Federal Energy Regulatory Commission

Office of Energy Projects

March 2016

Tennessee Gas Pipeline Company, L.L.C. **Docket No. CP15-77-000**

Broad Run Expansion Project

Environmental Assessment

Cooperating Agency

West Virginia Department of Environmental Protection

Washington, DC 20426

FEDERAL ENERGY REGULATORY COMMISSION
WASHINGTON, D.C. 20426

OFFICE OF ENERGY PROJECTS

In Reply Refer To:
OEP/DG2E/Gas Branch 1
Tennessee Gas Pipeline, L.L.C.
Docket No. CP15-77-000

TO THE PARTY ADDRESSED:

The staff of the Federal Energy Regulatory Commission (FERC or Commission) has prepared an environmental assessment (EA) for the Broad Run Expansion Project (Project) proposed by Tennessee Gas Pipeline, L.L.C. (Tennessee) in the above-referenced docket. Tennessee requests authorization and a Certificate of Public Convenience and Necessity pursuant to Sections 7(b) and 7(c) of the Natural Gas Act to construct new compressor stations and replace compression facilities in West Virginia, Kentucky, and Tennessee. The purpose of the Project is to provide an additional 200,000 dekatherms per day of firm incremental transportation service and to replace older, less efficient compression facilities with new, more efficient compression facilities.

The EA assesses the potential environmental effects of construction and operation of the Broad Run Expansion Project in accordance with the requirements of the National Environmental Policy Act (NEPA). The FERC staff concludes that approval of the proposed Project, with appropriate mitigating measures, would not constitute a major federal action significantly affecting the quality of the human environment.

The West Virginia Department of Environmental Protection participated as a cooperating agency in the preparation of the EA. Cooperating agencies have jurisdiction by law or special expertise with respect to resources potentially affected by the proposal and participate in the NEPA analysis.

The EA addresses the potential environmental effects of the construction, modification, and operation of the following facilities associated with the Project:

- four new compressor stations (CS): two in Kanawha County, West Virginia (CS 118A and CS 119A); one in Madison County, Kentucky (CS 875); and one in Davidson County, Tennessee (CS 563); and
- modifications (including abandonment and replacement of certain compression units, system components, and associated facilities) at the existing Clay City Compressor Station in Powell County, Kentucky (CS 106), and the existing Catlettsburg Compressor Station in Boyd County, Kentucky (CS 114).

The FERC staff mailed copies of the EA to federal, state, and local government representatives and agencies; elected officials; environmental and public interest groups; Native American tribes; potentially affected landowners and other interested individuals and groups; and newspapers and libraries in the Project area. Paper copy versions of this EA were mailed to those specifically requesting them; all others received a CD version. In addition, the EA is available for public viewing on the FERC's website (www.ferc.gov) using the eLibrary link. A limited number of copies are available for distribution and public inspection at:

Federal Energy Regulatory Commission
Public Reference Room
888 First Street NE, Room 2A
Washington, DC 20426
(202) 502-8371

Any person wishing to comment on the EA may do so. Your comments should focus on the potential environmental effects, reasonable alternatives, and measures to avoid or lessen environmental impacts. The more specific your comments, the more useful they will be. To ensure that your comments are properly recorded and considered prior to a Commission decision on the proposal, it is important that the FERC receives your comments on or before **April 11, 2016**.

For your convenience, there are three methods you can use to submit your comments to the Commission. In all instances, please reference the project docket number (CP15-77-000) with your submission. The Commission encourages electronic filing of comments and has expert staff available to assist you at (202) 502-8258 or efiling@ferc.gov.

1. You may file your comments electronically by using the eComment feature on the Commission's website (www.ferc.gov) under the link to Documents and Filings. An eComment is an easy method for interested persons to submit brief, text-only comments on a project;

2. You may file your comments electronically by using the eFiling feature on the Commission's website (www.ferc.gov) under the link to Documents and Filings. With eFiling, you can provide comments in a variety of formats by attaching them as a file with your submission. New eFiling users must first create an account by clicking on "eRegister." You will be asked to select the type of filing you are making. A comment on a particular project is considered a "Comment on a Filing"; or

3. You may file a paper copy of your comments by mailing them to the following address:

Kimberly D. Bose, Secretary
Federal Energy Regulatory Commission
888 First Street NE, Room 1A
Washington, DC 20426

Any person seeking to become a party to the proceeding must file a motion to intervene pursuant to Rule 214 of the Commission's Rules of Practice and Procedures (Title 18 Code of Federal Regulations Part 385.214).[1] Only intervenors have the right to seek rehearing of the Commission's decision. The Commission grants affected landowners and others with environmental concerns intervenor status upon showing good cause by stating that they have a clear and direct interest in this proceeding that no other party can adequately represent. **Simply filing environmental comments will not give you intervenor status, but you do not need intervenor status to have your comments considered.**

Additional information about the project is available from the Commission's Office of External Affairs, at (**866) 208-FERC,** or on the FERC website (www.ferc.gov) using the eLibrary link. Click on the eLibrary link, click on "General Search," and enter the docket number, excluding the last three digits in the Docket Number field (i.e., CP15-77). Be sure you have selected an appropriate date range. For assistance, please contact FERC Online Support at FercOnlineSupport@ferc.gov or toll free at (866) 208-3676; for TTY, contact (202) 502-8659. The eLibrary link also provides access to the texts of formal documents issued by the Commission such as orders, notices, and rulemakings.

In addition, the Commission offers a free service called eSubscription, which allows you to keep track of all formal issuances and submittals in specific dockets. This can reduce the amount of time you spend researching proceedings by automatically providing you with notification of these filings, document summaries, and direct links to the documents. Go to www.ferc.gov/docs-filing/esubscription.asp.

[1] See the previous discussion on the methods for filing comments.

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TECHNICAL ACRONYMS AND ABBREVIATIONS

ACM	asbestos-containing material
ACRP	Abandonment and Capacity Restoration Project
AQCR	Air Quality Control Region
ARAP	Aquatic Resource Alteration Permit
BCC	Birds of Conservation Concern
BCR	Bird Conservation Regions
bgs	below ground surface
BMP	best management practice
CAA	Clean Air Act of 1970
CEQ	Council on Environmental Quality
Certificate	Certificate of Public Convenience and Necessity
CFR	Code of Federal Regulations
CH_4	methane
CO	carbon monoxide
CO_2	carbon dioxide
CO_2e	carbon dioxide equivalents
Commission	Federal Energy Regulatory Commission
CS	Compressor Station (tables only)
CWA	Clean Water Act
dB	decibel
dBA	decibels on the A-weighted scale
DOT	U.S. Department of Transportation
Dth/d	dekatherms per day
EA	environmental assessment
ECMP	Environmental Compliance Management Plan
EI	environmental inspector
EIS	environmental impact statement
EO	Executive Order
EPA	U.S. Environmental Protection Agency
EPAct 2005	Energy Policy Act of 2005
ESA	Endangered Species Act
FEMA	Federal Emergency Management Agency
FERC	Federal Energy Regulatory Commission
FY	fiscal year
FWS	U.S. Fish and Wildlife Service
g	acceleration due to gravity
GHG	greenhouse gas
gpm	gallons per minute
GPP	Groundwater Protection Plan
HAP	hazardous air pollutant
hp	horsepower
HUC	Hydrologic Unit Code
KAR	Kentucky Administrative Regulation
KGS	Kentucky Geological Survey
KSNPC	Kentucky State Nature Preserve Commission
kV	kilovolt
KYDEP	Kentucky Department for Environmental Protection
L_{dn}	day-night sound level
L_{eq}	equivalent sound level

L_{max}	maximum instantaneous sound level
MBTA	Migratory Bird Treaty Act
$\mu g/m^3$	micrograms per cubic meter (tables only)
MOU	Memorandum of Understanding
MP	milepost
N_2O	nitrous oxide
NAAQS	National Ambient Air Quality Standards
NEPA	National Environmental Policy Act of 1969
NESHAP	National Emission Standards for Hazardous Air Pollutant
NGA	Natural Gas Act
NHPA	National Historic Preservation Act
NO_2	nitrogen dioxide
NO_x	nitrogen oxides
NOI	Notice of Intent to Prepare an Environmental Assessment for the Proposed Broad Run Expansion Project and Request for Comments on Environmental Issues
NPDES	National Pollutant Discharge Elimination System
NRCS	National Resources Conservation Service
NRHP	National Register of Historic Places
NSA	noise sensitive area
NWI	National Wetlands Inventory
NWP	Nationwide Permit
O_3	ozone
OEP	Office of Energy Projects
Pb	lead
PCB	polychlorinated biphenyls
PEM	palustrine emergent
PFO	palustrine forested
Plan	Upland Erosion Control, Revegetation, and Maintenance Plan
PM_{10}	particles with an aerodynamic diameter less than or equal to 10 microns
$PM_{2.5}$	particles with an aerodynamic diameter less than or equal to 2.5 microns
Procedures	Wetland and Waterbody Construction and Mitigation Procedures
Project	Broad Run Expansion Project
PSD	Prevention of Significant Deterioration
PSS	palustrine scrub-shrub
PTE	potential to emit
PUB	palustrine unconsolidated bottom
RPMM	Remediation Program Maintenance Manual
SCADA	supervisory control and data acquisition
Secretary	Secretary of the Commission
SHPO	State Historic Preservation Office
SO_2	sulfur dioxide
SPCC Plan	Spill Prevention, Control, and Countermeasure Plan
SWPA	Source Water Protection Area
TCA	Tennessee Code Annotated
TDEC	Tennessee Department of Environment and Conservation
Tennessee	Tennessee Gas Pipeline Company, LLC
TNHIP	Tennessee Natural Heritage Inventory Program
tpy	tons per year
TWRA	Tennessee Wildlife Resource Agency
UMTP	Utica Marcellus Texas Pipeline

Unanticipated Discoveries Plan	Plan and Procedures for Addressing Unanticipated Discoveries of Cultural Resources and Human Remains during Construction
USACE	U.S. Army Corps of Engineers
USDA	U.S. Department of Agriculture
USGS	U.S. Geological Survey
VOC	volatile organic compound
WVDEP	West Virginia Department of Environmental Protection
WVDNR	West Virginia Division of Natural Resources
WVDHHR	West Virginia Department of Health and Human Resources

1.0 PROPOSED ACTION

1.1 Introduction

The Federal Energy Regulatory Commission (Commission or FERC) staff has prepared this environmental assessment (EA) to assess the environmental impacts of the natural gas pipeline facilities proposed by Tennessee Gas Pipeline Company, LLC (Tennessee). We[2] prepared this EA in compliance with the requirements of the National Environmental Policy Act of 1969 (NEPA) under Title 40 of the Code of Federal Regulations (CFR), Parts 1500–1508 (40 CFR 1500–1508), and the Commission's implementing regulations under 18 CFR 380.

On January 30, 2015, Tennessee filed an application in Docket No. CP15-77-000 under Section 7(c) of the Natural Gas Act (NGA) and the certificate procedures of Part 157, Subpart F of the Commission's regulations for a Certificate of Public Convenience and Necessity (Certificate) authorizing construction, modification, and operation of natural gas pipeline facilities in West Virginia, Kentucky, and Tennessee. In addition, under Section 7(b) of the NGA, Tennessee is requesting approval to abandon compressor equipment. These proposed activities are referred to as the Broad Run Expansion Project (Project).

Based on its authority under the NGA and Energy Policy Act of 2005 (EPAct 2005), FERC is the lead federal agency for the preparation of this EA in compliance with the requirements of NEPA. This effort was undertaken with the participation and assistance of the West Virginia Department of Environmental Protection (WVDEP) as a "cooperating agency" under NEPA. The WVDEP assisted us in preparing this EA because they have jurisdiction by law and special expertise with respect to environmental impacts associated with Tennessee's proposal. The EA is an important and integral part of the Commission's decision on whether to issue Tennessee a Certificate to construct and operate the proposed facilities. Our principal purposes in preparing this EA are to:

- identify and assess potential impacts on the natural and human environment that could result from implementation of the proposed action;
- assess reasonable alternatives to the proposed action that would avoid or minimize adverse effects on the environment; and
- identify and recommend specific mitigation measures, as necessary, to minimize environmental impacts.

Under Section 7(c) of the NGA, the Commission determines whether interstate natural gas transportation facilities are in the public convenience and necessity and, if so, issues an order (Commission's Order) granting a Certificate to construct and operate them. The Commission bases its decisions on technical competence, financing, rates, market demand, gas supply, environmental impact, long-term feasibility, and other issues concerning a proposed project.

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[2] "We," "us," and "our" refer to the environmental staff of the Commission's Office of Energy Projects (OEP).

Section 7(b) of the NGA specifies that no natural gas company shall abandon any portion of its facilities subject to the Commission's jurisdiction without the Commission first finding that the abandonment will not negatively affect the present or future public convenience and necessity.

1.2 Purpose and Need

Tennessee states the purpose of the Project is to expand capacity of its pipeline system to provide up to 200,000 dekatherms per day (Dth/d) of firm incremental transportation services to Antero Resources Corporation, which has fully subscribed to the firm transportation capacity, and to replace older, less efficient compression facilities with new, more efficient compression facilities at two compressor stations. To accommodate the increase in gas transportation requirements, Tennessee proposes to modify two existing compressor stations and construct four new compressor stations (see section 1.5 for a more detailed description of the proposed facilities).

1.3 Scope of this Environmental Assessment

FERC prepared this EA in compliance with the requirements of NEPA, the Council on Environmental Quality's (CEQ) regulations for implementing NEPA (40 CFR 1500–1508), and FERC's regulations implementing NEPA (18 CFR 380). EPAct 2005 provides that FERC shall act as the lead agency for coordinating all applicable authorizations related to jurisdictional natural gas facilities and for purposes of complying with NEPA. As the lead federal agency for the Project, FERC is required to comply with Section 7 of the Endangered Species Act (ESA) and Section 106 of the National Historic Preservation Act (NHPA). These statutes have been considered in the preparation of this EA. FERC will use this document to consider the environmental impacts that could result if it authorizes the Project.

In addition to FERC, other federal, state, and local agencies may use this EA in approving or issuing permits for all or part of the proposed Project. Permits, approvals, and consultations for the Project are discussed in section 1.9.

The topics addressed in this EA include alternatives, geology, soils, groundwater, surface waters, wetlands, fisheries, wildlife, vegetation, species of special concern, cultural resources, socioeconomics (including transportation and traffic), air quality, noise, land use, recreation, aesthetics, reliability and safety, and cumulative impacts. This EA describes the affected environment as it currently exists and the environmental consequences of the Project, and compares the Project's potential impact with that of various alternatives. This EA also presents our recommended mitigation measures.

1.4 Public Review and Comment

On May 1, 2015, FERC issued a *Notice of Intent to Prepare an Environmental Assessment for the Proposed Broad Run Expansion Project and Request for Comments on Environmental Issues* (NOI). The NOI was published in the Federal Register[3] on May 7, 2015, announcing a 30-day comment period. The NOI was also sent to nearly 600 parties including federal, state and local officials; agency representatives; conservation organizations; local libraries and newspapers; Native American tribes; property owners

[3] See Federal Register Volume 80, Number 88, dated Thursday, May 7, 2015, pages 26239 -26240.

affected by the proposed facilities and within 0.5 mile of the compressor stations; and other interested stakeholders.

Prior to the release of the NOI, we received 32 comments. The Commission received an additional 140 comment letters during the public scoping period (May 1, 2015 through June 1, 2015) in response to the NOI. After the end of the scoping period, we received 154 comments. Comments were received from Senator Andy Barr of the 6th Congressional District of Kentucky and Representative Terry Mills of the 24th District of Kentucky. Additional comments were submitted by six government agencies, including: three field offices (Kentucky, Tennessee, and West Virginia) of the U.S. Fish and Wildlife Service (FWS), the Kentucky Department for Environmental Protection (KYDEP), the WVDEP, and the Madison County Fiscal Court. One tribe submitted a comment. Five nongovernmental organizations (the Ohio Valley Environmental Coalition, the Freshwater Accountability Project, Heartwood, Concerned Citizens for a Safe Environment, and the Allegheny Defense Project) submitted a total of four comments. Individuals and businesses submitted a total of 275 comments, and 33 interveners filed comments.

All written scoping comments are part of the public record for the Project and are available for viewing on the FERC internet website (http://www.ferc.gov/docs-filing/elibrary.asp).[4] A majority of the concerns brought up by commenters were related to air and noise impacts and quality of life impacts for nearby farms and wildlife. Table 1-1 below summarizes the issues identified in comments received during the scoping process. Substantive environmental issues are addressed in applicable sections of the EA.

Table 1-1

Issues Identified During the Public Scoping Process

Issue	EA Section Addressing Issue
General Project Description	
Project requires environmental impact statement	1.4
Shale gas development and hydraulic fracturing	1.4
Geology and Soils	
Concern about contamination of soils	2.1.2
Water Resources, Fisheries, and Wetlands	
Impacts on groundwater resources and wells	2.2.1
Impact on drinking water	2.2
Vegetation	
Loss of forest; fragmentation	2.3.1, 2.3.3
Wildlife and Threatened and Endangered Species	
Impacts on Walden's Puddle Wildlife Rehabilitation and Education Center	2.3.3
Impacts on wildlife habitat and migratory birds	2.3.3
Impacts on federal and state special status species	2.4

[4] Using the "eLibrary" link, select "General Search" from the eLibrary menu and enter the docket number excluding the last three digits in the "Docket Number" field (i.e., CP15-77). Select an appropriate date range.

Table 1-1

Issues Identified During the Public Scoping Process

Issue	EA Section Addressing Issue
Land Use, Visual Resources, and Recreation	
Concerns about locating industrial activity in agricultural/rural area	2.5.1
Project location near residences	2.5.1
Impacts on agricultural lands, including organic farms	2.5.1
Socioeconomics	
Concern about property values	2.6.5
Impacts on local traffic from construction traffic	2.6.2
Impacts on rural quality of life	2.6, 2.9
Benefit to local communities	2.6.1, 2.6.3, 2.6.5, 2.6.6
Air Quality and Noise	
Concerns about Project contribution to climate change/greenhouse gases	2.8, 2.11
Air emissions impacts	2.8.4
Noise from compressor station operation	2.9.3
Noise from blowdown events	2.9.3
Reliability and Safety	
Concerns about increasing pressure in older pipelines and corrosion	2.10
Safety of high pressure gas pipelines	2.10
Alternatives	
Renewable energy options	3.2
Alternative compressor station locations	3.5

We received comments recommending that an environmental impact statement (EIS) be prepared to assess the impacts of the Project rather than an EA. An EA is a concise public document that serves to provide sufficient evidence and analysis for determining a finding of no significant impact. Pursuant to 18 CFR 380.6(b) "If the Commission believes that a proposed action…may not be a major federal action significantly affecting the quality of the human environment, an EA, rather than an EIS, will be prepared first. Depending on the outcome of the EA, an EIS may or may not be prepared." In preparing this EA, we are fulfilling our obligation under NEPA to consider and disclose the environmental impacts of the Project. This EA addresses the impacts that could occur on a wide range of resources should the Project be approved and constructed. Based on our analysis and considering that the Project would obtain permits to comply with the Clean Air Act and would reduce operational noise at two existing compressor stations, we conclude that the impacts associated with this Project could be sufficiently mitigated to support a finding of no significant impact and, thus, an EIS is not warranted.

We received comments requesting that the Abandonment and Capacity Restoration Project (ACRP), Utica Marcellus Texas Pipeline Project (UMTP Project), and this Project be considered in one EIS. The ACRP would abandon about 964 miles of pipeline and associated facilities. To replace the natural gas capacity of the abandoned facilities for the ACRP, Tennessee would construct new compressor stations, modify one existing compressor station, modify the proposed Compressor Station 875 (which would be constructed as part of the Broad Run Expansion Project), construct 7.7 miles of new pipeline, and modify other pipeline facilities at about 150 sites along the route of the abandoned pipeline. The ACRP would modify Compressor Station 875, which would be built if the Broad Run Expansion Project is approved and constructed. Tennessee would then sell the abandoned line to a wholly-owned subsidiary, Utica Marcellus Texas Pipeline, LLC, which would construct the UMTP Project. The UMTP Project would convert the pipeline that had been abandoned for natural gas transport in ACRP to the transport of natural gas liquids produced in the Utica and Marcellus shale areas to the Gulf Coast for

refining. The natural gas liquids could include propane, butane, condensate, or gasoline. The UMTP Project would not fall under the Commission's jurisdiction.

The Broad Run Expansion Project is a stand-alone project, and not dependent on the successful completion of either the ACRP or the UMTP Project. The Broad Run Expansion Project would provide increased natural gas capacity to the southeastern United States, whereas the ACRP would replace existing natural gas capacity. The Broad Run Expansion Project does not share the same purpose as the ACRP or the UMTP Project. Consequently, the projects provide independent utility and do not constitute a single project for review by the Commission. Commission staff will therefore review the natural gas project applications on their own merits. However, the ACRP and UMTP Project would potentially impact some of the same resources geographically as the proposed Project in Kentucky and Tennessee. Therefore, the ACRP and UMTP Project are further described in the cumulative impacts analysis in section 2.11.

We received comments requesting that the Commission deny the Project because it would further induce development of natural gas resources. Our authority under the NGA and NEPA relates only to natural gas facilities that are involved with interstate commerce. Facilities that conduct gas production are not under FERC jurisdiction. The development of shale gas is regulated by the states, and environmental impacts are assessed on a state level. The CEQ's regulations require agencies to consider the indirect impacts of proposed actions. Indirect impacts are "caused by the proposed action" and occur later in time or farther removed in distance than direct project impacts, but are still "reasonably foreseeable."[5] For an agency to include consideration of an impact in its NEPA analysis as an indirect effect, approval of the proposed project and the related secondary effect must be causally related. We find no causal link between natural gas production from shale formations in the northeast region and the proposed Project, which is designed to provide Tennessee's customers with the requested additional natural gas transportation service. Development of natural gas will occur with or without the proposed Project and would find other avenues to serve industrial and energy market needs. Therefore, natural gas production is not considered in this EA as an indirect effect of the proposed action. In addition, as part of our analysis of cumulative impacts in section 2.11 of this EA, we did not identify any natural gas production projects within the region of influence for any resource analyzed.

1.5 Proposed Facilities

The Project would consist of the following on Tennessee's existing 100, 500, and 800 pipeline systems:

- modifying existing Compressor Stations 106 and 114 in Powell County and Boyd County, Kentucky, respectively;
- constructing two new compressor stations (118A and 119A) in Kanawha County, West Virginia;
- constructing one new compressor station (875) in Madison County, Kentucky; and
- constructing one new compressor station (563) in Davidson County, Tennessee.

[5] 40 CFR § 1508.8(b) (2014).

Tennessee would own and operate all the proposed facilities. Figure 1-1 depicts an overview map of the Project. Figures 1-2 through 1-7 show the individual locations of the existing compressor stations where modifications would be made and the proposed new compressor stations.

1.5.1 Existing Compressor Stations

Compressor Station 106

Compressor Station 106 currently has 14 reciprocating compressor units in Compressor Building A (for a combined rating of 20,300 horsepower [hp]), 15 units in Compressor Building B (for a combined rating of 22,300 hp), and one unit in Compressor Building C (rated at 5,500 hp). Compressor Station 106 interconnects with six existing Tennessee pipelines (Lines 100-1, 100-2, 100-3, 100-4, 800-1, and 800-2).

Compressor Station 106 also contains a motor control center, control building, auxiliary buildings and ancillary equipment. All building and equipment are within a security fence. Full-time onsite personnel currently operate this station and would continue to operate it after the modifications.

Tennessee would expand the fenced area to accommodate a new Compressor Building D which would house two 16,000 hp turbine compressor units. A new prefabricated control building and a new prefabricated auxiliary building would include motor control and automation equipment, a natural gas backup generator, and auxiliary facilities. A new supply warehouse and vehicle garage would also be installed. Tennessee would relocate and/or alter existing security, lighting, phone, and supervisory control and data acquisition (SCADA) systems.

Tennessee would abandon by removal the existing 14 compressor units within Compressor Building A. The abandoned compressors would be removed along with the compressor building, gas coolers, storage tanks, auxiliary equipment, and related piping. Tennessee would remove the existing utility and warehouse building and pipeline garage and relocate the existing fuel tank and drum storage buildings to make room for the new Compressor Building D.

Compressor Station 114

Compressor Station 114 currently has seven reciprocating compressor units in Compressor Building B (for a combined rating of 9,450 hp) and three units in Compressor Building C (for a combined rating of 14,301 hp). Compressor Station 114 interconnects with three existing 24-inch-diameter Tennessee pipelines (Lines 100-1, 100-2, and 100-3) at Milepost (MP) 0.0.

Compressor Station 114 also contains a motor control center, control building, auxiliary buildings, and ancillary equipment. All buildings and equipment are within a security fence. The station is currently operated by full-time onsite personnel. Tennessee would install necessary automation and controls to allow for remote station operation from Tennessee's gas control center in Houston, Texas.

Tennessee would install one 20,500 hp turbine compressor unit in a new Compressor Building D. A new prefabricated control building and a new prefabricated auxiliary building would include motor control and automation equipment, a natural gas backup generator, and auxiliary facilities. Tennessee would relocate and/or alter the existing security, lighting, phone, and SCADA systems. All new buildings and equipment would be within the existing security fence.

Tennessee would abandon by removal the existing seven units in Compressor Building B. The compressors, compressor building, storage tanks, auxiliary equipment, and related piping would be removed.

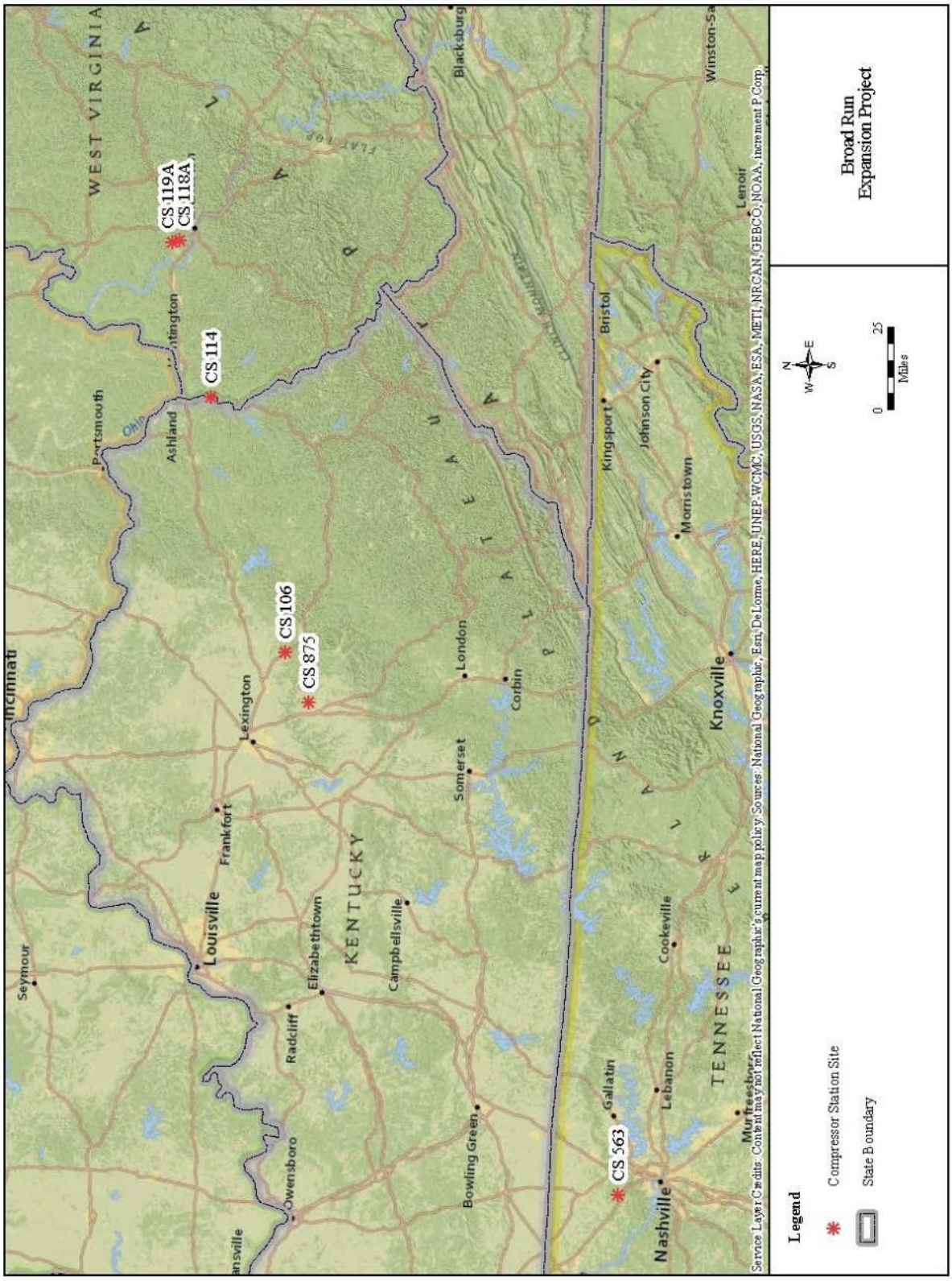

Figure 1-1. Overview Map of the Project

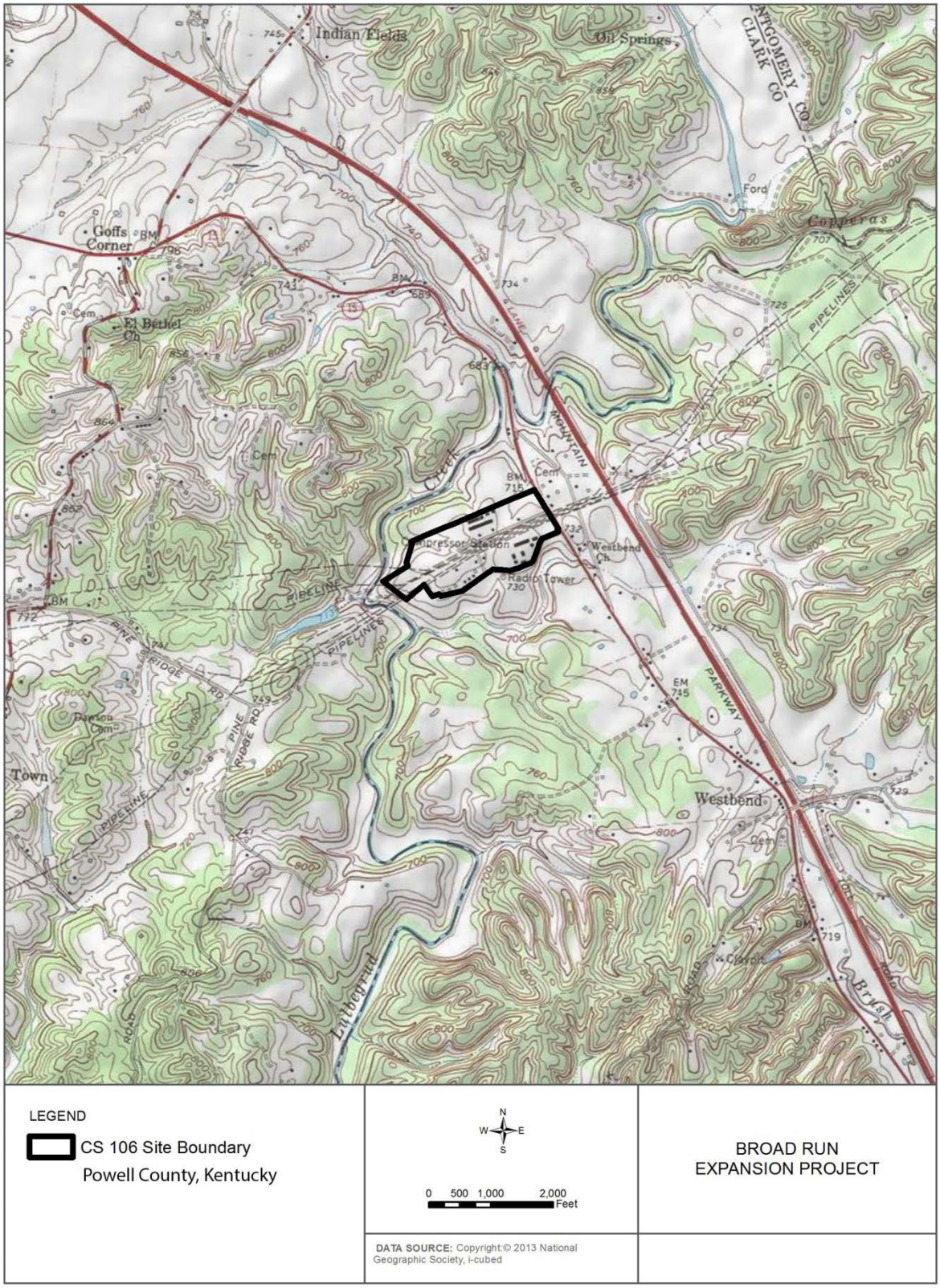

Figure 1-2. Location of Existing Compressor Station 106, Powell County, Kentucky

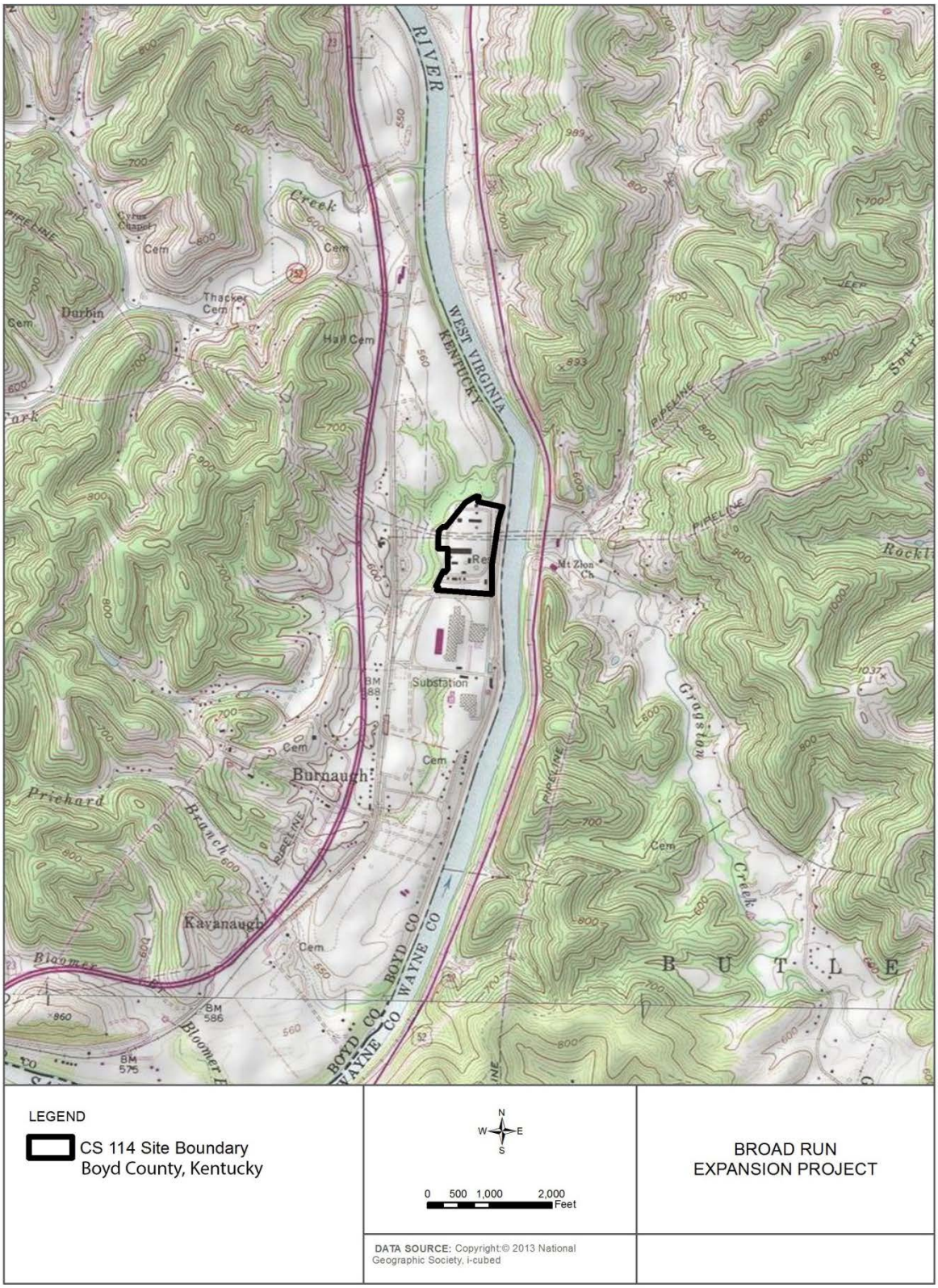

Figure 1-3. Location of Existing Compressor Station 114, Boyd County, Kentucky

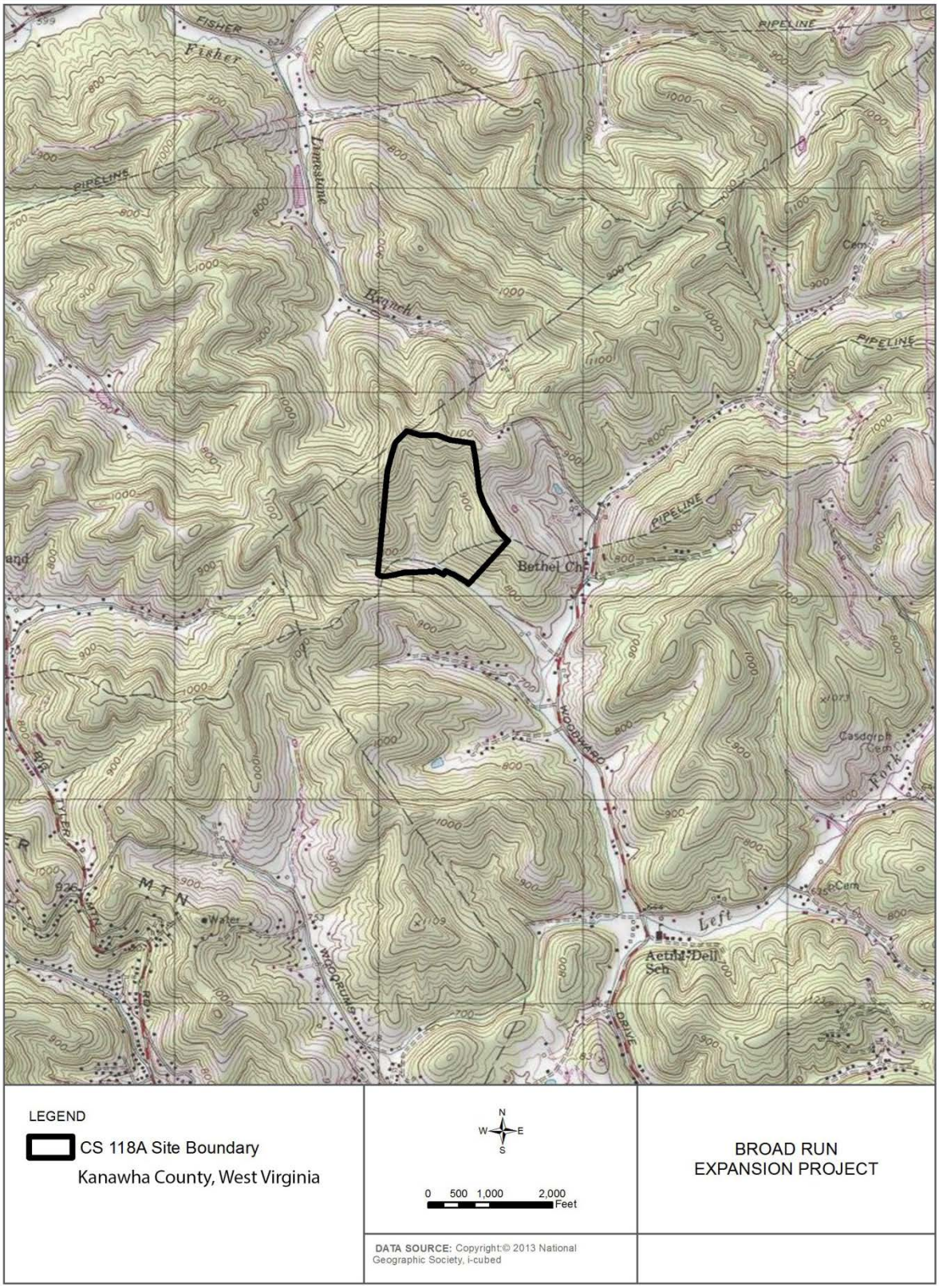

Figure 1-4. Location of Proposed Compressor Station 118A, Kanawha County, West Virginia

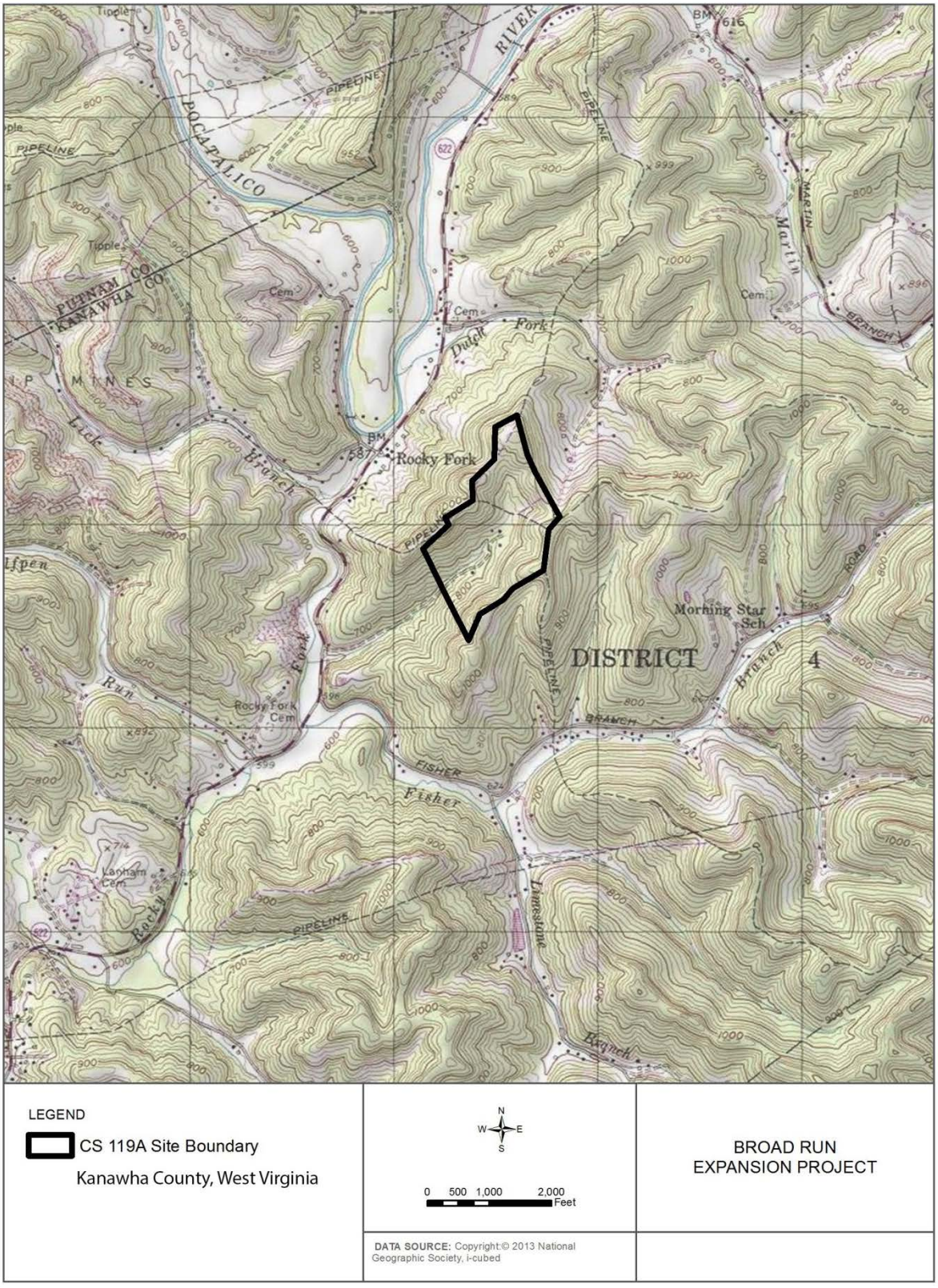

Figure 1-5. Location of Proposed Compressor Station 119A, Kanawha County, West Virginia

