessible by automobile near Patterson-Windrow Road. Turning northwest, the route would cross Patterson-Windrow Road and traverse mainly open pastureland before crossing Patterson Road (Opossum Trot Road) and entering the proposed Rutherford Substation site.

3.12.3. Almaville Transmission Line

The proposed Almaville 161-kV Transmission Line would begin at the existing Almaville Substation in Rutherford County. The substation is located in a heavily populated

residential area and is in the immediate foreground of numerous residents and motorists along Almaville Road, a major thoroughfare between SR 96 to the south and the town of Smyrna to the north. The new transmission line would begin on vacant, TVA-owned, 100-foot ROW to the east and would traverse dense vegetation before turning southeast at Stewart Creek.

Crossing Stewart Creek Road, the proposed line would continue through heavy vegetation east of Persimmon Knob and Gibbs Knob. The line would cross Manson Pike to the south, a major thoroughfare between Almaville and Murfreesboro. There are few homes in the area. Continuing south, the line would cross Shores Road, a minor road with no homes in the immediate area. Several structures in the area appear to be abandoned homesites. Vegetation is heavy adjacent to road ROW. Scenic attractiveness is minimal. Scenic integrity is low.

The proposed line would cross SR 96 near Hall Road. SR 96 is a major thoroughfare between Franklin, Tennessee, to the west and Murfreesboro to the east. Traffic is extremely heavy. There are few homes in the foreground distances in all directions. Farther south, just west of Patterson Road (Opossum Trot Road), the line route would turn west and cross steep, heavily vegetated terrain at the southern base of Indian Mountain. This area has little access for the public and is a major focal point in the landscape from all directions due to its prominent peaks. Turning northwest, the route would traverse the western base of Scales Mountain at an obtuse angle. This area has been identified as Scales Mountain Knobs SNA (Section 3.9). Turning west, the route would follow steep terrain across the westernmost peak of Scales Mountain before turning south and entering the proposed Rutherford 500-kV Substation. Scenic attractiveness is distinctive in this area. Scenic integrity is moderate.

3.12.4. Christiana Transmission Line

The proposed Christiana 161-kV Transmission Line would begin at the existing Christiana Substation on US 231 in Rutherford County, Tennessee, just west of the town of Christiana. US 231 is a major thoroughfare from Alabama to major towns in Tennessee east of Nashville. Traffic is extremely heavy, and the landscape is characterized by numerous service poles along the ROW, signage, and myriad residential development.

Just west of US 231, the route would follow open pastureland and cross Stones Creek. At Walnut Grove Road and Panther Creek Road, there are several homes in the foreground of the proposed route. This area is characterized by open pastureland interspersed with undisturbed woodland thickets. Scenic attractiveness is common. Scenic integrity is moderate.

The line route would continue west over steep terrain. The route would traverse the base of Garrett Knob and cross SR 99 just north of the town of Rockvale. There are no homes in the immediate area. However, SR 99 is a main thoroughfare, and traffic is heavy. There is dense vegetation outside of the road ROW, and numerous utility poles can be seen along the road shoulders.

Continuing past Rockvale Road, the line route would turn north and then west at Rowling Hill, crossing Windrow Road. The proposed crossing would be on mostly level terrain. There are several homes in the foreground, and vegetation is heavy along the ROW, obscuring views of existing structures. Dyer Road to the north would be in the foreground of the route, terminating at Dyer Cemetery.

To the west along Morgan Road, the route would be in the immediate foreground of Hayes Cemetery. This area is typical of the region, heavily vegetated with views limited to the roadway itself. The line would turn north just west of Morgan Road and follow steep terrain to Patterson-Windrow Road, Opossum Trot Road, and to the proposed Rutherford Substation.

3.13. Cultural Resources

The Central Basin of Middle Tennessee has been an area of human occupation for the last 12,000 years. Human occupation of the area is generally described in five broad cultural periods: Paleo-Indian (11,000-8000 B.C.), Archaic (8000-1600 B.C.), Woodland (1600 B.C.-A.D. 1000), Mississippian (A.D. 1000-1700), and Historic (A.D. 1700 to present). Prehistoric land use and settlement patterns vary during each period, but short- and long-term habitation sites are generally located on floodplains and alluvial terraces along rivers and tributaries. Specialized campsites tend to be located on older alluvial terraces and in the uplands.