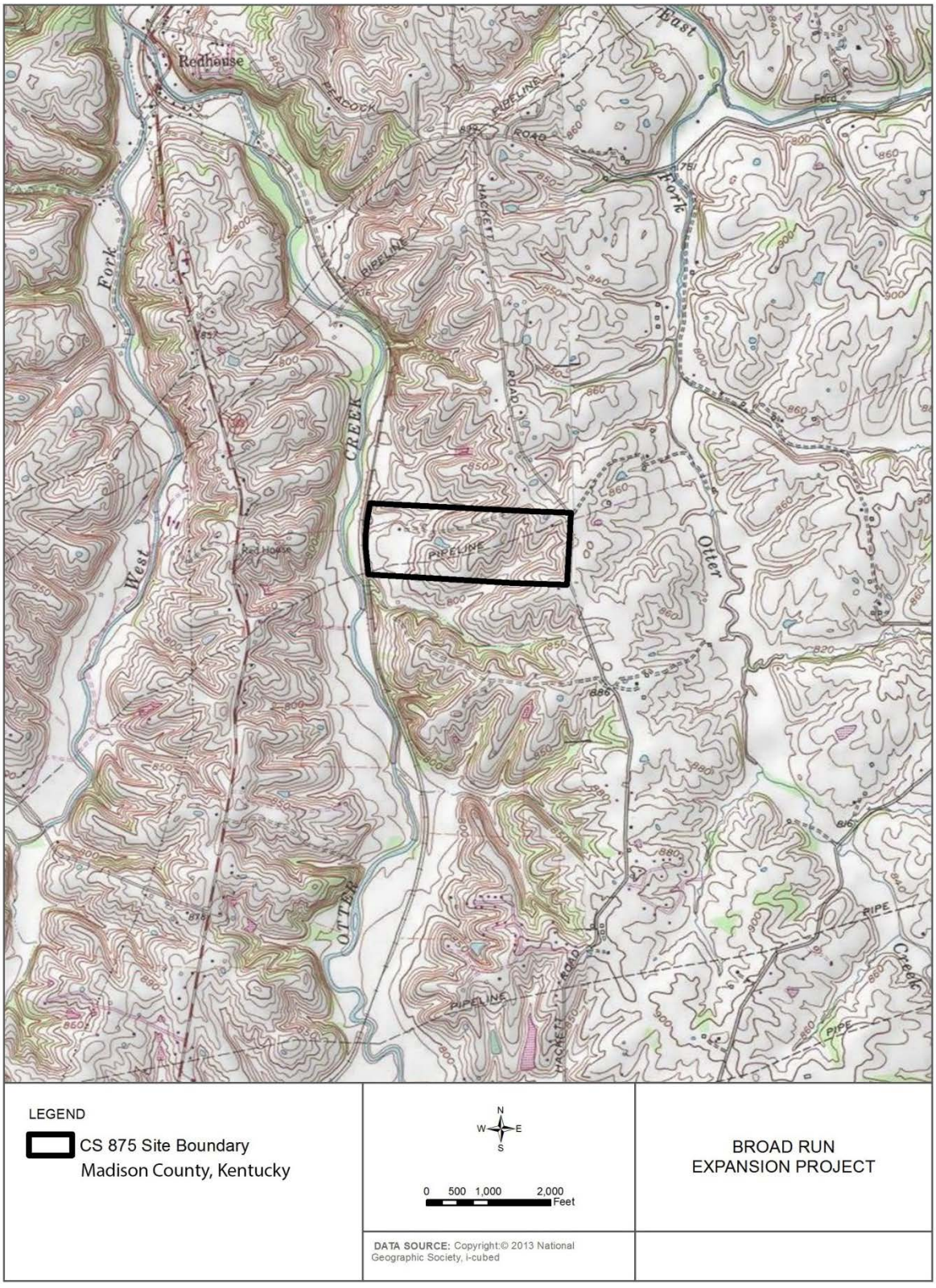

Figure 1-6. Location of Proposed Compressor Station 875, Madison County, Kentucky

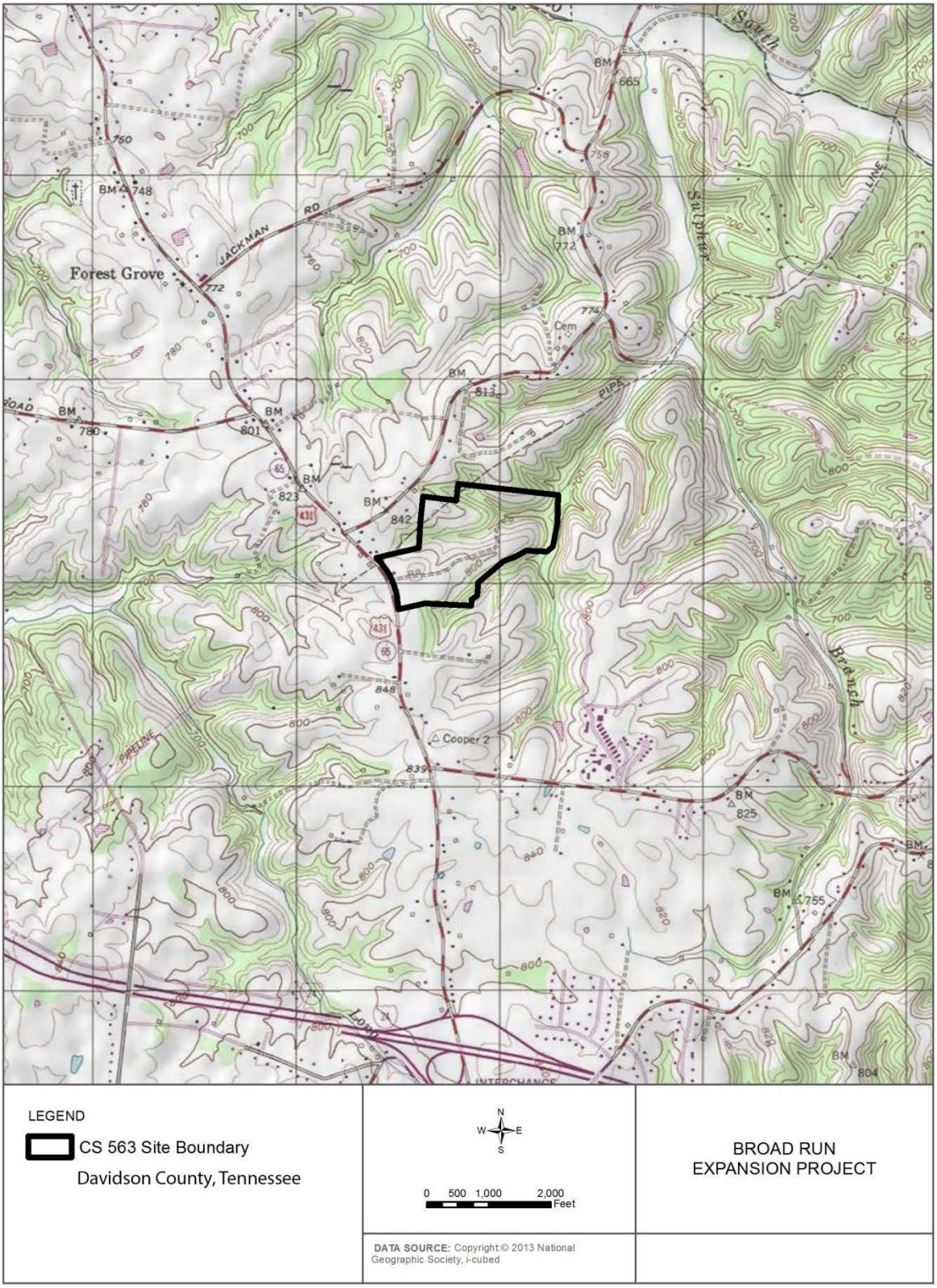

Figure 1-7. Location of Proposed Compressor Station 563, Davidson County, Tennessee

1.5.2 New Compressor Stations

Compressor Station 118A

Tennessee would construct a new bidirectional natural gas-fired compressor station that would be connected to the existing 20-inch-diameter Tennessee 100-1 pipeline (Line 100-1) at the mainline valve (MLV) 118 at MP 20.0. Compressor Station 118A would include one 10,771 hp turbine compressor unit housed in a new compressor building. A new prefabricated control building and a prefabricated auxiliary building would house automation equipment, natural gas-powered backup generator, and ancillary facilities. All buildings and equipment would be within a security fence.

Compressor Station 119A

Tennessee would construct a bidirectional natural gas-fired compressor station that would tie in to the existing 24-inch-diameter Tennessee Line 100-2 near MLV 119 at MP 6.4. A new compressor building would house the 20,500 hp turbine compressor unit. Equipment, buildings, and ancillary equipment at Compressor Station 119A would be similar to those described for Compressor Station 118A.

Compressor Station 875

Tennessee would construct a new bidirectional natural gas-fired compressor station that would interconnect at MLV 874 at MP 16.5 on both the existing 30-inch-diameter Line 800-1 and 36-inch-diameter Line 800-2. Compressor Station 875 would include one 16,000 hp turbine compressor unit within a new compressor building and include the same equipment, buildings, and ancillary equipment as described for Compressor Station 118A.

Compressor Station 563

Tennessee would construct a new bidirectional natural gas-fired compressor station that would connect to three existing pipelines. Compressor Station 563 would tie in to MLV 864 at MP 0.2 on the existing 30-inch-diameter Line 800-1, MLV 563 at MP 0.2 on the existing 30-inch-diameter Line 500-1, and MLV 563 at MP 0.2 on the existing 36-inch-diameter Line 500-2. The compressor station would include two 30,000 hp turbine compressor units within a new compressor building and include the same equipment, buildings, and ancillary equipment as described for Compressor Station 118A.

1.5.3 Contractor Yards and Access Roads

At Compressor Stations 106 and 114, Tennessee would use property it currently owns within or adjacent to the compressor station facilities for workspaces, storage, and staging of equipment and material, and parking. For the four new compressor stations, Tennessee would use temporary workspace for storage, staging, and parking. No additional contractor yards, staging or laydown areas, or rail yards would be used.

No new access roads or modifications to existing access roads would be needed for existing Compressor Stations 106 and 114. The Compressor Station 118A and 119A sites currently have gravel/dirt roads for access. Tennessee would place gravel to widen these roads by up to 10 feet, as needed for transporting construction equipment and materials. The roads would also be used for permanent access. Tennessee would construct access driveways from existing public roads within the fencelines of Compressor Stations 875 and 563 and would maintain them as part of permanent station operations. Table 1-2 summarizes these access roads for the Project.

Table 1-2

Proposed Access Roads [a]

Facility	Location	Access Road Type	Description	Land Use	Road Width (ft)	Length (ft)	Acres
Compressor Station (CS) 118A (Maxine Drive)	Kanawha County, West Virginia	Existing Permanent	Existing road with proposed modifications to widen the existing roadbed. A bridge would be installed to cross Stream 3.	Open Land	22	2,625	1.0
CS 119A (Berry Lane)	Kanawha County, West Virginia	Existing Permanent	Existing road with proposed modifications to widen the existing roadbed. A culvert would be installed at an area to be graveled and paved at Stream 1.	Forest / Open Land	20	2,297	1.1
						Project Total	**2.1**

[a] This table does not include existing public roads because no upgrades or modifications to these roads would be required. For Compressor Stations 875 and 563, Tennessee would construct access driveways within the fenceline, as shown on figures A-10 and A-12 in appendix A.

1.6 Non-jurisdictional Facilities

Under Section 7 of the NGA, the Commission is required to consider, as part of the decision to approve facilities under Commission jurisdiction, all factors bearing on the public convenience and necessity. Occasionally, proposed projects have associated facilities that do not come under the jurisdiction of the Commission. These "non-jurisdictional" facilities may be integral to the need for the proposed facilities, such as a power plant at the end of a jurisdictional pipeline, or they may be minor, nonintegral components of the facilities under the Commission's jurisdiction. The non-jurisdictional facilities for the Project would include minor facilities necessary to provide power, telephone, and water to the compressor stations.

Power is currently supplied to existing Compressor Station 106 by a 7.2-kilovolt (kV) overhead distribution powerline owned and operated by Clark Energy Cooperative. As part of compressor station modifications, Clark Energy Cooperative would reroute and extend this powerline to the new compression facilities. No federal, state, or local permits would be needed for the powerline. Because all work would occur within Compressor Station 106 boundaries, impacts associated with the construction and operation of the powerline are accounted for within the disturbance areas discussed for the jurisdictional facilities. The modifications to existing Compressor Station 114 would not require any construction of non-jurisdictional facilities.

Each new compressor station would require the installation of an electric powerline, telephone line, and potable water line. The impacts associated with construction of these utility lines within the compressor station boundaries are accounted for within the disturbance areas discussed in section 2 of this EA for the jurisdictional facilities. The impacts associated with constructing the lines outside of the compressor station boundaries are included in our cumulative impacts analysis (section 2.11). Tennessee intends to use municipal water at each new compressor station and is working with the local water utilities to determine the appropriate connections for each station. Information regarding the powerlines and telephone lines is summarized in table 1-3.

Table 1-3

Non-jurisdictional Power and Telephone Utilities for New Compressor Stations

Compressor Station	Facility	Company [a]	Description
CS 118A	12.47 kV powerline	Appalachian Power	6,500 feet of powerline from existing power facilities to the CS boundary; 2,110 feet of powerline and a transformer within the fenced CS yard
	Telephone line	Frontier Communications Corporation	1,650 feet of overhead telephone line from existing telephone facilities to the CS boundary; 2,110 feet within the fenced CS yard
CS 119A	12.47 kV powerline	Appalachian Power	1,700 feet of powerline from existing power facilities to the CS boundary; 447 feet of powerline and a transformer within the fenced CS yard
	Telephone line	Frontier Communications Corporation	2,500 feet of overhead telephone line from existing telephone facilities to the CS boundary; 447 feet within the fenced CS yard
CS 875	15 kV distribution powerline	Clark Energy Cooperative	1.4 miles of overhead powerline from existing substation on Hackett Road to the CS boundary; 2,480 feet of powerline and a transformer within the fenced CS yard
	Telephone line	AT&T	50 feet of overhead telephone line from existing telephone facilities to the CS boundary; 2,480 feet within the fenced CS yard
CS 563	29.5 kV powerline	Nashville Electric Service	1,115 feet of overhead powerline and a transformer within the fenced CS yard (an existing overhead powerline abuts the property)
	Telephone line	AT&T	1,115 feet of overhead telephone line within the fenced CS yard

[a] Company would permit, construct, own, and operate the facility.

1.7 Land Requirements

Modifications at existing Compressor Station 106 would require about 3 acres of land outside the existing security fence, but within property owned by Tennessee. Tennessee would expand the security fence to encompass the newly disturbed area. All activities at Compressor Station 114 would occur within the existing footprint. Table 1-4 presents the area of land needed for construction and operations at each compressor station site. Appendix A contains maps showing the operation and construction footprints for each of the compressor stations.

Table 1-4

Summary of Land Requirements

Facility	Land Affected During Construction (acres)	Land Affected During Operation (acres)
Existing Facilities [a]		
CS 106	37.4	37.4
CS 114	16.6	16.6
Existing Facilities Subtotal	**54.0**	**54.0**
New Facilities [b]		
CS 118A	46.2	30.2
CS 119A	48.0	48.0
CS 563	43.0	26.1
CS 875	48.5	24.9
New Facilities Subtotal	**185.7**	**129.1**
Project Total	**239.7**	**183.2**

Totals may not add up due to rounding

[a] Existing compressor station infrastructure and access roads are not included. CS 106 existing facility footprint is 52.8 acres and CS 114 existing facility footprint is 26.7 acres.

[b] Includes modifications to existing roads for access to CS 118A and CS 119A.

Although Tennessee has identified areas where extra workspace would be required, additional or alternative areas could be identified in the future due to changes in site-specific construction requirements. Tennessee would be required to file information on each of those areas for our review and approval prior to use.

1.8 Construction Procedures

The Project facilities would be designed, constructed, operated, and maintained in accordance with applicable requirements defined by U.S. Department of Transportation (DOT) regulations in 49 CFR 192, *Transportation of Natural and Other Gas by Pipeline: Minimum Federal Safety Standards*; by FERC's *Siting and Maintenance Requirements* in 18 CFR 380.15; and by other applicable federal and state safety regulations.

Tennessee would adopt our *Upland Erosion Control, Revegetation, and Maintenance Plan* (Plan) (FERC, 2013a) and our *Wetland and Waterbody Construction and Mitigation Procedures* (Procedures) (FERC, 2013b).[6] The Plan and Procedures provide baseline mitigation measures for minimizing the extent and duration of disturbances on soils, wetlands, and waterbodies. In addition, Tennessee would construct, restore, and maintain the Project according to the measures described in its Environmental Compliance Management Plan (ECMP). The ECMP comprises the following plans:

- FERC's Plan;
- FERC's Procedures;
- Spill Prevention, Control, and Countermeasure Plan (SPCC Plan);
- Winter Construction Plan;
- Groundwater Protection Plans (GPP) (Compressor Stations 106 and 114);
- Revegetation and Invasive Species Management Plan;
- Unanticipated Discovery Plan for Cultural Resources and Human Remains; and
- Polychlorinated biphenyls (PCB)/Hazardous Substance List Remediation Program Maintenance Manuals (RPMM).

Tennessee originally proposed to begin construction in March 2016 and place the Project into service by November 2017, subject to Commission approval and receipt of other required permits and approvals.

[6] Our Plan and Procedures can be accessed at the FERC's website, http://www.ferc.gov/industries/gas/enviro/plan.pdf and http://www.ferc.gov/industries/gas/enviro/procedures.pdf.

1.8.1 Compressor Station Construction Procedures

New Compressor Station Construction

Survey crews would stake construction limits and buffer zones, and areas that would not be disturbed by construction. Vegetation within work areas would be removed and the site would be graded. Topsoil from work areas would be segregated and protected during construction. As stipulated in the Plan, temporary erosion control would be installed immediately following initial ground disturbance.

Tennessee would excavate foundation sites with piers possibly up to 40 feet below finished grade. Crews would pour reinforced concrete foundations to support the new compressor units and buildings. Once the foundations are completed, Tennessee would erect buildings and install piping and electrical conduit systems. Some of the buildings would be built onsite, and others would be prebuilt, modularized buildings brought to the site and installed on the constructed foundations. All buildings and utilities would be weather-tight and tested after installation.

Tennessee would test the compressor station piping before the final connection to its existing natural gas pipeline system. Hydrostatic testing would comply with DOT regulations 49 CFR 192, American Society of Mechanical Engineers Standard B31.8, and applicable state and local regulations. Test water would be obtained from a municipal or commercial water source, trucked to the site, and stored in tanks. Pipeline connections would also be tested and site cleanup would commence. Except where cut and fill is required, work areas would be graded to match preconstruction contours and drainage patterns. Tennessee would reseed areas disturbed by construction with turf seed mix and install permanent erosion control measures following its ECMP. Excess materials would be disposed of at a licensed commercial disposal facility in accordance with applicable laws.

Tennessee would check and test all controls, safety equipment, and systems (including emergency shutdown, relief valves, gas and fire detection, engine over speed, and vibration) before placing them into service.

Existing Compressor Station Modifications

Construction procedures for the modifications to existing compressor stations would be similar to the construction procedures for new compressor stations. The exception would be that prior to site clean-up and restoration, select existing compressor equipment would be decommissioned. Tennessee would disconnect and remove the equipment from the station piping along with associated auxiliary equipment and electrical systems. Then the empty compressor building and foundation would be demolished and removed, and clean fill brought in, if necessary. Tennessee would transport all debris to a licensed commercial disposal facility in accordance with applicable laws. If PCB-impacted soils and/or materials are encountered, they would be managed and disposed of in accordance with the requirements of Tennessee's EPA Disposal Permit, the Toxic Substances Control Act (40 CFR 761), and other applicable federal and state regulations.

Work areas would be graded to match preconstruction contours and drainage patterns. Tennessee would install permanent erosion control measures and reseed bare earth with turf seed mix.

Existing compressor station modifications would not require vegetation clearing.

Facility Abandonment

After hydrostatic testing and new compressor unit commissioning, Tennessee would disconnect selected buildings at Compressor Station 106 and 114 from the station yard gas pipeline and retire them from service. Crews would remove compressor units within buildings along with associated auxiliary equipment, piping systems, electrical and jacket water coolers, and piping. Retired compressor building structures and foundations would then be demolished and removed.

Cleanup and Restoration

Areas other than those designated for permanent buildings, structures, and gravel/asphalt surfaces would be graded to match preconstruction contours and drainage patterns. Tennessee, in accordance with its ECMP, would reseed disturbed work areas within 6 working days of final grading. Turf seed mix would be used for areas within the permanent compressor station. Tennessee would install permanent erosion control measures in accordance with its ECMP. Crews would transport all excess materials and construction debris to a licensed commercial disposal facility in accordance with applicable laws.

Special Construction Procedures

Rugged and Steep Terrain

Special construction measures may be needed at Compressor Stations 118A, 119A, and 563 because of steep topography. Where the slope exceeds 30 percent, the preferred method of moving construction equipment would be by winching. A tractor would be positioned and anchored at the top of the slope while a winch is used to manipulate the equipment up and down the slope.

Blasting

Blasting would likely be required at Compressor Station 118A, and may be required at Compressor Station 119A, where bedrock underlies the surface. Blasting may also be used at sites where cut and fill is required to create a level working surface. Tennessee would develop and implement a blasting plan that addresses the procedures to be followed during blasting activities, including the prevention of damage to above and below ground structures, impacts on water resources, and the scattering of loose rock. Tennessee would notify occupants of nearby homes and businesses prior to blasting, and all blasting activities would take place during daylight hours. Section 2.1.1 provides additional information on blasting.

Winter Construction

Construction may occur during freezing temperatures, and therefore Tennessee has developed a draft Winter Construction Plan (included in its ECMP) to address the special considerations and concerns associated with construction and reclamation efforts conducted during winter, including site stabilization measures to implement if reclamation activities are delayed until spring or early summer. We have reviewed Tennessee's draft Winter Construction Plan and find it acceptable.

Polychlorinated Biphenyls

Oils, lubricants, and pipe coatings historically used at Compressor Stations 106 and 114 contained PCBs. Previous site investigations and remediation activities related to PCBs are discussed in section 2.1.2. Excavation or other ground-disturbing activities that may occur within identified PCB areas would be conducted in accordance with the procedures described in section 2.1.2.

1.8.2 Environmental Compliance Inspection and Monitoring

In preparing construction drawings and specifications for the Project, Tennessee would incorporate the mitigation measures identified in its permit applications, and additional requirements of federal, state, and local agencies. Tennessee would provide the construction contractors with copies of its ECMP, applicable environmental permits, as well as copies of "approved for construction" environmental construction alignment sheets and construction drawings and specifications.

Tennessee would conduct training for its construction personnel, including environmental inspectors (EI), contractors, and their employees regarding proper field implementation of its ECMP and other Project-specific plans and mitigation measures. The training would cover Project environmental documents and all Project-specific conditions contained in the Commission's Order and other applicable federal, state, and local permits and approvals.

Tennessee would employ at least four EIs to oversee and document environmental compliance, including one EI for construction activities at Compressor Stations 106 and 114, one EI at Compressor Stations 118A and 119A, one EI at Compressor Station 875, and one EI at Compressor Station 563. Depending on the progress of construction, additional EIs may be as assigned if necessary. The EIs would have authority to stop activities that violate the measures set forth in the Project documents and authorizations and would have the authority to order corrective action. FERC staff or its contractors would also conduct routine inspections during construction to determine compliance with the Commission's Orders and to inspect the construction conditions of the Project facilities.

1.8.3 Operations and Maintenance

The Project would be owned, operated, and maintained by Tennessee. All facilities would be operated and maintained in compliance with DOT regulations (49 CFR 192); the General Terms and Conditions of Tennessee's FERC Gas Tariff and applicable conditions of the Commission's Order for the Project; and federal, state, and local regulations. Facilities would be periodically inspected and maintained. Standard Tennessee compressor station operation procedures include activities such as:

- calibration, maintenance, and inspection of equipment;
- pressure, temperature, and vibration data monitoring;
- traditional landscape maintenance; and
- periodic checks of safety and emergency equipment and cathodic protection systems.

The compressor stations would also be linked to a central control system through a SCADA system that monitors the Tennessee system 24 hours a day, 365 days per year.

1.9 Consultations, Approvals, and Permits

Table 1-5 lists the federal, state, and local regulatory agencies that have permit or approval authority or consultation requirements and the status of that review for portions of the Project. Tennessee would be responsible for obtaining all necessary permits, licenses, and approvals required for its Project.

Table 1-5

Permits, Approvals, and Consultations for the Broad Run Expansion Project

Agency	Permit/Approval/Consultation	Status
Federal		
FERC	NGA, Section 7(c), Certificate and NGA, Section 7(b), Authorization to Abandon	Application submitted January 30, 2015, Docket No. CP15-77
U.S. Army Corps of Engineers (USACE), Huntington District	Clean Water Act (CWA), Section 404, Nationwide Permit (NWP) 12 Pre-construction Notification (PCN) for CS 118A and CS 119A	Consultations initiated January 23, 2015 and are ongoing
FWS, Kentucky Ecological Services Field Office	ESA Section 7 Consultation, Migratory Bird Treaty Act (MBTA), Bald and Golden Eagle Protection Act (BGEPA)	Consultation initiated January 22, 2015; Concurrence received March 14, 2015
FWS, Tennessee Ecological Services Field Office	ESA Section 7 Consultation, MBTA, BGEPA	Consultation initiated January 22, 2015; Concurrence received December 15, 2015
FWS, West Virginia Ecological Services Field Office	ESA Section 7 Consultation, MBTA, BGEPA	Consultation initiated January 22, 2015; Concurrence received September 25, 2015
Kentucky		
KYDEP, Division of Air Quality	Clean Air Permits	Application submitted January 30, 2015
Kentucky State Nature Preserves Commission	Review and comment regarding sensitive species and communities	Consultation initiated August 15, 2014; review completed September 8, 2014
Kentucky Heritage Council	NHPA, Section 106 consultation	Consultation initiated January 7, 2015; consultation completed May 19, 2015
Tennessee		
Metropolitan Health Department, Pollution Control Division	Clean Air Act of 1970 (CAA) Permits	Application submitted January 30, 2015
Tennessee Department of Environment and Conservation (TDEC), Division of Water Resources	CWA, Section 401 Water Quality Certificate Aquatic Resource Alteration Permit (ARAP) Tennessee General Permit for Utility Line Crossings	Application submitted January 23, 2015; follow-up submitted February 26, 2015; Permit initially issued May 14, 2015; modification issued June 24, 2015
TDEC, Division of Archaeology	Review of consultation regarding archaeological resources	Consultation initiated January 5, 2015; consultation completed January 27, 2015
TDEC, Division of Natural Areas	Review and comment regarding sensitive species and communities	Consultation initiated January 23, 2015; review completed February 9, 2015
Tennessee Wildlife Resources Agency	Review and comment regarding sensitive species	Consultation initiated October 8, 2015; consultation completed October 15, 2015
TDEC, Tennessee Historic Commission	NHPA, Section 106 Consultation	Consultation initiated January 5, 2015; consultation completed January 27, 2015
West Virginia		
WVDEP, Division of Air Quality	CAA Permits, CS 118A, CS 119A	Applications submitted January 30, 2015; approved May 14, 2015
WVDEP, Division of Water and Waste Management	General Water Pollution Control Permit for Stormwater Associate with Oil and Gas Related Construction Activities	Application Submittals Pending
	CWA, Section 402 National Pollutant Discharge Elimination System (NPDES) Water Pollution Control Permit for Hydrostatic Testing Water	Application Submittals Pending

Table 1-5

Permits, Approvals, and Consultations for the Broad Run Expansion Project

Agency	Permit/Approval/Consultation	Status
West Virginia Division of Culture and History	NHPA, Section 106 Consultation	Consultation initiated January 5, 2015; consultation completed February 2, 2015 (Archaeological) and March 11, 2015 (Architectural)
West Virginia Division of Natural Resources	Stream Activity Permit	Application Submittals Pending

[a] Tennessee would be responsible for obtaining all permits and approvals required to construct and operate the Project, regardless of whether or not they appear in this table.

2.0 ENVIRONMENTAL ANALYSIS

2.1 Geology and Soils

2.1.1 Geology

Geologic Setting

Existing Compressor Station 106 is in the Knobs physiographic region in western Powell County, Kentucky. The Knobs region borders the Outer Bluegrass region and consists of hundreds of isolated, steep sloping, often cone-shaped hills (KGS, 2014a). Knob terrains generally develop where resistant caprocks overlie easily eroded shale and siltstone. The Knobs are composed of Mississippian limestones, sandstones, and shales overlying Devonian black shales (NRCS, 1993). Compressor Station 106 overlies two geologic units: the Devonian New Albany Shale and Silurian Crab Orchard Formation/Brassfield Dolomite. New Albany shale underlies most of the site and consists of dark-gray to black and highly carbonaceous shale that weathers to medium gray to light brown. Crab Orchard Formate/Brassfield Dolomite underlies parts of the western edge of the site and consists of shale and dolomite (UK, 2014a). These geologic units are found beneath a thin veneer of topsoil and unconsolidated material with depths varying between 1 to 10 feet.

Existing Compressor Station 114 lies within the Eastern Kentucky Coal Field physiographic region. The Eastern Kentucky Coal Field region is part of a larger physiographic region called the Cumberland Plateau that extends from Pennsylvania to Alabama. The interior of the Eastern Kentucky Coal Field is dominated by forested hills and is highly dissected by V-shaped valleys (KGS, 2014a). The geology at Compressor Station 114 is Quaternary alluvium consisting primarily of silt, sand, and gravel from floodplain deposits (UK, 2014a). Fill is also present at the site. At locations onsite where Tennessee conducted advanced geotechnical borings, the alluvium extends to depths of over 50 feet.

The sites for Compressor Stations 118A and 119A are in the Appalachian Plateau Province physiographic region of West Virginia. The Appalachian Plateau covers the western two-thirds of the state where the rock formations are relatively flat, except for several distinct folds and faults on the eastern side of the Province (WVGES, 2014a). The geology at both sites comprises the Pennsylvanian Monongahela and Conemaugh Groups. The Monongahela Group consists of non-marine cyclic sequences of sandstone, siltstone, red and gray shale, limestone, and coal. The Conemaugh Group consists of mostly non-marine cyclic sequences of red and gray shale, siltstone, and sandstone, with thin limestones and coals (USGS, 1968). The Conemaugh Group underlies the majority of the Compressor Station 118A site with about 5 percent of the northern portion of the site underlain by the Monongahela Group. The Conemaugh Group underlies the central and western portions of the Compressor Station 119A site, and the Monongahela Group underlies the remainder of the site. At both sites, the bedrock units are overlain by soils and unconsolidated materials with a depth of up to 5 feet.

The Compressor Station 875 site is in the Knobs physiographic region of Kentucky, which was previously described for Compressor Station 106. The site overlies the Ordovician Drakes and Ashlock Formations and Quaternary alluvium. The Drakes Formation underlies about two-thirds of the eastern portion of the site and has multiple members consisting of dolomite, mudstone, and limestone. The Ashlock Formation underlies the western portion of the site and has multiple members consisting of limestone, dolomite, and shale. The primary lithology of the alluvium consists of light-brown silt and clay. Locally, the alluvium contains limestone and shale pebbles and cobbles, and occurs in stream valley bottoms (UK, 2014a). The alluvium is found at the surface on about 1 percent of the western portion of the site. The Drakes and Ashlock Formations are overlain by at least 5 feet of soils and unconsolidated materials.

The Compressor Station 563 site is in Tennessee's largest physiographic region, known as the Highland Rim. The Highland Rim is a crater-like structure, extending from central Tennessee north into Kentucky and south into Alabama. It surrounds the much lower Nashville Basin of central Tennessee. These physiographic regions represent the remnants of a huge domelike structure that has eroded away, leaving a crater-like center (University of Tennessee Knoxville, 2014). The Mississippian St. Louis and Warsaw Limestones underlie about 70 percent of the western portion of the site. The Mississippian Fort Payne Formation underlies about 30 percent of the eastern portion of the site and consists of bedded chert and minor shale (USGS, 2005a). Both units are overlain by soils and unconsolidated materials with a depth greater than 5 feet.

Mineral Resources

No mineral resources, mines, sand/gravel pits, borrow pits, or quarries were identified within 0.25 mile of any of the existing or new compressor station sites. No non-mineral geologic resources (e.g., coal, oil, and natural gas) were identified within 0.25 mile of any of the compressor station sites, except for the sites for Compressor Stations 118A and 119A. Both of these sites are within an area that has been identified as having potentially minable coal seams. However, Tennessee could not identify any plans for mining the coal in the area. A dry natural gas well was identified within the Compressor Station 119A site, but the closest active wells are about 0.5 mile away. Compressor Stations 118A and 119A are relatively small sites and would not preclude general development of mineral resources in the region (USGS, 2005b; UK, 2014b; KGS, 2008; TDEC, 2013; WVGES, 2014b). We conclude that the Project would not have significant impacts on mineral or other geologic resources.

Geologic Hazards and Impact Mitigation

Geologic hazards are natural physical conditions that could result in damage to land and/or structures, and injury to the public. Potential geologic hazards are seismic related, such as earthquakes, surface faulting, or soil liquefaction; landslides; flooding, and subsidence.

Earthquakes

Although the earthquake risk is generally low, all of the compressor station sites are in areas with historic seismic activity. Notable earthquakes that have occurred in the Project area include Kentucky's largest recorded earthquake (magnitude 5.2, Intensity VII) in 1980. This earthquake was 20 miles north of existing Compressor Station 106, 73 miles west of existing Compressor Station 114, and 32 miles southwest of the Compressor Station 875 site. Other recent earthquakes in Kentucky include a magnitude 4.0 in western Kentucky in 2003, and a magnitude 3.7 in eastern Kentucky in 2004 (USGS, 2012).

West Virginia's largest earthquake was of magnitude 4.5 (Intensity VI) and occurred in 1969 in southern West Virginia (USGS, 2012). Six earthquakes, magnitude 2.8 or less, were reported throughout West Virginia between July 20, 2013 and June 6, 2014 (WVGES, 2014c). Tennessee's largest earthquake (magnitude 5.0 and Intensity VII) occurred in 1865 about 200 miles southwest of the Compressor Station 563 site. In addition, a magnitude 4.5 earthquake occurred in eastern Tennessee in 1928 (USGS, 2012).

Seismic risk can be quantified by the motions experienced by the ground surface or structures during a given earthquake as expressed in terms of g (the acceleration due to gravity). The U.S. Geological Survey (USGS) has developed a series of maps for the entire United States that describe the likelihood for shaking of varying degrees to occur in a given area. The seismic hazard potential at each compressor station site was determined from the USGS seismic hazard maps (USGS, 2008).

- Compressor Station 106: the likelihood of a seismic event with intensity greater than 10 percent g in a 50-year period is 2 percent.
- Compressor Station 114: the likelihood of a seismic event with intensity greater than 6 percent g in a 50-year period is 2 percent.
- Compressor Stations 118A and 119A: the likelihood of a seismic event with intensity greater than 6 percent g in a 50-year period is 2 percent.
- Compressor Station 875: the likelihood of a seismic event with intensity greater than 8 percent g in a 50-year period is 2 percent.
- Compressor Station 563: the likelihood of a seismic event with intensity greater than 14 percent g in a 50-year period is 2 percent.

To minimize the potential hazards associated with earthquakes, Tennessee would design new facilities in accordance with current International Building Code guidelines for facilities in seismic zones, which would minimize life-threatening structural damage during an earthquake. Because of the low potential for seismic activity and because Tennessee would incorporate design measures to minimize damage during an earthquake, we conclude that earthquakes would not pose a significant risk to the Project.

Surface Faulting

Surface faulting is displacement of the earth's surface due to slip along a fault. The Utah Geological Survey (UGS) has developed guidelines for the analysis of the risks of surface fault rupture (UGS, 2004). The UGS recommends establishing a 1,000-foot setback on either side of mapped faults that have a risk of movement (i.e., faults that have had movement within the last 10,000 years) to minimize or avoid damage from surface fault ruptures. For the purpose of conservative analysis, we examined quaternary faults (i.e., those faults less than 1.6 million years old) within 0.5 mile of the compressor station sites. According to the USGS Quaternary Fault and Fold database, no Quaternary faults have been mapped within 0.5 mile of the sites for Compressor Stations 106, 114, 118A, 119A, and 563 (USGS, 2006a). Further analysis of local geologic mapping for these sites also did not reveal any quaternary faults within 0.5 mile (KGS, 2006a, 2006b, 2006c; USGS, 2015a; WVGES, 2014d).

According to the USGS Quaternary Fault and Fold database, Compressor Station 875 would be within the mapped Kentucky River Fault System (USGS, 2006a); however, this database does not present the location of individual faults. Local geologic mapping by the Kentucky Geological Survey (KGS) did not reveal any quaternary faults within 0.5 mile of the compressor station site.

Because no mapped quaternary faults occur within 0.5 mile of the compressor station sites, we conclude that surface faulting would not pose a significant risk to the Project.

Soil Liquefaction

Soil liquefaction occurs when loose (low density or uncompact) sandy, water-saturated soils temporarily lose their strength and liquefy during strong ground shaking due to earthquakes or other rapid loading. Based on a review of the USGS Soil Liquefaction Potential Map (USGS, 1999), the sites for Compressor Stations 106, 875, and 563 are in areas considered to have a low potential for liquefaction.

Compressor Station 114 is in an area with soils considered to have a higher potential for liquefaction. However, there is a low potential for an earthquake to occur at Compressor Station 114.

The geotechnical engineering reports for the Compressor Station 118A and 119A sites (Terracon, 2015a, 2015b) conclude that the liquefaction potential would be insignificant based on the presence of clay soils and shallow bedrock conditions. Furthermore, no quaternary faults are near either site and a large magnitude earthquake in this area is unlikely.

Most of the proposed Project facilities would be in areas with low potential for soil liquefaction, and at Compressor Station 114 where the liquefaction potential is higher, the seismic risk is low. Therefore, we conclude that soil liquefaction would not pose a significant risk to the Project.

Landslides

Landslides involve the down slope movement of earth materials under the force of gravity due to natural or man-made causes. Natural causes of landslides might include slope destabilization resulting from adverse bedrock conditions, steep slopes, groundwater, and soil characteristics.

The topography at existing Compressor Stations 106 and 114 is generally flat, with some slopes greater than 8 percent along the western and southern boundaries of Compressor Station 106 (USGS, 2006b). No mapped landslides are present near either site (UK, 2014c). We conclude that landslides would not pose a significant risk at Compressor Stations 106 and 114.

At the Compressor Station 118A and 119A sites, the topography is generally steep with the majority of slopes greater than 8 percent (USGS, 2006b). Several recent landslides are documented within 0.5 mile of the Compressor Station 118A site. Compressor Station 119A would be within an area that is mapped as having recent landslides but is currently stable (Lessing et al., 1976). Landslides in this area can be reactivated easily. The Compressor Station 118A and 119A sites have shallow bedrock conditions that would minimize the potential for deep-seated rotational slope failures; however, there is a risk of shallow transitional slope failures.

At the Compressor Station 563 site, the topography is generally steep with the majority of slopes greater than 8 percent (USGS, 2006b). No landslides have been documented within 0.5 mile of the site. The soils at the Compressor Station 563 site are generally stiff with a low potential for slope instability if the constructed slope is at a conceptual 3 to 1 inclination or flatter.

At Compressor Station 875, the topography of the site is generally hilly on the eastern portion with some slopes greater than 8 percent, and generally flat on the western portion (USGS, 2006b). No mapped landslides were observed near the site (UK, 2014c). No landslides have been documented within 0.5 mile of the site. The soils at the Compressor Station 875 site are generally stiff with a low potential for slope instability if the constructed slope is at a conceptual 3 to 1 inclination or flatter. Compressor Station 875 has shallow bedrock conditions that would minimize the potential for deep-seated rotational slope failures; however, a risk of shallow transitional slope failures exists.

Geotechnical engineering reports for each of the proposed compressor station sites (Terracon, 2015a, 2015b, 2015c, 2015d) contain site-specific mitigation measures to minimize the risk of landslides that Tennessee has stated it would implement where recommended. These include creation of slopes at a 3 to 1 horizontal to vertical ratio, compacting the soil at specified soil densities, and cutting benches into existing soil for placement of new structural fill. Because Tennessee would implement site-specific mitigation measures to minimize the risk of slope failure, we conclude that landslides at the proposed compressor station sites would not pose a significant risk to the Project.

Flash Flooding

According to flood maps produced by the Federal Emergency Management Agency (FEMA), the sites for Compressor Stations 119A, 875, and 563 and existing Compressor Station 106 are not within a floodplain. Therefore, we conclude that flash flooding would not pose a risk at these sites.

As further described in section 2.2.2, about 2.3 acres of the existing Compressor Station 114 lies within the FEMA-mapped 100-year floodplain associated with the Big Sandy River. At Compressor Station 118A, about 1.0 acre of the construction and operational footprint (including the tie-in point connecting the compressor station to the existing pipeline, portions of the access road, culverts, and a stormwater outflow pipe) would be within a 100-year floodplain. See section 2.2.2 for a discussion of why these facilities are located within the floodplain and an analysis of alternatives. The National Weather Service Flash Flood Guidance estimates that the amount of rainfall needed to generate flash flooding in the counties crossed by the Project is 1.6 to 2.2 inches per hour.

Because portions of Compressor Stations 114 and 118A would be within the floodplain, Tennessee has proposed measures to mitigate flooding impacts in case of a major storm event during construction of the Project. These measures would include daily monitoring of weather forecasts for information on upcoming severe weather events as well as walk-through inspections and preventative maintenance of erosion control devices. The erosion control structures would be inspected twice a week (no closer than 72 hours apart) and within 24 hours of rainfall exceeding 0.5 inch or greater. Sediment would be removed from the structures when their operational capacity is reduced by 30 percent or more. In the event that sediment escapes the site and accumulates, Tennessee would make arrangements with adjacent property owners as needed to properly remove and dispose of the sediment.

In addition, Tennessee would follow its local Area Operations Severe Weather Plan and its contractor's Severe Weather Plan, which provide procedures to follow in the event of flood alerts, watches, and warnings during Project construction. We have reviewed the measures proposed by Tennessee and conclude that potential impacts associated with flash flooding would be adequately mitigated.

Land Subsidence

Ground subsidence and earth fissures are often caused by groundwater withdrawals as the declining water table causes aquifer sediments to compact. Ground subsidence may also result from oil and natural gas extraction, underground mining, and the presence of karst topography. Karst topography and sinkholes typically form from dissolution of carbonate rocks such as limestone and dolomite, which underlie several areas in West Virginia, Kentucky, and Tennessee.

No wells would be installed at any of the compressor station sites and no large-scale groundwater withdrawal is occurring near any of sites. No active oil or gas wells were identified within 0.25 mile of any of the existing or new compressor station sites. Historic underground mining has occurred in the area of the sites for Compressor Stations 118A and 119A; however, the geotechnical investigations did not identify any previous mining activity at the sites (Terracon, 2015a, 2015b). Therefore, we conclude that ground subsidence as a result of groundwater withdrawals, oil and natural gas extraction, or underground mining would not pose a significant risk at any of the compressor station sites.

Tennessee did not observe karst features during geotechnical site investigations at any of the compressor station sites. The karst potential of the underlying geologic formations at existing Compressor Stations 106 and 114 was ranked as "non-karst" (UK, 2014d). In addition, no mapped karst

features were identified within 0.5 mile of either site using the Kentucky Geologic Map Information Service online mapping tool (UK, 2014d).

A review of USGS mapping of the area did not reveal any mapped karst features near either the Compressor Station 118A or 119A sites (USGS, 2004). Limestone is one of the geologic formations mapped beneath the sites. During Tennessee's geotechnical site investigations, no limestone samples were observed and the sites were determined to have a low potential for karst activity.

The karst potential of the underlying geologic formations at the Compressor Station 875 site was ranked as low; however, mapped karst features were identified within 0.5 mile of the site using the Kentucky Geologic Map Information Service online mapping tool (UK, 2014d). Limestone is one of the geologic formations mapped beneath the site.

The potential exists for sinkhole development at the Compressor Station 563 site because the area is underlain by carbonate bedrock. A review of broad-scale USGS mapping of the area revealed mapped karst features at the site (USGS, 2004). The geotechnical investigation report (Terracon, 2015d) acknowledges a risk for sinkhole development at the site due to the geology but stated that no obvious signs of soil softening or impending overburden collapse were observed during geotechnical exploration activities.