The Paleo-Indian Period represents the documented first human occupation of the area. The settlement and land use pattern of this period were dominated by highly mobile bands of hunters and gatherers. The subsequent Archaic Period represents a continuation of the hunter-gatherer lifestyle. Through time, there is increasing social complexity and the appearance of horticulture late in the period. The settlement pattern during this period is characterized by spring and summer campsites. Increased social complexity, reliance on horticulture and agriculture, and the introduction of ceramic technology characterize the Woodland Period. The increased importance of horticulture is associated with a less mobile lifestyle as suggested by semipermanent structures. The Mississippian Period, the last prehistoric period in East Tennessee, is associated with the pinnacle of social complexity in the southeastern United States. This period is characterized by permanent settlements, maize agriculture and chiefdom level societies.

Rutherford County was created from Davidson, Wilson, Williamson, and Sumner counties in 1803. In 1811, Murfreesboro became the county seat and served as the state capitol from 1818 to 1826. Due to its location between Nashville and Chattanooga, Rutherford County underwent numerous Civil War actions. The county's chief agricultural products continue to be livestock and grains (Hankins 1998).

Maury County was created from parts of Williamson and Dickson Counties. The rich fertile soil of the county attracted settlers, who planted cotton and tobacco and raised livestock. After the Civil War, farmers shifted from cotton to growing grain, although tobacco is still the county's largest cash crop. Today Maury County leads the state in the production of beef cattle and remains a major producer of corn, wheat, grain, sorghum, and cotton (Lightfoot 1998).

Williamson County was created from part of Davidson County in 1799. Like the other counties in the fertile Central Basin, Williamson County thrived on an agricultural economy. Phosphate mining became a profitable pursuit during the early 1890s. The county remained mostly agrarian through the 1960s, but during the late-20th century, urban sprawl from nearby Nashville forever changed the landscape of the area (Crutchfield 1998).

TVA is mandated under the National Historic Preservation Act of 1966 and the Archaeological Resources Protection Act (ARPA) of 1979 to protect significant archaeological resources and historic properties located on TVA lands or affected by TVA

undertakings. A historic property is defined under 36 CFR Part 800.16(1) as "any prehistoric or historic district, site, building, structure, or object included in, or eligible for inclusion in, the NRHP."

3.13.1. Rutherford 500-kV Substation

The area of potential effect (APE) for archaeological resources for the proposed substation site consists of a 78-acre area encompassing the smaller substation site and access road. The APE for architectural investigations includes a 0.5-mile radius surrounding the substation site, for a total area of 1,497 acres. Viewsheds to and from the project area were terminated where topography and vegetation obstructed line of sight.

Prior to any survey, background research was conducted, and two previously recorded archaeological sites (40RD265 and 40RD266) were identified within the APE (Deter-Wolf and Karpynec 2007). These sites are considered ineligible for listing on the NRHP because they do not have the potential to yield additional significant archaeological data.

The background research also identified 13 previously recorded architectural properties (RD-3136, 3149, 3150, 3151, 3154-3158, and 3161-3164) within the APE. The survey revealed that Sites RD-3150, 3151, 3154-3158, 3162, and 3163 have been destroyed since their initial recordation. The substation site is not visible from RD-3136, 3149, and 3164 due to the surrounding rolling terrain and dense tree growth, and no further evaluation of these properties was conducted. Site RD-3161 falls within the viewshed of the proposed substation site; however, it is considered ineligible for the NRHP due to modern exterior and interior alterations.

The archaeological survey was conducted on December 12-14, 2006, and no new sites were identified.

The historical/architectural survey of the APE identified six previously unrecorded buildings (HS-1–HS-6). These resources are considered ineligible for the NRHP due to the loss of integrity caused by modern alterations and/or damage.

3.13.2. Maury Transmission Line

The archaeological APE consists of the proposed 27-mile-long, 175-foot-wide ROW. A total area of approximately 572.4 acres was subjected to archaeological survey during the project. The APE for architectural studies included a 0.5-mile buffer surrounding the transmission line for a total area of 17,519.4 acres. Viewsheds to and from the project area were terminated where topography and vegetation obstructed line of sight.