The geology in the area of Compressor Stations 106 and 114 is not conducive to karst formation so no mitigation would be necessary. At the proposed compressor station locations, Tennessee would incorporate site-specific construction and design measures during final facility engineering and design to protect against potential subsidence and sinkholes. Tennessee's design engineer would follow the recommendations in the geotechnical reports and use best engineering practices for the foundation designs. Therefore, we conclude that ground subsidence as a result of karst would not pose a significant risk to the Project.

In summary, geologic hazards either do not exist at the various compressor station sites or where geologic hazards do exist, the mitigation measures to be implemented by Tennessee would minimize the hazards.

Blasting

Shallow and hard bedrock can restrict excavation, requiring special mechanical means or blasting in some areas to efficiently excavate the site to required design depths. Blasting would not be required at Compressor Stations 106, 114, 563, and 875. The depth to bedrock at Compressor Station 118A is less than 5 feet below ground surface (bgs); therefore, blasting would be required for the placement of foundations at the site. Geotechnical data indicates the presence of shale below topsoil at Compressor Station 119A; however, should harder rock than anticipated be discovered at the site, blasting would be required. All blasting activities would comply with federal, state, and local regulations governing the safe storage, handling, firing, and disposal of explosive materials. In addition, Tennessee would prepare a blasting plan to minimize the effects of blasting and ensure safety during blasting operations. Tennessee would ensure safety during blasting through adherence to these minimization measures:

- developing pre- and post-blasting inspection, notification, and repair procedures in coordination with appropriate agencies;
- reducing peak particle velocities in the vicinity of nearby underground structures and building foundations;
- using blasting mats or soil cover (as necessary) to prevent the scattering of loose rock;

- conducting blasting during daylight hours; and
- providing advance public notification of blasting activities.

Tennessee has not filed the blasting plan for our review. To ensure the mitigation measures are appropriately incorporated in this plan, **we recommend that**:

- **Prior to construction of Compressor Stations 118A and 119A, Tennessee should file a blasting plan with the Secretary of the Commission (Secretary), for review and written approval by the Director of the Office of Energy Projects (OEP).**

Based on Tennessee's proposed mitigation measures and our recommendation above, we conclude that blasting at Compressor Station 118A, and if needed at Compressor Station 119A, would not pose a significant risk to existing resources or safety.

2.1.2 Soils

Soil types that occur within the Project area were identified by the U.S. Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS) Major Land Resource Areas classification and the Soil Survey Geographic Database (NRCS, 2014a; 2014b; 2014c). Soils in the Project area are highly variable, ranging from nearly level to very steeply sloping, somewhat poorly to well drained, and with textures ranging from loams to silty clay loams.

Several general soil characteristics have the potential to affect, or be affected by, construction and operation of the proposed Project. These include prime farmlands, soil erosion, revegetation potential, shallow depth to bedrock, hydric soils, and shallow depth to the water table. No soils in the Project area were identified as having severe compaction potential or poor drainage potential. Table 2-1 summarizes soil characteristics and limitations by project component.

Table 2-1

Soil Characteristics and Limitations for the Broad Run Expansion Project (acres) [a]

Component	Prime Farmland [b]	High Erosion Potential [c]	Poor Revegetation Potential [d]	Shallow Bedrock	Hydric Soils	Shallow Water Table
Existing Facilities						
CS 106	0.8	0	0	0	0	0
CS 114	26.7	0	0	0	0	0.1
Existing Facilities Subtotal	**27.5**	**0**	**0**	**0**	**0**	**0.1**
New Facilities						
CS 118A	3.8	0	13.5	35.3	3.8	0
CS 119A	0	0	26.0	36.7	0	0
CS 563	6.2	28.7	14.1	2.3	0	0
CS 875	23.6	35.4	0	8.9	0	8.9
New Facilities Subtotal	**33.6**	**64.1**	**53.6**	**83.2**	**3.8**	**8.9**
Project Totals	**61.1**	**64.1**	**53.6**	**83.2**	**3.8**	**9.0**

[a] Each soil type can have more than one characteristic. No soils were identified as having severe compaction potential or poor drainage potential.
[b] USDA Designated Prime Farmland Soils.
[c] Includes soils with high erosion potential for wind or water.
[d] Includes soils having a revegetation potential rating of 7 or 8.
Sources: NRCS (2014a, 2014b, 2014c, 2014d, and 2014e)

Prime Farmland Soils

The USDA defines prime farmland as "land that has the best combination of physical and chemical characteristics for producing food, feed, forage, fiber, and oilseed crops and that is available for these uses." Prime farmland has an acceptable and reliable water supply from precipitation or irrigation, a favorable temperature and growing season, an acceptable level of acidity or alkalinity, an acceptable content of salt or sodium, and few or no rocks. In addition, soils that do not meet all the requirements to be considered prime farmland may be considered soils of local importance if they are capable of producing a high yield of crops when treated or managed according to accepted farming methods. For the purposes of this report, prime farmland includes USDA designations of "prime farmland," "prime farmland if drained," and "prime farmland of local significance" independent of whether these areas are or have been used for agricultural purposes (NRCS, 2015). Compressor Stations 106 and 114 are existing compressor stations. Although soils classified as prime farmland have been identified within the sites, the areas have already been precluded from farming and agricultural production. Therefore, we conclude that impacts associated with the loss of prime or unique farmland soils associated with the Compressor Station 106 and 114 sites would be negligible.

The Compressor Station 119A site does not contain any soils that are classified as prime farmland.

Construction of Compressor Station 118A would result in about 3.8 acres of impacts on soils classified as prime farmland. Of that total, compressor station operations would permanently disturb about 2.3 acres. Construction of Compressor Station 875 would result in about 6.2 acres of impacts on soils classified as prime farmland. All 6.2 acres would be permanently impacted by compressor station operations. Construction of Compressor Station 563 would result in about 23.6 acres of impacts on soils classified as prime farmland. Of that, operation of the Project would permanently impact about 16.4 acres. The sites for Compressor Stations 118A, 875, and 563 are either primarily undeveloped forested land with small patches of cleared area or undeveloped pastureland. The sites are not currently used in agricultural production, but any future agricultural use would be precluded for the life of the Project, thus the impacts on prime farmland soils would be permanent.

High Erosion Potential

Soil disturbance can increase wind and water erosion of exposed soils. In total, 28.7 acres of the soils at Compressor Station 563 and 35.4 acres of the soils at Compressor Station 875 are rated as having moderate to high susceptibility to water erosion. None of the soils are rated as having a high susceptibility to wind erosion. None of the soils at Compressor Stations 106, 114, 118A, or 119A are rated as having a high erosion potential. Tennessee would implement the erosion and sediment control and revegetation measures contained in its ECMP and FERC's Plan and Procedures to minimize erosion and offsite sediment migration, including:

- restoring construction work areas to preconstruction contours;
- grading disturbed areas within 20 days and revegetating within 6 days of final grading;
- installing and maintaining proper erosion and sedimentation control measures during construction to reduce the velocity and redirect runoff; and
- avoiding construction during times of unusual soil saturation, heavy rainfall, and snow melt.

Therefore, we conclude that impacts associated with soil erosion would be negligible.

Poor Revegetation Potential

Successful restoration and revegetation are important for maintaining soil productivity and protecting the underlying soil from potential damage, such as erosion. The revegetation potential of soils disturbed by the Project is based on the slope and the percentage of coarse rock fragments in the surface layer. In total, 13.5 acres of the soils disturbed at Compressor Station 118A, 26 acres of the soils disturbed at Compressor Station 119A, and 14.1 acres of the soils disturbed at Compressor Station 563 have low revegetation potential. In addition, revegetation may be more difficult in areas that are considered to have poor drainage, shallow depth to bedrock, rockiness, and steep slopes. Tennessee would revegetate previously vegetated disturbed areas that would not be occupied by buildings or covered with gravel upon the completion of construction in accordance with agency recommendations for seedbed preparation, seed mix, and application methods and rates. Vegetation impacts and mitigation are further discussed in section 2.3.1.

Shallow Depth to Bedrock

As described in section 2.1.1, shallow and hard bedrock can restrict excavation, requiring special mechanical means or blasting in some areas to efficiently excavate the site to required design depths. Compressor Stations 563, 875, 118A, and 119A have shallow bedrock present; however, the results of geotechnical investigations indicate that blasting would be required only at Compressor Station 118A and possibly at Compressor Station 119A. The Blasting Plan described in section 2.1.1 would minimize the potential for any adverse effects associated with blasting.

Hydric Soils

One soil map unit occurring within Compressor Station 118A is classified as partially hydric (5 percent). Tennessee would disturb about 3.8 acres of that unit during construction and permanently impact 2.3 acres of that area during operations. Although no hydric soils are classified at Compressor Stations 119A, 875, 563, and 106, hydric soils associated with wetland areas were identified at these sites during field surveys. Impacts on soils associated with wetland areas and associated mitigation measures are described in section 2.2.3.

Depth to Water Table

The water table is shallow on about 8.9 acres of the Compressor Station 875 site and 0.1 acre of the Compressor Station 114 site. Therefore, groundwater may be encountered during construction. Groundwater impacts and mitigation measures are addressed in section 2.2.1. Tennessee would follow the FERC's Plan during any dewatering from excavations to reduce erosion and deposition of sediments and minimize impacts on soils.

Contaminated Soils and Inadvertent Spills

Existing Compressor Stations 106 and 114 were impacted by past use of PCBs. Tennessee completed remediation at these sites and removed PCB-contaminated materials and soil. At Compressor Station 106, the cleanup extended offsite along several drainages where impacted sediments were removed. Residual PCB contamination remains at both sites. At Compressor Station 106, the proposed work would overlap several areas of residual PCB contamination, and at Compressor Station 114, the proposed work would be adjacent to residual PCB contamination. Tennessee has prepared site-specific RPMMs that provide maps depicting the locations of PCB-containing soils and remediation areas, and identify measures to be followed during construction and for future operations and maintenance activities. These measures include:

- notifying appropriate Tennessee environmental, health, and safety representatives prior to excavating, sampling, or conducting other intrusive activities in the immediate vicinity of identified PCB-containing soils and remediated drainlines or drainline components;
- notifying and obtaining approval from the KYDEP prior to earth disturbing activities in PCB-impacted areas;
- segregating, stockpiling, and covering soils excavated from identified PCB areas;
- returning excavated soils to the same excavation location, ensuring the top 1 foot of soil is segregated from other excavated soil and replaced in the top 1 foot of the excavation during backfilling;
- sampling and analyzing excavated soils prior to disposal at an offsite facility licensed to dispose of this waste; and
- documenting the extent of excavations, analytical results, and disposal methods.

Tennessee performed Phase I Environmental Site Assessments for Compressor Station 875 and Compressor Station 563 in December 2014. No recognized environmental conditions were identified at either site.

Tennessee performed a Phase I Environmental Site Assessment for Compressor Station 118A in February 2015. The Phase I Environmental Site Assessment identified one recognized environmental condition from the operation of a construction and demolition landfill that operated on the site between 2003 and 2004. Although the Phase I Environmental Site Assessment did not identify any direct evidence of toxic or hazardous materials, the report concluded that due to a lack of apparent regulatory oversight of the landfill, "it would be reasonable to conclude that hazardous substances or petroleum products are likely present on the site."

Tennessee conducted additional evaluation of the soils, sediments, and surface water at the site in May 2015 (Terracon, 2015e). Five test pits were conducted and fill with debris was observed at thicknesses of 1.5 feet and 2 feet in the two test pits closest to the proposed compressor station facilities. The fill thickened considerably to the west away from the proposed compressor station facilities. Although total metals were detected at concentrations exceeding potentially applicable regulatory levels, the report concluded that the metals concentrations are likely attributable to naturally occurring/background conditions. No other constituents were detected above applicable regulatory levels. The demolition landfill is shown as being close to the west edge of the proposed Compressor Station 118A facilities (Terracon, 2015f). However the exact limits of the landfill do not appear to have been clearly delineated. Geotechnical borings conducted at the site did not encounter fill or debris (Terracon, 2014a).

Tennessee performed a Phase I Environmental Site Assessment for Compressor Station 119A in January 2015. The Phase I Environmental Site Assessment did not find any evidence of recognized environmental conditions in connection with the site. However, two de minimis conditions were identified. These include the potential for encountering undocumented motor oil, hydraulic fluid, and other petroleum product disposal sites associated with maintenance and refurbishment of antique cars onsite; and the potential for encountering residual amounts of petroleum products associated with scrap vehicles present on site. The assessment concludes that these generally do not present a threat to human health or the environment.

Should contamination or debris be encountered during construction of the Project, Tennessee would implement its *Plan for the Unanticipated Discovery of Potentially Contaminated Soils, Groundwater, or Debris.*[7] Components of this plan include training of project personnel to identify contamination, notification and response procedures, documentation, and reporting.

Spills or leaks of fuels, lubricants, and coolant from construction equipment could adversely affect soils. Soils impacted by such spills or leaks could continue to leach and add contaminants to groundwater long after a spill has occurred. To minimize the risk of potential fuel or equipment fluid spills, Tennessee would implement its SPCC Plan, which would include the following measures:

- ensuring that all materials, cleanup wastes, and recovered spill materials are transported to an approved disposal facility licensed to accept such waste;
- training personnel on the operation and maintenance of equipment to prevent the accidental discharge or spill of fuel, oil, and lubricants;
- inspecting and maintaining equipment that must be fueled and/or lubricated according to a strict schedule;
- following the steps outlined in the SPCC Plan to minimize the magnitude of the spill and initiate cleanup;
- reporting of spills to the appropriate state and federal agencies;
- ensuring that fuel trucks transporting fuel to onsite equipment travel only on approved access roads within the compressor station sites; and
- ensuring that equipment is refueled and lubricated within the construction work areas, or fee property, and at least 100 feet away from all waterbodies and wetlands.

Because Tennessee would implement the mitigation measures outlined in its RPMMs, *Plan for the Unanticipated Discovery of Potentially Contaminated Soils, Groundwater, or Debris*, and SPCC Plan during construction to minimize the release of PCBs or potential of spills, and guide cleanup of any unanticipated contamination or spills of hazardous materials, the Project would not have significant impacts on soils or the environment from hazardous materials.

Expansive and Acidic Soils

Clay and silt soils can expand as a result of increased moisture content, and shrink upon drying. Expansion and shrinking of soils due to moisture fluctuations can cause damage to concrete slabs, foundations, and other confining structures. One indicator of the potential for soil expansion is the presence of pyritic sulfur.

Geotechnical site investigations for Compressor Station 106 revealed the presence of pyritic sulfur in concentrations above the threshold needed to cause soil expansion. Existing buildings at Compressor Station 106 have been in place since the 1940s and the foundations have shown no signs of

[7] Available on the FERC eLibrary under Docket No. CP15-77-000. This plan was filed as Attachment 8-2 on June 1, 2015.

the effects of soil expansion. However, in order to minimize the potential effects of soil expansion, Tennessee would implement the following mitigation measures:

- to the extent practical, foundations would be designed to avoid disturbing the bedrock layer;
- all buried pipe would be coated with fusion bonded epoxy; and
- a polyethylene vapor barrier would be included under all of the foundations.

No expansive soils were identified during the geotechnical site investigations at Compressor Station 114. Compressor Stations 563, 875, 118A, and 119A would be in areas considered to have a low to moderate potential for expansive soils. Tennessee would incorporate site-specific construction and design measures during final facility engineering and design to protect against soil expansion issues. Therefore, we conclude that soil expansion would not pose a significant risk to the Project.

Sulfuric acid generated by oxidation of pyritic sulfur at Compressor Station 106 could create the potential for corrosion. Tennessee stated that the existing foundations at the site have not shown indications of chemical damage from acidic soils. The mitigation measures described above for expansive soils would also provide protection from acidic soils. Additionally, where bedrock cannot be avoided, Tennessee would cover exposed pyritic bedrock with lime if wet, and spray the bedrock with an asphalt sealant if the excavation would stay open for a longer period. Fill would be placed as a barrier between bedrock and foundations. During trenching for underground pipe, Tennessee would also implement special mitigation measures, such as covering the sides and bottom of any trench in bedrock with lime, and backfilling as soon as possible. We conclude that Tennessee's measures would be sufficient to mitigate potential impacts from acidic soils at Compressor Station 106.

2.2 Water Resources and Wetlands

2.2.1 Groundwater Resources

Existing Groundwater Resources

The major aquifer in the area of the Compressor Station 106 site is the Silurian-Devonian aquifer, consisting of consolidated limestone, dolomite, and sandstone. Precipitation is the primary source of recharge to the aquifer (USGS, 1995). Wells generally range from 50 to 200 feet deep and yields commonly range from 2 to 20 gallons per minute (gpm) but can exceed 300 gpm. In Kentucky, the quality of groundwater used by households for private domestic supplies is generally good (KYDEP, 2013). However, elevated nitrates, high levels of iron and sulfur, high levels of total dissolved solids ("salty" or "hard" water), and nutrients and pesticides from agricultural activities can affect the groundwater quality (KGS, 2014b).

At the Compressor Station 106 site, the thickness of the limestone and dolomite aquifers range from 50 to 200 feet and the potential yield is estimated to be less than 300 gpm (USGS, 1995). Groundwater in the Interior Low Plateaus Province is particularly susceptible to contamination. Based on soil survey data (USDA, 2013), the depth to water table across the majority of the Compressor Station 106 site is greater than 6.5 feet bgs. Accurate water table elevations could not be determined from on-site geotechnical investigations because water was added during rock coring (CDI, 2014a).

The major aquifer in the area of the Compressor Station 114 site is the Pennsylvanian aquifer, consisting of sandstone and limestone. Water is also obtained from Permian sandstones and unconsolidated Quaternary sediments. Water quality in the Pennsylvanian aquifer is variable, depending

on depth in the aquifer, rock type, and proximity to recharge areas (KGS, 2004). Based on soil survey data, the water table across the majority of the Compressor Station 114 site is greater than 6.5 feet bgs (USDA, 2013). Groundwater was recorded at depths of 25.7 and 26.2 feet bgs in two geotechnical borings at the site (CDI, 2014b).

In West Virginia, the proposed Compressor Stations 118A and 119A sites overlie the Appalachian Plateaus aquifers, consisting of semi-consolidated to unconsolidated sediments containing silt, clay, and sand, with some gravel and lignite. In most areas, the water in the Appalachian Plateaus aquifers is generally highly saline except for near the surface. About half of the groundwater withdrawn from these aquifers is used for domestic and commercial supplies. About 40 percent of it is pumped for industrial, mining, and thermoelectric power purposes; most of this water was used in coal mining operations (USGS, 2014b). According to soil survey data, the water table across the majority of the Compressor Stations 118A and 119A sites is greater than 6.5 feet bgs (USDA, 2013). No free water was observed within any of the borings during geotechnical investigations at the sites of Compressor Stations 118A and 119A (Terracon, 2014a and 2014b).

The major aquifer beneath the Compressor Station 875 site is the Silurian-Devonian aquifer, as described for Compressor Station 106. Soil survey data indicates the water table is deeper than 6.5 feet bgs across most of the site (USDA, 2013). No free water was observed within any of the borings conducted during geotechnical investigations at the Compressor Station 875 site (Terracon, 2014c).

The Compressor Station 563 site overlies the Mississippian carbonate aquifer, consisting mostly of limestones (Tennessee Ground Water, 1986). The maximum reported yields of wells completed in these aquifers are highly variable; wells that penetrate solution openings in the limestone have large yields. Precipitation is the primary source of recharge. Water is generally hard, with high iron, manganese, and sulfate concentrations in some areas. The Mississippian carbonate aquifer has some protection from potential contamination because it is overlain by a clay-rich regolith that is 80 feet thick in some areas. The aquifer is used extensively for public drinking water supplies (Tennessee Ground Water, 1986). Soil survey data indicates the water table at the Compressor Station 563 site ranges from about 1.5 feet to greater than 6.5 feet bgs (USDA, 2013). Onsite geotechnical investigations at the Compressor Station 563 site recorded groundwater as shallow as 18 feet bgs while drilling, and as shallow as 23 feet bgs 24 hours after completion (Terracon, 2014d).

Sole Source Aquifers and Wellhead Protection Areas

The U.S. Environmental Protection Agency (EPA) defines a principal or sole source aquifer as one that supplies at least 50 percent of the drinking water consumed in the area overlying the aquifer. These areas tend to have no alternative drinking water sources that could physically, legally, and/or economically supply those who depend upon the aquifer for drinking water. There are no sole source aquifers in Kentucky, West Virginia, or Tennessee (EPA, 2014a and 2014b).

No wellhead protection areas are within 5 miles of any of the compressor station sites (TDEC, 2014a; KYDEP, 2014).

Public and Private Water Supply Wells

Water supply wells within 400 feet of the Project were identified using the USGS National Water Information System (USGS, 2014a), KGS groundwater data repository (KGS, 2014b, 2015a, and 2015b), West Virginia Water Resources Management Plan (WVDEP, 2014), Tennessee Ground Water National Water Summary, and Tennessee Department of Environment and Conservation (TDEC) Division of Water Resources, Drinking Water Unit databases (TDEC, 2014a and 2015). In addition, Tennessee

identified and mapped water features including water wells, springs, and seeps during field reconnaissance surveys in August, September, and November 2014 at the compressor station sites.

Two water supply wells, reported as unused, are about 247 and 292 feet northeast of the existing Compressor Station 106 site. No other private or community/municipal water supply wells were identified within 400 feet of the proposed work area at Compressor Station 106. No private or community/municipal water supply wells were identified within 400 feet of the proposed work area at Compressor Station 114. No seeps or springs are present within the construction work area at either of these compressor stations.

No documented private or community/municipal water supply wells are within 400 feet of the work areas for the four new compressor station sites. However, during field surveys, Tennessee observed an abandoned well that would be within the Compressor Station 563 site and 40 feet east of the construction work area. Field surveys also identified a spring about 107 feet southeast of the Compressor Station 563 work area. Tennessee identified two seeps/springs within the Compressor Station 119A site, one of which would be inside the construction work area and the second of which would be 54 feet west of the work area. None of these springs were identified as water supply sources.

Groundwater Contamination

As described in section 2.1.2, a construction and demolition landfill previously operated on the Compressor Station 118A site. Analysis of soil samples from the site did not indicate the presence of contaminants associated with this landfill. Tennessee conducted an analysis of groundwater conditions onsite in June 2015 (Terracon, 2015f). The evaluation was limited, however, due to an insufficient volume of groundwater present in the boreholes to enable sampling. The analysis concludes the steeply sloping site topography, cohesive soils, and low permeability of the bedrock make it unlikely that potential contamination at the surface would reach the water table.

Also as described in section 2.1.2, the Compressor Station 119A site has potential for petroleum contamination associated with vehicle maintenance and storage. However, significant impacts on groundwater would be unlikely. Should contaminated groundwater be unexpectedly encountered during construction of the Project, Tennessee would implement its *Plan for the Unanticipated Discovery of Potentially Contaminated Soils, Groundwater, or Debris.*

Tennessee previously installed 13 groundwater monitoring wells at Compressor Station 106 and 2 groundwater monitoring wells at Compressor Station 114 as part of investigation and remediation activities related to PCB contamination (see section 2.1.2). No PCBs were detected in the groundwater at Compressor Station 114, and the monitoring wells were plugged and abandoned. However, groundwater at Compressor Station 106 was affected by PCBs. Tennessee has since plugged and abandoned 12 of the monitoring wells at Compressor Station 106 and continues to sample one well every 5 years for PCBs. Although PCB-contaminated materials and soil have been removed from the sites, residual contamination remains.

Tennessee has site-specific RPMMs that provide maps depicting the locations of PCB-containing soils and remediation areas, and identify measures to follow for future operations and maintenance activities. However, the RPMM for Compressor Station 106 does not address groundwater. Therefore, **we recommend that:**

- **Prior to abandonment or construction activities at Compressor Station 106, Tennessee should file with the Secretary, for review and written approval by the Director of OEP, a plan for handling potential PCB-affected groundwater at Compressor Station 106 developed in coordination with KYDEP.**

Groundwater Impacts and Mitigation

No sole-source aquifers or wellhead protection areas occur within or near the Project area; therefore, these resources would not be affected by the Project.

Tennessee would not use groundwater for construction activities such as dust control, concrete mixing, or hydrostatic testing. Tennessee would use municipal water at all four proposed new compressor stations and would not install any water supply wells for operations.

During construction, Tennessee would excavate up to 30 to 40 feet bgs to accommodate the reinforced concrete foundation that is required for the new compressor units and buildings. Tennessee would minimize potential impacts from discharges associated with dewatering groundwater from trenches and excavations in accordance with its ECMP, which includes the following measures to minimize impacts from dewatering:

- verify that dewatering activities are properly monitored and do not result in the deposition of sand, silt, and/or sediment into sensitive environmental resource areas, including wetlands, waterbodies, cultural resource sites, and sensitive species habitats;
- stop dewatering activities if such deposition is occurring and ensuring the design of the discharge is changed to prevent reoccurrence; and
- remove the dewatering structures as soon as practicable after the completion of dewatering activities.

Accidental spills or leaks of fuels, lubricants, and coolant from construction equipment could impact groundwater. Tennessee would implement its SPCC Plan to protect water resources from accidental spills. Measures to be implemented to minimize potential impacts from accidental spills of fuels, solvents, and lubricants include:

- training personnel on the proper handling of fuels and other hazardous materials, and appropriate spill cleanup and notification procedures;
- ensuring all equipment is in good operating condition;
- inspecting equipment for leaks regularly and repairing identified leaks promptly; and
- maintaining a 400-foot setback from community and municipal wells and a 200-foot setback from private wells for hazardous materials storage, and equipment and vehicle maintenance and refueling activities.

In addition, if construction activities require 1,320 gallons or more of oil to be stored onsite, Tennessee would update and implement its SPCC Plan to comply with the requirements found in 40 CFR Part 112.

The states of Kentucky and West Virginia require preparation and implementation of a GPP for certain activities. Tennessee would continue to implement the GPPs previously developed for existing Compressor Stations 106 and 114, which are contained in the ECMP. Tennessee would develop and implement GPPs at Compressor Stations 875, 118A, and 119A.

In general, blasting activities have potential to damage nearby water supply wells or springs/seeps. Tennessee anticipates conducting blasting activities for construction of Compressor Station 118A. Tennessee does not anticipate conducting blasting activities at Compressor Stations 106,

114, 563, or 875, and does not expect blasting to be required at Compressor Station 119A unless harder than anticipated rock formations are encountered during construction. No wells were identified within 400 feet of the Compressor Station 118A or 119A construction work areas. Tennessee and its construction contractor would develop and implement a blasting plan that would include measures to minimize vibration impacts at the locations where blasting would be required.

Based on Tennessee's implementation of minimization and mitigation measures, we conclude that construction and operation of the Project would not significantly impact groundwater resources in the Project area.

2.2.2 Surface Water

Existing Surface Water Resources

Based on a review of USGS mapping and Tennessee's field investigations, a total of 13 waterbodies are within the proposed and existing compressor station sites (see table 2-2). Compressor station piping would cross one of these waterbodies and access roads or perimeter fencing would cross seven others. The remaining five waterbodies are within the construction workspace but would be avoided. All 13 waterbodies are classified as minor (less than 10 feet wide) and include three perennial waterbodies, four intermittent waterbodies, two ephemeral waterbodies, and four ephemeral/intermittent waterbodies. No waterbodies are present within the existing Compressor Station 114 site. No waterbodies with a state water quality designation classification were identified within any of the compressor station sites. Additionally, none of the waterbodies contain suitable habitat to support fisheries (see section 2.3.2).

Table 2-2

Waterbodies Crossed or Otherwise Impacted by the Project

Facility	Waterbody Name	Feature Type	Bank Width (feet)	Crossing Installation	FERC Classification [a]
Existing Facilities[b]					
CS 106	Unnamed tributary to Lulbegrud Creek (Stream 1)	Ephemeral	2	None[c]	Minor
New Facilities					
CS 118A	Unnamed tributary to Twomile Creek (Stream 1)	Ephemeral/Intermittent	3	None	Minor
	Unnamed tributary to Twomile Creek (Stream 2)	Perennial	2	Culvert	Minor
	Unnamed tributary to Twomile Creek (Stream 3)	Ephemeral/Intermittent	2	Bridge	Minor
	Unnamed tributary to Twomile Creek (Stream 4)	Intermittent	4	None	Minor
	Unnamed tributary to Twomile Creek (Stream 5)	Perennial	4	None	Minor
	Unnamed tributary to Twomile Creek (Stream 6)	Intermittent	4	None	Minor
CS 119A	Unnamed tributary to Rocky Creek (Stream 1)	Intermittent	4	Culvert	Minor
CS 875	Unnamed tributary to Otter Creek (KY0155_ST06)	Perennial	5	Fence	Minor
CS 563	Unnamed tributary to Sulphur Branch (Stream 1)	Ephemeral/Intermittent	3	Fence	Minor
	Unnamed tributary to Sulphur Branch (Stream 1)	Ephemeral	2	Fence	Minor
	Unnamed tributary to Sulphur Branch (Stream 3)	Ephemeral/Intermittent	3	Pipeline	Minor
	Unnamed tributary to Sulphur Branch (Stream 4)	Intermittent	2	Fence	Minor

[a] Classifications include: Major (greater than 100 feet wide); Intermediate (between 10 and 100 feet wide); and Minor (less than 10 feet wide).

[b] No waterbodies would be crossed at CS 114.

[c] None = waterbodies within the compressor station sites but avoided by construction activities.

In addition to the waterbodies listed above, the compressor station sites are crossed by swales or other drainage features (e.g., gullies or small washes characterized by low volume, infrequent, or short duration flow) and constructed drainages excavated wholly in and draining only uplands that do not carry a relatively permanent flow of water. These types of features generally do not fall under U.S. Army Corps of Engineers (USACE) jurisdiction and are not considered waters of the U.S. (EPA, 2008). These swales and drainage features within the compressor station sites are further described in the impacts and mitigation section.

Floodplains

Executive Order (EO) 11988 Floodplain Management, issued on May 24, 1977, requires federal agencies to avoid adverse effects on the 100-year floodplain, when possible. It also states that growth and development within the floodplain should not be encouraged, unless no alternatives exist, and that functions and habitat associated with floodplains should be protected.

The proposed sites of Compressor Stations 875, 563, and 106 are not within a floodplain. Portions of the Compressor Station 114 and 118A sites are in FEMA-mapped flood zones. According to FEMA, these floodplains have a 1 percent annual chance of a flood event. The existing access road that would be used during construction and operation for Compressor Station 119A is within the floodplain associated with Clay Bank Branch, but no development would occur within the floodplain.

About 2.3 acres (8 percent) of the existing Compressor Station 114 lies within a FEMA-mapped floodplain associated with the Big Sandy River; however, this is an existing facility and Tennessee would not install any permanent aboveground structures that could impede or redirect potential flows from any of the constructed drainages.

At the Compressor Station 118A site, some of the construction and operational footprints are within the floodplain associated with an unnamed waterbody. The Project, including an access road, tie-in to an existing pipeline, three culverts, and a stormwater outflow pipe, would impact approximately 1.02 acres within the 100-year floodplain. Tennessee would obtain a Floodplain Permit from Kanawha County, West Virginia for the proposed work at Compressor Station 118A prior to construction. The Floodplain Permit would provide any required information for the permitting of fill within the floodplain and any mitigation requirements, as well as documentation regarding compliance with EO 11988 on Floodplain Management. The floodplain cannot be avoided because of the location of the floodplain and the topography of the site. At our request, Tennessee evaluated an alternative location for the facility tie-in point, south of Wetland E and north of the proposed access road, which would be outside of the floodplain. The suction and discharge pipeline headers connected to the station at this location would result in significant impacts on Wetland E. Therefore, we conclude that this location would not be a preferable alternative to the proposed location. Tennessee would implement flood contingency measures in the case of a major storm event during construction as described in section 2.1.1.

Sensitive Waterbodies

The Project would not cross, and therefore not impact, any federal- or state-designated wild and scenic rivers, any rivers listed on the Nationwide Rivers Inventory (National Wild and Scenic Rivers System, 2014; NPS, 2011) or any waters identified as providing habitat for federally listed threatened or endangered species. Although not crossed by the existing Compressor Station 114 site, the Big Sandy River bordering the eastern boundary of the site is considered by USACE as a navigable waterway under Section 10 of the Rivers and Harbors Act (USACE, 2014).

State waters in Kentucky, West Virginia, and Tennessee are classified according to a waterbody's designated use (see table 2-3). The Project would not cross, and therefore not impact, any surface waterbody listed as impaired or contaminated (EPA, 2014c) under section 303(d) of the Clean Water Act (CWA).

The KYDEP, Division of Water, defines special use waters as rivers, streams, and lakes listed in Kentucky Administrative Regulations (KAR) that are worthy of additional protection. In Kentucky, no designated use waterbodies are in the Project areas (KYDEP, 2011).

The WVDEP has established an antidegradation policy that assigns all waters to specific tiers depending upon the level of protection necessary to maintain high quality and/or existing uses (WVDEP, 2015). In West Virginia, no Tier 1, Tier 2, or Tier 3 waters are in the Project area.

TDEC classifies all surface waters under Chapter 1200-4-4 of the Rules of TDEC, Division of Water Pollution Control. The proposed compressor station in Tennessee (Compressor Station 563) is in the Sycamore Creek watershed, and Sycamore Creek is designated by the TDEC for domestic, fish and aquatic life, recreation, livestock water and wildlife, and irrigation uses (TDEC, 2007).

Table 2-3

Watersheds within the Project Work Areas

Compressor Station	Watershed	County, State	Watershed Size (sq. miles)	Impairments [a]
CS 106	Lower Lulbegrud Creek	Powell County, KY	15,833	Chlorides, Escherichia coli, and pathogens
CS 114	Bear Creek-Big Sandy River [b]	Boyd County, KY	25,149	Ammonia, pathogens, and oxygen depletion
CS 118A	Twomile Creek	Kanawha County, WV	15,618	Aluminum, pH, fecal coliform, manganese, iron, sediment, and biological
	Rocky Fork [c]		12,144	
CS 119A	Rocky Fork	Kanawha County, WV	12,144	Aluminum, pH, fecal coliform, manganese, iron, sediment, and biological
	Kelly Creek-Pocatalico River		17,226	
CS 875	Upper Otter Creek	Madison County, KY	23,949	Pathogens
	Lower Otter Creek		17,973	
CS 563	Upper Sycamore Creek	Davidson County, TN	30,018	Escherichia coli

[a] EPA (2014d)

[b] Unnamed perennial tributary of the Big Sandy River (near but outside CS 114) is listed on Kentucky's 303(d) list.

[c] The only portion of the compressor station site within this watershed is the property fenceline, which would consist of a five-strand barbed wire fence.

sq. miles = square miles

Public Water Supply

The existing compressor station sites fall within local water districts that use surface waters for public water supplies. However, no waterbodies within mapped Source Water Protection Areas (SWPA) or public watersheds that provide surface water intakes occur within 5 miles of the Compressor Stations 106 or 114 sites (KYDEP, 2013).

The sites for Compressor Stations 118A, 119A, 875, and 563 fall within local water districts that use surface waters for public water supplies. The Compressor Stations 118A and 119A sites fall within the area covered by the *Kanawha Valley Source Water Assessment and Protection Program Report for Elk River*, which indicates that it meets the Source Water Assessment and Protection and Safe Drinking

Water Act regulations. No waterbodies within mapped SWPAs or Watershed Delineation Areas for the Elk River Watershed occur within 5 miles of the Compressor Stations 118A and 119A sites (West Virginia Department of Health and Human Resources [WVDHHR], 2002). No waterbodies within mapped SWPAs or public watersheds that provide surface water intakes occur within 5 miles of the Compressor Station 875 site (KYDEP, 2013). In the state of Tennessee, SWPAs for public water systems using surface water are generally based on the portion of the watershed area upstream of the water intake. No surface water intakes, SWPAs, or public watersheds occur within 5 miles of the Compressor Station 563 site (TDEC, 2003 and 2014b).

All the compressor station sites are within water district service areas that use surface water for public water supply (see table 2-4). However, no potable surface water intakes occur within 5 miles of any of the compressor station sites.

Table 2-4

Water Supply Sources for Compressor Station Sites

Facility ID	Water District/Service Area	Water Source
Existing Facilities		
CS 106	Powell Valley Water District	Licking River
CS 114	Big Sandy Water District	Big Sandy River and Ohio River
New Facilities		
CS 118A	West Virginia American Water Service Area	Elk River
CS 119A	West Virginia American Water Service Area	Elk River
CS 875	Madison County Utilities District	Kentucky River
CS 563	Metro Water Services Service Area	Cumberland River

Sources: PVWD (2014), Kentucky Infrastructure Authority (2014), Public Service Commission of Kentucky (2015), BSWD (2012), WVAW (2014), MCUD (2014), MWS (2014).

Impacts and Mitigation

Swales and Drainage Features

Construction of Compressor Station 106 would impact six constructed drainages, two other drainages, and one vegetated swale. Placement of fill in drainages and swales would result in a total of about 404 linear feet of permanent impacts at Compressor Station 106. Four constructed drainages would be temporarily impacted at the Compressor Station 114 site; however, no permanent impacts would occur.

Compressor Station 118A construction would impact 17 vegetated swales and 2 constructed drainages. About 1,904 linear feet of permanent impacts would result from placement of fill in swales. At the Compressor Station 119A site, Tennessee would permanently fill 10 vegetated swales, representing about 1,605 linear feet. Two vegetated swales and three erosional gullies would be permanently filled at the Compressor Station 875 site resulting in about 532 linear feet of permanent impacts. At the Compressor Station 563 site, six vegetated swales would be permanently impacted from placement of fill, representing about 1,033 linear feet. None of the fill activity would be within USACE jurisdictional waters or require a permit.

Potential impacts associated with disturbing or filling of swales or erosional features would include reduced infiltration and increased flow velocity of stormwater runoff to downgradient waterbodies and wetlands. These features, identified at the existing and new compressor station sites,

provide stormwater attenuation during and after heavy rains. The permanent fill of the drainages, gullies, and swales would reduce infiltration of water into the ground and increase runoff to the waterbodies. To minimize these impacts, Tennessee would implement best management practices (BMP) including the measures in our Plan and Procedures, to prevent erosion and sediment-laden stormwater from entering the waterbodies.

Surface Waters

Modifications to the existing compressor stations would largely avoid impacts on surface waters because no waterbodies are present at Compressor Station 114 and Tennessee would establish an exclusion area around the ephemeral waterbody within the construction work area at the Compressor Station 106 site. There would be a 50-foot setback for construction work areas and a 100-foot setback for equipment parking. During construction, Tennessee would delineate the boundaries of the exclusion area with silt fence and would not perform any ground-disturbing activities within the fenced exclusion areas to avoid direct impacts on surface water resources.

At the new compression stations, Tennessee has designed the operational layout to avoid existing waterbodies to the extent possible. One waterbody, Stream 1, at the Compressor Station 119A site (see table 2-5) would be diverted through a culvert to maintain flows where the waterbody crosses under an area to be graveled and paved. In other areas, waterbodies would be crossed by access roads or perimeter fencing. Tennessee's modifications to widen access roads at Compressor Stations 118A and 119A would cross three waterbodies. The modifications would include construction of new crossing structures (bridge or culvert) that would be adequately sized for potential flow conditions and installed during no or low-flow periods to minimize downstream turbidity.

The WVDEP commented that culverts installed for the Project should be properly sized and counter-sunk to provide natural substrate along the bottom which lowers water velocity and allows for movement of aquatic organisms. Therefore, **we recommend that**:

- **Prior to construction of Compressor Stations 118A and 119A, Tennessee should consult the WVDEP and file with the Secretary designs for culverts that would be constructed at Compressor Stations 118A and 119A and any WVDEP comments on the designs.**

The length of the waterbodies diverted through culverts would total about 218 linear feet at the Compressor Station 118A site. Tennessee would impact about 149 linear feet of the waterbody at the Compressor Station 119A site due to the placement of riprap at a stormwater outlet and installation of a culvert to maintain flows where the stream crosses under an area designated for graveling/paving. In total, Tennessee would permanently impact 367 linear feet of streams.

Installation of property and security fences would fully span stream channels and not impede flow or require in-channel fill. Six waterbodies would be crossed by fencing: one waterbody at each of Compressor Stations 118A, 119A, and 875, and three waterbodies at Compressor Station 563 (see table 2-2). Following construction, temporarily affected surface water features would be restored in accordance with Tennessee's ECMP and, as applicable, federal and state permit requirements. Tennessee would return all stream banks to preconstruction contours or to a stable angle of repose as approved by the EI. Riprap would not be used unless flow conditions preclude effective vegetative stabilization techniques such as seeding and erosion control fabric. Waterbodies that would not be disturbed during construction would be flagged or fenced for avoidance.

Tennessee would cross one ephemeral/intermittent waterbody at Compressor Station 563 to connect one 36-inch-diameter piping segment and two 42-inch-diameter piping segments to connect the

new compressor station to Tennessee's existing pipeline system. Tennessee would install the piping segments within a single 75-foot-wide temporary right-of-way using standard open-cut methods. At the crossing location, the unnamed waterbody is about 3 feet wide and would likely be dry during construction. If flow is present at the time of the crossing, Tennessee would complete in-stream construction activities within 24 hours in accordance with the FERC Procedures for minor waterbody crossings (classified as less than 10 feet wide). Tennessee would excavate the trench from either side of the waterbody using a temporary bridge, as needed, for equipment crossings. Spoils would be stockpiled at least 10 feet from the edge of the waterbody. Following pipeline installation, the streambed would be restored to its original contours and erosion control measures would be placed around the disturbed area until vegetation becomes established. Additionally, Tennessee would implement BMPs, to prevent erosion and sediment-laden stormwater from entering the drainage, and to ensure that water quality for this stream and downstream drainages are not degraded. Tennessee filed for an Aquatic Resource Alteration Permit (ARAP) with TDEC for this crossing on Jan 23, 2015 and submitted a follow-up to its application on February 26, 2015. TDEC issued this permit under the General Permit for Utility Line Crossings on May 14, 2015, and issued a modification to the permit on June 24, 2015.

Potential impacts on stream water quality would include increased sedimentation and turbidity. Levels of sedimentation would be highest as a result of the waterbody crossing at Compressor Station 563 using the open-cut method. Additionally, vehicle traffic and equipment used during construction could compact soils, which could increase stormwater volume and velocity entering waterbodies. To minimize these impacts, Tennessee would conduct in-stream work during no-flow or low-flow periods and implement the BMPs contained in the ECMP.

Tennessee would install temporary erosion and sediment control measures following initial ground disturbance in accordance with the FERC Plan and Procedures. Examples of erosion and sediment control measures include use of silt fence, rock pads, staked straw bales, erosion control interceptor dikes, erosion control silt fabric, erosion control blankets, and soil-retaining berms. Tennessee has committed to the following measures to minimize erosion and sedimentation of onsite and adjacent surface water features:

- installing erosion and sediment controls immediately following initial soil disturbance where required;
- inspecting and maintaining erosion and sediment controls throughout the duration of construction and restoration;
- repairing or replacing erosion and sediment controls within 24 hours of identifying deficiencies; and
- restoring temporary disturbance areas to pre-construction contours and drainage patterns.

Tennessee identified locations where construction workspaces would be within 50 feet of a waterbody and provided justification for each (see table 2-5), as well as additional protective mitigation measures to ensure indirect impacts are minimized.