Prior to any survey, background research was conducted, and 10 previously recorded archaeological sites (40MU354, 40MU355, 40WM34-38, 40WM40-41, and 40WM324) were identified within the APE (Hockersmith and Karpynec 2007a). Site 40WM35 is an Early, Late Woodland and 20th century site and is considered potentially eligible for listing on the NRHP because there is a potential for intact, buried deposits, including on the portion within the APE.

TVA considered the following archaeological sites ineligible for listing on the NRHP:

- Site 40WM324 (William Ogilvie house) is a Mississippian, historic-18th century to the present site; the portion of the site that is located within the APE is considered ineligible for listing on the NRHP because it lacks integrity.

- Site 40MU354 is an Early Woodland site; the portion of the site that is located within the APE is considered ineligible for listing on the NRHP due to the lack of intact features.
- Site 40MU355 is an unknown prehistoric and 20th century site; the portion of the site that is located within the APE is considered ineligible for listing on the NRHP because it is unlikely to yield any additional significant information regarding the prehistory.
- Site 40WM34 is an unknown prehistoric open habitation; the portion of the site that is located within the APE is considered ineligible for listing on the NRHP because it lacks integrity.
- Site 40WM36 is an Archaic, Late Archaic, historic site; the portion of the site that is located within the APE and considered ineligible for listing on the NRHP lacks integrity.
- Site 40WM37 is a Late Archaic, Early Woodland, Mississippian, and historic-20th century site; the portion of the site that is located within the APE is considered ineligible for listing on the NRHP because it lacks integrity.
- Site 40WM38 is an undetermined prehistoric and historic-20th century site; the portion of the site that is located within the APE is considered ineligible for listing on the NRHP because it lacks integrity.
- Site 40WM40 is a Late Archaic, Early Woodland site; the portion of the site that is located within the APE is considered ineligible for listing on the NRHP because it lacks integrity.
- Site 40WM41 is an Archaic site; the portion of the site that is located within the APE is considered ineligible for listing on the NRHP because it lacks integrity.

The background search conducted identified 70 previously recorded architectural resources within the APE (Table 3-16). Half of these have been previously destroyed since their initial recordation, and 12 are located outside the visual line of sight to the project route. The remaining 23 extant architectural resources are ineligible for the NRHP due to their lack of architectural distinction and loss of integrity caused by modern alterations and/or damage.

In addition to the previously recorded architectural resources, three NRHP-listed properties (William Ogilvie house, William Allison house, and Smithson-McCall farm) are located within the proposed APE.

The William Ogilvie house (WM-233) is a two-story, double-pen house with an enclosed central breezeway that was constructed between circa 1800-1820. The William Ogilvie house was listed on the NRHP for its association with the early settlement of Williamson County and as a local example of an early 19th-century log residence (Thomason and Matter 1987). Since the date of its listing, the house has been severely altered through the construction of the rear two-story addition, the interior modification to the circa 1920 shed extension, and the loss of three contributing outbuildings. As a result, the William Ogilvie house does not retain sufficient integrity to remain listed on the NRHP.

Table 3-16. Architectural Resources From the Proposed Project Area

Status of Architectural Resource	Previously Recorded Architectural Resources
Destroyed	MU-61; MU-1967; MU-1982; MU-1984; MU-2006; MU-2025; MU-2113; MU-2134; MU-2150; MU-2151; MU-2153; MU-2155; MU-2157; MU-2177; MU-2179; MU-2180; MU-2181; MU-2182; MU-2188; MU-2190; MU-2191; MU-2192; RD-1598; RD-3000; RD-3005; RD-3007; RD-3009; RD-3018; WM-284; WM-302; WM-378; WM-379; WM-384; WM-906; WM-1044
Outside the Line of Sight	MU-2005; MU-2007; MU-2015; MU-2026; MU-2108; MU-2166; RD-3010; WM-220; WM-230; WM-304; WM-380; WM-382
Ineligible	MU-59; MU-468; MU-469; MU-490; MU-491; MU-1960; MU-1961; MU-1975; MU-1976; MU-1977; MU-1983; MU-2008; MU-2152; MU-2156; MU-4920; RD-3006; RD-3011; WM-231; WM-386; WM-1038; WM-1039; WM-1045; WM-1048

The William Allison house (WM-232) is a two-story, brick federal-influence house with an original two-story ell that was constructed between circa 1827-1832. The William Allison house was listed on the NRHP for its association with Thomas Allison, a two-term member of the Tennessee Legislature, and as a local example of a federal-influenced, central-passage brick residence (ibid). The NRHP boundary for the resource includes the 1-acre lot located off US 31A.