Table 2-5

Construction Workspace Within 50 Feet of Waterbodies [a]

Waterbody	Distance From Workspace (feet)	Purpose for Workspace
Unnamed tributary to Twomile Creek (Stream 1) [b]	10	Necessary for construction of retaining wall in steep terrain.
Unnamed tributary to Twomile Creek (Stream 2)	<5	Improvements to existing access road within existing roadbed, including installation of temporary equipment mats for construction access and placement of gravel or asphalt (as needed) to restore road to preconstruction condition following construction.
Unnamed tributary to Twomile Creek (Stream 4)	27	Construction of permanent access driveway and retaining wall in steep topography.
Unnamed tributary to Twomile Creek (Stream 5)	<5	Improvements to existing access road within existing roadbed, including installation of temporary equipment mats for construction access and placement of gravel or asphalt (as needed) to restore road to preconstruction condition following construction.
Unnamed tributary to Twomile Creek (Stream 6)	<5	Improvements to existing access road within existing roadbed, including installation of temporary equipment mats for construction access and placement of gravel or asphalt (as needed) to restore road to preconstruction condition following construction.
Unnamed tributary to Rocky Creek (Stream 1)	<5	Improvements to existing access road within existing roadbed, including installation of temporary equipment mats for construction access and placement of gravel or asphalt (as needed) to restore road to preconstruction condition following construction.
Unnamed tributary to Otter Creek (KY0155_ST06)	48	Installation of compressor station security fence.
Unnamed tributary to Otter Creek (KY0155_ST07)	17	Installation of compressor station security fence.
Unnamed tributary to Otter Creek (KY0155_ST10)	17	Installation of barbed wire fence at compressor station property boundary fence and use of existing road that accesses the site and Tennessee's existing mainline valve and pipeline infrastructure.
Unnamed tributary to Sulphur Branch (Stream 1)	30	Installation of compressor station security fence.
Unnamed tributary to Sulphur Branch (Stream 2)	0	Installation of barbed wire fence at compressor station property boundary.
Unnamed tributary to Sulphur Branch (Stream 3)	25	Installation of compressor station security fence.
Unnamed tributary to Sulphur Branch (Stream 4)	0	Installation of barbed wire fence at compressor station property boundary.

Tennessee proposes to install reinforced silt fence to protect resources at locations where the setbacks cannot be maintained. Additional protective measures may be employed where waterbodies are downslope of construction work areas. These measures include:

- installing protective walls;
- using waterbody coverings; and
- using special earth moving construction techniques; or other measures as dictated by site conditions.

Refueling of vehicles and storage of fuel, oil, or other hazardous materials near surface waters and spills from equipment working in waterbodies could create a potential for contamination, which, if a spill were to occur, could degrade downstream water quality. Impacts related to spills would be minimized as previously described for groundwater. In accordance with the FERC Procedures, Tennessee would maintain the following setbacks from waterbodies and wetlands throughout construction and operation (unless otherwise noted):

- Construction spoil piles would be set back a minimum of 10 feet.
- No equipment or vehicle parking, hazardous materials storage, concrete coating, refueling, herbicide application, or pesticide use would occur within 100 feet.

Tennessee would not install permanent aboveground structures that could impede or redirect potential flows from any of the constructed drainages. Although no flood-related issues are anticipated, Tennessee would suspend construction activities to the extent feasible if significant 100-year rainfall events are forecast for the area. As described in section 2.1.1, we have evaluated Tennessee's proposed measures to mitigate flooding impacts in case of a major storm event during construction of the Project and find them acceptable. Therefore, no significant impacts on floodplains are anticipated as a result of the Project.

Tennessee does not propose to conduct blasting in streams or wetlands. Where blasting is required near sensitive areas such as wetlands or streams, Tennessee would take additional safeguards as described in section 2.2.1.

Hydrostatic Testing

Tennessee would conduct hydrostatic testing of compressor station piping to verify structural integrity. Hydrostatic testing would comply with DOT regulations and applicable state and local regulations. Tennessee would obtain test water from a municipal or commercial water source, truck it to the site, and store it on site in tanks. Test segments would be capped and filled with water, and then pressurized for at least 8 hours in accordance with 49 CFR 192. Detected leaks would be repaired and the segment retested, if necessary. Upon completion of hydrostatic testing of piping systems, each line would be de-pressurized and water discharged.

The total estimated volume of water used for hydrostatic testing of all six compressor stations is 1,600,000 gallons. Table 2-6 provides the estimated amount of water needed for hydrostatic testing at each compressor station. Discharge of water for hydrostatic testing could result in erosion, increased turbidity in surface waters, and changes in water temperature and oxygen levels. However, Tennessee would use energy dissipating devices where necessary to control erosion and sedimentation. Test water would contact only new pipe, no chemicals or additives would be added to the test water. Discharge points would be selected to avoid waterbody and wetland features and all test water would be discharged on site in accordance with applicable National Pollutant Discharge Elimination System (NPDES) or state discharge permits.

Table 2-6

Estimated Hydrostatic Test Water Volumes

Facility	Estimated Test Water Volume (Gallons)
Existing Facilities	
CS 106	100,000
CS 114	500,000
Existing Facilities Subtotal	**600,000**
New Facilities	
CS 118A	150,000
CS 119A	150,000
CS 875	200,000
CS 563	500,000
New Facilities Subtotal	**1,000,000**
Project Total	**1,600,000**

Because Tennessee would implement the hydrostatic testing procedures summarized above, we conclude that the impacts on surface water associated with hydrostatic test water withdrawal and discharge would be minor and temporary.

2.2.3 Wetlands

Both the USACE and the EPA define wetlands as "those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas." To be considered a USACE-jurisdictional wetland, an area must show hydrophytic vegetation, hydric soils, and wetland hydrology under normal conditions (USACE, 2007).

The FERC Procedures define wetlands as "any area that is not in actively cultivated or rotated cropland and that satisfies the requirements of the current federal methodology for identifying and delineating wetlands." Tennessee would conduct crossings of FERC-defined wetlands in accordance with the Project ECMP (unless otherwise noted).

- Louisville District (Kentucky compressor station sites);
- Huntington District (West Virginia compressor station sites); and
- Nashville District (Tennessee compressor station site).

None of the Kentucky sites (Compressor Stations 106, 114, and 875) would cross USACE-jurisdictional features; therefore, no permit is required from the Louisville District. USACE-jurisdictional features at the Compressor Station 118A, 119A, and 563 sites would be affected and would qualify for coverage under Nationwide Permit (NWP) 12. Tennessee filed for an ARAP with TDEC on January 23, 2015 and was issued this permit under the General Permit for Utility Line Crossings by TDEC on May 14, 2015. TDEC issued a modification to the ARAP on June 22, 2015.

Existing Wetland Resources

Tennessee conducted wetland surveys in August, September, and November 2014 at the compressor station sites in accordance with the *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Eastern Mountains and Piedmont Region (Version 2.0)* (USACE, 2012). Wetland types were assigned based on the National Wetlands Inventory classifications as described in Cowardin et al. (1979). In total, Tennessee delineated one palustrine forested (PFO) wetland, one palustrine unconsolidated bottom (PUB) wetland associated with a palustrine emergent (PEM) wetland, and four PEM wetlands in the workspaces.

Impacts and Mitigation

Temporary and permanent impacts on wetlands are summarized in table 2-7. No wetlands would be affected at the sites of Compressor Stations 106, 114, or 875.

Table 2-7

Summary of Wetlands Affected by the Broad Run Expansion Project

Facility	Wetland Type [a]	Construction Impacts (acres)	Operation Impacts (acres)
CS 118A	PUB/PEM	0.07	0.07
CS 119A	PEM	0.23	0.23
CS 563	PFO	<0.01	<0.01
	Total	0.30	0.30

[a] Cowardin Classification

The Project would impact one PFO wetland at the Compressor Station 563 site. This slope wetland, associated with an unnamed tributary to Sulphur Branch Creek (not located within the compressor station site), is characterized by an overstory of hickory (*Carya* sp.) trees with an herbaceous layer dominated by beggarticks (*Bidens frondosa*). The PFO wetland falls within the permanent footprint of the compressor station property fence and might be impacted during construction, for a total disturbance of less than 0.01 acre. While Tennessee stated that it would try to avoid affecting the wetland during fence installation, any impacts on the wetland would be considered permanent because of the recovery time associated with a forested wetland.

The Project would impact one PUB/PEM wetland at the Compressor Station 118A site. This riverine wetland is associated with Twomile Creek (not located within the compressor station site) and is characterized by black willow (*Salix nigra*) and narrowleaf cattail (*Typha angustifolia*). This wetland would be permanently filled for a total permanent wetland disturbance of about 0.07 acre. Permanent impacts would result from compressor station buildings, aboveground structures, or access road modifications.

The Project would impact four PEM wetlands at the Compressor Station 119A site. These slope and depressional wetlands, associated with an unnamed tributary to Clay Bank Branch Creek, are characterized by rush (*Juncus* sp.) and bulrush (*Scirpus* sp.) species. All four wetlands would be permanently filled for a total permanent wetland disturbance of about 0.24 acre. Permanent impacts would result from installation of compressor station buildings, aboveground structures, a retaining wall, and a stormwater pond.

In total, Tennessee would impact 0.30 acre of wetlands by the construction of new facilities, and all of these impacts would be permanent. No wetlands at the existing facilities would be affected. The Project would convert less than 0.01 acres of PFO wetlands to non-forested/scrub-shrub wetlands as a result of this Project. No PSS wetlands would be affected. Tennessee would comply with the requirements of USACE Section 404 NWP 12 for Utility Line Activities and TDEC's conditions specified in the associated ARAP for Compressor Station 563.

Tennessee would protect waterbodies and wetlands by implementing these measures to avoid or minimize direct and indirect impacts:

- establishing an exclusion area within the construction work area to avoid direct impacts on wetlands;
- retaining a minimum 50-foot forested buffer on each side of streams and around wetlands, as feasible;

- installing erosion and sediment controls prior to initial soil disturbance where required;
- inspecting and maintaining erosion and sediment controls throughout the duration of construction and restoration;
- repairing or replacing erosion and sediment controls within 24 hours of identifying deficiencies; and
- restoring temporary disturbance areas to pre-construction contours and drainage patterns (except where cut and fill is required).

The primary impact on wetlands from construction would be the removal or alteration of wetland vegetation; however, emergent wetland vegetation would be expected to quickly reestablish following construction activities. Tennessee redesigned construction work areas and permanent facility locations to avoid wetland areas, including establishing exclusion areas within the construction work area to avoid direct impacts on wetlands. Tennessee established an exclusion area around two wetlands that occur within the Compressor Station 106 construction work area and one wetland (Wetland B) that occurs within the middle of the construction work area at the Compressor Station 563 site. Tennessee would delineate the boundaries of the exclusion areas with silt fence during construction and no ground-disturbing activities would be allowed within the fenced exclusion areas. Additionally, Tennessee has designed the construction work area to avoid impacts on nearby wetlands at the Compressor Station 875 site (see table 2-8).

Tennessee identified areas where it would locate construction workspaces within 50 feet of a wetland and where additional mitigation measures would be used to minimize indirect impacts to the wetlands (see table 2-8). Tennessee would maintain the 100-foot setback for parking, except where wetlands would be permanently filled.

Table 2-8

Workspace within 50 Feet of Wetlands [a]

Facility	Wetland ID	Distance From Workspace (feet)	Purpose of Workspace
CS 106	Wetland A	<5	Wetland is adjacent to existing access road into the compressor station site that will be used for construction access.
	Wetland D	15	Use of existing access driveway within compressor station site for construction access.
CS 118A	Wetland B	<5	Installation of stormwater outfall pipe is dictated by site topography.
	Wetland C	10	Installation of barbed wire fence at compressor station property boundary.
	Wetland D	10	Installation of barbed wire fence at compressor station property boundary.
	Wetland E	0	Construction of the permanent access driveway would result in permanent fill of portion of wetland and installation of culvert along Stream 2.
	Wetland F	<5	Improvements to existing access road within existing roadbed, including installation of temporary equipment mats for construction access and placement of gravel or asphalt (as needed) to restore road to preconstruction condition following construction.
CS 119A	Wetland B	<10	Construction of permanent access driveway and installation of compressor station security fence.
CS 875	KY0155_WL03	<10	Installation of compressor station security fence.
	KY0155_WL05	<5	Construction of permanent access driveway.
CS 563	Wetland A	0	Installation of barbed wire fence at compressor station property boundary.

[a] This table does not include wetlands that would be crossed, which are listed in table 2-7.

Tennessee proposes to install reinforced silt fence at workspace locations within 50 feet of wetlands. Where wetlands are downslope of construction work areas, Tennessee would employ additional protective measures, such as installing protective walls, using special earth moving construction techniques, or other measures as dictated by site conditions. Tennessee would flag or fence wetlands that would not be disturbed. Tennessee would implement applicable measures in the Project ECMP to further minimize the potential for indirect impacts.

Inadvertent spills of fluids used during construction, such as fuels, lubricants, and solvents, could contaminate wetland soils and vegetation. Tennessee would maintain construction equipment according to the manufacturer's specifications and would contain and store fuels and other potentially hazardous materials appropriately. If a spill or leak were to occur, Tennessee would implement measures in its SPCC Plan to contain the spill and minimize the potential for, and extent of, associated contamination.

Following construction, Tennessee would restore disturbed features that would not be permanently filled in accordance with its ECMP and the USACE and state permit requirements, as applicable. Vegetation maintenance procedures would be conducted in accordance with the ECMP. In general, the wetlands affected by temporary construction activities would continue to provide important ecological functions such as sediment/toxicant retention, nutrient removal/transformation, flood attenuation, groundwater recharge/discharge, and wildlife habitat in the long term.

As discussed above, the Project would permanently impact 0.3 acres of wetlands, less than 0.01 acre of forested wetlands, and 367 linear feet of streams, for which USACE and WVDEP would require compensatory mitigation. Tennessee has submitted Pre-construction Notifications and ARAPs that would address Sections 404 and 401 of the CWA. Appropriate mitigation for unavoidable temporary and permanent impacts would be determined in consultation with the USACE Huntington District and WVDEP. Such mitigation may include purchasing credits at an approved mitigation bank, as necessary. Stream mitigation credits are available in at least one mitigation bank in the same watershed. Tennessee is also evaluating in-lieu fee mitigation options with the WVDEP for wetland mitigation. Less than 0.01 acre of forested wetlands would be converted to non-forested/scrub-shrub wetlands as a result of this Project. The loss of less than 1 acre of non-forested wetlands would not represent a significant impact on wetlands resources in the area.

2.2.4 Water Resources and Wetlands Conclusions

In conclusion, we find that surface water and wetland impacts associated with the construction and operation of the Project would be minimized and compensated for by implementing the construction, restoration, and mitigation measures proposed by Tennessee and as may be required by the USACE and state agencies. With implementation of Tennessee's mitigation measures to compensate for temporary and permanent impacts on wetlands and waterbodies, we conclude that impacts would be reduced to less than significant levels. Additionally, we find that the Project would not result in any significant long-term or permanent impacts on groundwater resources based on Tennessee's implementation of appropriate minimization and mitigation measures.

2.3 Vegetation, Fisheries, and Wildlife

2.3.1 Vegetation

Existing Vegetation Resources

Tennessee identified existing vegetation cover types at the compressor station sites using available data and field surveys of the proposed sites. Vegetation types at the compressor station sites are generally composed of open uplands displaying various levels of disturbance and past land uses, deciduous forest communities (upland and bottomland), and developed areas. Table 2-9 presents these vegetation cover types and communities based on classification of *Deciduous Forests of Eastern North America* (Braun, 1950).

Table 2-9

Vegetation Cover Types Associated with the Broad Run Expansion Project

Vegetation Cover Type	Vegetation Communities	Common Species
Open upland	Agricultural lands (fallow field, disturbed grassland, pastureland, hay fields), scrub-shrub	Agricultural lands: herbaceous and small woody species dominated by foxtail, goldenrod, blackberry, barnyard grass, bluegrasses, ironweed, and fescues.
		Scrub-shrub: herbaceous species and small woody species dominated by blackberry, autumn olive, eastern red cedar, goldenrod, and yellow foxtail.
Disturbed upland forest	Young disturbed forests, young disturbed forest and scrub-shrub, disturbed forest-pasture, and young disturbed oak-hickory forest	Young disturbed forests (early successional woody species): eastern red cedar, red maple, autumn olive, bush honeysuckle.
		Scrub-shrub species: blackberry, autumn olive, eastern red cedar, goldenrod, black locust, and hawthorn.
		Disturbed forest-pasture: American sycamore, shagbark hickory, and sugar maple.
		Disturbed oak-hickory forest: white oak, black oak, shagbark hickory, shellbark hickory, American beech, and red maple.
Mature forest	Mature oak-hickory forest	Mature, second growth forest: white oak, black oak, shagbark hickory, pignut hickory, shellbark hickory, sugar maple, and chestnut oak. Includes about 0.1 acres of bottomland forest and less than 0.01 acres of forested wetland.
Developed	Maintained right-of-way, maintained grass, disturbed residential	Existing right-of-way: herbaceous species dominated by bluegrasses and fescues.
		Maintained grass: regularly mowed grass dominated by bluegrass and fescues; also includes ornamental trees.
		Disturbed/overgrown residential: overgrown lawn, pasture, and recently graded areas associated with a homestead.

Sensitive Vegetation Communities

The Project would result in clearing of mature oak-hickory forests, which are important habitat for federally listed Indiana bat and northern long-eared bat, and specifically provide potential roost trees and potential maternity roost trees for these special-status bats. Tennessee identified shagbark hickory trees at Compressor Stations 118A (15 potential roost trees), 119A (63 potential roost trees), and 563 (26 potential roost trees; 5 potential maternity roosts) that may be suitable for bat roosting. Additionally, there are two potential roost trees at Compressor Stations 106 and 114 in Kentucky, which would be avoided during construction. Other than available bat habitat, no other upland vegetation communities of special concern, designated natural areas, or unique plant communities were identified by Tennessee as occurring in the Project area. Impacts on bat habitat and consultation with the appropriate FWS field offices are discussed in section 2.4.

Noxious and Invasive Weeds

Noxious and invasive plant species are non-native plants that have been introduced into an ecosystem, either directly or indirectly, and pose a major threat to agriculture and/or natural ecosystems. Noxious species have the potential to rapidly dominate and out-compete native species, potentially resulting in large-scale ecosystem impacts. West Virginia, Kentucky, and Tennessee have ranked non-native, invasive plant species based on potential threats to each state's environmental and economic conditions to encourage the identification and eradication of priority noxious weeds (KDFWR, 2008; TNDOA, 2014; WV Legislature, 2014). Tennessee conducted site-specific surveys for invasive and non-native species at each compressor station and identified five species that are considered a severe threat/highly invasive or a moderate threat/moderately invasive according to the state rankings. These include Japanese knotweed (Compressor Stations 106 and 114), bush honeysuckle (Compressor Stations 106 and 563), kudzu (Compressor Station 118A), princess tree (Compressor Station 118A), and autumn olive (Compressor Station 118A). Bush honeysuckle is prevalent throughout the shrub layer of Compressor Stations 106 and 563 whereas the other documented noxious weeds are in discrete locations, which could allow them to be more easily treated and contained.

Impacts and Mitigation

The Project would impact developed land (27.6 percent), open upland (26.4 percent), mature forest (24.7 percent), and disturbed upland forest (21.4 percent). Wetlands are discussed in section 2.2.3. Table 2-10 summarizes the approximate acreage of vegetation cover type that would be affected by both construction and operational activities.

Construction activities would necessitate the removal of vegetation from work areas for installation of structures, piping, property and security fencing, access driveway, and utility lines. These activities would result in the alteration and loss of vegetation and could result in increased soil erosion, changes to surface water flow and infiltration, increased potential for the introduction and establishment of noxious weeds, and a local reduction in available wildlife habitat. Operation of the aboveground facilities would result in the permanent conversion of the existing cover types to industrial uses. The majority of these areas would be fenced in, paved, graveled, and/or used for building foundations.

In areas that are not permanently converted, the relative degree of impact would depend on the type and amount of vegetation affected, the rate at which the vegetation would regenerate after construction, and the frequency of vegetation maintenance conducted during operation. For instance, impacts on communities dominated by herbaceous species would be short-term, as these areas would revegetate relatively quickly (over one to three growing seasons). Scrub/shrub impacts would be moderate, as these vegetation types would recolonize to previous condition in 3 to 5 years. Mature forested areas would experience the greatest vegetation impacts due to the time required for woody vegetation to revert to preconstruction conditions (more than 60 years).

Table 2-10

Summary of Vegetation Affected by the Broad Run Expansion Project in Acres

	Open Upland		Disturbed Upland Forest		Open Wetland		Mature Forest		Developed		Total[a]	
	Const	**Oper**	**Const**	**Oper**	**Const**	**Oper**	**Const**	**Oper**	**Const**	**Oper**	**Const**	**Oper**
New Facilities												
CS 118A	11.1	7.6	11.2	5.5	0.07	0.07	20.0	14.1	3.8	2.9	46.2	30.2
CS 119A	0.0	0.0	7.4	7.4	0.24	0.25	30.5	30.5	9.9	9.9	48.0	48.0
CS 563	0.0	0.0	34.6	20.5	0.0	0.0	5.8	2.9	2.6	2.6	43.0	26.1
CS 875	48.5	24.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	48.5	24.9
Existing Facilities												
CS 106	9.6	9.6	1.4	1.4	0.0	0.0	0.0	0.0	26.4	26.4	37.4	37.4
CS 114	0.0	0.0	0.5	0.5	0.0	0.0	0.1	0.1	16.0	16.0	16.6	16.6
Project Total	**69.2**	**42.0**	**55.1**	**35.1**	**0.3**	**0.3**	**56.4**	**47.6**	**58.7**	**57.8**	**239.7**	**183.2**

Const = Construction

Oper = Operation

Impact acreages include proposed access road modifications.

Totals may not add up due to rounding.

[a] Totals do not include existing compressor station infrastructure at Compressor Stations 106 and 114 or existing access roads.

Construction of the compressor stations would disturb about 56.4 acres of mature forest that are known to contain mature shagbark hickory which is an important roosting tree species for federally listed bats. Impacts on federally listed bat species are addressed in section 2.4. Tennessee would allow a portion of the cleared mature forest (8.8 acres) to revert to preconstruction conditions. However, 47.6 acres of mature forest would be permanently converted to industrial uses. Removal of forest habitat, forest habitat fragmentation, edge effects, and an increased potential for invasive species establishment would occur (Harper et al., 2005; Motzkin et al., 1999). The removal of mature trees would also result in secondary impacts such as increased erosion, increased light penetration, change in air temperature, and loss of soil moisture (Matlack, 1993; Murcia, 1995). These factors would decrease the quality of remaining or adjacent forested habitat for wildlife (Skole and Tucker, 1993). The clearing of forest would result in a long term decrease in the quality of wildlife habitat as forest cleared for construction would take decades to recover.

About 69.2 acres of open upland would be affected by construction or modification, about 42.0 acres of which would become permanent industrial cover as part of the operational footprint. The vegetation communities in open upland within the Project area all have characteristics of disturbed landscapes. In general, disturbance in areas that would not be within the operational footprint would be considered short term. Impacts on the open upland cover type would be minor because this vegetation type would be capable of recovering and would not be significantly altered by maintenance activities. After mitigation steps are implemented, the herbaceous components of this cover type would typically regenerate within two growing seasons for herbaceous communities and three to five growing seasons for scrub-shrub communities.

Tennessee would not construct any new temporary or permanent access roads outside of any of the compressor station sites; instead, it would use and/or improve existing access roads. At Compressor Stations 875 and 563, Tennessee would construct permanent access driveways within the fenceline of the station. These driveways and the improvements to existing roads at Compressor Stations 118A and 119A may require surface modifications, widening, and tree clearing based on the equipment that would use the road. Operational activities would not result in impacts on vegetation unless maintenance activities are required that would involve excavation and/or vegetation removal. In such instances, the potential impacts and proposed mitigation measures would be similar to those for construction activities, described below.

Tennessee would avoid and minimize impacts or revegetate disturbed areas according to measures outlined in its *Revegetation and Invasive Species Management Plan*, including:

- flagging or fencing resource buffer zones and/or sensitive avoidance areas, such as wetlands;
- where feasible, stripping up to 12 inches of topsoil across temporary construction work areas, and redistributing topsoil during cleanup and restoration;
- installation of temporary and permanent erosion and sediment control measures following initial ground disturbance;
- grading to match preconstruction contours and drainage patterns, except where cut and fill is required;
- adherence to recommended seed mixes, application methods and rates, and to timing windows provided by local resource agencies; and
- seeding of temporary disturbance areas within 6 working days following final grading (unless specified by local resource agencies), weather and soil conditions permitting.

Disturbance related to construction and maintenance activities in both forested and open upland areas would have the potential to introduce and increase the spread of noxious weed species, particularly in areas where vegetation is cleared. Activities on disturbed areas can spread weed species quickly as those same species can establish quickly and more effectively than native species. Once spread or newly established, noxious weed infestations can become permanent if left uncontrolled. Tennessee would control the spread of noxious and invasive plants by implementing measures in its *Revegetation and Invasive Species Management Plan*, including:

- ensuring all construction equipment is cleaned and weed-free prior to Project work and removing excess dirt and mud from equipment and vehicles prior to leaving areas with known weed populations;
- using only certified weed-free straw or hay bales for sediment barrier installations and mulch, and using certified weed-free seed mixes for post-construction revegetation;
- controlling existing noxious weeds on compressor station sites using mechanical or herbicide application; and
- adhering to applicable invasive species management practices in accordance with federal, state, and local regulations.

Tennessee would assign EIs to oversee and document environmental compliance to include the implementation of the measures listed above. According its *Revegetation and Invasive Species Management Plan*, Tennessee would conduct follow-up inspections of all disturbed areas, as necessary, to determine the success of revegetation efforts. At a minimum, Tennessee would conduct inspections after the first and second growing seasons.

In summary, construction of the Project would impact 239.7 acres of vegetation, consisting primarily of developed area, open upland, mature upland forest, and disturbed upland forest. About three-quarters of these impacts would be permanent, including 47.6 acres of mature forest. Tennessee would avoid and minimize impacts or revegetate disturbed areas according to measures outlined in its *Revegetation and Invasive Species Management Plan*. Because the areas of vegetation that would be permanently cleared are relatively small and within larger areas of similar vegetation, we conclude that the impacts would not be significant.

2.3.2 Fisheries

As described in section 2.2, three perennial, four intermittent, and six ephemeral waterbodies are within the compressor station sites. Based on field surveys conducted by Tennessee, waterbodies within the Project area are not suitable to support fish populations due to the steep gradient of the streams (headwater streams) and lack of quality in-stream habitat (such as riffle-pool complexes and suitable substrate). The nearest fish-bearing waterbodies to the two existing compressor stations in Kentucky are Lulbegrud Creek and Big Sandy River. Lulbegrud Creek is about 100 feet west of Compressor Station 106 and the Big Sandy River borders the eastern property boundary of Compressor Station 114. Both waterbodies are classified as warm-water fisheries and support game fish (smallmouth bass, largemouth bass, spotted bass, catfish, drum, and carp) and state-listed fish (northern brook lamprey and American brook lamprey) (KDFWR, 2014a and 2014b). Although Lulbegrud Creek and Big Sandy River also support federally listed mussel species, surveys conducted by Tennessee concluded that the waterbodies within the sites of Compressor Stations 106 and 114 do not contain suitable mussel habitat. See section 2.4 for more information on state and federally listed species in the Project area.

The new facilities in West Virginia (Compressor Stations 118A and 119A) would impact intermittent waterbodies that do not support fish. In Kentucky, Compressor Station 875 would be constructed within about 50 feet of Otter Creek, which supports warm-water fish species, such as smallmouth bass. In Tennessee, the construction workspace for Compressor Station 563 would impact one ephemeral/intermittent waterbody that does not support fish. The nearest fish-bearing waterbody is Sycamore Creek. One of its tributaries, South Fork Sycamore Creek, is about 0.25 mile east of Compressor Station 563. In a letter dated February 9, 2015, TDEC requested that BMPs be implemented, monitored, and maintained to protect this system.

Fisheries of Special Concern

State waters in Kentucky, West Virginia, and Tennessee are classified according to a waterbody's designated use (i.e., aquatic life, water supply, or recreation). As described in section 2.2.2, no waterbodies with a state water quality designation classification were identified within any of the compressor station sites. No perennial streams or waterways with suitable aquatic habitat to support fish populations, fisheries of special concern or essential fish habitat are within the compressor station sites.

Impacts and Mitigation

Modification of the existing facilities would not impact fisheries, as the Project would not cross any waterbodies which support fish and Tennessee would implement erosion control measures outlined in its ECMP to minimize Project-related turbidity in nearby waterbodies. In addition, Tennessee would maintain a 25-foot-wide exclusion area around the one ephemeral waterbody at Compressor Station 106 that drains into the fish-bearing Lulbegrud Creek. During construction, Tennessee would delineate the boundaries of the exclusion area with silt fence and prevent vegetation clearing and ground disturbance near the waterbody, which would reduce the potential for downstream effects on Lulbegrud Creek. Similarly, modifications to Compressor Station 114 would not disturb the riparian vegetation along Big Sandy River.

Construction of new facilities would involve culvert installation, pipeline installation, grading, and discharge of hydrostatic test water, which could cause temporary increases in turbidity that could affect fish populations downstream. However, most waterbodies crossed by the new facilities are intermittent or ephemeral and would likely be dry at the time of construction. Tennessee would implement erosion control measures outlined in its ECMP to reduce the likelihood of sediment leaving the construction work areas. Implementing these measures at Compressor Station 563 would avoid indirect impacts on and protect South Fork Sycamore Creek system, as requested by TDEC in a letter dated February 9, 2015.

Following construction, Tennessee would restore the contours and elevations of the waterbodies to preconstruction conditions, and rehabilitate and revegetate disturbed riparian areas according to its *Revegetation and Invasive Species Management Plan*. Based on the lack of fish presence at the compressor station sites and Tennessee's proposed measures for erosion control and post-construction revegetation, we conclude that the Project would not impact fisheries.

2.3.3 Wildlife Resources

Tennessee identified wildlife habitat within the work areas based on the vegetation cover types described in section 2.3.1.

Vegetation types at existing Compressor Stations 106 and 114 are primarily open upland areas of maintained turf grass or fallow fields. Wildlife species associated with this vegetation cover type are

primarily opportunistic species (rodents, scavenger species, small and large mammals, and songbirds) that are capable of utilizing human-modified habitats. For example, Tennessee observed eastern cottontail, northern raccoon, American crow, and American goldfinch during field surveys. These species use a wide range of habitats and are commonly found throughout Kentucky. Few trees within the existing compressor stations could be used for bird nesting, and regular mowing likely prevents ground nesting birds from using the operational areas of the compressor stations. Tennessee did not find any evidence of bird or raptor nesting during field surveys at either compressor station. No habitat is present to support either bald eagles or golden eagles, and the nearest location likely to support individuals of either species is about 30 miles away from Compressor Station 106 and about 9.5 miles from Compressor Station 114.

Riparian areas associated with Lulbegrud Creek near Compressor Station 106 and Big Sandy River near Compressor Station 114 provide shelter, foraging areas, and nesting habitat for various species of birds, mammals, reptiles, amphibians, and invertebrates. For example, Tennessee observed waterfowl, including Canada goose and wood duck, along the Big Sandy River at Compressor Station 114. Existing wetlands and stormwater facilities may also provide seasonal habitat for reptiles and amphibians (Dickson, 2004), but none were documented by Tennessee during field surveys. Section 2.2 provides additional information on Lulbegrud Creek and Big Sandy River.

The mature upland forest habitats within the two proposed new facilities in West Virginia, Compressor Stations 118A and 119A, are characterized by relatively undisturbed, second growth oak-hickory forest with steep terrain. The oak-hickory forests provide an abundance of food for wildlife. Acorns and hickory nuts provide food for gray squirrel, fox squirrel, eastern chipmunk, and blue jays (USFS, 1995). Other habitats at these sites include small areas of fallow fields, scrub-shrub, and young disturbed forest. These sites are also traversed by an access road, maintained pipeline right-of-way, and at Compressor Station 119A, two residential sites. Wildlife observed during field surveys of the mature upland forest habitat at the Compressor Station 118A and 119A sites included white-tailed deer, gray fox, eastern chipmunk, woodchuck, eastern gray squirrel, wild turkey, ruffed grouse, barred owl, pileated woodpecker, Kentucky warbler, northern water snake, and dusky salamander.

Tennessee would construct the new facility in Kentucky, Compressor Station 875, on relatively flat agricultural land currently used as hay production or pastureland with one area of fallow field interspersed with scrub-shrub vegetation. These cover types and land uses provide habitat for a variety of wildlife species, such as black bear, gray fox, woodland vole, northern cardinal, mockingbird, summer tanager, brown thrasher, snapping turtle, blackspot shiner, eastern cottontail, eastern gray squirrel, white-tailed deer, and eastern chipmunk.

The proposed site for new Compressor Station 563 in Tennessee contains areas of young, disturbed upland forest and, to a lesser extent, mature upland forest. These cover types and land uses provide habitat for a variety of wildlife species similar to those described above for Compressor Station 875, in addition to a variety of songbirds and woodpeckers. The Compressor Station 563 site also surrounds a man-made pond and borders Otter Creek, which provides limited habitat for aquatic-dependent wildlife such as American bullfrog, northern slimy salamander, snapping turtle, blackspot shiner, and dusky salamander.

Mature shagbark hickory, which are considered potential roost trees for federally listed bats, occur on the sites of Compressor Stations 118A, 119A, and 563 and potential maternity roosts for bats were also documented at Compressor Station 563. No bird or raptor nests were observed at any of the new compressor station sites during the surveys; however, numerous songbirds were observed and red-shouldered hawks were observed at Compressor Stations 118A and 119A. No habitat is present to support either bald eagles or golden eagles, and the nearest location likely to support individuals of either

species is about 3.5 miles away from Compressor Station 118A, 5.5 miles from Compressor Station 119A, 13 miles from Compressor Station 563, and 15.5 miles from Compressor Station 875.

Managed and Sensitive Wildlife Areas

Wildlife resources of special concern include significant or sensitive habitats that provide breeding, rearing, nesting, foraging, or migration routes. Significant wildlife habitats include National Wildlife Refuges, state game refuges, wildlife management areas, wildlife sanctuaries, rookeries, waterfowl colonies, wildlife viewing areas, nature preserves, and other unique or sensitive areas. No refuges, management areas, sanctuaries, rookeries, waterfowl colonies, preserves, migration routes, or other unique or sensitive areas were identified within 10 miles of the compressor station sites (TWRA, 2010; KDFWR, 2014c; WVDNR, 2014).

In Kentucky, Compressor Stations 106 and 875 fall within a 10 million-acre Grassland Bird Conservation Area. This conservation area's boundaries are a mix of ecoregional boundaries, concentrations of species occurrence records, and other important grassland areas as identified by state biologists (KDFWR, 2014c). Similar conservation areas, called Bird Conservation Regions (BCR), also cover each of the compressor stations and are discussed in the *Migratory Birds* section below.

Impacts and Mitigation

Construction and operation of the Project could result in various short- and long-term impacts on wildlife including the displacement, stress, and injury of some individuals. As shown in table 2-10, the proposed modifications at the existing, fenced-in compressor station yards would result in the clearing of about 11.6 acres of land that provides some habitat for species such as birds and small mammals. Maintained grass within the compressor station fencelines would not be considered wildlife habitat. The construction of the new compressor stations would result in clearing of about 186 acres of vegetation that also provides wildlife habit. Operation of the new compressor stations would result in the long-term conversion of about 129 acres of vegetated land for operation of industrial facilities. Vegetation clearing and construction activities could displace wildlife from the construction areas and adjacent habitats, and could cause direct mortality of small, less-mobile mammals, reptiles, and amphibians that are unable to leave the construction area (Moseley et al., 2009). More mobile species (e.g., birds, small mammals) should be able to avoid the active work area, and would likely return to the adjacent habitat following construction and site restoration. The degree of impact on wildlife species and their habitat would vary depending on the requirements of each species and the existing habitat at each compressor station. Tennessee would implement the following measures to minimize the potential for impacts on wildlife:

- properly disposing of trash and food debris in secured containers;
- allowing wildlife that has entered the work area to leave the area on their own;
- providing environmental awareness training to all construction personnel working on the Project;
- checking for wildlife under vehicles and equipment that have been stationary for more than 1 hour and each morning prior to moving or operation;
- checking trenches, excavations, and uncapped pipe segments for wildlife and installing escape ramps at night;
- complying with posted speed limits; and
- prohibiting firearms and pets at Project work sites.

The proposed tree clearing at Compressor Stations 118A, 119A, and 563 would cause fragmentation of interior forest habitat that may result in the loss of habitat connectivity or reduce habitat quality (Harper et al., 2005; Sheets et al., 2013). Much of the forested areas near Compressor Stations 118A, 119A, and 563 already exhibit edge effects, as the areas have been previously fragmented by agricultural land and developments including other maintained utility corridors. Conversion of forested areas to early successional vegetation would likely attract species adapted to edges and open habitats (e.g., most passerines and certain species of raptors), and in some cases cause increased songbird nest predation and parasitism (Harris, 1984; Yahner, 1998). Because there is abundant similar habitat surrounding the compressor station sites, the conversion of forested habitats to open upland habitats would not have an adverse impact on wildlife populations.

Security fencing installed around the permanent operational compressor station facilities could create a permanent barrier to movement across the site by larger terrestrial wildlife (e.g., white-tailed deer). No documented migration or wildlife movement corridors traverse the compressor station sites. Although each fenced compressor station site would create an obstruction for some terrestrial species, sufficient habitat is accessible adjacent to each of the compressor station sites to allow for wildlife movement around the compressor stations. As such, we conclude that impacts on wildlife movement would be minimal.

Noise associated with construction and operation of the facilities also may disturb wildlife. We received numerous comments expressing concern about the effects of noise on the Walden's Puddle Wildlife Rehabilitation and Education Center, which is located about 0.9 mile (about 4,850 feet) from the edge of the proposed site of Compressor Station 563 in Joelton, Tennessee. Wildlife response to noise is dependent on noise type (i.e., continuous or intermittent), the ability to detect the noise, prior exposure to noise, proximity to a noise source, stage in the breeding cycle, activity (e.g., foraging), age, and gender. Response to continuous noise could result in behavioral effects such as reduced communication, interference with predator/prey detection, habitat avoidance, and reduced pairing success (Barber et al., 2009; Francis and Barber, 2013). Bursts of noise or pulse noise, such as an alarm or short-term venting at the compressor stations, could result in startle or flushing effects.

Noise associated with construction equipment would generally constitute continuous noise. Assuming all construction equipment is operating simultaneously at the same location, construction sound levels are conservatively estimated to attenuate to background levels in about 4,800 feet. In reality, sound levels would be lower with equipment spaced apart. Daytime short-term blasting is proposed at Compressor Station 118A, with each blast lasting at most a few seconds. Additionally, blast noise would be relatively low-level, and would attenuate to approximately 50 decibels on the A-weighted scale (dBA) maximum instantaneous sound level (Lmax) at 4,800 feet. For perspective, general conversation is around 60 dBA. Blasting noise would constitute short-term, intermittent, pulse noise.

The newly built gas-turbine-driven compressors would generate continuous background noise that could disturb wildlife near the compressor station. Based on noise modeling, operational noise from most of the compressor stations would attenuate to background levels within 2,000 feet. At Compressor Station 119A, the distance to background levels was modeled to be approximately 2,900 feet. Compared to the existing conditions, the upgrades to Compressor Station 106 would reduce operational compressor station noise levels by about 1 to 16 dBA, also reducing the amount of surrounding habitat affected by operational noise.

Tennessee has indicated that noise from periodic blowdown events would last for about 1 minute per event, and would occur only after the station is shut down for extended periods of time, which would likely happen a few times per year. The compressor stations would utilize blowdown vents with silencers that either result in 75 or 70 dBA Lmax at 300 feet. At 0.5 mile, blowdown noise levels would attenuate to about 56 or 51 dBA Lmax, depending on the vent/silencer combination employed. At 1 mile, blowdown noise levels would be about 6 dBA lower than at 0.5 mile.

Due to the relatively small areas that would be affected by operational noise and the ability of some wildlife species to adapt to continuous noise, we conclude that compressor station noise would not significantly impact wildlife populations or the Walden's Puddle Wildlife Rehabilitation and Education Center. Noise impacts and Tennessee's noise mitigation measures are further addressed in section 2.9.

Impacts associated with construction and operation of the Project would be minor given the mobile nature of most wildlife in the area, the relatively small areas impacted by construction, and the availability of similar habitat adjacent to each of the compressor stations. Tennessee would minimize construction and operation-related impacts by implementing the measures described in its ECMP including:

- minimizing vegetation clearing to those areas needed to safely and efficiently construct the compressor station facilities; and
- revegetating disturbed work areas that would not be permanently graveled, paved, or otherwise occupied by buildings or aboveground infrastructure.

Migratory Birds

Migratory birds are protected under the Migratory Bird Treaty Act (MBTA), originally passed in 1918, and EO 13186 of 2001, which directs governmental departments and agencies to take certain actions to further implement the MBTA. The MBTA states that it is unlawful to pursue, hunt, take, capture, kill, possess, sell, purchase, barter, import, export, or transport any migratory bird, or any part, nest, or egg of any such bird, unless authorized under a permit issued by the Secretary of the Interior. Take is defined in the regulations as "pursue, hunt, shoot, wound, kill, trap, capture, or collect, or attempt to pursue, hunt, shoot, wound, kill, trap, capture, or collect" (50 CFR 10). Further, EO 13186 emphasizes the responsibilities of all federal agencies, such as the Commission, to plan and implement actions to conserve birds in the conduct of their other federally mandated responsibilities.

EO 13186 was issued, in part, to ensure that environmental analyses of federal actions assess the impacts on migratory birds. It also states that emphasis should be placed on species of concern, priority habitats, and key risk factors and it prohibits the take of any migratory bird without authorization from the FWS. The destruction or disturbance of a migratory bird nest that results in the loss of eggs or young is also a violation of the MBTA. Numerous migratory bird species, including colonial nesting waterbirds, waterfowl, and neotropical songbirds, could potentially occupy areas of the proposed Project facilities.

On March 30, 2011, the FWS and the Commission entered into a Memorandum of Understanding (MOU) that focuses on avoiding or minimizing adverse impacts on migratory birds and strengthening migratory bird conservation through enhanced collaboration between the Commission and the FWS by identifying areas of cooperation. This voluntary MOU does not waive legal requirements under the MBTA, the ESA, the Federal Power Act, the NGA, or any other statutes and does not authorize the take of migratory birds.

Birds of Conservation Concern (BCC) are a subset of protected birds under the MBTA and include all species, subspecies, and populations of migratory nongame birds that are likely to become candidates for listing under the ESA of 1973 without additional conservation actions (FWS, 2008). The BCC are organized according to BCRs. FWS defined 38 BCRs that cover North America; the Project would cross two BCRs: the Central Hardwoods BCR and the Appalachian Mountains BCR (FWS, 2008).

The Central Hardwoods BCR spans more than 75 million acres of land across six states, and is dominated by oak-hickory deciduous forest. The Central Hardwoods BCR occupies a transition zone between historic tallgrass prairie, oak savanna, and woodlands to its north and west; pine forests and woodlands to the south; and oak and mixed mesophytic forests to the east (USFS, 2005). Many birds use this region for breeding and overwintering, or use its floodplains of large waterbody systems as stopover

habitat during migration to other areas. Modification to existing Compressor Station 106 and the new facilities of Compressor Station 875 and 563 would occur within the Central Hardwoods BCR (NABCI, 2014), resulting in about 147.6 acres of temporary impacts and about 107 acres of permanent impacts.

The Appalachian Mountains BCR spans more than 103 million acres of land across 10 states, and is generally rugged terrain dominated by oak-hickory and other deciduous forest types at lower elevations and various communities of pine, hemlock, spruce, and fir forests at upper elevations. This region contains headwaters of several major eastern waterbody systems that are used by various waterfowl species during migration and large wetland complexes which provide waterfowl breeding habitat (NABCI, 2014). Modifications to existing Compressor Station 114 and the new facilities of Compressor Stations 118A and 119A would be within the Appalachian Mountains BCR.

A variety of migratory bird species, including songbirds, raptors, and waterfowl use the habitat found within the Project area. The FWS established BCC lists for various regions in the country in response to the 1988 amendment to the Fish and Wildlife Conservation Act, which mandated the FWS to identify migratory nongame birds that, without additional conservation actions, were likely to become candidates for listing under the ESA. The BCC lists, last updated in 2008, are divided by regions. A total of 35 species are included on the BCC list for the Central Hardwoods and Appalachian Mountains BCRs (see table 2-11). During field surveys for the new facilities (Compressor Station 118, Compressor Station 119, Compressor Station 563, and Compressor Station 875), Tennessee observed three species (brown thrasher, Kentucky warbler, and the northern bobwhite) that are considered to be BCC. The Tennessee Field Office of the FWS also identified suitable habitat on Compressor Station 563 for other BCC including Bachman's sparrow, cerulean warbler, peregrine falcon, and Bewick's wren. However, none of these species were observed during field surveys.