The Smithson-McCall farm is a 256-acre farmstead anchored by a center-hall plan house that was built circa 1830. The Smithson-McCall farm was listed on the NRHP for its association with progressive agricultural practices of the early 20th century and for its architectural distinction as a good example of an early 20th-century Middle Tennessee farmstead. The farm is also a registered Tennessee Century Farm in recognition of having been owned and farmed by the same family for over 100 years. In order to help preserve the farm, the farm owners have conveyed a conservation easement for the farm to the Land Trust of Tennessee.

The archaeological survey identified six previously unrecorded sites (40MU581-585 and 40WM414) and revisited the 10 previously identified sites. Sites 40MU581-40MU584 are undetermined prehistoric sites and are considered ineligible for listing on the NRHP due to the lack of intact deposits and lack of integrity. Site 40MU585 is an undetermined prehistoric and historic-20th century site; the portion of the site that is located within the proposed APE is considered ineligible for listing on the NRHP because it lacks integrity. Site 40WM414 is an undetermined prehistoric site and is considered ineligible for listing on the NRHP due to the lack of intact deposits and lack of integrity.

The historic/architectural survey identified 31 previously unrecorded architectural resources (HS-1–HS-31) within the proposed APE. All of these resources are considered ineligible for the NRHP due to their lack of architectural distinction and loss of integrity caused by modern alterations and/or damage.

3.13.3. Almaville Transmission Line

The archaeological APE for this transmission line consists of the proposed 9-mile-long, 100-foot-wide ROW. The APE for architectural studies includes a 0.5-mile buffer surrounding the transmission line. Viewsheds to and from the project area were terminated where topography and vegetation obstructed line of sight.

Prior to any survey, background research was conducted, and no previously recorded archaeological sites and 15 previously recorded architectural resources were identified within the proposed APE (Hockersmith and Karpynec 2007b). Of these, five (RD-3049, 3050, 3052, 3059, 3096) have been destroyed since their initial recordation and eight (RD-3029, 3067, 3068, 3097, 3098, and 3130–3132) are located outside the visual line of sight to the project ROW. The remaining two (RD-3053 and 3095) extant architectural resources are ineligible for the NRHP due to their lack of architectural distinction and loss of integrity caused by modern alterations and/or damage.

The archaeological survey identified one previously unrecorded site (40RD282), which is an Early to Late Archaic open habitation site that consists of shallow, disturbed deposits and is considered ineligible for listing on the NRHP.

The historic/architectural survey identified one previously unrecorded architectural resource (HS-47) within the proposed APE. This resource is considered ineligible for the NRHP due to the lack of architectural distinction and loss of integrity caused by modern alterations and/or damage.

3.13.4. Christiana Transmission Line

The archaeological APE for this transmission line consists of the proposed 15-mile-long, 100-foot-wide ROW. The APE for architectural studies included a 0.5-mile buffer surrounding the transmission line. Viewsheds to and from the project area were terminated where topography and vegetation obstructed line of sight.

Prior to any survey, background research was conducted, and no previously recorded archaeological sites and 34 previously recorded architectural resources were identified within the proposed APE (ibid). Of these architectural resources, 12 (RD-1492, 1515, 1516, 3005, 3008, 3009, 3154, 3155, 3157, 3158, 3162, and 3163) have been destroyed since their initial recordation and nine (RD-1471, 1491, 1496, 1497, 3006, 3010, 3014, 3019, 3164) are located outside the visual line of sight to the project ROW. The remaining 13 (RD-1465–1470, 1495, 3011–3013, 3053, 3095, and 3161) extant architectural resources are ineligible for the NRHP due to their lack of architectural distinction and loss of integrity caused by modern alterations and/or damage.

In addition to the previously recorded architectural resources, one NRHP-listed property (RD-1494 [Rockvale Store]) is located within the APE. The Rockvale Store is a one-story, front-gable commercial building that was constructed circa 1884. The Rockvale Store was listed on the NRHP in 1995 for its local significance in the commercial history of the Rockvale Community and as a local example of a commercial building featuring Folk Victorian detailing (West and Besser 1995). Since the date of its listing, the building has been severely altered through the construction of the rear shed extension; the application of corrugated metal as an exterior siding, which has concealed original door and window openings; the reconstruction of the façade porch; and the installation of a modern door and window along the building's north elevation. As a result, the Rockvale Store does not retain sufficient integrity to remain listed on the NRHP.

The archaeological survey identified two previously unrecorded sites (40RD280 and 40RD281). Site 40RD280 is a mid-19th to the early 20th-century historic cemetery and brick scatter that is considered ineligible for listing on the NRHP; however, in accordance with Tennessee laws regarding the treatment of graves and human remains the cemetery should be avoided during construction and maintenance. If avoidance were not possible, then preservation, termination, and removal options would be evaluated. Following the

initial site identification, TVA designed an alternate route to avoid the historic cemetery. The proposed relocated route passes south of the cemetery. Site 40RD281 is a collection of stone features of indeterminate age and is considered potentially eligible for listing on the NRHP for its potential to contribute additional information on the history or prehistory of the region (Parker and King 1998). If avoidance of this site were not possible, then Phase II testing would be undertaken to assess conclusively its significance as a traditional cultural property, examine the integrity and research potential of the stone features, and conclusively determine the presence or absence of human remains. Following the initial identification, TVA designed an alternate route to avoid impacting the site. The proposed relocated route passes south of Site 40RD281.

The historic/architectural survey identified 15 previously unrecorded architectural resources (HS-32-46) within the proposed APE. These resources are considered ineligible for the NRHP due to their lack of architectural distinction and loss of integrity caused by modern alterations and/or damage.

3.14. Socioeconomics

The proposed substation would be located in Rutherford County, and the proposed transmission lines would be in Rutherford, Williamson, and Maury counties (Section 2.4.2). Tables 3-17 through 3-19 have demographic and economic data for these counties, the state, and the nation.

Table 3-17. Population

Area	1990	2000	2006	Percent Increase 1990-2006	Persons per Square Mile, 2006
Rutherford County	118,570	182,023	228,829	93.0	369.7
Williamson County	81,021	126,638	160,781	98.4	275.9
Maury County	54,812	69,498	78,309	42.9	127.8
Total	254,403	378,159	467,919	83.9	257.9
Tennessee	4,877,185	5,689,283	6,038,803	23.8	146.5
U.S. (000)	248,709.9	281,421.9	299,398.5	20.4	84.6

Source: U.S. Census Bureau, www.census.gov

Table 3-18. Employment, 2005

	Total	Farm	Construction	Manufacturing	Trade	Government	Other
Number of Workers							
Rutherford Co.	127,500	1,877	8,010	23,005	19,652	13,704	61,252
Williamson Co.	100,875	1,753	7,855	3,429	15,554	8,327	63,957
Maury Co.	43,845	1,940	2,507	7,710	5,710	6,590	19,388
Total	272,220	5,570	18,372	34,144	40,916	28,621	144,597
Tennessee	3,630,959	98,051	226,005	424,041	557,012	438,664	1,887,186
U.S. (000)	174,249.6	2,914.0	10,845.7	14,860.9	25,342.4	23,837.0	96,449.6
Percent Distribution							
Rutherford Co.	100.0	1.5	6.3	18.0	15.4	10.7	48.0
Williamson Co.	100.0	1.7	7.8	3.4	15.4	8.3	63.4
Maury Co.	100.0	4.4	5.7	17.6	13.0	15.0	44.2
Total	100.0	2.0	6.7	12.5	15.0	10.5	53.1
Tennessee	100.0	2.7	6.2	11.7	15.3	12.1	52.0
U.S. (000)	100.0	1.7	6.2	8.5	14.5	13.7	55.4

Source: U.S. Bureau of Economic Analysis, www.bea.gov/reis

Table 3-19. Labor Force, Unemployment, and Income

Area	Labor Force and Unemployment, 2006			Personal Income, 2005	
	Civilian Labor Force	Unemployed	Rate of Unemploy-ment	Per Capita	Percent of U.S.
Rutherford Co.	122,090	4,920	4.0	29,784	86.4
Williamson Co.	83,900	2,940	3.5	47,712	138.4
Maury Co.	36,420	1,970	5.4	27,775	80.6
Total	242,410	9,830	4.1	35,581	103.2
Tennessee	2,990,200	154,600	5.2	30,969	89.8
U.S. (000)	151,428.0	7,001.0	4.6	34,471	100.0