Table 2-11

Birds of Conservation Concern within the Project Area

Common Name Scientific Name	Primary Breeding Habitat	Central Hardwoods BCC [a]	Appalachian Mountains BCC [b]
Bachman's sparrow *Aimophila aestivalis*	Open pine forests	X	
Bald eagle *Haliaeetus leucocephalus*	Forests (riparian)	X	X
Bell's vireo *Vireo bellii*	Riparian scrub	X	
Bewick's wren (*bewickii* ssp.) *Thryomanes bewickii bewickii*	Open woodlands (riparian)	X	X
Black Rail *Laterallus jamaicensis*	Coastal Salt	X	
Black-capped chickadee (S. Appalachian population) *Poecile atricapillus*	Excavated dead snags or rotten branches (often in alder of birch trees)		X
Blue-winged warbler *Vermivora pinus*	Abandoned fields, swamp/wetlands	X	X
Brown-headed nuthatch *Sitta pusilla*	Mature Pine Stands	X	
Buff-breasted sandpiper *Tryngites subruficollis*	Dry, grassy tundra (Grasslands), plowed fields	X	
Canada warbler *Wilsonia canadensis*	Forest (ground)		X
Cerulean warbler *Dendroica cerulea*	Mature Upland Oak Woods (Wooded Hillsides along Streams and Rivers)	X	X

Table 2-11

Birds of Conservation Concern within the Project Area

Common Name Scientific Name	Primary Breeding Habitat	Central Hardwoods BCC [a]	Appalachian Mountains BCC [b]
Golden-winged warbler *Vermivora chrysoptera*	Tangled, shrubby, regenerating/disturbed habitat		X
Henslow's sparrow *Ammodramus henslowii*	Ephemeral Grassland	X	X
Kentucky warbler *Oporornis formosus*	Deciduous Woods of Floodplains, Swamps, and Ravines	X	X
LeConte's sparrow *Ammodramus leconteii*	Open habitat (marshy meadows, grassy fields, prairie with grass averaging two feet high)	X	
Loggerhead shrike *Lanius ludovicianus*	Pasture and Cropland with Scattered tress and Hedgegrows	X	X
Louisiana waterthrush *Seiurus motacilla*	Along gravel-bottomed streams in deciduous forests		X
Northern saw-whet owl (S. Appalachian breeding population) *Aegolius acadicus*	Mature forests with open understory		X
Olive-sided flycatcher *Contopus cooperi*	Forest edges and openings (next to meadows and ponds)		X
Painted bunting *Passerina ciris*	Semi-open habitat with scattered shrubs or tress	X	
Peregrine falcon *Falco peregrinus*	Cliffs or manmade structures (riparian)	X	X
Prairie warbler *Dendroica discolor*	Old fields/pastures with young trees	X	X
Red crossbill (S. Appalachian population) *Loxia curvirostra*	Mature coniferous forests		X
Red-headed woodpecker *Melanerpes erythrocephalus*	Open woodlands with scattered trees	X	X
Rusty blackbird *Euphagus carolinus*	Wet forest	X	X
Sedge wren *Cistothorus platensis*	Moist upland sedge meadow	X	X
Short-eared owl *Asio flammeus*	Field stubble/grasslands	X	
Smith's longspur *Calcarius pictus*	Dry, grassy, and hummocky tundra	X	
Solitary sandpiper *Tringa solitaria*	Taiga	X	
Swainson's warbler *Limnothlypis swainsonii*	Bottomland forests (cove hardwoods with dense deciduous understory)	X	X
Upland sandpiper *Bartramia longicauda*	Native prairie and other dry grasslands/croplands		X
Whip-poor-will *Caprimulgus vociferus*	Open woodlands	X	X
Wood thrush *Hylocichla mustelina*	Moist, lowland deciduous forest	X	X
Worm-eating warbler *Helmitheros vermivorus*	Woodlands with dense understory	X	X

Table 2-11

Birds of Conservation Concern within the Project Area

Common Name Scientific Name	Primary Breeding Habitat	Central Hardwoods BCC [a]	Appalachian Mountains BCC [b]
Yellow-bellied sapsucker (S. Appalachian breeding population) *Sphyrapicus varius*	Cavity nesters in deciduous tree forests		X

[a] Includes Compressor Stations 106, 875, and 563

[b] Includes Compressor Stations 114, 118A, and 119A

The potential impacts on migratory birds, including BCC, would include the temporary and permanent loss of habitat associated with the removal of existing vegetation. Construction and operations of the new compressor stations would reduce the amount of habitat available for nesting, foraging, and cover from predators and would temporarily displace birds into adjacent habitats. This could, in turn, increase stress, susceptibility to predation, and negatively impact reproductive success for certain species of birds (Keyser et al., 1997; King et al., 2010; DeGregorio et al., 2014). The conversion of 82.6 acres of forest would reduce the available habitat for migratory birds that rely on forested habitat. In addition, forest fragmentation could increase predation, competition, and reduce nesting habitat for migratory and ground-nesting birds (Faaborg et al., 1995).

The greatest potential to impact migratory birds would occur if tree removal and mowing take place during the nesting periods. Construction of the proposed facilities is scheduled to overlap with the nesting season of migratory birds. Construction activities, such as tree removal, brush hogging and mowing during critical breeding and nesting periods could potentially result in the loss of nests, eggs, or young. In a letter dated May 21, 2015, the Kentucky Field Office of the FWS requested that Tennessee develop a migratory bird conservation plan to address unforeseen circumstances that would require clearing during the nesting season. However, Tennessee has instead committed to avoiding impacts on nesting birds by conducting tree and vegetation clearing at times outside of the migratory bird nesting season (April 15 through August 31). Based on the date of issuance of this EA, Tennessee's proposed construction start date of March 2016 would not be possible. Therefore, based on Tennessee's commitment to conduct clearing outside nesting season, Tennessee would not begin tree and vegetation clearing before August 31, 2016, unless consultation with the FWS is reinitiated. If vegetation trimming or clearing is necessary during operation of the Project, Tennessee would conduct those activities outside of the nesting season or would consult with the FWS.

Based on our assessment of the characteristics and habitat requirements of wildlife and migratory birds known to occur in the Project area, the amount of similar habitat adjacent to and near the Project, and Tennessee's adherence to FWS guidelines and implementation of mitigation measures, we conclude that construction and operation of the Project would not have significant impacts on migratory bird populations.

Wildlife Resources Conclusions

Construction and operation of the Project could result in various short- and long-term impacts on wildlife including the displacement, stress, and injury of some individuals. Tennessee would implement measures to avoid and minimize the potential direct and indirect impacts on wildlife. This includes measures in its ECMP, which are meant to avoid indirect impacts on habitat.

The potential impacts on migratory birds, including BCC, would include the temporary and permanent loss of habitat associated with the removal of existing vegetation. Construction and operation of the new compressor stations would reduce the amount of habitat available for nesting, foraging, and cover from predators and would temporarily displace birds into adjacent habitats. However, similar habitat is readily available in the area. Because Tennessee has committed to avoiding vegetation clearing during the nesting season, we conclude that impacts on migratory birds would not be significant.

2.4 Threatened, Endangered, and Other Special Status Species

Special status species are those species for which state or federal agencies afford an additional level of protection by law, regulation, or policy. Included in this category are federally listed species that are protected under the ESA, as amended, federal candidate species, and state sensitive species. Under Section 7 of the ESA, federal agencies are required to ensure that any actions authorized, funded, or carried out by the agency would not jeopardize the continued existence of a federally listed or proposed endangered or threatened species, or result in the destruction or adverse modification of designated critical habitat of a federally listed or proposed species. As the federal lead agency authorizing the Project, FERC is responsible for consulting with the FWS to determine whether federally listed threatened or endangered species or designated critical habitat are found in the vicinity of the Project, and to determine the proposed action's potential effects on those species or critical habitats. In accordance with the Commission's regulations contained in 18 CFR 380.13(b), Tennessee was designated as the Commission's non-federal representative for purposes of informal consultation with the FWS.

Tennessee conducted reconnaissance-level biological surveys in August, September, and November 2014 to document fish, wildlife, and plant species observations and evaluate vegetation associated with existing wildlife habitat at the compressor station sites. Tennessee also conducted desktop analyses of existing data and mapping to evaluate the potential for suitable habitat to occur in the Project area.

2.4.1 Federally Listed Threatened and Endangered Species

Tennessee, acting as FERC's non-federal representative, initiated informal consultation with the FWS field offices in Kentucky, Tennessee, and West Virginia to determine the federally listed species that may occur within the Project area (see table 2-12). The Kentucky Field Office of the FWS identified seven federally listed threatened or endangered species that have the potential to occur near Compressor Stations 106, 114, and 875, including gray bat, Indiana bat, northern long-eared bat, Virginia big-eared bat, Short's bladderpod, running buffalo clover, and white-haired goldenrod. Tennessee also identified potential habitat for snuffbox mussel near Compressor Station 106. The Tennessee Field Office of the FWS identified three federally listed threatened or endangered species (Indiana bat, northern long-eared bat, and Price's potato-bean) that have the potential to occur near Compressor Station 563. The West Virginia Field Office of the FWS identified seven federally listed threatened and endangered species that have the potential to occur near Compressor Stations 118A and 119A, including Indiana bat, northern long-eared bat, red knot, pink mucket, clubshell, northern riffleshell, and fanshell. In total, there are four federally listed bat species, one bird species, five mussel species, and four plant species that may occur in the Project area.

No federally listed fish species or essential fish habitat managed by the National Marine Fisheries Service under the Magnuson Stevens Act is present in the Project area. Species with the potential to occur in the Project area, as well as their protection status and habitat preferences are summarized in table 2-12 and discussed below.

Table 2-12

Federally Listed Species Potentially Occurring in the Project Area

Species	Federal Status [a]	State Status [a] KY	TN	WV	Facility	Habitat Description	Effect Determination [b]
Mammals							
Gray bat *Myotis grisescens*	E	T	NA	NA	CS 106 CS 114 CS 875	Roosts in caves and feed along rivers and lakes (Decher and Choate, 1995)	NLAA
Indiana bat *Myotis sodalis*	E	E	NA	E	CS 106 CS 114 CS 875 CS 118A CS 119A CS 563	Caves or abandoned mines in winter, forests in summer (Thomson, 1982)	LAA for CS 563 and NLAA for others
Northern long-eared bat *Myotis septentrionalis*	T	E	NA	T	CS 106 CS 114 CS 875 CS 118A CS 119A CS 563	Caves or abandoned mines in winter, forests in summer (Caceres and Barclay, 2000)	LAA for CS 563 and NLAA for others
Virginia big-eared bat *Corynorhinus townsendii virginianus*	E	E	NA	NA	CS 106 CS 114 CS 875	Roost in caves and forages in forests (Kunz and Martin, 1982)	NLAA
Birds							
Red knot *Calidris canutus*	T	NA	NA	T	CS 118A CS 119A	Intertidal, estuarine, and marine habitats (FWS, undated)	No effect
Mussels							
Pink mucket *Lampsilis abrubta*	E	NA	NA	E	CS 118A CS 119A CS 563	Mud and sand in shallow stream riffles. Requires stable, undisturbed habitat (FWS, 1997a)	No effect
Clubshell *Pleurobema decisum*	E	NA	NA	E	CS 118A CS 119A	Clean, loose sand and gravel in small to medium rivers Requires stable, undisturbed habitat (FWS, 1997b)	No effect
Northern riffleshell *Epioblasma torulosa rangiana*	E	NA	NA	E	CS 118A CS 119A	Firmly packed sand or gravel. Requires stable, undisturbed habitat (FWS, 1997c)	No effect

Table 2-12

Federally Listed Species Potentially Occurring in the Project Area

Species	Federal Status [a]	State Status [a] KY	TN	WV	Facility	Habitat Description	Effect Determination [b]
Fanshell *Cyprogenia stegaria*	E	E	NA	E	CS 106 CS 104 CS 118A CS 119A	Sand or gravel in deep water of moderate current Requires stable, undisturbed habitat (FWS, 1997d)	No effect
Snuffbox *Epioblasma triquetra*	E	E	NA	NA	CS 106	Swift current of small- to medium-sized creeks, large rivers, and in Lake Erie (FWS, 2014c)	No effect
Plants							
Price's potato-bean *Apios priceana*	T	NA	E	NA	CS 563	Openings in rich woods (TNHIP, 2014)	NLAA
Short's bladderpod *Physaria globosa*	E	E	NA	NA	CS 106 CS 114 CS 875	Limestone talus slopes and cliffs (TNHIP, 2014)	NLAA
Running buffalo clover *Trifolium stoloniferum*	E	T	NA	NA	CS 106 CS 114 CS 875	Mesic habitats exposed to partial or filtered light and frequent disturbance (FWS, 2007)	NLAA
White-haired goldenrod *Solidago albopilosa*	T	T	NA	NA	CS 106 CS 114 CS 875	Sandy soil behind the drip line of sandstone rock shelters and on rock ledges (FWS, 1993)	NLAA

[a] T = threatened; E = endangered; NA = not applicable for county associated with CS; KY = Kentucky; WV = West Virginia; TN = Tennessee;

[b] NLAA = not likely to adversely affect; LAA=likely to adversely affect; NA = not applicable

Gray Bat

The FWS listed gray bat as endangered under the ESA in 1976 due to population declines attributed to human disturbance of cave hibernacula (Harriman, 2003; FWS, 2015b). Gray bats live in caves year-round and are susceptible to disturbance while roosting or hibernating in caves. During the winter, gray bats use deep, vertical caves for hibernation and during the summer, use caves along streams or rivers in limestone karst areas (Harriman, 2003; FWS, 2015b). According to the FWS, gray bats have also been documented to roost in rock shelters, abandoned mines, and under tunnels and bridges during the spring, summer, and fall. Gray bats have relatively small distribution and are generally limited to limestone karst areas of the southeastern United States (FWS, 2015b). The three compressor station sites in Kentucky (Compressor Stations 106, 114, and 875) are within the range of the gray bat, but no cave habitats that could support gray bat hibernation or summer roosting are within or near these compressor station sites. Additionally, Compressor Stations 106 and 114 are existing compressor stations that will be decommissioned and demolished on already developed land. Following the FWS protocols, Tennessee conducted mist-net surveys to evaluate bat use at the Compressor Station 875 site. Tennessee captured 22 individual bats comprising five species, including five gray bats. No caves or cave-like structures are within the proposed Compressor Station 875 site to support bat hibernation or roosting, but the results of the mist-net surveys indicate that gray bats use the area surrounding the site for summertime foraging habitat along nearby waterbodies.

Since gray bats do not roost in trees, the Kentucky Field Office of the FWS agreed with Tennessee's assessment that gray bats would not use the Compressor Station 106, 114, or 875 sites for winter hibernation or summer roost habitat. However, due to known gray bat occurrences within Boyd and Powell Counties in Kentucky, the Kentucky Field Office of the FWS concluded that gray bats likely use areas near existing Compressor Stations 106 and 114 as forage habitat. Gray bats eat a variety of flying aquatic and terrestrial insects found along waterbodies. Ground disturbance during construction could result in increased sedimentation to adjacent waterbodies which could indirectly reduce the amount of prey available for gray bats. Tennessee would implement erosion control measures outlined in its ECMP to minimize the potential for sediment delivery to waterbodies. In a letter dated March 4, 2015, the Kentucky Field Office of the FWS concurred with Tennessee's assessment that habitat loss associated with the Project would *not likely adversely affect* the gray bat. We agree with this determination because the Project would have no effect on gray bat hibernacula or summer roost habitat and erosion control measures proposed by Tennessee would adequately minimize potential impacts on forage habitat. Therefore, Section 7 ESA consultation for the gray bat is complete for the Project.

Indiana Bat

The Indiana bat was originally protected under the Endangered Species Preservation Act of 1966 and is currently listed as endangered under the ESA. Thirteen winter hibernacula (11 caves and 2 mines) in six states were designated as critical habitat for Indiana bat in 1976 (41 FR 41914). Bat Cave in Carter County, Kentucky is the closest critical habitat to any of the compressor station sites; it is approximately 30 miles from Compressor Station 114 and approximately 60 miles from Compressor Station 106. From the time of listing in 1967 through 2003, most of the overall population declines were attributed to declines at high-priority hibernacula. Recently, white-nose syndrome has emerged as a new threat to bats in the northeastern United States and has caused mortality of thousands of hibernating Indiana bats among other bat species (FWS, 2007).

Indiana bats are found over most of the eastern half of the United States. Most populations of Indiana bats hibernate in well-developed limestone caverns found in Indiana, Kentucky, and Missouri. More than 85 percent of the known population of Indiana bats hibernates in only nine caves (FWS, 2014a). When active, the Indiana bat roosts in dead or dying trees with crevices and live trees with

exfoliating bark, such as shagbark hickory. During the summer months, reproductive females mostly occupy roost sites that consist of live trees and/or snags that have exfoliating bark, cracks, crevices, and/or hollows and receive direct sunlight for more than half the day. Roost trees are generally found within canopy gaps in a forest, fence line, or along a wooded edge. Maternity roosts are found in riparian zones, bottomland and floodplain habitats, wooded wetlands, as well as upland communities. Indiana bats forage in semi-open to closed forested habitats, forest edges, and riparian areas (FWS, 2007 and 2015a).

In Kentucky, the Compressor Station 106, 114, and 875 sites are within the range of Indiana bat. The existing compressor stations (106 and 114) each contain potential Indiana bat summer roost and maternity roost trees. Compressor Station 106 contains three potential summer roost trees and Compressor Station 114 contains two potential summer roost trees and one maternity roost tree. However, construction would avoid clearing these identified Indiana bat summer roost trees. Tennessee conducted presence/absence mist-net surveys at Compressor Station 875 in August 2014, and did not capture any Indiana bats. Indiana bats would not likely use the Compressor Station 875 site for summer roost/forage habitat due to the lack of suitable trees. Tennessee obtained concurrence from the Kentucky Field Office of the FWS in a letter dated April 17, 2015 that activities at Compressor Station 106, 114, and 875 sites would *not likely adversely affect* Indiana bats or their habitat in Kentucky. We agree with this determination and ESA consultation on Indiana bats is complete for these facilities. However, in a letter to FERC dated May 21, 2015, the Kentucky Field Office of the FWS stated that additional consultation would be required if impacts to potential Indiana bat or northern long-eared bat habitat occur after May 14, 2016 when the bat survey results become invalid. Based on the date of issuance of this EA, Tennessee would likely clear bat habitat after May 14, 2016, and therefore, as described below, Tennessee would be required to consult with the Kentucky Field Office of the FWS regarding impacts on potential habitat for Indiana bat or northern long-eared bat and file for our approval the results of the consultation and any additional bat surveys or mitigation measures required by the FWS.

In West Virginia, Compressor Stations 118A and 119A would be constructed within the range of the Indiana bat and Tennessee observed potential suitable habitat for Indiana bats at both sites. Specifically, Tennessee identified 15 potential roost trees and one shagbark hickory stand occupying less than 0.07 acre at the Compressor Station 118A site and 63 potential roost trees and portions of four shagbark hickory stands totaling about 1.5 acres at the Compressor Station 119A site.

Tennessee has not conducted species-specific surveys for Indiana bat in West Virginia. Because of the presence of suitable habitat, the West Virginia Field Office of the FWS recommended that Tennessee assume that Indiana bats are present in the Project area and requested that Tennessee develop a *Myotid Bat Conservation Plan* to avoid and minimize impacts on Indiana bats during construction. According to the FWS, the *Myotid Bat Conservation Plan* is intended to address both Indiana bats and northern long-eared bats (described below) because these species share similar habitats.

To characterize the amount and quality of potential Indiana and northern long-eared bat summer, foraging, and roosting habitat that would be cleared by the Project, Tennessee conducted site-specific habitat assessments as required by the FWS within a 2-mile area of the center point of each compressor station. An estimated 69 acres (31 acres at Compressor Station 118A and 38 acres at Compressor Station

119A) of forest would be cleared for the Project, including 78 potential bat roost trees. In addition, Tennessee conducted a winter habitat assessment addressing cave and mine portals following the *Draft Protocol for Assessing Abandoned Mines/Caves for Bat Use.* No portals or caves were observed. Tennessee included the summer and winter habitat assessment data in its *Myotid Bat Conservation Plan*[8]. The West Virginia Field Office of the FWS issued a concurrence with the *Myotid Bat Conservation Plan* on September 25, 2015, and Section 7 consultation with the West Virginia Field Office of the FWS has been completed.

Tennessee's avoidance, minimization, and conservation measures for the Indiana bat in West Virginia include:

- restricting clearing of trees greater than or equal to 3 inches diameter at breast height to occur between November 15 and March 31;
- erosion and sedimentation measures outlined in its ECMP;
- maintaining a 50-foot or greater forested buffer on both sides of streams;
- girdling 68 trees; and
- erecting 10 artificial roosting structures.

We conclude that implementation of the approved *Myotid Bat Conservation Plan* would be adequate to offset habitat impacts associated with the Project, and the Project would *not likely adversely affect* Indiana bats in West Virginia.

In Tennessee, Compressor Station 563 would be constructed within the range of the Indiana bat. Potential habitat for Indiana bats within the construction workspace at Compressor Station 563 would include 26 potential roost trees and 5 potential maternity roosts. Tennessee would permanently remove 43 acres of forested habitat suitable for roosting Indiana bats. To avoid mortality of roosting bats during construction, Tennessee would restrict vegetation clearing in the state of Tennessee to the FWS-recommended timeframe when Indiana bats would not be present (i.e., between August 16 and March 31).

During its review of the Project, the Tennessee Field Office of the FWS concluded, in a letter dated March 5, 2015, that even with incorporation of seasonal cutting restrictions to avoid lethal take of roosting bats or flightless pups, the Project may still adversely affect Indiana bat due to habitat loss. On June 24, 2015, Tennessee and the Tennessee Field Office of the FWS entered into an Indiana Bat Conservation MOU[9]. The MOU describes voluntary measures that Tennessee would implement to offset the habitat loss impacts on Indiana bats and northern long-eared bats. Specifically, Tennessee has agreed to follow the FWS-recommended seasonal tree cutting restrictions; to not clear more than 43 acres of forest containing suitable bat roosting structures; and to contribute to the Indiana Bat Conservation Fund administered by the Kentucky Natural Lands Trust. Incidental take for Indiana bat is provided under the terms of the FWS's 2015 intra-service biological opinion with acceptance of Project-specific conservation

[8] Available on the FERC eLibrary under Docket No. CP15-77-000. This plan was filed in Attachment E on August 22, 2015.

[9] Available on the FERC eLibrary under Docket No. CP15-77-000. The MOU was filed in Attachment 1-1 on July 22, 2015.

agreements such as the MOU between Tennessee and the FWS. Due to habitat loss, we conclude the Project would *likely adversely affect* Indiana bats in Tennessee. In a letter dated December 15, 2015, the Tennessee Field Office of FWS agreed with this conclusion and stated that consultation under Section 7 of the ESA is complete for the Indiana bat in Tennessee.

Due to construction timing restrictions and the issuance date of this EA, tree clearing would be required to occur after November 15, 2016 in West Virginia and after August 16, 2016 in Tennessee. Otherwise re-initiation of consultation with the FWS would be required, as described below.

Northern Long-eared Bat

Northern long-eared bats spend their winters hibernating in variously sized caves and mines with constant temperatures, high humidity, and no air currents. Suitable summer habitat consists of a wide variety of forested/wooded areas with varying canopy cover containing live or dead trees with exfoliating bark, cracks, crevices, and/or cavities. These habitats can be found adjacent to or contain interspersed non-forested habitats such as emergent wetlands, agricultural fields, old fields, and pastures. They have also been observed roosting in human-made structures, such as buildings, barns, bridges, and bat houses (FWS, 2015c).

The FWS listed the northern long-eared bat as threatened under the ESA on April 2, 2015 due to dramatic population declines attributed to white nose syndrome, a fungus-caused disease affecting hibernating bats. White nose syndrome has caused extensive mortality of northern long-eared bats, especially throughout the northeast where the species has declined by up to 99 percent from pre-white nose syndrome levels at many hibernation sites (FWS, 2015g). The FWS has identified counties where white nose syndrome is known to exist as part of an interim rule under Section 4(d) of the ESA. All compressor station sites are within counties with verified occurrences of white nose syndrome (FWS, 2015c).

The FWS considers the entire state of Kentucky as potential habitat for northern long-eared bats and northern long-eared bats are known to occur within Madison, Powell, and Boyd Counties near existing Compressor Stations 106, 114, and the site for Compressor Station 875, respectively (FWS, 2015e). Compressor Station 106 has three trees that offer potential roost habitat and Compressor Station 114 has two trees that offer potential roost habitat and one tree that offers potential maternity roost habitat for northern long-eared bat. These trees would be avoided by construction activities within Compressor Stations 106 and 114; therefore, no impacts on northern long-eared bat summer roost trees would occur at these sites. Tennessee conducted mist-net surveys in August 2015 at the Compressor Station 875 site, but did not capture any northern long-eared bats.

In a letter dated April 17, 2015, the Kentucky Field Office of the FWS concluded, based on Tennessee's bat surveys, that northern long-eared bats likely do not use this area for summer roost/forage habitat. No construction activities in Kentucky would occur near known hibernacula; therefore, the Project would not contribute to the spread of white nose syndrome. Because no northern long-eared bats were captured during bat surveys and no suitable summer roost trees would be removed, the Kentucky Field Office of the FWS concluded that the Project would *not likely adversely affect* northern long-eared bat in Kentucky and we agree. The FWS further indicated that consultation was complete. However, in a letter to FERC dated May 21, 2015, the Kentucky Field Office of the FWS stated that additional consultation would be required if impacts to potential northern long-eared bat habitat occur after May 14, 2016 when the bat survey results become invalid. Based on the date of issuance of this EA, Tennessee would likely clear bat habitat after May 14, 2016. Therefore, as described below, we are recommending that Tennessee consult with the Kentucky Field Office of the FWS regarding impacts to potential habitat

for Indiana bat or northern long-eared bat and file for our approval the results of the consultation and any additional bat surveys or mitigation measures required by the FWS.

Due to construction timing restrictions and the issuance date of this EA, tree clearing would be required to occur after November 15, 2016 in West Virginia and after August 16, 2016 in Tennessee. Otherwise re-initiation of consultation with the FWS would be required, as described below.

In West Virginia, the proposed sites for Compressor Stations 118A and 119A are within the range of the northern long-eared bat. Habitat for northern long-eared bats is similar to Indiana bat, and therefore the same potential roost trees and shagbark hickory stands at the sites for Compressor Stations 118A and 119A described above for Indiana bat could also be used as summer roost habitat for northern long-eared bats. There are no known hibernation sites near the Compressor Station 118A and 119A sites; therefore, the Project activities would not contribute to the spread of white nose syndrome. As mentioned previously, the West Virginia FWS has reviewed and approved Tennessee's *Myotid Bat Conservation Plan* and habitat evaluation, which address both Indiana bats and northern long-eared bats. The mitigation and conservation measures described previously for Indiana bat would also apply to northern long-eared bats. We conclude that implementation of an approved *Myotid Bat Conservation Plan* along with Tennessee's proposed measures to avoid tree clearing during bat roosting periods would be adequate to offset habitat impacts associated with the Project, and the Project would *not likely adversely affect* northern long-eared bats in West Virginia. Therefore, Section 7 ESA consultation for northern long-eared bats in West Virginia is complete.

In Tennessee, the construction of Compressor Station 563 would result in the loss of about 43 acres of potential northern long-eared bat habitat, including 26 potential roost trees and 5 potential maturity roost trees (these same trees may also be used by Indiana bat as described above). Most of the habitat loss (82 percent) would be younger forest with low density of suitable roost trees and a small number of trees with exfoliating bark. Clearing of high quality habitat or mature oak hickory forest would account for less than 15 percent of the habitat to be impacted. While the quantity of high quality habitat to be cleared would be relatively minor, development of Compressor Station 563 may lead to habitat fragmentation at a landscape scale. Fragmentation of forested stands would reduce the amount of habitat available for both bat roosting and foraging. Tennessee would conduct clearing activities in the state of Tennessee (Compressor Station 563) within the restricted timeframe of August 16 and March 31, when northern long-eared bats are leaving the area to prepare for winter.

As described above, the Tennessee Field Office of the FWS concluded, in a letter dated March 5, 2015, that even with incorporation of seasonal cutting restrictions to avoid lethal take of roosting bats or flightless pups, the Project may still adversely affect northern long-eared bats due to 43 acres of habitat loss. Tennessee and the FWS have agreed to an MOU that describes seasonal cutting restrictions for construction and how Tennessee would contribute to the Indiana Bat Conservation Fund. According to the Tennessee Field Office of the FWS, contribution to this fund "also promotes the survival and recovery of the northern long-eared bat" (FWS, 2015f). As with Indiana bat, incidental take for northern long-eared bat is provided under the terms of the FWS's 2015 intra-service biological opinion with acceptance of Project-specific conservation agreements such as the MOU. Due to habitat loss, we conclude the Project would *likely adversely affect* northern long-eared bats in Tennessee. In a letter dated December 15, 2015, the Tennessee Field Office of the FWS agreed with this conclusion and stated that consultation under Section 7 of the ESA is complete for the northern long-eared bat in Tennessee.

Virginia Big-Eared Bat

The FWS listed Virginia big-eared bat as endangered under the ESA in 1979 due to loss of habitat, vandalism, and increased human visitation to maternity roosts and hibernacula. The Virginia big-

eared bat occurs in parts of western North Carolina, eastern Tennessee, southwestern Virginia, eastern Kentucky, and southern West Virginia. It inhabits caves year-round in karst regions (landscape characterized by limestone caves and sinkholes) dominated by oak-hickory or beech-maple-hemlock forest (FWS, 2011). According to the Kentucky Field Office of the FWS, Virginia big-eared bat may occur near the Compressor Station 106, 114, and 875 sites in Kentucky. During field studies, Tennessee identified three potential Virginia big-eared bat roost trees at Compressor Station 106 but they would be outside the construction footprint. No suitable habitat was identified at either Compressor Station 114 or the site for Compressor Station 875. In a letter dated April 17, 2015, the Kentucky Field Office of the FWS concurred with Tennessee's assessment that habitat loss associated with the Project would *not likely adversely affect* Virginia big-eared bats. We agree. Therefore, Section 7 ESA consultation for the Virginia big-eared bat is complete.

Red Knot

The red knot is a migratory shorebird that was federally listed as threatened under the ESA on January 12, 2014. It migrates annually between its breeding grounds in the Canadian Arctic and several wintering grounds, one of which is the southeast United States. Red knots are typically restricted to ocean coasts during migration, typically feeding on intertidal invertebrates in coastal and marine estuarine habitat (FWS, 2014b). However, some are reported to fly over the interior United States during spring and fall using the Central Flyway (eBird, 2015). Based on surveys conducted by Tennessee, no suitable breeding habitat or migratory stop-over habitat for the red knot occurs within the Project area. Based upon the lack of habitat within the immediate and surrounding Project area and the low likelihood of occurrence, we conclude that the Project would have *no effect* on red knot.

Mussels

One federally listed freshwater mussel, fanshell, potentially occurs near existing Compressor Stations 106 and 114 in Kentucky. An additional species, snuffbox, also has potential to occur near Compressor Station 106. These two mussel species require stable, undisturbed stream habitat (FWS, 1997). Habitat within Compressor Stations 106 and 114 is not suitable for these species, which require medium to large streams with clean, sand/gravel substrates. Therefore, Tennessee has not conducted species-specific surveys for mussels.

Compressor Station 106 is bordered approximately 71 feet to the west by Lulbegrud Creek where potential mussel habitat occurs. An ephemeral tributary to Lulbegrud Creek crosses the northwest corner of the compressor station site. Tennessee would not cross this stream, but would clear trees near the stream. Tennessee would implement a 25-foot-wide exclusion zone around this ephemeral waterbody to avoid downstream impacts on mussels. Tree clearing would not occur in the exclusion zone or within 50 feet of the tributary. The exclusion zone would be delineated with a silt fence and no ground-disturbing activities would be allowed within the fenced exclusion area. Tennessee would also maintain a 100-foot setback for equipment parking, concrete-coating, and hazardous materials storage from the edge of the tributary and the edge of Lulbegrud Creek. The Compressor Station 114 site is bordered to the east by Big Sandy River. Although Big Sandy River has potential mussel habitat, there are no drainages or tributaries within the compressor station site that would drain into the river.

Three additional federally listed freshwater mussel species (pink mucket, clubshell, and northern riffleshell) potentially occur near the Compressor Station 118A and 119A sites in West Virginia and Compressor Station 563 in Tennessee. Four intermittent and two perennial streams were identified within the Compressor Station 118A site. Of these, only one perennial and one intermittent stream are tributaries to Twomile Creek, which is a tributary of Kanawha River, known mussel habitat. One intermittent stream, a tributary of Clay Bank Branch, was identified within the Compressor Station 119A site. Clay

Bank Branch is a tributary of the Pocatalico River and ultimately flows into the Kanawha River. Three intermittent streams and one ephemeral stream were identified at Compressor Station 563. Only one intermittent stream is a tributary of Sulphur Branch Creek, a tributary of Sycamore Creek. Sycamore Creek ultimately flows into the Cumberland River, known mussel habitat. These mussel species require medium to large streams with clean, sand/gravel substrates and this habitat is not present within any of the three compressor station sites, or within close proximity downstream. Because the Project does not involve in-water work in perennial waterbodies where mussels occur and Tennessee would implement erosion control measures to protect sedimentation effects downstream according to its ECMP, we conclude that the Project would have *no effect* on the federally listed mussels.

Price's Potato-bean

The FWS listed Price's potato-bean as threatened under the ESA in 1990 due to grazing and trampling by cattle and by timber clearcutting and herbicides applied to highway rights-of-way. Price's potato-bean is a plant that prefers lightly disturbed areas such as forest openings, wood edges, and where bluffs descend to streams. It has also been found growing along highway rights-of-way and powerline corridors. Suitable soil includes well-drained loams on old alluvium or over limestone. Price's potato-bean is often found in understories of mixed hardwood forests. Known populations of Price's potato-bean occur at 21 sites in 5 states; however, approximately 40 percent of these occurrences are no longer extant. A large, robust population occurs in Marion County, Tennessee where hundreds of plants are scattered on a bluff near a roadside, approximately 98 miles southeast of Compressor Station 563. Another small, but robust population (20 to 30 individuals), grows along a creek in Montgomery County, Tennessee about 16 miles northwest of Compressor Station 563 (FWS, 2015d). The primary threat for Price's potato-bean is cattle, which graze and trample on the plant. Timber clearcutting is also attributed to habitat loss and herbicides kill individual populations of the plant (FWS, 2015d).

Price's potato-bean does not occur in West Virginia. It is suspected to occur in Kentucky, but the Price's potato-bean was not identified by the Kentucky Field office of the FWS as a possible species that would occur near the compressor stations in Kentucky. Tennessee did not observe Price's potato-bean or its suitable habitat within the Compressor Station 106, 114, or 875 sites in Kentucky. Therefore, we conclude that Price's potato-bean would not occur at the compressor station sites in Kentucky.

Tennessee identified potential suitable habitat for Price's potato-bean habitat at Compressor Station 563 in Tennessee, although there are no records or known populations of Price's potato-bean within the county where Compressor Station 563 would be constructed. In response to a March 5, 2015 letter from the Tennessee Field Office of the FWS, Tennessee conducted a species-specific survey on July 21, 2015, during the appropriate blooming period for this species. Tennessee did not detect Price's potato bean during the survey, but did document potential suitable habitat. The Tennessee Field Office of the FWS reviewed the results of Tennessee's survey and agreed, in an email dated September 1, 2015, that Price's potato-bean is unlikely to occur at the Compressor Station 563 site. In a letter dated December 15, 2015, the Tennessee Field Office of the FWS agreed with our conclusion that the Project would *not likely adversely affect* the Price's potato-bean and stated that consultation under Section 7 of the ESA is complete for Price's potato-bean in Tennessee.

Short's Bladderpod, Running Buffalo Clover, and White-haired Goldenrod

Tennessee's field surveys indicated that no suitable habitat is present for running buffalo clover or Short's bladderpod at the sites for Compressor Stations 875 or 106 and that no suitable habitat for white-haired goldenrod occurs at Compressor Station 106. We conclude that the Project would *not likely adversely affect* these species. The Kentucky Field Office of the FWS issued a concurrence letter dated March 4, 2015 and therefore Section 7 ESA consultation is complete.

Conclusions for Federally Listed Threatened and Endangered Species

Based on our analysis and concurrence from the FWS, we conclude that the Project would have *no effect* on one federally listed bird species and five federally listed mussel species; would *not likely adversely affect* three federally listed plant species and four federally listed bat species in Kentucky and West Virginia, including Indiana and northern long-eared bats; and would *likely adversely affect* Indiana and northern long-eared bats at Compressor Station 563 in Tennessee only. Adverse impacts on Indiana and Northern long-eared bats would result from habitat loss due to tree-clearing at Compressor Station 563. Tennessee signed an MOU with the Tennessee Field Office of the FWS, which includes conservation measures to offset habitat loss for the federally listed bat species. Because the MOU is covered under FWS's intra-service biological opinion, which outlines the terms for incidental take of the Indiana and northern long-eared bat, our ESA Section 7 consultation obligations are complete for the states of West Virginia and Tennessee.

For Indiana and northern long-eared bat in Kentucky, additional consultation with FWS is required. In a letter to FERC dated May 21, 2015, the Kentucky Field Office of the FWS stated that additional consultation would be required if impacts to potential Indiana bat or northern long-eared bat habitat occur after May 14, 2016, when the bat survey results become invalid. Therefore, **we recommend that:**

- **<u>Prior to construction</u>, Tennessee should consult with the Kentucky Field Office of the FWS regarding impacts to potential habitat for Indiana bat or northern long-eared bat and file with the Secretary, for review and written approval by the Director of OEP, the results of the consultation and any additional bat surveys or mitigation measures required by the FWS.**

Tennessee has stated that it would complete tree clearing activities within the approved clearing season. If Tennessee requests any modification to the clearing restrictions, FERC would reinitiate ESA consultations with the FWS. Furthermore, to ensure that Indiana bats and northern long-eared bats are not adversely affected by tree clearing activities, **we recommend that:**

- **Tennessee should not clear trees outside the window of August 16 to March 31 in Project workspaces in Tennessee or outside the window of November 15 to March 31 in Project workspaces in West Virginia, or until:**

  a. the staff completes consultation with the FWS; and

  b. Tennessee has received written notification from the Director of OEP that construction may begin.

2.4.2 State-listed Threatened and Endangered Species

State laws and regulations regarding rare plant and wildlife species vary by state. For example, Kentucky does not have state level endangered species laws, but regulations for wildlife defer to federal regulations (301 KAR 3:061). Kentucky does have legislation governing rare plants under the Rare Plant Recognition Act (Kentucky Revised Statutes Annotated §§146.600-619). This act is governed by the Kentucky State Nature Preserve Commission (KSNPC) and requires that threatened and endangered plant species be listed and associated location and population information be kept. However, this act does not create any obligation on the part of landowners, either public or private, to protect the rare plants on these lists. Instead, this act is intended to provide an educational tool to demonstrate the importance of rare plants in understanding environmental health. Similarly, the KSNPC also publishes a list of species of "Greatest Conservation Need" through the Kentucky Natural Heritage Program. The KSNPC monitors

the state's biodiversity and maintains a list of state endangered, threatened, and special concern species, but these designations convey no legal protection (Floyd, 2014).

The KSNPC identified 17 state threatened and endangered species with potential to occur within the Project area (see table 2-13). However, neither the KSNPC nor the Kentucky Field Office of the FWS requested species-specific surveys.

The state of Tennessee has two acts of state legislation for the protection of plant and wildlife species. The Nongame and Endangered or Threatened Wildlife Species Conservation Act (Tennessee Code Annotated [TCA] §70-8-101-112) protects wildlife species listed by the state of Tennessee, and designates the Tennessee Wildlife Resource Agency (TWRA) to oversee the protection of animal species, including those considered rare, threatened, or endangered. The TWRA (TCA §70-8-301-314) protects plant species listed by the state of Tennessee. The TDEC Division of Natural Areas oversees the plant program and coordinates activities with other state agencies.

TDEC Division of Natural Areas identified two state rare species that occur within 4 miles of the Compressor Station 563 site: Eggert's sunflower (Helianthus eggertii) and meadow jumping mouse (Zapus hudsonius) (see table 2-13). During surveys, Tennessee did not identify suitable habitat for Eggert's sunflower within Compressor Station 563. Tennessee did identify suitable habitat for meadow jumping mouse within Compressor Station 563. Tennessee coordinated with the TWRA to ensure that legal requirements for protection of state-listed rare animals would be addressed. Based on its review, the TWRA does not anticipate impacts on meadow jumping mouse would result from construction of the Project.

The state of West Virginia does not have state-level endangered species laws for plants or wildlife, and instead defers to the federal ESA. The West Virginia Division of Natural Resources (WVDNR) has a Natural Heritage Program that documents species occurrences within the state of West Virginia. WVDNR indicated in a letter dated August 22, 2014 that there were no known records or surveys of rare, threatened, or endangered species or sensitive habitat within the Project area.

The status, habitat preference, and impacts for these state species are summarized in table 2-13. Tennessee would implement measures to avoid impacts on wildlife and vegetation (see sections 2.3.3 and 2.3.4, respectively). These measures, as well as the ones described above for federally listed species, would mitigate impacts on state-listed species. We conclude that the Project would result in negligible impacts on state-listed species.

Table 2-13

State-listed Species Potentially Occurring in the Project Area

Species	State Status[a] KY	TN	Facility	Habitat Description	Impacts
Amphibians					
Northern leopard frog *Rana pipiens*	S		CS 875	Variety of aquatic habitats including ponds, lakes, creeks, streams, and wetlands (MNHP, 2014)	Aquatic habitats of Otter Creek and nearby man-made pond would be avoided by construction. No impacts are anticipated. Downstream indirect effects would be avoided by implementing the ECMP.
Birds					
Barn owl *Tyto alba*	S		CS 875	Open and partly open country, often around human habitation; farms (TNHIP, 2014)	Tree clearing at CS 875 could reduce available suitable habitat for barn owls but surrounding areas would provide ample habitat. Tennessee would avoid direct impacts on owls by clearing vegetation outside of nesting season.

Table 2-13

State-listed Species Potentially Occurring in the Project Area

Species	State Status[a] KY	TN	Facility	Habitat Description	Impacts
Fish					
American brook lamprey *Lampetra appendix*	T		CS 106	Slow moving streams with forested edges (NatureServe, 2015)	Waterbodies on or near CS 106 are unlikely to support lamprey. Tennessee would maintain an exclusion zone around waterbody within CS 106 to avoid indirect downstream effects. Therefore, no impacts are anticipated.
Northern brook lamprey *Ichthyomyzon fossor*	T		CS 106	Clear streams averaging ~60 feet in width and ~2 feet in depth (MNDNR, 2014) [b]	Large waterbodies preferred by northern brook lamprey are not present on or near CS 106. In addition, Tennessee would maintain an exclusion zone around waterbody within CS 106 to avoid indirect downstream effects. Therefore, no impacts are anticipated.
Mammals					
American black bear *Ursus americanus*	S		CS 106	Large home ranges across a wide range of habitats (Lariviere, 2001)	Black bears typically avoid areas that experience a significant amount of human activity unless attracted by a food source. Tennessee would provide for regular collection, containment, and disposal of garbage during construction as required by the Plan. Therefore, no impact is anticipated.
Eastern spotted skunk *Spilogale putorius*	S		CS 106	Forests with dense ground cover (Kinlaw, 1995) [b]	Perimeter fencing around the existing CS 106 and lack of cover within the site likely precludes use of the compressor station by skunks. Daytime construction is unlikely to disturb this nocturnal species. An additional 0.6 acres of vegetation clearing would occur in the permanent workspace outside of the existing fence. This impact is expected to be negligible.
Evening bat *Mycticeius humeralis*	S		CS 106 CS 875	Roosts in trees and buildings, forages in forests (Watkins, 1972)	CS 106 is already developed and Tennessee would avoid clearing suitable roost trees near CS 106. The CS 875 site lacks suitable trees for roosting, and vegetation clearing is unlikely to reduce available habitat for evening bats.
Least weasel *Mustela nivalis*	S		CS 106 CS 875	Wide range of habitats including forests and open habitats (Sheffield and King, 1994)	Modifications to the existing CS 106 would not affect forest habitat. Temporary work spaces at CS 875 would be replanted according to Tennessee's ECMP.
Meadow jumping mouse *Zapus hudsonius*		D	CS 563	Open grassy fields; often abundant in thick vegetation near water bodies; statewide (TNHIP, 2014)	The majority of the CS 563 is densely forested and does not contain natural grass open areas preferred by meadow jumping mouse, so there would be low likelihood of encountering this species. No impact is expected.
Molluscs					
Little spectaclecase *Villosa lienosa*	S		CS 106	Soft substrates in slow moving waters of small creeks to medium-sized rivers (KDFWR, 2014d) [b]	Tennessee would maintain an exclusion zone around waterbody within CS 106 to avoid indirect downstream effects. Therefore, no impacts are anticipated.
Plants					
Drooping bluegrass *Poa saltuensis*	E		CS 106	Dry, rocky soil in deciduous forests (NatureServe, 2015) [b]	Potential habitat occurs outside Project work areas along the Lulbegrud Creek riparian corridor.
Globe beak-rush *Rhynchospora recognita*	S		CS 106	Moist, usually sandy soils in fields, bogs, borders, and clearings (ODNR, 2014)	CS 106 is already developed and rare plants are unlikely to occur. Therefore, no impact is anticipated.
Peach-leaved willow *Salix amygdaloides*	H		CS 106	Edge of range in Kentucky; occurs in sand, silt, or gravel soils in wetlands (USFS, 2014)	CS 106 is already developed and rare plants are unlikely to occur. Therefore, no impact is anticipated.

Table 2-13

State-listed Species Potentially Occurring in the Project Area

Species	State Status[a] KY	TN	Facility	Habitat Description	Impacts

[a] T = threatened; E = endangered; S = special concern; D = Deemed in need of management; H = Historical
[b] - Potential habitat occurs outside Project work areas.

2.5 Land Use, Recreation, and Visual Resources

2.5.1 Land Use

Land use in the Project area consists primarily of undeveloped forested areas and pasturelands. The land area required to construct the Project includes various types of land use, including open land, developed lands, forest land, and wetlands (see table 2-14).

Construction of the new facilities for Compressor Stations 118A, 119A, 875, and 563 would disturb about 184 acres of land. Upon completion, the facilities would have a permanent footprint of about 127 acres. Following construction, Tennessee would restore and revegetate the disturbed areas not required for operational purposes. Tennessee would also make modifications at Compressor Stations 106 and 114. These existing facilities are within the fenceline of parcels currently owned by Tennessee. These modifications would permanently disturb about 54 acres of land. Construction and operation of the Project would permanently disturb a total of about 240 acres of land.

Table 2-14

Summary of Land Uses Affected by the Broad Run Expansion Project in Acres

Compressor Station	Open Land		Developed Land		Forest Land		Total[a]	
	Const	Oper	Const	Oper	Const	Oper	Const	Oper
Existing Facilities								
CS 106	9.6	9.6	26.4	26.4	1.4	1.4	37.4	37.4
CS 114	0.0	0.0	16.0	16.0	0.6	0.6	16.6	16.6
Total	9.6	9.6	42.4	42.4	2.0	2.0	54.0	54.0
New Facilities								
CS 118A	10.2	6.7	3.8	2.9	31.2	19.6	45.2	29.2
CS 119A	0.0	0.0	9.9	9.9	37.0	37.0	46.9	46.9
CS 875	48.5	24.9	0.0	0.0	0.0	0.0	48.5	24.9
CS 563	0.0	0.0	2.6	2.6	40.4	23.4	43.0	26.0
Total	58.7	31.6	16.3	15.4	108.6	80	183.6	127
Access Roads								
Maxine Drive (CS 118A)	1.0	1.0	0.0	0.0	0.0	0.0	1.0	1.0
Berry Lane (CS 119A)	0.2	0.2	0.0	0.0	0.9	0.9	1.1	1.1
Total	1.2	1.2	0.0	0.0	0.9	0.9	2.1	2.1
Project Total	**69.5**	**42.4**	**58.7**	**57.8**	**111.5**	**82.9**	**239.7**	**183.1**

Const = Construction
Oper = Operation
Totals may not add up due to rounding
[a] Totals do not include existing compressor station infrastructure at Compressor Stations 106 and 114 or existing access roads.

Open Land

Open land in the Project area consists of non-forested areas that are not otherwise classified as developed land, and includes maintained grass areas, agricultural land, unmaintained fallow grasslands, unmaintained fallow agricultural fields, and non-forested wetlands. Wetlands in the Project area consist of PUB/PEM wetlands, PEM wetlands, and less than 0.01 acres of PFO wetlands, as described in section 2.2.3.

Construction of the new facilities and access roads would affect about 59.9 acres of open land. About 27.1 acres would be temporarily disturbed and allowed to revert to original condition after construction. The remaining 32.8 acres of open land would be permanently converted to developed land for the compressor stations and access roads. Modifications to existing facilities would affect about 9.6 acres of open land consisting of open space adjacent to existing industrial facilities. The 9.9 acres of open land would be permanently converted to developed land for the modified compressor stations. Open land would compose about 29.0 percent of the permanent Project disturbance.

Although no active agricultural lands are found within any of the compressor station sites, comments were received expressing concern about the potential impacts that operation of Compressor Station 563 would have on nearby organic farming and livestock operations. Commenters also expressed concern that organic farmers could lose their organic certification. In response to these comments, Tennessee noted that they do not employ large-scale or bulk use of herbicides, pesticides, or fertilizers at compressor station sites. Open areas within a facility would generally consist of maintained turf grass, where fertilizers are generally not used or needed. Tennessee would periodically use household herbicides or pesticides for specific, targeted use, such as control of non-native, invasive species and for protection of human health (e.g., wasp or hornet control). Use of these herbicides or pesticides would be subject to appropriate regulatory oversight, and product application would occur in accordance with manufacturer instructions and safeguards. In addition, Tennessee would construct Compressor Station 563 with a 1,000-foot setback from adjacent properties. This would minimize the potential for transportation of materials such as herbicides or pesticides from the compressor station site to adjacent properties. If quantifiable farm production losses should occur, Tennessee would negotiate compensation with affected landowners. Because Tennessee would only be using targeted applications of herbicides and pesticides and no fertilizer would be used, we conclude that operations at Compressor Station 563 would not pose a risk to nearby organic farming operations or certification.

Developed Lands

Developed lands that would be affected by the Project include maintained pipeline right-of-way, graveled areas, and previously disturbed areas at existing compressor stations, and disturbed residential areas.

Construction of the new Project facilities would affect about 16.3 acres of developed land. About 0.9 acres would be temporarily disturbed. The remaining 15.4 acres of open land would be permanently converted to developed land for the compressor stations. Construction would disturb about 42.4 acres of developed land for the modification of existing facilities. All 42.4 acres would remain in a developed condition for operation of the Project. Developed land accounts for about 24.5 percent of the land that the Project would permanently affect.

Residential land includes developed residential areas or residentially zoned areas, and existing residences near the Project footprint. No residential, commercial, or industrial structures occur within 50 feet of the proposed sites of Compressor Stations 118A, 119A, 563, or 875.

The nearest residence to Compressor Station 118A is about 920 feet south of the site (53 feet from the Maxine Drive access road) and the nearest commercial structure is about 329 feet to the west. An existing single family residence and several storage sheds are within the site for Compressor Station 119A. Tennessee would purchase these buildings as part of the land acquisition process and demolish them prior to construction of the compressor station. Another residential structure is about 208 feet to the south of the site and the nearest commercial structure is about 291 feet to the west. The nearest residential structure to Compressor Station 875 is about 143 feet to the south of the site; no commercial structures are within 875 feet of the site.

The nearest residential structure to Compressor Station 563 is about 75 feet to the west of the site and the nearest commercial structure is about 184 feet to the west. During the preparation of this EA, comments were received expressing concern about siting Compressor Station 563 in an area that is primarily residential and agricultural in nature. This area is zoned as AR2a, which is an agricultural district. The Metro Government Code of Ordinances 17.08.020 (Metro Government, 2015a) identifies compressor stations (or gas substations) as a permitted use subject to specific conditions. However, in August 2015, the Metro Council voted to pass a policy that restricts gas compressor stations to only industrial-zoned areas in Davidson County. We note that federal preemption would apply to county zoning ordinances and find the use of this land to be appropriate for siting the proposed compressor station facility.

Forest Land

Forest land includes upland forest or woodland, and forested wetlands. Forested areas consist of mature oak-hickory forests and disturbed forests as described in section 2.3.1. Forested wetlands in the Project area consist of less than 0.01 acres and are described in section 2.2.3. Based on ecological field survey data, about 108.6 acres of forest land would be cleared for construction of the new facilities and access roads, and 2.0 acres of forest land would be cleared for the modifications to existing facilities. Construction activities in forested areas would require removal of all trees within the construction workspaces. Impacts would range from long-term within temporary work areas to permanent within areas where forested land would be converted to other land use types. Temporary work areas would be allowed to revegetate following construction. About 28.6 acres would be temporarily disturbed and allowed to revert to original condition after construction, and 82.9 acres of forest land would be permanently converted to developed land for the facilities and access roads. Forest land accounts for about 46.5 percent of the land that would be permanently affected by the Project.

2.5.2 Planned Development

No planned or future residential or commercial developments were identified within 0.25 mile of the Project (Boyd County, 2014; Kanawha County, 2014a; Madison County, 2015; and Metro Government, 2014a).

2.5.3 Public Land, Recreation, and Special Interest Areas

Based on available aerial imagery and geographic information system (GIS) data sources, no state or local designated trails, nature preserves, game management areas, national or state forests, national or state parks, golf courses, public or private hunting areas, designated recreational areas, or lands included in or designated for study for inclusion in the National Trails System would be within 0.25 mile of the Project (National Recreational Trails, 2014; Kentucky State Nature Preserves Commission, 2014; Metro Government, 2014b and 2014c; Kentucky Department of Fish and Wildlife Resources, 2014a and 2014b; WVDNR, 2014; TWRA, 2014a, 2014b, 2014c, and 2014d; U.S. Forest Service, 2014; Kentucky State Parks, 2014a and 2014b; West Virginia State Parks and Forests, 2014; Kanawha County, 2014b; Madison

County, 2010; Tennessee State Parks, 2014; Tennessee Association of RV Parks and Campgrounds, 2014; NPS, 2014). Therefore, we conclude that the Project would not have any impacts on these resources.

Paradise Ridge Community Park is adjacent to and east of the Compressor Station 563 site in Nashville, Tennessee. Accessed from Morgan Road, the 98-acre park includes a community center, playgrounds, restrooms, picnic shelters, basketball courts, and walking/jogging paths (Metro Government, 2014b and 2014c). The Project would not directly impact the park; however, indirect impacts associated with increases in traffic and associated noise surrounding the park during construction at the Compressor Station 563 site could occur. These construction-related impacts would be temporary in nature. The compressor station site has been configured so that a forested buffer would be maintained between the facility and the park. Because this forested area would provide screening and a noise buffer, we conclude that the Project would not have significant impacts on recreational users at Paradise Ridge Park.

2.5.4 Visual Resources

The proposed Project would alter existing visual resources from the presence of construction equipment and activities in the viewshed or from aboveground facilities that would represent permanent alterations to the viewshed. The significance of these visual impacts would depend primarily on the quality of the viewshed, the degree of alteration of that view, the sensitivity or concern of potential viewers, and the perspective of the viewer.

Compressor Stations 106 and 114 are operational compressor stations. The modification of the facilities would not change the visual character of the existing facilities. Construction activities would be visible temporarily within the site; however, both compressor station sites are shielded by forested buffers and other existing industrial development, which would minimize any potential visual impacts on residents or motorists traveling by the sites.

Tennessee would construct Compressor Station 118A in a heavily forested rural area with little surrounding development. The nearest existing residential and commercial developments are about 0.3 mile from the site. A thick forested buffer surrounds the site on all four sides, which would shield views of the constructed compressor station. Construction equipment and materials would be visible traveling along County Route 22/1 and Maxine Drive during the construction period.

The site for Compressor Station 119A is also in a heavily forested rural area with minimal surrounding development. A few residences are within 1,000 feet of the proposed site; however, no visual impacts are anticipated from construction and operation of Compressor Station 119A. A heavily forested buffer that surrounds the site is on all four sides, which would shield any potential viewers of the constructed compressor station. During construction, equipment and materials would be visible to travelers on West Virginia Route 622 and Berry Lane.

The site for Compressor Station 875 and surrounding area are primarily open space and pastureland with a few residences within 500 feet of the site. The open space and pasture land provide little shielding of the surrounding area from the compressor station site other than the hilly nature of the environment. Therefore, construction of the compressor station would have visual impacts on nearby residents and motorists with largely unobstructed views of the site. These impacts would be mitigated as described below under *Minimization Measures*.

The site for Compressor Station 563 is in a heavily forested rural area with minimal surrounding development. A few residences are within 1,000 feet of the proposed site; however, no visual impacts are anticipated from construction and operation of Compressor Station 563. Potential views of the

compressor station would be shielded by a thick forest buffer to the north, south, and east of the site. During construction, equipment and materials would be visible moving along Tennessee Route 65/U.S. Highway 431; however, any associated visual impact would be temporary.

Minimization Measures

Tennessee has committed to the following measures to minimize visual impacts at compressor station sites:

- locating the compressor station facilities out of the viewshed of homes and roadways, to the extent practicable;
- maintaining existing foliage, to the maximum extent practicable, around the compressor station to serve as a visual barrier to the compressor station equipment and buildings;
- painting buildings and equipment to blend into the existing natural environment; and
- installing downward-facing, shielded lights to mitigate off-site exposure.

Specifically at Compressor Station 875, Tennessee would locate the station equipment away from residential areas on Hackett Road. The lighting design for the compressor station would incorporate low-intensity lighting and directional reflectors to mitigate fugitive lighting coming from the property while still meeting safety requirements.

2.5.5 Land Use, Recreation, and Visual Resources Conclusions

No developments are planned within 0.25 mile of the Project. The only recreational or special interest area within 0.25 mile of the Project would be Paradise Ridge Park in Nashville, Tennessee, which would not be affected by the Project. Because Tennessee would restore disturbed areas not needed for operations, and would not construct adjacent to residential or commercial structures, or disturb recreational or special interest lands, we conclude that the Project would not have significant impacts on land use.

Most of the Project facilities are in heavily forested areas that would provide a visual buffer, and impacts from construction traffic would be temporary. With Tennessee's minimization measures described above, we conclude that the Project would not result in significant visual impacts.

2.6 Socioeconomics

The potential socioeconomic effects of construction and operation of the Project include changes in local population levels or demographics, increased traffic or traffic disruptions during construction, increased job opportunities, increased demand for housing and public services, and increased tax revenue associated with sales, payroll, and property taxes. We received comments on potential adverse effects on values of properties close to the proposed compressor station sites, impacts on the rural character and quality of life, increased traffic, potential effects on revenue from organic farms and livestock, and the executive order on environmental justice for minority and low-income populations.

2.6.1 Population, Economy, and Employment

Table 2-15 provides a summary of key demographic and socioeconomic data at the state and county levels for each compressor station considered as part of the Project.

Existing Compressor Station 106 is in Powell County, Kentucky. Powell County is rural, with a population of 12,494. It is also economically distressed, as evidenced by a low per capita personal income ($28,934) and a high unemployment rate (10.7 percent). Only about 40 percent of its population participates in the civilian labor force (5,055). The composition of its employment base is different from that at the state level; in particular, manufacturing is not one of the top three industries.

Compressor Station 114 is in Boyd County, Kentucky. Like Powell County, Boyd County (population 48,886) is economically distressed, with a per capita personal income ($33,829) lower than the state average, a high unemployment rate (9.1 percent), and low labor force participation (about 40 percent). But, unlike Powell County, the composition of the employment base in Boyd County is similar to that at the state level, with a large number of people working in educational, health, and social services.

Tennessee would construct both Compressor Station 118A and Compressor Station 119A in Kanawha County, West Virginia. The population of Kanawha County is 191,275. Compared to other counties affected by the Project, Kanawha County has a healthy economy, with a per capita personal income of $44,817 and an unemployment rate of 5.7 percent. Its civilian labor force totals 88,300 (about 46 percent) and the number one employment sector (by number of employees) is educational, health, and social services.

Compressor Station 875 would be built in Madison County, Kentucky, with a population of 85,590. At $30,835, Madison County's per capita personal income is lower than the state average. However, it has a lower unemployment rate (6.6 percent) and more than half of its population is in the labor force. This is due, in part, to a strong manufacturing sector, with the presence of large international firms such as Hitachi.

Tennessee proposes to build Compressor Station 563 in Davidson County, Kentucky near the Davidson-Cheatham county line. Davidson County and Cheatham County have very different socioeconomic profiles. Most of the population of Davidson County resides in the City of Nashville, while Cheatham County is rural. Davidson County has a population of 658,602 and its population density is estimated at 1,307 persons per square mile, whereas Cheatham County has a population of 39,492 and its population density is about 131 persons per square mile. Davidson County's economy is stronger than Cheatham County's economy, with a significantly higher per capita personal income ($51,245 versus $35,594), lower unemployment rate (5.9 versus 6.6 percent), and higher labor force participation rate (54 versus 51 percent). The composition of employment is also different, as shown in table 2-15. A larger proportion of Davidson County workers are employed in arts, entertainment, and recreation, and in accommodation and food services.

Table 2-15

Socioeconomic Conditions in the Project Area (2013)

Area (State/County)	Population [a]	Population Density (persons/sq. mile) [b]	Per Capita Income ($2013) [c]	Civilian Labor Force [d]	Unemployment Rate (%) [d]	Major Industries [c]
CS 106						
Kentucky	4,395,295	111	$36,214	2,057,369	8.0	E, R, M
Powell County	12,494	70	$28,934	5,055	10.7	R, E, F
CS 114						
Kentucky	4,395,295	111	$36,214	2,057,369	8.0	E, R, M
Boyd County	48,886	306	$33,829	19,642	9.1	E, R, A
CS 118A / CS119A						
West Virginia	1,854,304	77	$35,533	796,200	6.5	E, R, A
Kanawha County	191,275	212	$44,817	88,300	5.7	E, R, A
CS 875						
Kentucky	4,395,295	111	$36,214	2,057,369	8.0	E, R, M
Madison County	85,590	196	$30,835	45,798	6.6	E, M, R
CS 563						
Tennessee	6,495,978	158	$39,558	3,053,651	8.3	E, R, A
Davidson County	658,602	1,307	$51,245	353,381	5.9	E, A, F
Cheatham County	39,492	131	$35,594	20,024	6.6	E, M, R

[a] U.S. Census Bureau (2015).

[b] Calculated based on U.S. Census Bureau data.

[c] Bureau of Economic Analysis, Regional Data.

[d] Bureau of Labor Statistics, Local Area Unemployment Statistics.

Major industries: A = Arts, entertainment, and recreation; and accommodation and food services; E = Educational, health and social services; F = Finance and insurance; real estate, rental and leasing; M = Manufacturing; R = Retail trade.

Table 2-16 presents Tennessee's estimates of the number of workers that would be required for construction and operation of the Project. As shown in table 2-16, the Project would result in a very small increase in the local population during the construction phase and virtually no change during the operational phase. It is expected that 90 percent of the workforce would come from outside the local area to supplement local workers. Tennessee estimates that 106 construction personnel would be required for the modifications at both of the existing compressor stations and an average of about 73 construction personnel for each of the new compressor stations. Given the relatively short construction period (12 months or less), most nonlocal workers would not be accompanied by their families. The temporary influx of construction workers would also generate indirect and induced impacts on the local economy in the form of additional revenues for businesses. Overall, based on the estimates reported in table 2-15 and table 2-16, the number of workers who might relocate to the Project area would not result in a significant increase in population or the labor force.

Table 2-16

Estimated Project Personnel during Construction and Operations

		Construction Personnel (Temporary)		Operations Personnel (Permanent)
Facility	**County, State**	**Average Number**	**Peak Number**	**Number**
CS 106	Powell County, Kentucky	106	150	2
CS 114	Boyd County, Kentucky	106	150	1
CS 118A	Kanawha County, West Virginia	67	110	1
CS 119A	Kanawha County, West Virginia	74	134	1
CS 875	Madison County, Kentucky	70	129	1
CS 563	Davidson County, Tennessee	82	142	2

2.6.2 Transportation and Traffic

The transportation infrastructure near the Project consists mostly of paved local and state roadways and a few U.S. highways.

- Compressor Station 106 is on the west side of Kentucky Route 15, about 0.2 mile west of Kentucky Route 9000.
- Compressor Station 114 is on the north side of Boyd County Road 1119, about 0.1 mile east of Boyd County Road 1117 and 0.3 mile east of U.S. Highway 23.
- Compressor Station 118A would be on the north side of Maxine Drive (an unpaved, one-lane road), about 0.4 mile west of Kanawha County Route 22/1.
- Compressor Station 119A would be about 0.3 mile east of West Virginia Route 622.
- Compressor Station 875 would be on Berry Lane (an unpaved, one-lane road), about 0.3 mile north of Windy Ridge Lane and 0.8 mile west of Hackett Road.
- Compressor Station 563 would be on the east side of Tennessee Route 65/U.S. Highway 431, less than 0.1 mile southeast of Greenbrier Road.

Because the compressor stations would be in sparsely populated, rural areas, minor, short-term impacts would likely occur along some roadways from the movement and delivery of equipment, materials, and workers. We received comments on the risks associated with an increase in traffic on two-lane rural roads near the proposed site of Compressor Station 563, especially during construction. Tennessee's construction contractors would obtain all necessary roadway transport and load permits from applicable federal, state, and local agencies. To minimize impacts on local traffic, Tennessee would implement the following mitigation measures:

- scheduling oversize/overweight equipment and materials deliveries to occur during non-peak traffic hours;
- using pilot cars for oversize/overweight equipment and material deliveries;
- installing signage and/or using flaggers at roadway turnoffs; and
- encouraging carpooling for workers commuting to the compressor station sites.

On average, each compressor station would require five to six round-trips per day for trucks delivering equipment and materials, and about 80 vehicles per day for construction workers commuting to the sites. Tennessee estimates construction activities would occur 6 days per week for about 9 months for Compressor Stations 106, 114, 118A, and 119A, about 12 months for Compressor Station 875, and about 10 months for Compressor Station 563. The Project would have minor impacts on transportation and traffic during the 9 to 12 months of construction activities. Operation of the facilities would result in negligible impacts on traffic.

2.6.3 Housing

As mentioned in section 2.6.1, if the local workforce does not possess the skills required, 90 percent of construction workers would come from outside the local area. A majority of these workers would reside in temporary housing near the compressor station sites. Temporary accommodations include short-term rental units (hotels, motels, bed and breakfasts, and apartments), trailers, recreational vehicles, and campgrounds. Temporary housing availability varies based on the location and the season. Generally speaking, temporary housing is at its lowest point during the summer months because of tourism; however, none of the compressor station sites are in highly touristic areas.

The Project would have negligible impact on temporary housing and would last only for the duration of construction activities, which would range from 9 to 12 months. Adequate temporary housing options are available in the towns and cities surrounding the compressor station sites to accommodate non-resident construction workers.

2.6.4 Public Services

A wide range of public services are presently offered within the communities surrounding each compressor station site, including law enforcement (police departments and sheriff's offices), fire departments, medical facilities (such as the Vanderbilt University Medical Center in Davidson County, Tennessee), and educational institutions (elementary schools and high schools for the most part).

During construction, Tennessee would need up to 150 workers at each compressor station site. Though most of the workers would come from outside the local area, their families are not expected to accompany them, given the brief construction period. This would result in minor, temporary, or no impact on local public services. The counties, cities, and towns in the Project area have adequate infrastructure and services to meet the needs of nonlocal workers. In particular, the anticipated demand for police, fire, and medical services in case of an emergency is not expected to exceed existing capacities.

Construction of the Project could temporarily increase demand for medical, police, and fire protection services in the event of a fire or other emergency. Tennessee would work with local law enforcement and emergency response agencies to coordinate effective emergency procedures for the Project during construction and operation, and has committed to conducting:

- periodic visits with emergency agencies to coordinate emergency response in the event of an incident;
- periodic tabletop emergency exercises and mock emergency drills;
- annual communications about:
  - potential hazards associated with Tennessee's facilities in its service area;
  - types of emergencies that may occur at those facilities;

  - how to recognize and respond to pipeline emergencies; and
  - how to contact Tennessee for additional information;

- special information meetings and training at the invitation of the municipalities; and
- circulation of literature listing emergency telephone numbers and other pertinent data.

Based on the number of police and fire stations and emergency medical services in the area, we conclude that it is unlikely that the Project would represent an increased burden on the public services in the area.

2.6.5 Property Values

Tennessee has purchased or plans to purchase the properties where the compressor stations would be located. Landowners were compensated for any agricultural or timberland production as part of the sale.

We received comments from a number of landowners who are concerned that the Project would make it more difficult to sell their homes or would reduce their property values. Commenters noted a number of factors that can result in compressor stations being viewed negatively by the community, including the risk of fire and explosion as well as the effects of air emissions, groundwater pollution, and noise.

Each of the proposed new compressor stations would be built on parcels that are already crossed by Tennessee's existing pipeline system. Residential and other properties have been purchased and/or constructed adjacent to the existing system after Tennessee's pipelines were built. It is not known whether the prices paid by landowners were reduced because of the presence of Tennessee's existing facilities.

We are unaware of any studies that have specifically addressed the effects of compressor stations on property values. A number of studies have been conducted since the early 1990s on the effects of proximity to pipelines on property values. In a few of them, advanced statistical techniques have been applied to evaluate transaction sales data before and after the construction of a pipeline. A literature review of these studies can be found in Wilde et al. (2013). The paper concludes that natural gas pipelines have no statistically significant impact on the values of nearby properties. If landowners believe that the presence of a compressor station reduces the value of their land, resulting in an overpayment of property taxes, they have the right to appeal the issue of the assessment and subsequent property taxation to the local assessor's office.

Some residents in Davidson County, Tennessee expressed concerns that the Project could have a detrimental effect on organic farming and that the public perception of the presence of the proposed Compressor Station 563 could reduce the economic viability of nearby organic farms. However, as described in section 2.5.1, none of the activities at the compressor station are anticipated to adversely impact nearby farms.

2.6.6 Tax Revenue

Table 2-17 reports state sales tax rates, along with recent yearly estimates of sales and use tax revenues, and property tax revenues. The state sales tax rate is 6.0 percent in Kentucky and West Virginia, and 7.0 percent in Tennessee.[10] In addition, the City of Charleston, West Virginia levies a 0.5 percent local sales tax and the City of Nashville, Tennessee levies a 2.25 percent sales tax.

Table 2-17

State Tax Rates and Revenues

State	Sales Tax Rate (%)	Sales and Use Tax Revenues	Property Tax Revenues
Kentucky	6.0	$3,131,126,876 [a]	$223,393,888
West Virginia	6.0	$1,253,500,000 [b]	$6,700,000
Tennessee	7.0	$629,642,609 [a]	n/a

[a] 2013–2014 fiscal year (FY).

[b] Estimated 2014–2015 FY collections.

Sources: Kentucky Department of Revenue (2013 and 2014); West Virginia Department of Revenue (2014); Tennessee Department of Revenue (2014a, 2014b, and 2014c).

Construction activities and operation of the compressor stations would result in additional state and local tax revenues related to retail sales and payroll. Construction workers would spend money locally on housing, fuel, food, and entertainment. Additionally, equipment fuel and construction materials such as gravel and fencing materials likely would be purchased from local or regional vendors. These revenues would result in short-term beneficial impacts on businesses by generating additional revenues, and contributing to the tax base. Moreover, once in operation, Tennessee would need to pay *ad valorem* taxes based on the assessed value of the compressor stations. Finally, Tennessee would have to pay county environmental and construction permit fees during the development phase of the Project.

Based on calculations by Tennessee, construction materials purchases for all compressor stations would yield a combined $467,000 in sales tax revenues: $69,000 for Compressor Station 106, $69,000 for Compressor Station 114, $65,000 for Compressor Station 118A, $65,000 for Compressor Station 119A, $60,000 for Compressor Station 875, and $139,000 for Compressor Station 563. Once in operation, annual sales tax revenues would amount to about $182,000: $27,240 for Compressor Station 106, $13,140 for Compressor Station 114, $21,255 for Compressor Station 118A, $21,255 for Compressor Station 119A, $26,280 for Compressor Station 875, and $72,705 for Compressor Station 563.

After completion of construction, Tennessee would have to pay annual property taxes on the assessed value of each compressor station. Tennessee estimates that a*d valorem* taxes on all compressor stations in the first year would yield about $7,032,000: $607,000 for Compressor Station 106, $563,000 for Compressor Station 114, $1,354,000 for Compressor Station 118A, $1,354,000 for Compressor Station 119A, $612,000 for Compressor Station 875, and $2,542,000 for Compressor Station 563.

[10] The State of Tennessee also has a lower tax rate for certain types of items.

2.6.7 Environmental Justice

In 1994, the President signed EO 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations. The EO requires each federal agency to address disproportionally high and adverse health or environmental effects of its programs, policies, and activities on minority and low-income populations. An environmental justice area is defined as an area where the community's minority population is equal to or greater than 50 percent of the community population and/or a community in which the percentage of persons living below the poverty level is higher than the county average.

Table 2-18 provides recent data on minority populations and income at the county and state levels, for comparison purposes at each of the compressor station sites. Based on data provided by the U.S. Census Bureau, the counties in the Project area are primarily inhabited by white, non-Hispanic populations. Apart from Davidson County, the proportion of minority populations represents less than 25 percent. In conclusion, minority and low-income populations comprise less than 50 percent of the population in the states and counties that would be affected by the Project. As such, we conclude that the Project would not disproportionately affect minority or low-income populations.

Table 2-18

Race/Ethnicity and Income Statistics (2013)

Area (State/County)	Black/African American (%)	Native American (%)	Hispanic (%)	Asian (%)	Native Hawaiian (%)	Below Poverty Level (%)[b]
CS 106						
Kentucky	8.2	0.3	3.3	1.3	0.1	18.6
Powell County	0.8	0.1	1.3	0.1	0.0[a]	28.9
CS 114						
Kentucky	8.2	0.3	3.3	1.3	0.1	18.6
Boyd County	3.0	0.3	1.6	0.5	0.0[a]	19.2
CS 118A / CS 119A						
West Virginia	3.6	0.2	1.4	0.8	0.0[a]	17.6
Kanawha County	7.6	0.2	1.0	1.1	0.0[a]	14.2
CS 875						
Kentucky	8.2	0.3	3.3	1.3	0.1	18.6
Madison County	4.5	0.4	2.2	1.1	0.1	21.0
CS 563						
Tennessee	17.0	0.4	4.9	1.6	0.1	17.3
Davidson County	28.1	0.5	9.9	3.2	0.1	18.5
Cheatham County	1.7	0.4	2.6	0.4	0.1	13.8

[a] Value greater than 0 but less than one-half unit of measure shown.
[b] 2009–2013 average.
Sources: U.S. Census Bureau, State and County QuickFacts.

2.7 Cultural Resources

Section 106 of the NHPA of 1966, as amended, requires FERC to take into account the effects of its undertakings on properties listed on or eligible for listing on the National Register of Historic Places (NRHP) and to afford the Advisory Council on Historic Preservation an opportunity to comment. Tennessee is assisting us by providing information, analyses, and recommendations, as allowed by the Advisory Council on Historic Preservation's regulations for implementing Section 106 at 36 CFR 800.2(a)(3), and outlined in our Guidelines for Reporting on Cultural Resources Investigations for Pipeline Projects (18 CFR 380.12[f]).

2.7.1 Cultural Resource Investigations

Tennessee performed archaeological surveys of the proposed compressor station sites in West Virginia, Kentucky, and Tennessee and existing Compressor Stations 106 and 114 in Kentucky. In total, 449.2 acres were surveyed for archaeological resources. Additionally, surveys for historic-age architecture were conducted within a 0.5-mile radius of each proposed and existing compressor station.

Archaeological investigations were conducted using a combination of systematic pedestrian survey, visual inspection, and shovel test pits. Standing structures within 0.5 mile of each compressor station were inventoried and evaluated for NRHP eligibility.

2.7.2 Survey Results

West Virginia

The archaeological surveys at the sites for Compressor Stations 118A and 119A in West Virginia documented two new archaeological sites, 46KA662 and 46KA641, both of which are cemeteries, and recommended not eligible for NRHP listing (see table 2-19). Although the cemeteries are recommended not eligible, Tennessee has agreed to avoid the cemeteries during construction. The historic-age architecture survey identified 26 previously undocumented historic-age resources, and one previously documented resource. None of the newly identified or previously recorded historic-age structures are recommended eligible for NRHP listing, either individually or as contributing resources to a historic district. Tennessee determined that construction of Compressor Stations 118A and 119A would not adversely affect historic properties.

Tennessee submitted the report *Phase I Archaeological Survey of the Broad Run Expansion Project, Proposed Compressor Station 118A and 119A, Kanawha County, West Virginia* to West Virginia's State Historic Preservation Office (SHPO) on January 5, 2015. In a letter dated February 2, 2015, the SHPO concurred with the report's findings and agreed no additional archaeological investigations are necessary within the Project area.

Tennessee submitted the report *Architectural Survey of the Broad Run Expansion Project, Proposed Compressor Station 118A and 119A, Kanawha County, West Virginia* to the West Virginia SHPO on January 5, 2015. In a letter dated February 2, 2015, the West Virginia SHPO responded to the submission with a request for additional information on two newly identified resources. Tennessee submitted the revised report on February 20, 2015. In a letter dated March 11, 2015, the Deputy SHPO concurred with the report's recommendations and agreed no further consultation is necessary regarding architectural resources.

We have also reviewed the information presented in the draft and revised reports and likewise concur with their findings.

Table 2-19

Cultural Resources Sites Identified in West Virginia

Compressor Station/ Site Number or Name	Description	Recommendation/NRHP Status
Archaeological Sites		
CS 118A		
46KA662	Cemetery - Mid 20th century	Not Eligible
CS 119A		
46KA641	Cemetery – Early to Mid 20th Century	Not Eligible
Historic Architectural Sites		
CS 118A		
FS-118-1	Residential – Circa 1920	Not Eligible
FS-118-2	Residential – Circa 1900	Not Eligible
FS-118-3	Residential – Circa 1910	Not Eligible
FS-118-4	Residential – Circa 1930	Not Eligible
FS-118-5	Residential – Circa 1930	Not Eligible
FS-118-6	Residential – Circa 1930	Not Eligible
FS-118-7	Chapel – Circa 1920	Not Eligible
FS-118-8	Residential – Circa 1930	Not Eligible
FS-118-9	Residential – Circa 1920	Not Eligible
FS-118-10	Residential – Circa 1940	Not Eligible
FS-118-11	Industrial – Circa 1940	Not Eligible
FS-118-12	Industrial – Undetermined	Not Eligible
FS-118-13	Residential – Circa 1950	Not Eligible
CS 119A		
FS-119-1	Residential – Circa 1930	Not Eligible
FS-119-2	Commercial – Circa 1930	Not Eligible
FS-119-3	Residential – Circa 1930	Not Eligible
FS-119-4	Residential – Circa 1930	Not Eligible
FS-119-5	Residential – Circa 1930	Not Eligible
FS-119-6	Residential – Circa 1950	Not Eligible
FS-119-7	Residential – Circa 1930	Not Eligible
FS-119-8	Residential – Circa 1930	Not Eligible
FS-119-9	Burford Cemetery – Early to Mid 20th Century	Not Eligible
FS-119-10	Residential – Circa 1945	Not Eligible
FS-119-11	Residential – Circa 1945	Not Eligible
FS-119-12	Residential – Circa 1940	Not Eligible
FS-119-13	Residential – Circa 1930	Not Eligible
KA-0086	James Baily Farm and Cemeteries – Early 20th Century	Not Eligible

Kentucky

Tennessee performed cultural resource investigations at the sites for Compressor Stations 106, 114, and 875 in Kentucky. Investigations for Compressor Station 875 included two alternatives: Compressor Station 875 East and Compressor Station 875 West. The Compressor Station 875 West alternative was later selected as the site for Compressor Station 875. The cultural resource investigations documented two new archaeological sites at Compressor Station 875 East, both of which are recommended not eligible for NRHP listing (see table 2-20). The architecture survey identified ten previously undocumented historic-age resources and two previously documented resources. The two previously documented resources are unevaluated for NRHP eligibility. Tennessee determined that proposed modifications to the compressor stations would be consistent with current use and would not introduce new elements that would affect the resources' historic character or NRHP eligibility. None of the newly documented historic-age resources within the Project locations in Kentucky were recommended eligible for NRHP listing.

Tennessee submitted the report *Archaeological Overview of the Broad Run Expansion Project, Compressor Stations 106 and 114, Powell and Boyd Counties, Kentucky,* to the Kentucky SHPO on January 7, 2015. In a letter dated February 13, 2015, the Kentucky SHPO concurred with the report's determination that modifications to the compressor stations would not adversely affect archaeological resources and would not require further archaeological work.

Tennessee submitted the report *Historic Architectural Survey for the Proposed Broad Run Expansion Project for Compressor Stations 106 and 114 in Powell and Boyd Counties, Kentucky* to the Kentucky SHPO on January 7, 2015. Tennessee recommended that modifications to the compressor stations would cause no adverse effect to architectural resources and no further work was necessary. In a letter dated January 30, 2015, the Kentucky SHPO responded to the submission with a request for a more detailed historical context of the gas industry in Kentucky, additional information about similar resources in Kentucky, and an updated Project summary. Tennessee submitted the revised report to the Kentucky SHPO on March 6, 2015. In a letter dated April 24, 2015, the Kentucky SHPO concurred with the revised report's recommendations.

Tennessee submitted the report *Phase I Archaeological Survey for the Proposed Compressor Station 875, Broad Run Pipeline Project, Madison County, Kentucky* to the Kentucky SHPO on January 7, 2015. Tennessee recommended that archaeological resources near the Compressor Station 875 site are not eligible for NRHP listing and no further archaeological work is necessary. In a letter dated February 26, 2015, the Kentucky SHPO requested deep testing in floodplain settings at the Compressor Station 875 East alternative to determine if deeply buried archaeological deposits were present. Tennessee informed the Kentucky SHPO that the east alternative was no longer under consideration and submitted a revised report on April 10, 2015. In a letter dated May 19, 2015, the Kentucky SHPO concurred with the report's findings and agreed no further archaeological work is necessary.

Tennessee submitted the report *Historic Architectural Survey for the Proposed Compressor Station 875, Broad Run Pipeline Project, Madison County, Kentucky* to the Environmental Site Review Coordinator at the Kentucky Heritage Council on January 7, 2015. Tennessee recommended that architectural resources near the Compressor Station 875 site are not eligible for NRHP listing and no further work is necessary. In a letter dated January 30, 2015, the Kentucky SHPO responded to the submission, concurring with the report's determination that new construction for Compressor Station 875 would not affect historic properties in the area.

We have reviewed the draft and revised reports for Compressor Stations 106, 114, and 875 and likewise concur with their findings.

Table 2-20

Cultural Resources Sites Identified in Kentucky

Compressor Station/Site Number or Name	Description	Recommendation/NRHP Status
Archaeological Sites		
CS 875		
15MA506	Prehistoric Lithic Scatter	Not Eligible
15MA507	Prehistoric Lithic Scatter	Not Eligible
CS 106		
None		
CS 114		
None		
Historic Architectural Sites		
CS 875		
MA-1031	Johnson Farm –1920–1949	Not Eligible
CS 106		
PO28	McIntosh House – Mid19th to Mid 20th Century	Not Assessed
PO29	Napier House – 1875–1899	Not Assessed
PO166	Compressor Building A1/A2	Not Eligible
PO167	Maintenance Garage	Not Eligible
PO168	Flammable Storage Building	Not Eligible
PO169	Liquid Fuel Pavilion	Not Eligible
PO170	Corrosive Materials Storage Shed	Not Eligible
PO171	Liquid Storage Waste Building	Not Eligible
PO172	Lawn Care Shed	Not Eligible
PO173	Hardware Fasteners Storage Building	Not Eligible
CS 114		
BD486	Compressor Building B (1955)	Not Eligible

Tennessee

Tennessee surveyed two alternative sites for Compressor Station 563: Area 3 and Area 4. Area 3 was later selected as the site for Compressor Station 563. One previously unrecorded archaeological site and two isolated finds were identified in Area 3 (see table 2-21). The archaeological site, 40DV665, is an early nineteenth to early twentieth century farmstead recommended eligible for NRHP listing. Tennessee has designed the construction and operation footprints at the compressor station to avoid this site. The historic-age architecture field survey effort identified 19 historic-age resources within 0.5 mile of Area 3, one of which, DV07746, was recommended eligible for NRHP listing. Tennessee determined construction of the new Compressor Station 563 would not adversely affect site DV07746 because vegetation and topography screen the compressor station from view.

Tennessee submitted the draft report *Cultural Resources Survey of the Broad Run Expansion Project, Proposed Compressor Station 563, Areas 3 and 4, Davidson County, Tennessee* to the Tennessee SHPO on January 5, 2015. In a letter dated January 27, 2015, the Tennessee SHPO concurred with the report's findings that construction at Compressor Station 563 would not affect historic properties in the area. Based on our review, we also concur there would be no adverse effect.

Table 2-21

Cultural Resources Sites Identified in Tennessee

Compressor Station/Site Number or Name	Description	Recommendation/NRHP Status
Archaeological Sites		
CS 563		
40DV665	Farmstead – Early 19th to Early 20th Century	Eligible
Isolate 1	Debitage – Prehistoric	Not Eligible
Isolate 2	Debitage – Prehistoric	Not Eligible
Historic Architectural Sites		
CS 563		
40DV666	Railey Cemetery – 1865	Not Eligible
DV07746	Residential –1914	Eligible
DV07747	Residential – 1912	Not Eligible
DV2600	Residential – 1959	Not Eligible
DV07743	Residential – 1919	Not Eligible
DV26001	Residential – 1959	Not Eligible
DV26002	Residential – 1945	Not Eligible
DV07740	Residential – 1923	Not Eligible
DV07738	Residential – 1930	Not Eligible
DV26003	Residential – 1954	Not Eligible
DV26004	Residential – 1935	Not Eligible
DV26005	Residential – 1963	Not Eligible
DV26006	Residential – 1954	Not Eligible
DV26007	Residential – 1945	Not Eligible
DV26008	Residential – 1945	Not Eligible
DV26009	Residential – 1965	Not Eligible
DV26010	Residential – 1945	Not Eligible
DV26011	Residential – 1959	Not Eligible
DV26012	Residential – 1953	Not Eligible

2.7.3 Native American Consultation

On November 10, 2014, Tennessee provided a project introduction letter and solicitation of comments to 16 Native American tribes that may attach religious or cultural significance to the Project area. The 16 tribes consist of the Absentee Shawnee Tribe of Oklahoma, the Alabama-Quassarte Tribal Town, the Cherokee Nation, the Chickasaw Nation, the Choctaw Nation of Oklahoma, the Eastern Band of Cherokee Indians, the Eastern Shawnee Tribe of Oklahoma, the Kialegee Tribal Town, the Miami Tribe of Oklahoma, the Muscogee (Creek) Nation, the Peoria Tribe of Indians of Oklahoma, the Poarch Band of Creek Indians, the Quapaw Tribe of Oklahoma, the Shawnee Tribe, the Thlopthloco Tribal Town, and the United Keetoowah Band of Cherokee. Tennessee followed up with phone calls on January 9, 2015 and emails on May 1, 2015 to tribes that had not responded to the consultation request. To date, Tennessee has received responses from seven tribes. Two tribes, the Choctaw Nation of Oklahoma and the Quapaw Tribe of Oklahoma, indicated the Project is outside their area of interest. Five tribes requested additional information or consultation with FERC: the Chickasaw Nation, the Eastern Band of Cherokee Indians, the Muscogee (Creek) Nation, the Peoria Tribe of Indians of Oklahoma, and the United Keetoowah Band of Cherokee. Several tribes requested copies of the Phase I cultural resources reports, which Tennessee provided.

We sent our NOI to these same tribes. The Quapaw Tribe of Oklahoma responded on December 31, 2015 that the Project is outside the Tribe's area of interest. No other responses to our NOI have been received.

2.7.4 Unanticipated Discoveries Plan

On November 6, 2014, Tennessee provided the West Virginia SHPO with a copy of Tennessee's Draft *Plan and Procedures for Addressing Unanticipated Discoveries of Cultural Resources and Human Remains during Construction* (Unanticipated Discoveries Plan). The letter requested approval and concurrence of the proposed plan. The West Virginia SHPO concurred with the proposed plan in a letter dated December 9, 2014. On November 6, 2014, Tennessee provided the Kentucky SHPO with a copy of Tennessee's Draft Unanticipated Discoveries Plan and requested approval and concurrence of the proposed plan. Concurrence was received on December 5, 2014. On November 6, 2014, Tennessee provided the Tennessee SHPO with a copy of Tennessee's Draft Unanticipated Discoveries Plan and requested approval and concurrence of the proposed plan. Concurrence was received on November 25, 2014. We have reviewed the information and also find the Draft Unanticipated Discoveries Plan acceptable.