Sources: Tennessee Division of Employment Security, www.tn.state.gov/; U.S. Bureau of Economic Analysis, www.bea.gov/reis

3.14.1. Rutherford 500-kV Substation

The Rutherford Substation would be located in Rutherford County. As shown in Table 3-17, Rutherford County has a total population of about 229,000, and has experienced rapid population growth in recent years. It is much more densely populated than the state, with almost 370 persons per square mile, about 2.5 times the state average. Total employment in Rutherford County in 2005 was 127,500, of which 18 percent was manufacturing, a significantly higher share than in the state or the nation (Table 3-18). The county has a relatively low share of employment in farming, about 1.5 percent, compared to the state share of 2.7 percent. In 2006, over 122,000 residents of Rutherford County were in the labor force (Table 3-19), of which 4.0 percent were unemployed, an unemployment rate lower than the state average of 5.2 percent and the national average of 4.6 percent. Per capita personal income in 2005 was $29,784, somewhat lower than the state average of $30,969 and 86.4 percent of the national average of $34,471.

3.14.2. Maury 500-kV Transmission Line

The Maury Transmission Line would be largely in Maury and Rutherford counties, with a small portion in Williamson County. All of these counties have experienced significant population growth in recent years, with Maury County increasing by almost 43 percent from 1990 to 2006, while Rutherford and Williamson counties increased at much faster rates, 93 and over 98 percent, respectively (Table 3-17). Population density in Maury County, at almost 128 persons per square mile, is below the state average of over 146 per square mile; however, Rutherford and Williamson are well above the state average, at about 370 and 276 persons per square mile, respectively. Total employment in 2005 in the three counties was over 272,000 (Table 3-18). Of these jobs, almost 44,000 were in Maury County, 127,500 in Rutherford County, and almost 101,000 in Williamson County. Manufacturing employment was a significantly larger share of total employment in both Maury and Rutherford counties than statewide, but a much smaller share in Williamson County. In Maury County, farm employment, at 4.4 percent of the total, was more important than in the other counties or the state. The civilian labor force in the three counties was more than 242,000. Of these, slightly more than half lived in Rutherford County, almost 35 percent in Williamson County, and about 15 percent in Maury County. Unemployment rates ranged from 3.5 percent in Williamson County to 5.4 percent in Maury County, with Rutherford County at 4.0 percent. Per capita personal income varied widely among the counties in 2005 (Table 3-19) with Williamson County at more than 103 percent of the national average at $35,581, while Maury County was $27,775, almost 81 percent of the national average, and Rutherford County was $29,784, over 86 percent of the national average.

3.14.3. Almaville 161-kV Transmission Line

The Almaville Transmission Line would be located in Rutherford County, going east from the Rutherford Substation for a short distance, then north to the existing Almaville Substation. Since the Rutherford Substation would also be located in Rutherford County, the description above for the substation also applies to this transmission line.

3.14.4. Christiana 161-kV Transmission Line

The Christiana Transmission Line would go approximately southeast between the Rutherford Substation and the Christiana Substation, passing through a portion of Rutherford County. Since the Rutherford Substation would also be located in Rutherford County, the description above for the substation also applies to this transmission line.

3.15. Environmental Justice

The counties within the proposed project area all have smaller numbers of minority population and lower levels of poverty than the state as a whole or the nation (Tables 3-20 and 3-21). Specific areas that could be impacted by the proposed substation or by any of the proposed transmission lines are discussed below under each proposed action.

Table 3-20. Minority Population, 2000

Area	Total Population	Minority Population			
		Nonwhite	White Hispanic	Total	Percent of Total
Rutherford Co.	182,023	25,973	2,288	28,261	15.5
Williamson Co.	126,638	10,697	1,764	12,461	9.8
Maury Co.	69,498	12,236	935	13,171	19.0
Total	378,159	48,906	4,987	53,893	14.3
Tennessee	5,689,283	1,125,973	57,380	1,183,353	20.8
U.S. (000)	281,421,906	69,961,280	16,907,852	86,869,132	30.9

Source: U.S. Bureau of the Census, www.census.gov/

Table 3-21. Persons Below Poverty Level (Percent)

Area	1999	2004
Rutherford Co.	9.0	10.0
Williamson Co.	4.7	5.4
Maury Co.	10.9	12.6
Total	7.9	8.8
Tennessee	13.5	15.0
U.S. (000)	12.4	12.7

Source: U.S. Bureau of the Census, www.census.gov/

3.15.1. Rutherford 500-kV Substation

The Rutherford Substation would be located in Rutherford County, in Census Tract (CT) 408.04, Block Group (BG) 1. The minority population in this block group, as of the 2000 Census of Population, was 19, only 2.4 percent of the total. The poverty level was 14.4 percent.