2.7.5 Compliance with the National Historic Preservation Act

Based on the information provided and consultation with the SHPOs and Native American tribes, FERC has determined the proposed Project would have no effect on any properties listed on or eligible for listing on the NRHP. The Unanticipated Discoveries Plan would adequately resolve adverse effects to any properties discovered during construction. FERC has completed compliance with Section 106 of the NHPA for the proposed Project.

2.8 Air Quality

2.8.1 Existing Air Quality

Construction and operation of the Project could have an effect on local and regional air quality. Federal and state air quality standards have been designed to protect people and the environment from airborne pollutants. The EPA has established National Ambient Air Quality Standards (NAAQS) for nitrogen oxides (NO_x), carbon monoxide (CO), ozone (O_3), sulfur dioxide (SO_2), lead (Pb), and inhalable particulate matter (PM_{10} and $PM_{2.5}$). PM_{10} and $PM_{2.5}$ include particles with aerodynamic diameters of 10 microns or less and 2.5 microns or less, respectively. States are allowed to adopt stricter standards than the NAAQS; however, Kentucky, Tennessee, and West Virginia have adopted the NAAQS. The NAAQS are listed in table 2-22.

Greenhouse gases (GHG) are most commonly composed of carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), O_3, water vapor, hydrofluorocarbons, and perfluorocarbons and result from human activities, such as burning fossil fuels, as well as occurring naturally. Combustion of fossil fuels emits CO_2, CH_4, and N_2O, which are reported in terms of CO_2 equivalents (CO_2e) calculated based on the global warming potential of each gas.

Table 2-22

National Ambient Air Quality Standards

Pollutant	Averaging Period	Primary Standards (ppm)	Primary Standards ($\mu g/m^3$)	Secondary Standards (ppm)	Secondary Standards ($\mu g/m^3$)	Form of Standard
O_3	8-hour	0.075	n/a	0.075	n/a	Annual fourth-highest daily maximum 8-hour concentration, averaged over 3 years
CO	1-hour	35	40,000	n/a	n/a	Not to be exceeded more than once per year
	8-hour	9	10,000	n/a	n/a	
NO_2	1-hour	0.1	188	n/a	n/a	98th percentile of 1-hour daily maximum concentrations, averaged over 3 years
	Annual	0.053	100	0.053	100	Annual mean
SO_2	1-hour	0.075	196	n/a	n/a	98th percentile of 1-hour daily maximum concentrations, averaged over 3 years
	3-hour	n/a	n/a	0.5	1,300	Not to be exceeded more than once per year
$PM_{2.5}$	24-hour	n/a	35	n/a	35	98th percentile averaged over 3 years
	Annual	n/a	12	n/a	15	Annual mean averaged over 3 years
PM_{10}	24-hour	n/a	150	n/a	150	Not to be exceeded more than once per year on average over 3 years
Pb	Rolling 3-month	n/a	0.15	n/a	0.15	Not to be exceeded

Source: EPA (2014e)
$\mu g/m^3$ = micrograms per cubic meter of air
NO_2 = nitrogen dioxide
ppm = parts per million

Under the Prevention of Significant Deterioration (PSD) regulations, special consideration is given to Class I Areas or areas of special national or regional value from a natural, scenic, recreational, or historical perspective. If a new source or major modification of an existing source is subject to the PSD program and within 62 miles (100 kilometers [km]) of a Class I Area, the facility is required to notify the appropriate federal officials and assess the impacts of the proposed Project on the Class I Area. The closest Class I Area to the Project is Mammoth Cave National Park, which is 66 miles (107 km) from the Compressor Station 563 site. Because no Class I Areas are within 62 miles (100 km) of the Project, we conclude that the Project would have negligible effects on Class I Area air quality.

2.8.2 Climate

The climate for the Project area is somewhat variable given the large distance that the Project would span. The annual average temperature ranges from 32.9 degrees Fahrenheit (ºF) in Lexington, Kentucky near the Compressor Station 106 and 875 sites to 37.7 ºF in Nashville, Tennessee near Compressor Station 563. Annual average total precipitation across the Project area ranges from 42.6 to 47.3 inches. Temperatures above l00 ºF and below 0 ºF are relatively rare. Precipitation is relatively even in the winter, spring, and summer with slightly less precipitation occurring in the fall. Snow is infrequent in the lower elevations and more frequent in the higher elevations, typically coinciding with the West Virginia compressor station sites.

2.8.3 Existing Ambient Air Quality and Attainment Status

Measured ambient air pollutant concentration levels are used to determine the status of air quality for a given area. Areas that are at or below the NAAQS are designated as "attainment areas," whereas those areas that are above the NAAQS are designated "nonattainment areas." Those areas lacking data to determine attainment status are referred to as "unclassified areas." Attainment areas that were once in nonattainment of the NAAQS for a given pollutant are referred to as "maintenance areas" for that pollutant.

Air Quality Control Regions (AQCR) have been established by the EPA in accordance with Section 107 of the Clean Air Act of 1970 (CAA). The AQCRs are defined as contiguous areas considered to have relatively uniform ambient air quality, and are treated as single geographical units. Boyd County, Kentucky is part of the Huntington (West Virginia) - Ashland (Kentucky) - Portsmouth - Ironton (Ohio) Interstate AQCR (EPA, 2012). Compressor Station 114, in Boyd County, Kentucky, is within an AQCR, whereas the remainder of the Project is outside this AQCR area.

Based on ambient air monitoring data in the Project area for the most recent quality-checked 3-year period (2011 to 2013), all monitored pollutant values are below the respective NAAQS for each pollutant and averaging period given for each of the sites. Background ambient air quality values near each of the compressor station sites are provided in table 2-23 and table 2-24.

Table 2-23

Background Ambient Air Quality Near Existing Compressor Stations

			Location				Monitored Design Value	
Pollutant	Averaging Period	Monitoring Station ID	City, State	Distance (km)	Direction (deg)	Rank	(ppm)	(µg/m³)
Compressor Station 106								
SO_2	1-Hour	21-067-0012	Lexington, KY	47	289	99th Percentile	0.017	43.6
$PM_{2.5}$	Annual	21-151-0003	Richmond, KY	34	231	Arithmetic Mean	n/a	8.7
	1-Hour	21-067-0012	Lexington, KY	47	289	98th Percentile	0.045	85.2
NO_2	Annual	21-067-0012	Lexington, KY	47	289	Arithmetic Mean	0.008	15.7
	1-Hour	39-061-0040	Cincinnati, OH	141	342	H2H	1.5	1,718
CO	8-Hour	39-061-0040	Cincinnati, OH	141	342	H2H	1.0	1,145
O_3	8-Hour	21-067-0012	Lexington, KY	47	289	4th High	0.071	n/a
Compressor Station 114								
SO_2	1-Hour	21-019-0017	Ashland, KY	21	345	99th Percentile	0.021	54.0
$PM_{2.5}$	Annual	54-011-0006	Huntington, WV	22	38	Arithmetic Mean	n/a	10.4
	1-Hour	21-067-0012	Lexington, KY	170	81	98th Percentile	0.045	85.2
NO_2	Annual	21-067-0012	Lexington, KY	170	81	Arithmetic Mean	0.008	15.7
	1-Hour	39-061-0040	Cincinnati, OH	193	300	H2H	1.5	1,718
CO	8-Hour	39-061-0040	Cincinnati, OH	193	300	H2H	1.0	1,145
O_3	8-Hour	21-019-0017	Ashland, KY	21	345	4th High	0.064	n/a

Source: EPA (2014f)
deg = degree
H2H = High Second High
n/a = not applicable
NO_2 = nitrogen dioxide
ppm = parts per million

Table 2-24

Background Ambient Air Quality Near New Compressor Stations

Pollutant	Averaging Period	Monitoring Station ID	Location			Rank	Monitored Design Value	
			City, State	Distance (km)	Direction (deg)		(ppm)	(µg/m³)
Compressor Station 118A								
SO_2	1-Hour	54-039-0010	Charleston, WV	11	142	99th Percentile	0.042	108.9
$PM_{2.5}$	Annual	54-039-1005	South Charleston, WV	6	169	Arithmetic Mean	n/a	10.9
	1-Hour	21-067-0012	Lexington, KY	247	260	98th Percentile	0.045	85.2
NO_2	Annual	21-067-0012	Lexington, KY	247	260	Arithmetic Mean	0.008	15.7
	1-Hour	39-049-0005	Columbus, OH	212	149	H2H	2.6	2,977
CO	8-Hour	39-049-0005	Columbus, OH	212	149	H2H	1.6	1,832
O_3	8-Hour	54-039-0010	Charleston, WV	11	142	4th High	0.073	n/a
Compressor Station 119A								
SO_2	1-Hour	54-039-0010	Charleston, WV	14	148	99th Percentile	0.042	108.9
$PM_{2.5}$	Annual	54-039-1005	South Charleston, WV	10	168	Arithmetic Mean	n/a	10.9
	1-Hour	21-067-0012	Lexington, KY	247	259	98th Percentile	0.045	85.2
NO_2	Annual	21-067-0012	Lexington, KY	247	259	Arithmetic Mean	0.008	15.7
	1-Hour	39-049-0005	Columbus, OH	209	328	H2H	2.6	2,977
CO	8-Hour	39-049-0005	Columbus, OH	209	328	H2H	1.6	1,832
O_3	8-Hour	54-039-0010	Charleston, WV	14	148	4th High	0.073	n/a
Compressor Station 875								
SO_2	1-Hour	21-113-0001	Nicholasville, KY	31	287	99th Percentile	0.016	40.9
$PM_{2.5}$	Annual	21-151-0003	Richmond, KY	8	198	Arithmetic Mean	n/a	8.7
	1-Hour	21-067-0012	Lexington, KY	35	323	98th Percentile	0.045	85.2
NO_2	Annual	21-067-0012	Lexington, KY	35	323	Arithmetic Mean	0.008	15.7
	1-Hour	21-111-1019	Louisville, KY	135	290	H2H	2.9	3,321
CO	8-Hour	21-111-1019	Louisville, KY	135	290	H2H	1.9	2,176
O_3	8-Hour	21-113-0001	Nicholasville, KY	31	287	4th High	0.070	n/a
Compressor Station 563								
SO_2	1-Hour	47-125-0106	Clarksville, TN	50	290	99th Percentile	0.024	61.8
$PM_{2.5}$	Annual	47-165-0007	Hendersonville, TN	20	107	Arithmetic Mean	n/a	9.7
	1-Hour	47-037-0011	Nashville, TN	19	145	98th Percentile	0.042	79
NO_2	Annual	47-037-0011	Nashville, TN	19	145	Arithmetic Mean	0.011	21.5
	1-Hour	47-037-0021	Nashville, TN	22	159	H2H	1.9	2,176
CO	8-Hour	47-037-0021	Nashville, TN	22	159	H2H	1.5	1,718
O_3	8-Hour	47-037-0011	Nashville, TN	19	145	4th High	0.066	n/a

Source: EPA (2014f)
deg = degree
H2H = High Second High
n/a = not applicable
NO_2 = nitrogen dioxide
ppm = parts per million

2.8.4 Federal, State, and Regional Air Quality Regulations

Operation of the Project would emit air pollutants that are regulated by federal and state rules that are driven by the CAA. At the federal level, the EPA is responsible for regulating air quality emissions from the Project. At the state level, the Kentucky Division of Air Quality would regulate air quality emissions from Compressor Stations 106 and 875. For Compressor Stations 114, 118A, and 119A the West Virginia Division of Air Quality would be responsible for regulating air quality emissions. Compressor Station 563 would fall under the jurisdiction of the Metropolitan Government of Nashville and Davidson County, Tennessee.

Title V Operating Permit Program

The Title V Major Source Operating Permit Program (40 CFR Part 70) is administered by the state or local jurisdiction where the source is located, and the permits are often referred to as Title 70 permits. For facilities in attainment areas, those facilities with the potential to emit (PTE) greater than 100 tons per year (tpy) for criteria pollutants, 10 tpy for any single hazardous air pollutant (HAP), or 25 tpy for total combined HAPs are subject to the Title V program. Title V applies as described below.

- **Compressor Station 106:** This existing compressor station is currently a major source for Part 70 purposes. The facility's NOx, CO, volatile organic compound (VOC), single HAP, and total HAP emissions would continue to exceed the Part 70 major source thresholds after the Project is placed in service.
- **Compressor Station 114:** This existing facility is currently a major source for purposes of Part 70 permit applicability. Because all major existing emissions units would be retired, Compressor Station 114 would fall below all Part 70 major source thresholds as a result of the Project.
- **New Compressor Stations 118A, 119A, and 875:** The emissions for these compressor stations would be below all major source thresholds, and therefore, Part 70 permitting is not applicable.
- **New Compressor Station 563**: Major source thresholds for NO_x and CO would be exceeded by the compressor station; therefore, the facility is subject to Part 70 permitting requirements, but would be classified as an area source for HAP purposes.

Prevention of Significant Deterioration Requirements

The New Source Review federal regulatory program includes the PSD regulations, which are intended to protect national public health and welfare while preserving the existing air quality in areas of special national or regional scenic, natural, recreational, or historic value where regulated pollutant levels are in compliance with the NAAQS (i.e., attainment areas). For existing major PSD sources, modifications that exceed the PSD significant emissions increase rates are subject to the PSD regulations. For sources like the Project's compressor stations, a PSD major source is one that emits or has the potential to emit any PSD-regulated pollutant equal to or greater than 250 tpy. PSD regulations would apply as described below.

- **Compressor Station 106**: This compressor station is classified as an existing PSD major source because of its PTE; however, based on the Project's net emissions increases, the proposed modification would not trigger PSD; therefore, no additional PSD review is needed.

- **Compressor Station 114**: This compressor station is considered an "existing major source" for PSD. The Project's net emissions increases would not exceed the emissions increase threshold. Therefore, the Project would not trigger PSD applicability and no further PSD review is needed.
- **New Compressor Stations 118A, 119A, 563, and 875:** The PTE for each of these new compressor stations would fall below the PSD major source threshold. Therefore, no PSD review is required.

New Source Performance Standards Requirements

The New Source Performance Standards are set forth by the EPA at 40 CFR Part 60, Subparts A through OOOO and each applies to specific sources of air pollution. The relevant subparts are described below.

- Subpart A – Applies to operators of stationary sources, such as the combustion turbines and emergency generators that are subject to the New Source Performance Standards.
- Subpart JJJJ – Applies to stationary spark-ignition internal combustion engines installed or modified after June 12, 2006, such as the emergency generators for the Project.
- Subpart KKKK – Applies to stationary combustion turbines with peak loads equal to or greater than 10 million British Thermal Units, such as the new turbines proposed for the Project.
- Subpart OOOO – Applies to certain activities at crude oil and natural gas production, transmission, and distribution facilities. Based on the Project and Subpart OOOO applicability criteria, Subpart OOOO is not anticipated to apply to any of the compressor stations.

The equipment at each of the compressor stations would be procured, installed, maintained, and operated such that compliance with these requirements is met.

National Emissions Standards for Hazardous Air Pollutants

The National Emission Standards for Hazardous Air Pollutants (NESHAP) regulations established in 40 CFR Parts 61 and 63 regulate emission of air toxics. Part 63 NESHAP standards primarily apply to major sources of HAP, though some subparts of Part 63 include non-major area sources. The relevant subparts are described below.

- 40 CFR Part 61 Subpart M – Applies to project demolition and/or renovation activities that include asbestos.
- 40 CFR Part 63 Subpart YYYY – Applies to stationary combustion turbines at major sources of HAP emissions. Major sources of HAPs include any facility with the potential to emit 25 tpy of total HAPs or 10 tpy of any single HAP.
- 40 CFR Part 63 Subpart ZZZZ – Applies to reciprocating internal combustion engines, such as the Project's emergency generators. With the exception of Compressor Station 106, because the emergency generators for the Project would comply with 40 CFR 60 Subpart JJJJ and each station is in an area source for Part 63 purposes, no further requirements apply under 40 CFR Part 63 Subpart ZZZZ.

- 40 CFR Part 63 Subpart DDDDD – Subpart DDDDD applies only to boilers at major sources. All compressor stations are area sources. Subpart JJJJJJ applies to boilers at area sources, but exempts natural gas fired boilers. Therefore, neither applies to the Project.
- These regulations would apply to the various compressor stations as described below.
- 40 CFR Part 61, Subpart M applies regardless of Part 63 status.
- Compressor Station 106: This compressor station would continue to be a major HAP source. Therefore, Subpart YYY and the major source provisions of Subpart ZZZZ would apply.
- Compressor Station 114: Because the compressor station would become an area source as a result of the Project, only the third bullet item above would apply.
- Compressor Stations 118A, 119A, 563 and 875: Each of these new compressor stations would be area sources for Part 63 purposes. Therefore, only the third bullet item above would apply.

Greenhouse Gas Reporting Rule

Petroleum and natural gas facilities with GHG emissions equal to or greater than 25,000 metric tons of CO_2e are required to report GHGs from various processes within the facility per 40 CFR Part 98, Subpart W. The following GHG rule applies.

- All existing and new compressor stations: Because the compressor stations potentially could emit CO_2e in excess of 25,000 metric tons, they may be subject to this rule.

General Conformity

Federal actions are subject to the thresholds provided in Subpart B of 40 CFR Part for determining conformity of these actions to state or federal Implementation Plans. However, these conformity levels apply to nonattainment areas and maintenance areas. Because the Project would be in attainment areas, it is not subject to the General Conformity standards. The General Conformity Thresholds are provided in table 2-25 to give some scale to the emissions estimates.

Table 2-25

General Conformity Thresholds

Pollutant/Nonattainment area	Tons/Year
O_3 (VOCs or NO_x)	
Serious NAAs	50
Severe NAAs	25
Extreme NAAs	10
Other O_3 NAAs outside an Ozone Transport Region	100
Other O_3 NAAs inside an Ozone Transport Region	
VOC	50
NO_x	100
Carbon monoxide: All NAAs	100
SO_2 or NO_2: All NAAs	100
PM_{10}	
Moderate NAAs	100
Serious NAAs	70
$PM_{2.5}$	
Direct emissions	100
SO_2	100
NO_x (unless determined not to be a significant precursor)	100
VOC or ammonia (if determined to be significant precursors)	100
Pb: All NAAs	25

_____

NO_2 = nitrogen dioxide
Source: EPA (2004)

State of Kentucky

For the two new and two modified existing compressor stations in Kentucky, portions of the following state requirements would potentially apply:

- 401 KAR Chapter 50 – Division for Air Quality; General Administrative Procedures;
- 401 KAR Chapter 51 – Attainment and Maintenance of the NAAQS;
- 401 KAR Chapter 52 – Permits, Registrations, and Prohibitory Rules (including the State Only permit);
- 401 KAR Chapter 53 – Ambient Air Quality;
- 401 KAR Chapter 57 – Hazardous Pollutants (40 CFR Part 61);
- 401 KAR Chapter 58 – Asbestos;
- 401 KAR Chapter 59 – New Source Standards;
- 401 KAR Chapter 60 – New Source Performance Standards;
- 401 KAR Chapter 61 – Existing Source Standards (Existing Equipment Only); and
- 401 KAR Chapter 63 – General Standards of Performance – NESHAPs.

State of West Virginia

For the new compressor stations in West Virginia, relevant state requirements would include:

- 45 CSR 4 – To Prevent and Control the Discharge of Air Pollutants into the Air Which Causes or Contributes to an Objectionable Odor;
- 45 CSR 8 – Ambient Air Quality Standards;
- 45 CSR 10 – To Prevent and Control Air Pollution from the Emission of Sulfur Oxides;
- 45 CSR 13 – Permits for Construction, Modification, Relocation and Operation of Stationary Sources of Air Pollutants;
- 45 CSR 16 – Standards of Performance for New Stationary Sources;
- 45 CSR 29 – Rule Requiring the Submission of Emissions Statements for Volatile Organic Compounds Emissions and Oxides of Nitrogen Emissions;
- 45 CSR 34 – Emission Standards for Hazardous Air Pollutants; and
- 45 CSR 35 – Determining Conformity of General Federal Actions to Applicable Implementation Plans (General Conformity).

Metropolitan Government of Nashville and Davidson County, Tennessee

For the new compressor station in the regional area of Metropolitan Government of Nashville and Davidson County, Tennessee (Compressor Station 563), the applicable regional requirements would include:

- Metropolitan Code of Law Chapter 10.56 – Air Pollution Control:
  - Section 10.56.020: Construction Permits;
  - Section 10.56.040: Operating Permit;
  - Section 10.56.080: Permit and Annual Emission Fees;
  - Section 10.56.160: Ambient Air Quality Standards;
  - Section 10.56.160: Emission of Gases, Vapors or Objectionable Odors;
  - Section 10.56.210: Hazardous Air Pollutants;
  - Section 10.56.240: Internal Combustion Engines;
  - Section 10.56.260: Process Emissions;
  - Section 10.56.270: Visible Emissions; and
  - Section 10.56.280: Start-ups, Shutdowns and Malfunctions;
- Metropolitan Health Department Division of Pollution Control Regulation No. 4 – Regulation for Control of Hazardous Air Pollutants;
- Metropolitan Health Department Division of Pollution Control Regulation No. 5 – Standards of Performance for New Stationary Sources;
- Metropolitan Health Department Division of Pollution Control Regulation No. 13 – Part 70 Operating Permit Program; and

- Metropolitan Health Department Division of Pollution Control Regulation No. 14 – Regulation for Control of Nitrogen Oxides.

2.8.5 Air Quality Impacts

Construction Emissions and Impacts

A temporary impact on ambient air quality from construction emissions and fugitive dust may result from the Project. Emissions and fugitive dust would result from use of fossil-fueled construction equipment. In general, these emissions would be temporary, localized, and insignificant. Emissions of PM_{10} and $PM_{2.5}$ would represent the majority of air emissions during construction, primarily in the form of fugitive dust. Fugitive dust would be generated from land clearing, grading, excavation, concrete work, and vehicle traffic on paved and unpaved roads. Emissions would be variable, but would be greater during dry periods and in areas of fine-textured soils subject to surface activity.

Table 2-26 provides the construction emissions estimates for the Project by facility and county. The emission factors used in the construction emission calculations are from MOVES2014 (EPA, 2014g), EPA-published AP-42 data (EPA, 2014h) and, where appropriate, the most up-to-date formulation from NONROAD2008 (EPA, 2014i).

Table 2-26

Project Emissions from Construction by Facility and County

Facility (County, State)	Total Site Emissions (tons/year)							
	NO_x	VOC	CO	SO_2	PM_{10}	$PM_{2.5}$	GHGs	HAPs
CS 106 (Powell, KY)	15.44	1.34	11.54	0.022	10.58	2.30	972.09	0.30
CS 114 (Boyd, KY)	17.40	1.51	9.35	0.021	56.59	6.21	998.78	0.37
CS 118A (Kanawha, WV)	18.05	1.59	12.03	0.020	42.27	5.69	963.29	0.37
CS 119A (Kanawha, WV)	26.27	2.04	15.90	0.025	69.70	9.11	2,059.35	0.52
CS 875 (Madison, KY)	31.35	2.65	15.81	0.03	59.46	8.43	1,514.92	0.62
CS 563 (Davidson, TN)	20.58	1.93	15.80	0.02	33.20	5.09	1,176.33	0.45
Conformity de Minimis	**100**	**100**	**-**	**100**	**100**	**100**	**-**	**-**

Operation Emissions and Impacts

Operational emissions would permanently affect ambient air quality as a result of the Project. As detailed in section 1.0, the Project consists of four new compressor stations and modifications at two existing stations to provide additional compression. Generally, operational Project air quality emissions would result from new natural gas fired reciprocating engines, emergency generators, and negligible emissions from ancillary equipment. Dispersion modeling, using the EPA's AERMOD model, was conducted for these new and modified emissions sources. The dispersion modeling effort was not performed for SO_2 or PM_{10}. Because of the use of natural gas fuel and the low resulting SO_2 and Pb emissions, the impact of the Project on SO_2 and Pb concentrations was assumed to be negligible. Additionally, because the $PM_{2.5}$ standard is more stringent than the PM_{10} standard, modeled compliance for $PM_{2.5}$ demonstrates modeled compliance for PM_{10}. A summary of the maximum, or worst case, modeled impacts for nitrogen dioxide (NO_2), $PM_{2.5}$, and CO is shown in table 2-27 for each of the compressor stations.

As table 2-27 shows, operational emissions from the Project would be well below the NAAQS. Furthermore, emissions at the existing compressor stations (Compressor Stations 106 and 114) would be greatly reduced and, therefore, a net benefit to ambient air quality would result from the Project.

Table 2-27

Emissions from Project Operation by Facility and County

			Total Site Emissions (tons/year)			
Facility ID	**Pollutant**	**Averaging Period**	**Modeled NAAQS Impact (µg/m³)**	**Background Monitor Concentration (µg/m³)**	**Total (µg/m³)**	**NAAQS (µg/m³)**
CS 106 (Powell, KY)	NO_2	1-Hour	10.86	85.2	96.1	188
		Annual	0.28	15.7	16.0	100
	$PM_{2.5}$	24-Hour	0.39	19.0	19.4	35
		Annual	0.04	8.7	8.7	12
	CO	1-Hour	21.61	1,718	1,740	40,000
		8-Hour	13.78	1,145	1,159	10,000
CS 114 (Boyd, KY)	NO_2	1-Hour	14.39	85.2	99.6	188
		Annual	0.22	15.7	15.9	100
	$PM_{2.5}$	24-Hour	0.22	21.3	21.6	35
		Annual	0.031	10.4	10.4	12
	CO	1-Hour	31.21	1,718	1,749	40,000
		8-Hour	8.32	1,145	1,153	10,000
CS 118A (Kanawha, WV)	NO_2	1-Hour	38.00	85.2	123.2	188
		Annual	0.48	15.7	16.2	100
	$PM_{2.5}$	24-Hour	0.25	22.3	22.6	35
		Annual	0.040	10.9	10.9	12
	CO	1-Hour	50.20	2,977	3,027	40,000
		8-Hour	12.10	1,832	1,844	10,000
CS 119A (Kanawha, WV)	NO_2	1-Hour	36.60	85.2	121.8	188
		Annual	1.33	15.7	17.0	100
	$PM_{2.5}$	24-Hour	0.79	22.3	23.1	35
		Annual	0.12	10.9	11.0	12
	CO	1-Hour	85.37	2,977	3,062	40,000
		8-Hour	23.11	1,832	1,855	10,000
CS 875 (Madison, KY)	NO_2	1-Hour	7.12	85.2	92.32	188
		Annual	0.16	15.7	15.9	100
	$PM_{2.5}$	24-Hour	0.08	19.0	19.1	35
		Annual	0.012	8.7	8.7	12
	CO	1-Hour	15.94	3,321	3.337	40,000
		8-Hour	6.28	2,176	2,182	10,000
CS 563 (Davidson, TN)	NO_2	1-Hour	31.23	48.1	79.3	188
		Annual	0.65	14.0	14.7	100
	$PM_{2.5}$	24-Hour	0.68	19.6	20.3	35
		Annual	0.04	9.7	9.7	12
	CO	1-Hour	31.69	2,176	2,208	40,000
		8-Hour	25.21	1,718	1,743	10,000

2.8.6 Air Quality Mitigation Measures

Tennessee has committed to mitigate impacts on ambient air quality from Project construction and operational emissions by:

- equipping each compressor station turbine with SoLoNOx™ (a lean-premixed combustion technology that ensures uniform air/fuel mixture and prevents formation of regulated pollutants) to reduce NO_x emissions;
- maintaining turbine combustion efficiency following manufacturer's recommendations for scheduled maintenance to reduce emissions;
- testing and repairing pressure safety valves regularly to reduce CH4 and other emissions;
- using water for dust control during demolition of buildings or structures, grading of roads, clearing lands, and during general construction operations to reduce fugitive dust emissions;
- using water on dirt and gravel access roads, material stockpiles, and other surfaces that may result in fugitive dust emissions;
- maintaining access roads in good working condition to reduce fugitive dust;
- removing of earth or other material from paved streets that may otherwise result in fugitive dust emissions;
- covering haul trucks with tarps, as needed, to reduce fugitive dust emissions;
- using paved roads when possible for construction vehicle traffic;
- keeping vehicle speeds low to reduce fugitive dust generation; and
- maintaining construction equipment and vehicles according to equipment manufacturer's specifications and complying with applicable standards to reduce emissions.

Potential impacts on air quality associated with construction and operation of the Project would be minimized by adherence to all applicable federal and state regulations. Based on the analysis presented above, we believe that the Project would have no significant impact on regional air quality.

2.9 Noise

Federal regulatory agencies typically assess noise impacts using two sound metrics: the equivalent sound level (L_{eq}) and the day-night sound level (L_{dn}). The energy of noise is measured in decibels (dB). The units presented for all sound levels in this section are dBA, which filters noise frequencies to characterize the human ear's response to sound. Human hearing can detect a 3 dBA change with a 5 dBA change being readily noticeable. Humans perceive a 10 dBA change in noise level as a doubling or halving of noise. The L_{eq} is the energy averaged sound level for a given period of time, for example hourly or a 24-hour period. An L_{dn} is also time averaged, but sound levels occurring during nighttime hours (that is, 10:00 PM to 7:00 AM) incur a penalization of an additional 10 dBA to account for greater sensitivity, such as sleep disturbance, during these times. An L_{dn} of 55 dBA is equivalent to a continuous L_{eq} noise level of 48.6 dBA. Table 2-28 provides sound pressure levels and relative loudness of typical noise sources.

Table 2-28

Sound Pressure Levels and Relative Loudness of Typical Noise Sources

Noise Source or Activity	Sound Level (dBA)	Subjective Impression	Relative Loudness (perception of different sound levels)
Jet aircraft takeoff from carrier (50 ft)	140	Threshold of pain	64 times as loud
50 hp siren (100 ft)	130		32 times as loud
Loud rock concert near stage or Jet takeoff (200 ft)	120	Uncomfortably loud	16 times as loud
Float plane takeoff (100 ft)	110		8 times as loud
Jet takeoff (2,000 ft)	100	Very loud	4 times as loud
Heavy truck or motorcycle (25 ft)	90		2 times as loud
Garbage disposal, food blender (2 ft), or Pneumatic drill (50 ft)	80	Loud	Reference loudness
Vacuum cleaner (10 ft)	70	Moderate	1/2 as loud
Passenger car at 65 mph (25 ft)	65		
Large store air-conditioning unit (20 ft)	60		1/4 as loud
Light auto traffic (100 ft)	50	Quiet	1/8 as loud
Quiet rural residential area with no activity	45		
Bedroom or quiet living room or bird calls	40	Faint	1/16 as loud
Typical wilderness area	35		
Quiet library, soft whisper (15 ft)	30	Very quiet	1/32 as loud
Wilderness with no wind or animal activity	25	Extremely quiet	
High-quality recording studio	20		1/64 as loud
Acoustic test chamber	10	Just audible	
	0	Threshold of hearing	

Adapted from Beranek (1988) and EPA (1971).

We received a number of comments voicing concerns that noise from operation of the Project, and to a lesser extent construction of the Project, would result in damage to human and/or domesticated animal health or substantially change the acoustic environment. The concerns about changes to the acoustic environment focused on disruptions to peace and tranquility common to the rural areas of the Project. This section focuses on the effects of Project noise on humans. Effects on wildlife from Project noise are addressed in section 2.3.

2.9.1 Regulatory Requirements

In 1974, the EPA published *Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety* (EPA, 1974). This publication evaluates the effects of environmental noise with respect to health and safety. The document provides information for state and local governments to use in developing their own ambient noise standards. The EPA has determined that in order to protect the public from activity interference and annoyance outdoors in residential areas, noise levels should not exceed an L_{dn} of 55 dBA. We have adopted this criterion for the operational modifications to existing compressor stations and new compressor stations proposed for the Project. We also implement this criterion for some construction processes, such as horizontal directional drilling; however, no such construction process is proposed for this Project. General construction is not evaluated against the 55 dBA L_{dn} criterion.

There are no state noise regulations that would apply to the Project. Davidson County, Tennessee prescribes a noise level limit of 75 dBA L_{eq} at the property line of an industrial facility or agricultural operation via their Code of Ordinances Section 17.28.090 (Metro Government, 2015b). No other local jurisdictions have quantitative noise regulations that would apply to the Project.

2.9.2 Construction Noise and Vibration Impacts

Construction of the Project would result in temporary, localized elevated noise levels from the use of heavy construction equipment. Construction would last 9 months to 1 year. Table 2-29 provides the predicted construction noise levels at the nearest noise sensitive areas (NSA) based on acoustic modeling of worst case conditions during earth moving and clearing.

Table 2-29

Predicted Project Construction Noise Levels

Compressor Station	Distance and Direction of NSA to Site Center (feet)	Predicted Construction L_{dn} (dBA)
CS 106	1,400 east	55.8
	1,880 southeast	47.6
	2,930 south/southeast	42.0
	3,230 southwest	46.3
	2,700 northwest	47.3
	1,900 northeast	43.2
	1,290 east/northeast	55.9
CS 114	1,400 west	56.3
	1,560 west/northwest	55.7
	1,850 east/northeast	46.4
CS 118A	1,720 north	27.1
	1,950 southeast	46.0
	2,130 east	28.7
	2,630 west/southwest	24.2
CS 119A	1,890 northwest	26.5
	2,340 northeast	24.4
	2,490 southeast	23.5
	2,770 southwest	42.1
CS 563	1,080 northwest	57.8
	1,060 south	57.6
	1,040 southwest	59.9
	1,390 north	50.3
CS 875	2,050 north	49.5
	2,310 northeast	44.5
	2,835 east/northeast	41.8
	2,820 southeast	42.0
	2,120 south	45.2
	1,265 southwest	51.0
	1,635 west	54.4
	2,380 northwest	49.9

Temporary increases in noise levels due to construction are predicted to be perceptible at nearby NSAs (e.g., residences), but would be partially mitigated by conducting construction during daytime hours to the extent practicable. Additionally, Tennessee would keep construction equipment in good working order and functioning in accordance with manufacturers' specifications. Because construction noise is temporary, localized, and would cease once the Project is constructed, we conclude that no significant impacts would result from construction noise associated with the Project.

Blasting would be required to construct Compressor Station 118A and could be required at Compressor Station 119A, if harder than anticipated rock formations are discovered at the site. During blasting, Tennessee would place perimeter monitors along the property lines to monitor the energy and seismographs at varying intervals where blasting is conducted to ensure substantial shear waves are not generated by the blasting. In addition, monitoring personnel would be on site during blasting activities to document perimeter pressure wave measurements. Because exact locations and sizes of blasting charge weights have not been established, it is not possible to make accurate predictions of blasting noise at nearby NSAs. The closest NSA to Compressor Station 118A is 1,720 feet from the proposed compressor building, and the closest NSA to Compressor Station 119A is 1,890 feet from the proposed compressor building. Though very short-term ground-borne vibration due to blasting might be perceptible at these distances, the levels would be reduced by distance such that blasting would have no significant impact on structures or residents.

Other than blasting, Tennessee would use conventional construction techniques, which generally do not result in perceptible levels of ground-borne vibration since levels attenuate quickly with distance. Therefore, we conclude that ground-borne vibration would not be significant at the NSAs during the construction phase.

2.9.3 Operation Noise and Vibration Impacts

Significant noise sources at the compressor stations would include turbine-compressor casing noise that penetrates the compressor building, turbine exhaust and air intake systems, lube oil coolers, a gas aftercooler, and aboveground piping and components. Three-dimensional acoustic models were used to analyze potential operational noise impacts at NSAs in the vicinity of the Project compressor stations.

At existing Compressor Stations 106 and 114, acoustic modeling was used to determine the sound levels from existing equipment at the nearest NSAs. These levels were confirmed via field measurements and used to validate the existing compressor station contributions. The acoustic modeling of the existing stations was then adjusted to account for removal of existing equipment and addition of new equipment as part of the Project.

Tennessee conducted preconstruction sound surveys and estimated the sound levels at nearby NSAs that would result from operation of the existing modified and new compressor stations (see table 2-30).

Table 2-30

Location of Nearest Noise Sensitive Areas and Estimated Noise Levels from Operation of the Project

Compressor Station	Distance and Direction of NSA to Site Center (feet)	Ambient L_{dn} (dBA) [a]	Compressor Station Operating L_{dn} (dBA)	Compressor Station Operating plus Ambient L_{dn} (dBA) [b]	Increase in Ambient Noise Level (dB)
CS 106	1,400 east	74.7	47.0	58.3	-16.4
	1,880 southeast	66.5	44.9	56.3	-10.2
	2,930 south/southeast	60.9	42.5	54.6	-6.3
	3,230 southwest	61.1	44.9	60.7	-0.4
	2,700 northwest	60.0	43.9	57.1	-2.9
	1,900 northeast	63.1	39.1	60.4	-2.7
	1,290 east/northeast	68.3	48.3	62.6	-5.7
CS 114	1,400 west	53.1	54.7	57.0	-0.3
	1,560 west/northwest	53.2	52.3	55.8	-1.0
	1,850 east/northeast	58.5	48.0	58.9	-0.1
CS 118A	1,720 north	49.8	24.0	49.8	0.0
	1,950 southeast	46.0	44.0	48.1	2.1
	2,130 east	53.3	31.3	53.3	0.0
	2,630 west/southwest	38.9	26.4	39.1	0.2
CS 119A	1,890 northwest	55.0	24.0	55.0	0.0
	2,340 northeast	42.8	29.8	43.0	0.2
	2,490 southeast	51.0	24.0	51.0	0.0
	2,770 southwest	45.7	40.7	46.9	1.2
CS 563	1,080 northwest	48.2	50.0	52.2	4.0
	1,060 south	51.6	49.7	53.8	2.2
	1,040 southwest	54.1	51.7	56.1	2.0
	1,390 north	51.3	46.5	52.5	1.2
CS 875	2,050 north	52.3	41.8	52.7	0.4
	2,310 northeast	52.3	39.6	52.5	0.2
	2,835 east/northeast	52.3	37.4	52.4	0.1
	2,820 southeast	52.3	40.1	52.6	0.3
	2,120 south	52.3	40.7	52.6	0.3
	1,265 southwest	52.3	47.4	53.5	1.2
	1,635 west	52.3	46.1	53.2	0.9
	2,380 northwest	52.3	41.6	52.7	0.4

[a] Ambient refers to the measured sound level at the nearest NSAs.
[b] Operational refers to the operational noise associated with the new and or modified compressor stations.

The new equipment that would be installed at the existing stations and the new compressor stations has been designed to comply with the FERC regulatory limits and local noise limits where applicable. The operational acoustic emissions analyzed for the Project are for new equipment only and legacy equipment at the existing compressor stations would continue to operate as currently configured. Additionally, the modifications at Compressor Stations 106 and 114 would result in lower operational noise compared to what is currently operated, thus resulting in a net benefit to nearby NSAs. At all but three of the nearest NSAs to the Project, sound levels would change by less than 3 dBA, which is not perceptible to average human hearing.

The estimated noise impacts for the compressor stations incorporate mitigation measures. The turbines and turbine-driven compressors would be installed within acoustically designed buildings, including sound insulated metal roofs, walls, and roll-up doors. Building vent silencers and solar turbine inlet and exhaust custom silencers would also be incorporated. Above ground piping would include lagging, which is composite material used to reduce flow noise levels in pipes.

Based on the noise analysis above, noise levels attributable to operation of the Project would be less than 55 dBA L_{dn} at all of the NSAs. To ensure that the noise from the compressor stations does not exceed an L_{dn} of 55 dBA at the nearest NSAs, **we recommend that:**

- **Tennessee should file a noise survey with the Secretary no later than 60 days after placing each compressor station into service. If a full power load condition noise survey is not possible, Tennessee should provide an interim survey at the maximum possible power load and provide a full power load survey within 6 months. If the noise attributable to the operation of the Project equipment under interim or full power load exceeds an L_{dn} of 55 dBA at any nearby NSA, Tennessee should:**

  c. file a report on what changes are needed;

  d. install additional noise controls to meet the level within 1 year of the in-service date; and

  e. confirm compliance with this requirement by filing a second full power noise survey with the Secretary no later than 60 days after it installs the additional noise controls.

Noise would also be generated during blowdown events, which may be required if any of the compressor stations have extended periods of inactivity. Blowdown events are used to release pressure in the compressor casing and unit piping in a controlled manner. These events would each last for about 1 minute and would be mitigated by using a blowdown silencer designed to limit the sound levels to 55 dBA L_{eq} or less. Table 2-31 provides the predicted blowdown sound levels at NSAs. Because Tennessee would implement the silencer and because the blowdown events would last for a relatively short duration, the accompanying sound levels would have little effect on the L_{dn} at any of the NSAs.

Table 2-31

Predicted Blowdown Sound Levels at Noise Sensitive Areas

Compressor Station	Distance and Direction of NSA to Compressor Building (feet)	Estimated Contribution of Blowdown (L_{eq} dBA)
CS 106	1,400 east	53.4
	1,880 southeast	46.1
	2,930 south/southeast	42.1
	3,230 southwest	49.7
	2,700 northwest	50.1
	1,900 northeast	44.6
	1,290 east/northeast	54.1
CS 114	1,400 west	49.9
	1,560 west/northwest	43.2
	1,850 east/northeast	48.7

Table 2-31

Predicted Blowdown Sound Levels at Noise Sensitive Areas

Compressor Station	Distance and Direction of NSA to Compressor Building (feet)	Estimated Contribution of Blowdown (L_{eq} dBA)
CS 118A	1,720 north	27.1
	1,950 southeast	53.4
	2,130 east	28.2
	2,630 west/southwest	25.5
CS 119A	1,890 northwest	27.1
	2,340 northeast	29.0
	2,490 southeast	25.0
	2,770 southwest	42.3
CS 563	1,080 northwest	50.2
	1,060 south	50.5
	1,040 southwest	50.1
	1,390 north	50.6
CS 875	2,050 north	43.9
	2,310 northeast	39.0
	2,835 east/northeast	36.5
	2,820 southeast	36.9
	2,120 south	36.9
	1,265 southwest	55.8
	1,635 west	52.6
	2,380 northwest	47.4

Ground-borne vibration is not anticipated from blowdown events; however, low frequency sound associated with the blowdown events may be perceived at NSAs as ground-borne vibration.

Based on the noise analyses above and our recommendation, we conclude that operation of the Project would not have a significant impact on the noise environment in the vicinity of the compressor stations.

2.10 Reliability and Safety

The pressurization of natural gas at a compressor station involves some risk to the public in the event of an accident and subsequent release of gas. The greatest hazard is a fire or explosion following a leak or rupture at the facility. Methane, the primary component of natural gas, is colorless, odorless, and tasteless. It is not toxic, but is classified as a simple asphyxiate, possessing a slight inhalation hazard. If breathed in high concentration, oxygen deficiency can result in serious injury or death.

The compressor stations must be designed, constructed, operated, and maintained in accordance with the DOT Minimum Federal Safety Standards in 49 CFR Part 192. The regulations are intended to ensure adequate protection for the public and to prevent facility accidents and failures.

Part 192.163–192.173 of 49 CFR specifically addresses design criteria for compressor stations, including emergency shutdowns and safety equipment. Part 192 also requires a pipeline operator to establish a written emergency plan that includes procedures to minimize the hazards in an emergency.

Additionally, the operator must establish a continuing education program to enable the public, government officials, and others to recognize an emergency at the facility and report it to appropriate public officials. Tennessee would provide the appropriate training to local emergency service personnel before the facilities are placed in service.

We received comments expressing concern about the safety of high pressure gas pipelines. Natural gas pipelines must be operated and maintained in accordance with the DOT Minimum Federal Safety Standards in 49 CFR 192. The regulations are intended to ensure adequate protection for the public and to prevent natural gas facility accidents and failures. The DOT specifies material selection and qualification; minimum design requirements; and protection from internal, external, and atmospheric corrosion. Any natural gas facility has some degree of risk and, although any structure will eventually degrade, the DOT rules require regular inspection and maintenance, including repairs as necessary, to ensure the pipeline has adequate strength to transport the natural gas safely.

Under an MOU on Natural Gas Transportation Facilities dated January 15, 1993, between the DOT and the FERC, the DOT has the exclusive authority to promulgate federal safety standards used in the transportation of natural gas. Section 157.14(a)(9)(vi) of the FERC's regulations require that an applicant certify that it will design, install, inspect, test, construct, operate, replace, and maintain the facility for which a Certificate is requested in accordance with federal safety standards and plans for maintenance and inspection. Alternatively, an applicant must certify that it has been granted a waiver of the requirements of the safety standards by the DOT in accordance with Section 3(e) of the Natural Gas Pipeline Safety Act. The FERC accepts this certification and does not impose additional safety standards. If the Commission becomes aware of an existing or potential safety problem, there is a provision in the Memorandum to promptly alert DOT. The MOU also provides for referring complaints and inquiries made by state and local governments and the general public involving safety matters related to pipelines under the Commission's jurisdiction. The FERC also participates as a member of the DOT's Technical Pipeline Safety Standards Committee which determines if proposed safety regulations are reasonable, feasible, and practicable.