3.15.2. Maury 500-kV Transmission Line

The Maury 500-kV Transmission Line would go west from the Rutherford Substation to the Maury Substation, passing through parts of Rutherford, Williamson, and Maury counties, as shown in Table 3-22 below. With the exception of CT 511, BG 1 in Williamson County, the

minority population share in each of these block groups is lower than the corresponding county average. In five of the eight block groups, the poverty level is somewhat higher than the county level; however, all but two of these block groups have poverty levels below the state average of 13.5 percent (see Table 3-22).

Table 3-22. Minority and Low-Income Populations in Census Tracts and Block Groups in the Vicinity of the Maury 500-kV Transmission Line

County and Block Group	Minority Population Share (%), 2000	Poverty Rate, 1999
Rutherford County:	**15.5**	**9.0**
CT 408.04, BG 1	2.4	14.4
CT 408.02, BG 2	6.3	6.2
Williamson County:	**9.8**	**4.7**
CT 511, BG 3	5.0	8.7
CT 511, BG 2	7.2	6.0
CT 511, BG 1	14.8	8.7
Maury County:	**19.0**	**10.9**
CT 104, BG 1	16.9	15.6
CT 103, BG1	18.1	3.4
CT 102, BG 3	13.4	6.5

Note: CT = Census Tract; BG = Block Group. The U.S. Census Bureau divides counties into census tracts, which are further subdivided into block groups and individual blocks.
Source: U.S. Census Bureau, Census of the Population, 2000, www.census.gov/

3.15.3. Almaville Transmission Line

The Almaville Transmission Line would go south from the Almaville Substation to the Rutherford Substation, passing through a portion of Rutherford County. The line would go through CT 408.04, BGs 1 and 4. Both of these block groups have much lower minority population shares than the county as a whole (Table 3-23). The poverty rate in BG 4 is well below the county average. However, the rate in BG 1 is well above the county average and somewhat higher than the state average of 13.5.

Table 3-23. Minority and Low-Income Populations in the Census Tract and Block Groups in the Vicinity of the Almaville Transmission Line

County and Block Group	Minority Population Share (%), 2000	Poverty Rate, 1999
Rutherford County:	**15.5**	**9.0**
CT 408.04, BG 1	2.4	14.4
CT 408.04, BG 4	7.0	4.0

Note: CT = Census Tract; BG = Block Group. The U.S. Census Bureau divides counties into census tracts, which are further subdivided into block groups and individual blocks.
Source: U.S. Census Bureau, Census of the Population, 2000, www.census.gov/

3.15.4. Christiana Transmission Line

The Christiana Transmission Line would go approximately southeast between the Rutherford Substation and the Christiana Substation, passing through a portion of Rutherford County. The line would pass through several block groups (see Table 3-24). In

all of these block groups, the minority population share is well below the county average. Poverty levels are well below the county average in all of the block groups except CT 408.04, BG 1; the rate in this block group is well above the county average and somewhat higher than the state average of 13.5 percent.

Table 3-24. Minority and Low-Income Populations in the Census Tracts and Block Groups in the Vicinity of the Christiana Transmission Line

County and Block Group	Minority Population Share (%), 2000	Poverty Rate, 1999
Rutherford County:	**15.5**	**9.0**
CT 407, BG 2	6.9	3.6
CT 407, BG 3	8.9	3.8
CT 408.02, BG 1	5.3	2.6
CT 408.02, BG 2	6.3	6.2
CT 408.04, BG 1	2.4	14.4

Note: CT = Census Tract; BG = Block Group. The U.S. Census Bureau divides counties into census tracts, which are further subdivided into block groups and individual blocks.
Source: U.S. Census Bureau, Census of the Population, 2000, www.census.gov/