As described in section 2.1.2, although Tennessee completed remediation of PCB-contaminated materials and soil at Compressor Stations 106 and 114, residual PCB contamination remains. The RPMMs for Compressor Stations 106 and 114 identify areas where PCBs remain and specify procedures for maintenance activities, which include removal or demolition. Worker safety for handling PCBs is included. The RPMMs contain procedures for removal and disposal of soil, drain lines, and low-contact building surfaces; however, compressor units and associated equipment are not included. Therefore, **we recommend that:**

- **<u>Prior to any abandonment activities at Compressor Stations 106 and 114</u>, Tennessee should file the following information with the Secretary for review and written approval by the Director of OEP:**

  a. identification of any equipment, including compressor units and piping, proposed for abandonment that may be contaminated with PCBs;

  b. verification that the appropriate PCB testing would be conducted on this equipment, and discussion of how any abandoned PCB-contaminated facilities would be properly disposed of; and

  c. measures to be implemented to provide adequate worker safety for handling PCB-contaminated materials.

Older compressor station piping and associated pipeline tie-ins could have been coated with asphalt material that may also contain asbestos. Such asbestos-containing materials (ACM) may be present on the facilities proposed to be abandoned at Compressor Stations 106 and 114. ACMs may also have been used in insulation materials in and around compressors. Tennessee has not identified measures it would take to identify facilities to be abandoned that may have ACMs, provide worker safety while working with ACMs, or provide for the proper disposal of any ACM containing facilities. Therefore, **we recommend that:**

- **Prior to any abandonment or construction activities at Compressor Stations 106 and 114, Tennessee should file the following information with the Secretary for review and written approval by the Director of OEP:**

  a. identification of any known facilities to be abandoned or disturbed having ACMs;

  b. protocols to comply with the appropriate requirements to identify ACMs that might be encountered;

  c. if facilities with ACMs would be abandoned or disturbed, methods to separate the ACMs for proper disposal; and

  d. protocols for worker protection and proper disposal of ACMs.

Tennessee's construction and operation of Compressor Stations 106, 114, 118A, 119A, 875, and 563 would represent a minimum increase in risk to the nearby public, and we are confident that with implementation of the required design criteria for these compressor stations, Tennessee would construct and operate the facilities safely.

2.11 Cumulative Impacts

In accordance with NEPA and FERC policy, we evaluated the potential for cumulative effects of the Project in the context of the proposed action. When added to other past, present, and reasonably foreseeable future activities, cumulative impacts represent the incremental effects of a proposed action regardless of the agency or party undertaking such other actions. Cumulative impacts can result from individually minor but collectively significant actions, taking place over time.

The purpose of this cumulative impacts analysis is to identify and describe cumulative impacts that would potentially result from implementation of the Project. This cumulative impact analysis generally follows the methods set forth in relevant guidance (EPA, 1999; CEQ, 1997) and focuses on potential impacts from the proposed Project on resource areas or issues where their incremental contribution would be potentially significant when added to the potential impacts of other actions. To avoid unnecessary discussions of insignificant impacts and projects and to adequately address and accomplish the purposes of this analysis, an action must first meet the following three criteria to be included in the cumulative analysis:

- impact a resource area potentially affected by the proposed Project;
- cause this impact within all or part of the proposed Project area; and
- cause this impact within all, or part, of the time span for the potential impact from the Project.

Cumulative effects are the incremental effects of a Project when added to the aggregate effects of other past, present, and reasonably foreseeable future actions. For this analysis, the time span is fiscal year (FY) 2016 through FY 2017 for construction-related impacts, and FY 2016 to the future for operations-related impacts. The spatial area, or region of influence, is identified below for each resource area.

Tennessee provided an initial review of potential past, present, and reasonably foreseeable cumulative actions. The review focused on any action within the region of influence developed for each resource area. This research produced the list of 87 potential cumulative actions contained in appendix B. We further reviewed this list against potential Project impacts to develop a realistic understanding of the potential cumulative actions.

We conducted online research of federal, state, and local municipality permit actions; free-access database searches; and communications with local municipalities. The cumulative actions that were defined within the region of influence include: the portion of the non-jurisdictional facilities listed in table 1-3 that would be outside the compressor station footprints, 20 oil and gas projects, 8 coal mining projects, 5 electric utility line projects, 11 water and sewer line projects, 17 transportation projects, 18 commercial projects, 5 residential projects, and 2 other projects. For most resource areas, the present effects of past actions are now part of the existing environment described in sections 2.1 through 2.10. The effects of present and reasonably foreseeable actions are detailed below.

As determined through the analyses provided in sections 2.1 through 2.10, the Project would not result in an appreciable (i.e., more than negligible) change from the existing conditions of geology and soils; groundwater; fisheries; land use, recreation, and visual resources; climate change; and cultural resources. Therefore, we concluded that the Project would not contribute to or result in any significant cumulative impact on these resources. In addition, the Project would result in beneficial socioeconomic impacts.

Resources that have the potential to be cumulatively impacted by the Project, when combined with other past, present, and reasonable foreseeable future actions, include vegetation and wildlife; threatened and endangered species; and noise and air quality resources (see appendix B). However, we determined that no significant, cumulative impacts are expected. In addition, Tennessee would minimize potential adverse effects of the Project by implementing appropriate measures described throughout sections 2.1 through 2.10.

We received comments about ACRP and the UMTP Project. As outlined in the criteria for cumulative impacts discussed above, these two projects do potentially impact some of the same resources geographically. Specifically, they are relevant to the compressor stations in Kentucky and Tennessee, but not West Virginia. Where appropriate, we discuss ACRP and the UMTP Project below.

We received several comments regarding the cumulative effects of upstream hydraulic fracturing and the impacts from that industry on natural resources in the region. These comments have been addressed in section 1.3.

2.11.1 Geology and Soils

Project impacts on geology and soils would be highly localized and limited to the Project footprint during the period of construction. Therefore, the region of influence for cumulative impacts on geology and soils is the footprint of the proposed compressor stations. Cumulative impacts on geology and soils would only occur if other projects are constructed at the same time and place as the proposed facilities or if the facilities are undermined in the future. None of the projects identified in appendix B

would overlap the footprint of the proposed compressor stations with the exception of the ACRP. The ACRP would modify Compressor Station 875, which is proposed as part of the Broad Run Expansion Project. The Project would not result in more than negligible impacts on geology and soils. No soil contamination was found at new compressor station sites or in areas with planned ground disturbing activities at existing compressor stations. No mining occurs at the Project sites and none is planned. Tennessee would also implement BMPs and its ECMP during construction and restoration to minimize the risk of erosion and spills of hazardous materials. Appropriate measures would be taken to identify and properly dispose of any PCB contaminated equipment where facilities would be abandoned at the existing compressor stations, to clean up contaminants that may be discovered during construction, and clean up any spills of hazardous materials during construction. We conclude that cumulative impacts on geology and soils from the Project in consideration with other projects would be minor.

2.11.2 Groundwater

The region of influence considered for cumulative impacts on water resources and wetlands is the watershed boundary (Hydrologic Unit Code [HUC] 12), which contains the proposed Project, as impacts within waters or wetlands could migrate downstream within the watershed. The health of a water system and cumulative impacts are both traditionally assessed on a watershed level. Ten actions identified in appendix B, including, collectively, the non-jurisdictional facilities, would be within watersheds shared by the Project. The Project would not result in impacts on groundwater resources. No sole-source aquifers or WPAs are present. Tennessee would develop an SPCC Plan for each site to limit any effects of potential spills. Groundwater would not be withdrawn as part of construction or operations. Therefore, the Project would not contribute to cumulative effects on groundwater.

2.11.3 Waterbodies and Wetlands

The region of influence considered for cumulative impacts on waterbodies and wetlands is the immediate watershed boundary (HUC 12) surrounding each compressor station, as impacts within waters or wetlands could migrate downstream within the watershed. The Project would result in minor impacts on waterbodies and wetlands. Ten actions identified in appendix B would be within watersheds shared by the Project. Five of those actions (the non-jurisdictional facilities, the ACRP, the UMTP Project, the Broad Run Flexibility Project, and the Kanawha Valley Area Transmission Reinforcement Project) would be constructed within the same timeframe as the Project, resulting in potentially additive sedimentation and erosion impacts on the resource. Those actions are discussed below.

The Project is expected to have minor impacts on waterbodies and wetlands. Compressor station piping would cross one 3-foot-wide ephemeral/intermittent waterbody and access roads or perimeter fencing would cross seven others resulting in largely temporary impacts. About one-third acre of PEM wetland would be permanently filled at Compressor Stations 118A and 119A, combined. The ACRP and UMTP Project would not result in additional wetland impacts at Compressor Stations 118A or 119A, but may impact minor streams within the watersheds of the other compressor stations. The greatest potential for cumulative impacts would come from an increase in sediment loading from construction within or runoff into wetlands or waterbodies, resulting from stream crossings and stormwater runoff. Both the ACRP and UMTP Project would be required by various federal, state, and local agencies to use mitigation measures to minimize erosion and sedimentation into surface water resources. For ACRP, Tennessee would also implement best management practices, including the measures in our Plan and Procedures, to prevent erosion and sediment-laden stormwater from entering the waterbodies. For the UMTP Project, UMTP would follow the Kinder Morgan construction procedures.

The USACE would approve appropriate mitigation for unavoidable temporary and permanent impacts on wetlands for this Project and any wetland impacts to occur within the shared watersheds. The

Project, in combination with past and future projects, is not anticipated to result in significant cumulative impacts on waterbodies and wetlands.

2.11.4 Vegetation, Fisheries, and Wildlife

The region of influence considered for cumulative impacts on vegetation, fisheries, and wildlife is 5 miles surrounding each compressor station due to the localized nature of the Project impacts. Past, present, and reasonably foreseeable actions that could provide additive or cumulative impacts on these resources would include the ACRP, the UMTP Project, non-jurisdictional facilities, coal mining operations, new prospects for coal extraction, water and wastewater upgrades and improvements, and transmission line upgrades (see appendix B). When combined with other actions in the immediate area, the cumulative impacts would include the permanent increase of impervious surfaces, the loss of vegetative ground cover, and the loss of mature forest.

Loss of the existing vegetated ground cover could result in soil erosion and the potential establishment of noxious weeds. Tennessee would implement its Revegetation and Invasive Species Management Plan to mitigate these temporary impacts to negligible levels.

The net increase of 213 acres of impervious surface would result in unavoidable, minor, but long-term adverse impacts on vegetation and decrease the overall percentage of vegetative cover. Sixteen additional actions within the region of influence are expected to create impervious surfaces as a result of construction activities, or operations. These actions would be required to follow local and regional permits and regulations, which require the use of industry-wide BMPs to reduce sedimentation and erosion runoff. Furthermore, county planning offices where each action would be permitted, would also determine whether impacts would be consistent with existing and foreseeable future uses within the region of influence. No change to current land use practices would be anticipated. However, these actions would be cleared through a county planning office where it would be determined whether impacts would be consistent with existing and foreseeable future uses within the region of influence. No change to current land use practices would be anticipated.

The construction of Compressor Stations 118A and 119A would result in the loss of mature forest. Kanawha County, West Virginia is in the Appalachian Mountains where the landscape is dominated by mature upland forest. Forest fragmentation in this area would be exacerbated when combined with other past, present, and future actions in Kanawha County. The Project would result in the permanent loss of mature upland forest, but relative to other activities within Kanawha County, it would not result in a significant long-term cumulative effect on vegetation, fisheries, and wildlife. The Project combined with other actions would also result in the loss of several acres of mature forest at Compressor Stations 106, 114, and 563, resulting in the permanent conversion of forest to industrial land. In addition, 17 other actions within the region of influence including transmission, transportation, and sewer rehabilitation projects are expected within the general timeline of the Project. Although these actions would disturb existing rights-of-way, and not undisturbed forest, the long-term loss of wildlife habitat through forest fragmentation and edge effects would be exacerbated. We do not, however, consider the forest fragmentation effects of the Project to be a significant contribution to the overall cumulative impacts of forest fragmentation.

No perennial streams or waterways with suitable aquatic habitat to support fish populations, fisheries of special concern, or essential fish habitat are within or adjacent to the compressor sites. Due to the lack of suitable aquatic habitat at the compressor station sites, we conclude that the Project would not contribute to cumulative impacts on fish, fisheries of special concern, or essential fish habitat.

2.11.5 Threatened, Endangered, and Other Special Status Species

Similar to vegetation, fisheries, and wildlife discussed above, the region of influence considered for cumulative impacts on threatened, endangered, and special status species is 5 miles surrounding each compressor station due to the localized nature of the impacts. The Project would result in a minor adverse effect on threatened, endangered, and federal- and state-listed species when combined with other past, present, and reasonably foreseeable future actions.

In total, 17 past, present, and reasonably foreseeable actions could contribute to additive or cumulative impacts on these resources. Actions include the ACRP, the UMTP Project, coal mining operations, new prospects for coal extraction, water and wastewater upgrades and improvements, and transmission line upgrades (see appendix B). When combined with other actions in the region of influence, the cumulative impacts would include the permanent increase of impervious surfaces, and the loss of vegetative ground cover. The greatest potential for cumulative impacts to sensitive species would come from loss of forested habitat associated with the ACRP and UMTP Project. Tennessee is consulting with the FWS in each state crossed by the ACRP and UMTP Project and would be required by the FWS to minimize or avoid indirect effects from habitat loss and adhere to seasonal clearing restrictions to avoid direct take of individuals. For the Broad Run Expansion Project, Tennessee has consulted with regional FWS field offices to develop avoidance and mitigation plans as well as a *Myotid Bat Conservation Plan* to offset the loss of potential habitat for the Indiana bat and northern long-eared bat. Although the Project would not affect designated critical habitat, the ACRP and UMTP Project would result in the loss of about 200 acres of forest habitat for the northern long-eared bat and the Indiana bat. However, we find that these indirect effects when combined with mitigation measures for the Project would not significantly contribute to the overall cumulative impacts on these species.

2.11.6 Land Use, Recreation, and Visual Resources

The region of influence considered for cumulative impacts on land use, recreation, and visual resources is a 1-mile radius surrounding each compressor station to encompass the viewshed potentially affected by the Project. The Project would permanently convert pasture and forest to industrial use as the new compressor stations have been sited in rural areas. Tennessee would restore disturbed areas not needed for operations, and would not construct adjacent to residential or commercial structures, or disturb recreational or special interest lands. Construction of the non-jurisdictional power and telephone lines to Compressor Stations 118A, 119A, and 875 would result in pole structures that would likely be visible to nearby residents, but the lines would be similar in nature to existing utilities in the area and would not span large distances. Based on the limited scope and land requirements for the planned power and telephone line facilities and the oversight from permitting authorities, we do not believe the non-jurisdictional power and telephone lines would result in a significant impact on the Project areas. ACRP, the UMTP Project, and two other projects listed in appendix B could also change land use and affect visual resources in the Project areas. Based on the limited scope and land requirements of the components of these projects within 1 mile of the Broad Run Expansion Project, we do not consider that these projects would have a significant impact on Project areas. Therefore, the Project would not contribute to cumulative effects on land use, recreation, or visual resources.

2.11.7 Socioeconomics

For each compressor station, the region of influence considered for cumulative impacts on socioeconomics is the county, as demographic statistics are generally assessed on a county basis. In addition, Cheatham County was added to the region of influence for Compressor Station 563. Of the projects included in appendix B, 63 projects were identified within the region of influence. Twelve of

these projects are anticipated to be constructed during the same time frame as the Broad Run Expansion Project.

The activities associated with these various projects would result in a range of cumulative socioeconomic impacts in the region of influence, such as increased employment and tax revenues. The proposed Project would contribute short-term positive economic impacts during the construction phase. The majority of these benefits would be temporary and minor, including increased activity from construction crews at restaurants, hotels/motels, and retailers. State and local communities would also benefit from local sales and property taxes that Tennessee would pay during ongoing operation of the proposed Project, and indirect and induced impacts within the region of influence. Other major energy projects, infrastructure improvements, and residential/commercial projects in the region of influence, such as the Ridges Residential Development, ACRP and UMTP Project, would likely have similar impacts on the economy during construction. The Blue Grass Army Depot project would contribute positive economic impacts during construction and operation.

Although several projects have the potential to occur within the same counties at the same time, they may be separated by 50 miles or more. As such, adverse impacts on housing, public services, and infrastructure associated with a given project may be localized and not contribute to a cumulative adverse impact countywide. No long-term cumulative impact on infrastructure and public services is anticipated. Because each community is required to collect state sales and use taxes and counties assess annual property taxes, a net positive economic impact on any local community would have a net positive impact at the county and state level as well.

Therefore, we conclude the Project would not contribute to adverse cumulative effects on socioeconomics.

2.11.8 Cultural Resources

The region of influence for cultural resources is a 0.5-mile radius surrounding each compressor station. This region of influence is used because cumulative impacts on cultural resources would only occur if other projects were to affect the same historic properties as the proposed Project. The Project is not expected to impact cultural or historical resources of value. Tennessee has developed plans and mitigation measures in the event a historical artifact is found during construction.

Section 106 of the NHPA requires federal agencies issuing approvals and permits to consider impacts on historic properties. In accordance with 36 CFR 800, an agency must consult with the appropriate SHPOs and Indian tribes, identify historic properties in the APE that may be affected, and resolve adverse effects. Based on the available information for the projects identified, three projects in addition to the non-jurisdictional facilities were identified within the region of influence and are listed in appendix B. These projects, the ACRP, UMTP Project, and the Broad Run Flexibility Project, like the Broad Run Expansion Project, would require federal permits and would therefore be subject to Section 106 of the NHPA. The projects would need to consult with the SHPO, identify historic properties that may be affected, and implement measures to resolve impacts on affected properties. The non-jurisdictional facilities would need to comply with conditions that may be imposed by state permitting agencies with regard to the protection of cultural resources. Since no impacts on cultural resources are anticipated from the proposed Project and given the state and federal laws and regulations that protect cultural resources, we conclude it is not likely that there would be significant cumulative impacts on historic properties resulting from the Project in addition to other actions that may occur in the Project area.

2.11.9 Climate Change

Climate change is the change in climate over time, whether due to natural variability or as a result of human activity, and cannot be represented by single annual events or individual anomalies. For example, a single large flood event or particularly hot summer is not an indication of climate change, while a series of floods or warm years that statistically change the average precipitation or temperature over years or decades may indicate climate change.

The United States Global Change Research Program was established by Presidential Initiative in 1989 and mandated by Congress in the Global Change Research Act of 1990 to "assist the Nation and the world to understand, assess, predict, and respond to human-induced and natural processes of global change." The United States Global Change Research Program notes the following environmental impacts that may be attributed to climate change in the Southeast region:

- rising sea level;
- increasing temperatures and associated increase in frequency, intensity, and duration of extreme heat events; and
- decreased water availability (United States Global Change Research Program, 2014).

GHG emissions are a primary cause of climate change (EPA, 2014j). Of the GHGs emitted, CO_2 is the most prevalent, accounting for 82 percent of all United States emissions in 2012 (EPA, 2014k). Methane (CH_4) is the second most prevalent, accounting for 9 percent of the total United States emissions (EPA, 2014l). Between 1990 and 2012, natural gas and petroleum systems accounted for 29 percent of CH_4 emissions in the United States. Although the amount of CH_4 being emitted into the atmosphere is significantly less than that of CO_2, the comparative impact of CH_4 on climate change over a 100-year period is more than 20 times greater (EPA, 2014m). Fugitive CH_4 emissions are common in natural gas systems and can occur during natural gas production, transmission, storage, and distribution (EPA, 2014n).

Currently there is no standard methodology to determine how the Project's contribution to GHGs would translate into physical effects on the global environment (CEQ, 2014). However, emissions during construction and compressor station emissions during operation of the Project would increase the atmospheric concentration of GHGs, and Tennessee would be required to report CO_2 emissions as discussed in section 2.8. The Project, in combination with past and future emissions from all other sources, is anticipated to contribute incrementally to climate change.

2.11.10 Air Quality

The region of influence considered for cumulative impacts on air quality is at least 50 km surrounding each compressor station, or the AQCR, if applicable. Project construction and other activities in the area would require the use of heavy equipment that would generate emissions of air contaminants and fugitive dust. Operation of the proposed Project when combined with other actions would produce and emit incremental amounts of gases known to degrade air quality. In total, 87 other actions would incrementally degrade air quality within the region of influence. These actions, listed in appendix B, include oil, gas, and coal construction and operation projects, utility projects, transportation projects, and new commercial and residential projects.

Potential air quality impacts were modeled at each compressor station to show how the Project would affect current ambient air quality within the region of influence. Modeling showed that emissions for Compressor Stations 118A, 119A, 114, and 875 would not be high enough to be categorized as a

major source of pollution, and therefore operations would not require a Title V air permit. Emissions from all past and current projects within the region of influence for these compressor stations are well below de minimis thresholds. In addition, modifications at Compressor Station 114 would reduce the current emissions, resulting in a net beneficial impact on current air quality within the region of influence.

Additional compression is planned at Compressor Station 875 as part of the ACRP. If the Broad Run Expansion Project is not authorized, Compressor Station 875 would not be constructed and the ACRP would not modify it. Assuming both projects are approved, cumulative emissions from construction and operation of the additional ACRP compression combined with the Broad Run Expansion Project emissions are shown in table 2-32 and table 2-33, respectively. Combined emissions would be below conformity de minimis and NAAQS thresholds.

Table 2-32

Combined Construction Emissions for CS 875 for Broad Run Expansion Project and ACRP

Facility (County, State)	Total Site Emissions (tons/year)						
	NO_x	VOC	CO	SO_2	PM_{10}	$PM_{2.5}$	GHGs
Construction of CS 875 (Madison, KY)	33.03	3.37	18.06	0.037	68.82	9.5	2,201.92
Conformity de Minimis	**100**	**100**	**-**	**100**	**100**	**100**	**-**

Table 2-33

Combined Emissions from Operation of CS 875 as Proposed for Broad Run Expansion Project and ACRP

			Total Site Emissions (tons/year)			
Facility ID	Pollutant	Averaging Period	Modeled NAAQS Impact ($\mu g/m^3$)	Background Monitor Concentration ($\mu g/m^3$)	Total ($\mu g/m^3$)	NAAQS ($\mu g/m^3$)
CS 875 (Madison, KY)	NO_2	1-Hour	33.90	85.2	119.10	188
		Annual	0.868	15.7	16.6	100
	$PM_{2.5}$	24-Hour	0.62	19	19.6	35
		Annual	0.06	8.7	8.8	12
	CO	1-Hour	38.36	3,321	3,359	40,000
		8-Hour	21.69	2,176	2,198	10,000

Modifications to Compressor Station 106 would also result in a net reduction in air emissions within the region of influence; however, this site would still operate under a Title V permit as a major source of pollution for HAPs. All future actions within the region of influence would be required to comply with federal, state, and local air regulations to control emissions of certain pollutants, designed to ensure compliance with the NAAQS.

Operation of Compressor Station 563 would exceed the Title V major threshold for NO_x. Cumulative actions within Davidson County would be required to comply with federal, state, and local air regulations to control emissions of certain pollutants, designed to ensure compliance with the NAAQS. As a whole, the Project's operational contribution to air emissions would not significantly contribute to cumulative effects on air quality.

2.11.11 Noise

The region of influence for cumulative impacts on noise is 1 mile surrounding each compressor station. Construction noise would be localized and short-term. Tennessee would employ BMPs to reduce sound and vibration from extending outside the construction zone. Additionally, the noise impact analysis showed that noise attenuation from operations would not reach a noticeable level to the closest receptors. Four of the projects listed in appendix B would be within the region of influence for noise. The non-jurisdictional facilities and the UMTP Project would contribute noise during construction. The ACRP and Broad Run Flexibility Project would also contribute additional ongoing noise in the Project area, but would be required to implement mitigation measures to meet the FERC guideline of 55 dBA L_{dn} at the nearest NSA.

At Compressor Station 875, additional compression added as part of the ACRP would result in increased noise levels at the nearest noise sensitive receptors. Specifically, acoustic modeling for the ACRP demonstrates that in combination with the Broad Run Expansion Project, sound levels at the closest noise sensitive receptor would be 49.9 dBA L_{dn}, a level that is below the FERC guideline of 55 dBA L_{dn}. In comparison to the existing sound levels at the closest noise sensitive receptor, this additional compression would result in a change in sound levels of approximately 2 dBA over existing conditions. This sound level is not generally perceptible to human hearing.

Because the estimated sound levels would comply with FERC guidelines and, where applicable, local regulatory noise limits, noise levels attributed to construction and operation of the Project would be negligible. Therefore, we conclude the Project combined with the other projects within the area of influence would have minimal cumulative effects on noise receptors.

2.11.12 Conclusions on Cumulative Impacts

We conclude impacts associated with the Project would be relatively minor, and would be further mitigated by our recommended additional measures to reduce the environmental impacts associated with the Project. A majority of the cumulative impacts identified from other projects or activities in the region of influence would also be temporary and minor. Short-term cumulative benefits would be realized through the creation of jobs and purchase of local goods and services from projects. We find that each of these projects would also result in mostly temporary and minor effects during construction and each current or foreseeable future project would also contribute to small impacts on resources in the counties identified as the region of influence for this Project. Consequently, an insignificant cumulative effect is anticipated when the impacts of the Project are added to other projects in the regions of influence.

3.0 ALTERNATIVES

As required by NEPA and the Commission's implementing regulations, we considered alternatives to the proposed action. Specifically, we considered the no-action alternative, system alternatives, and compressor station alternatives. The evaluation criteria used for developing and reviewing alternatives were:

- technical feasibility and practicality;
- significant environmental advantage over the proposed action; and
- ability to meet the Project's stated objective.

Each alternative was considered to the point where it was clear the alternative was not reasonable, would result in greater environmental impacts than those of the proposed Project, or it could not meet the Project objective.

3.1 No Action Alternative

Under the no-action alternative, Tennessee would not construct the proposed Project and none of the adverse or beneficial impacts of the Project (as described in section 2) would occur. The no-action alternative would also not meet the objectives of the Project, which are to:

- expand capacity of Tennessee's pipeline system to provide up to 200,000 Dth/d of firm incremental transportation services to Antero Resources Corporation, which has fully subscribed to the firm transportation capacity; and
- replace older facilities with new, more efficient compression facilities at two existing compressor stations.

At this time, no alternative projects have been planned that could meet the purpose and need of the proposed Project. Thus it is impossible to say with certainty what other facilities might be built in lieu of the proposed Project. Assuming the demand for service in the southeastern United States continues, it is likely that other natural gas projects would be proposed. Such actions could result in impacts similar to or greater than the proposed Project, and might not meet the Project's purpose and need within the proposed timeframes. Therefore, we conclude that the no-action alternative would not satisfy the Project objectives.

3.2 Energy Conservation or Alternative Energies

We received a number of comments recommending the evaluation of renewable energy sources as an alternative to the Project. Coal, oil, and nuclear energy currently provide a substantial portion of the nation's energy, and conservation and renewable technologies are expected to play an increasing role in meeting future energy needs. However, the generation of electricity from renewable energy sources is a reasonable alternative for a review of power generating facilities. Authorizations related to demands for electricity are not part of the application before the Commission and their consideration is outside the scope of this EA. Therefore, because the purpose of the Project is to provide up to 200,000 Dth/d of firm incremental natural gas transportation services to Antero Resources Corporation, and the generation of electricity from renewable energy sources or the gains realized from increased energy efficiency and conservation are not transportation alternatives; they cannot function as a substitute for the Project and are not considered or evaluated further in this analysis.

3.3 System Alternatives

System alternatives would use other existing, modified, or proposed facilities to meet the objectives of the proposed Project. A system alternative would make it unnecessary to construct all or part of the Project, although modifications or expansion of existing or proposed pipeline systems may be required. These modifications or additions could result in environmental impacts that are less than, similar to, or greater than those associated with construction and operation of the Project. The purpose of identifying and evaluating system alternatives is to determine whether the environmental impacts associated with construction and operation of the Project could be avoided or reduced by using another pipeline system, while still meeting the objectives of the Project.

3.3.1 Other Pipeline Systems

Although other existing natural gas pipeline systems are in the region, we are not aware of any system alternatives that would meet the objectives of the proposed Project. The Project would transport natural gas from a receipt point in West Virginia to a delivery point in Mississippi, as shown in figure 3-1. In addition to Tennessee's pipeline system, the figure shows several existing natural gas pipeline systems, including the Columbia Gas System and the Columbia Gulf Transmission System, the Texas Eastern Transmission System, and the Transco Pipeline System.

In order to meet the purpose and need of the Project, the other pipeline companies would need to build new pipeline facilities in addition to adding compression and/or looping to their existing systems to connect to the proposed receipt and delivery points and to deliver the additional capacity. Construction of these facilities would likely result in impacts similar to the Project and would therefore not provide a significant environmental advantage over the proposed action. For these reasons, we have eliminated these pipeline system alternatives from further consideration. Additionally, these significant modifications would not meet the schedule of the proposed Project or Tennessee's contractual commitments.

3.3.2 Pipeline Only Alternative

We examined a system alternative in which Tennessee would expand its pipeline system by constructing new looping pipeline in place of constructing new compressor stations. Based on computer modeling, the equivalent increased capacity of the Project could be obtained by building about 308 miles of new pipeline in seven looping segments. This alternative is illustrated in figure C-1 of appendix C. About 233 miles of 36-inch-diameter looping pipeline and about 75 miles of 42-inch-diameter looping pipeline would be required to meet the Project objectives.

The looping pipeline alternative would cross several large navigable rivers, including the Elk River, the Kentucky River, the Cumberland River, the Harpeth River, and the Duck River, as well as 417 other waterbodies and about 80 wetlands. Assuming a construction right-of-way width of 100 feet and an incremental operational right-of-way width of 25 feet, this alternative would impact about 3,700 acres during construction, with about 900 acres maintained as permanent pipeline right-of-way during operation. Construction and operation of these pipeline facilities would result in lower impacts on air and noise than the proposed action, but would result in more land disturbance, more impacts on waterbodies and wetlands, and would affect a greater number of landowners. Therefore, this alternative would not provide a significant environmental advantage over the proposed action and we eliminated this alternative from further consideration.

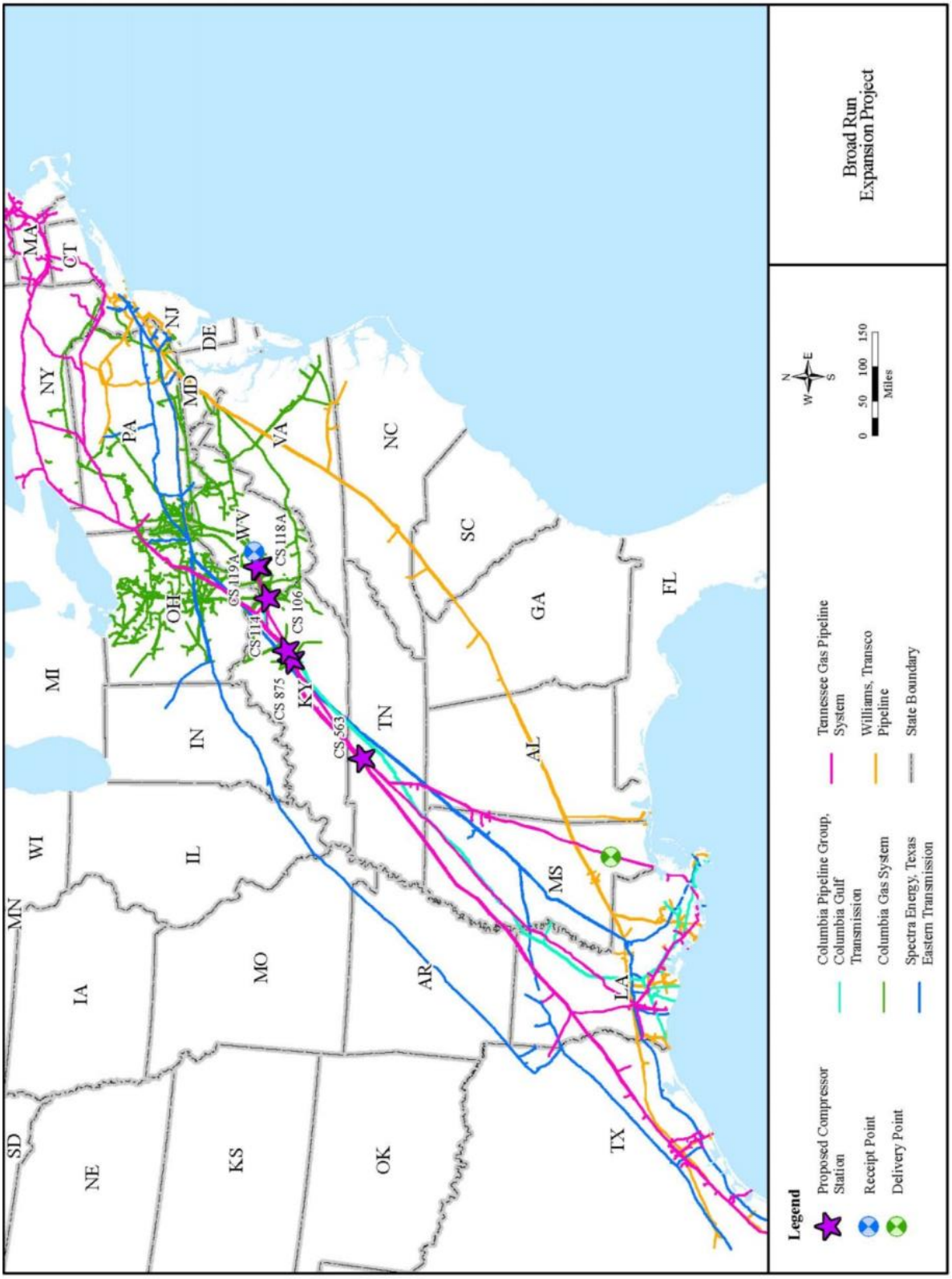

Figure 3-1. Other Pipeline System Alternatives

3.4 Combined Compression and Pipeline Alternative

We evaluated a system alternative in which Tennessee would expand its pipeline system by constructing a combination of additional compression and new looping pipeline. Under this alternative, Tennessee would construct two new compressor stations, abandon and replace certain units at two existing compressor stations, and build 240 miles of new looping pipeline. As shown in figure C-2 of appendix C, Compressor Stations 118A and 119A would be built in Kanawha County, West Virginia. The new pipeline for this alternative would comprise about 165 miles of 36-inch-diameter pipeline and 75 miles of 42-inch-diameter pipeline. The new pipeline would be adjacent and parallel to Tennessee's existing Line 100-1 and Line 800-1 in the state of Kentucky, and the existing Line 500-1 in the state of Tennessee.

The pipeline for this combined compression and pipeline alternative would cross four navigable rivers (Kentucky, Cumberland, Harpeth, and Duck), 334 other waterbodies, and about 67 wetlands. This alternative would impact about 3,000 acres during construction and permanently impact about 800 acres during operation (assuming a construction right-of-way width of 100 feet, an incremental operational right-of-way width of 25 feet, and the same disturbance for Compressor Stations 118A and 119A as described for the proposed action). The alternative would add about 54,000 hp of compression to Tennessee's system at new Compressor Stations 118A and 119A, compared to a total of about 130,000 hp for the proposed action. Construction of this combined compression and pipeline alternative would result in fewer air and noise impacts than the proposed action, but would result in more land disturbance, more impacts on waterbodies and wetlands, and would affect a greater number of landowners. Therefore, we conclude that this alternative would not provide a significant environmental advantage over the proposed action and we have eliminated this alternative from further consideration.

3.5 Alternative Compressor Station Locations

Tennessee conducted hydraulic modeling and field surveys to determine the sites for the new compressor stations that would meet the Project's objectives. This modeling was based on Tennessee's existing facilities and considered topography and geologic hazards, proximity to residential areas, existing road accessibility, the presence of sensitive environmental resources, vegetated buffers that would reduce visual and noise impacts, and the willingness of landowners to negotiate easement rights. We evaluated alternative locations for each new compressor station based on a number of environmental factors. In some cases, there were tradeoffs between environmental resources identified during the alternatives analysis, as minimization of impacts on one set of resources had to be compared to increased impacts on a different set of resources. We did not evaluate site alternatives for Compressor Stations 106 and 114 because they are existing facilities.

3.5.1 Compressor Station 118A

We evaluated 9 alternative sites for Compressor Station 118A as shown in table 3-1 and figure C-3. Each site was in Kanawha County, West Virginia, and each was about 40 acres in size. Two of the alternative sites, B and C, would require the construction of additional pipeline to connect the compressor station to Tennessee's existing pipeline. Site I and site H are close to the proposed site, as shown in figure C-3 in appendix C. All the alternative sites would be located in areas of high landslide potential and in areas where federally and state-listed species have the potential to occur. None of the alternative sites would impact National Wetlands Inventory (NWI) wetlands, outstanding or exceptional resource waters, sole source aquifers, critical wildlife habitat, sites listed on the NRHP, active mines, or designated parks or recreational land.

Table 3-1

Comparison of Alternative Sites for Compressor Station 118A

Environmental Factor	Proposed Site	Alternative Site A	Alternative Site B	Alternative Site C	Alternative Site D	Alternative Site E	Alternative Site F	Alternative Site G	Alternative Site H	Alternative Site I
Site Area (acres)	46.1	40.0	40.0	40.5	41.1	40.1	40.8	40.1	41.1	41.1
Length of Associated Pipeline (miles)	n/a	n/a	2.7	2.8	n/a	n/a	n/a	n/a	n/a	n/a
Pipeline Construction Footprint (acres) [a]	n/a	n/a	49.7	50.7	n/a	n/a	n/a	n/a	n/a	n/a
Perennial Waterbodies Crossed (number)	2	1	1	0	0	1	0	3	1	1
Floodplain Area Crossed (acres)	3.1	0.0	0.0	0.0	6.8	3.8	1.1	0.0	1.6	1.5
Prime Farmland (acres)	3.8	0.0	0.0	0.0	5.2	4.7	2.5	0.0	0.7	0.7
Steep Slopes or Extreme Topography (acres)	43.5	38.8	39.9	38.7	37.1	35.3	38.2	37.9	39.9	39.9
Oil and Gas Wells (number)	0	0	0	0	0	1	1	2	0	0
Impacts on Forested Lands (Deciduous and Mixed Forests) (acres)	39.6	40.0	40.0	40.1	33.4	32.8	21.2	38.7	37.3	37.5
Residential Structures within 0.5 mile (number)	88	46	65	131	106	66	261	92	64	67

[a] Assumes a 150-foot-wide construction right-of-way; approved right-of-way width would likely be less

With the exception of alternative sites A and C, which would impact more land because of the associated pipeline, the sites would have generally similar impacts on environmental resources. In some cases, sites with lower impacts on one resource would have increased impacts on another resource. For example, although alternative site F would have lower impacts on forests than the proposed site, it was also the site with the highest number of residences within 0.5 mile. Based on our review of the compressor station site alternatives, we conclude that none of the alternatives offer significant environmental advantages over the proposed site for Compressor Station 118A.

3.5.2 Compressor Station 119A

We evaluated two alternative sites for the location of Compressor Station 119A (see figure C-4 in appendix C and table 3-2). Each site is in Kanawha County, West Virginia, and about 40 acres in size. Alternative site 119-2A is on Tennessee's existing pipeline system and close to the proposed site for Compressor Station 119A. Alternative site 1 would require a 2.7-mile-long pipeline to connect the compressor station to Tennessee's existing pipeline system. Each of the three sites is in an area of steep slopes with high landslide potential and is primarily forested. No karst areas were identified at any of the three sites.

Table 3-2

Comparison of Alternative Sites for Compressor Station 119A

Environmental Factor	Proposed Site	Alternative Site 1	Alternative Site 119-2A
Site Area (acres)	47.5	40.5	42.6
Length of Associated Pipeline (miles)	n/a	2.7	n/a
Pipeline Construction Footprint (acres) [a]	n/a	49.7	n/a
Perennial Waterbodies Crossed (number)	1	1	1
Prime Farmland (acres)	0.0	1.8	0.0
Steep Slopes or Extreme Topography (acres)	46.9	39.8	41.1
Oil and Gas Wells (number)	0	0	1
Impacts on Forested Lands (Deciduous and Mixed Forests) (acres)	47.5	40.1	42.5
Residential Structures within 0.5 mile (number)	121	40	101

[a] Assumes a 150-foot-wide construction right-of-way; approved width would likely be less

Alternative site 1 would impact more land than the other alternative sites because of the associated pipeline. The proposed site and alternative site 119-2A would have generally similar impacts on environmental resources. The proposed site would make better use of the flatter terrain in the area. Based on our review of the compressor station site alternatives, we conclude that neither alternative site offers significant environmental advantages over the proposed site for Compressor Station 119A.

3.5.3 Compressor Station 875

We evaluated five alternative locations for the site of Compressor Station 875 in Madison County, Kentucky (see figure C-6 in appendix C and table 3-3). Each site is about 40 acres and the primary land use is for hay or pasture land. Habitat for federal and state-listed species is present at each alternative site, but no site has critical wildlife habitat, or outstanding or exceptional resource waters. No NRHP-eligible sites or NWI wetlands are present at any of the alternative sites. Each site has a low potential for landslides and none of the alternative sites is in an area of karst topography or active mines.

Table 3-3

Comparison of Alternative Sites for Compressor Station 875

Environmental Factor	Proposed Site	Alternative Site 1	Alternative Site 2	Alternative Site 3	Alternative Site 4	Alternative Site 5
Site Area (acres)	48.6	40.7	40.0	41.0	40.8	40.1
Perennial Waterbodies Crossed (number)	0	0	1	0	0	0
Intermittent Waterbodies Crossed (number)	1	0	0	1	1	1
Prime Farmland (acres)	6.2	6.6	4.2	0.6	7.6	11.0
Floodplains (acres)	0.0	0.9	4.1	0.0	0.0	3.7
Steep Slopes (acres)	32.2	24.1	20.6	20.3	22.9	26.7
Faults or High Seismicity Areas within 10 miles	45	47	44	46	45	46
Residential Structures within 0.5 mile (number)	66	14	34	19	61	24

All alternative sites are located in areas of similar seismic activity and have similar amounts of steep slopes. Tennessee identified constructability advantages for the proposed site, including good roadway access, and a lack of powerlines or other obstructions on the site. Tennessee has purchased the proposed site but has not contacted the owners of the alternative sites to determine if they are willing to sell or negotiate easement rights. Based on our review of the compressor station site alternatives, we conclude that none of the alternatives offer significant environmental advantages over the proposed site for Compressor Station 875.

3.5.4 Compressor Station 563

We received a number of comments about the location of Compressor Station 563 and required Tennessee to analyze other alternatives for the site, including locations outside Davidson County. We evaluated a total of 12 alternative sites in addition to the proposed site, as shown in table 3-4 and figure C-5 in appendix C. These sites are in Davidson, Davidson/Sumner, Robertson, and Cheatham Counties in Tennessee. Sites C1 and C2 were identified by a commenter as potential alternative sites for Compressor Station 563. Alternative sites D1, D2, R2, and C2 would require the most land because of the need to construct a new pipeline to connect the compressor station to the existing pipeline system. Alternative site 2 is the smallest site, at 13 acres. All the alternative sites would be in areas of low landslide potential and in areas where federally and state-listed species have the potential to occur. All the alternative sites would cross areas where karst topography is present. Karst topography and the potential for sinkhole formation are described in section 2.1.1. None of the alternative sites would impact outstanding or exceptional resource waters, sole source aquifers, or active mines.

Sites D1, D2, R2, and C2 would impact the greatest amount of land and site 2 would impact the least. The other sites are generally the same size, around 40 acres. In some cases, sites with lower impacts on one resource had increased impacts on other resources. With the exception of site C1, the proposed site would have the least number of residential structures within 0.5 mile radius and would have less steep slope terrain than site C1. Additionally, Tennessee has identified a landowner willing to negotiate the sale of the property at the proposed site. Based on our review of the compressor station site alternatives, we conclude that none of the alternatives offer significant environmental advantages over the proposed site for Compressor Station 563.

Table 3-4

Comparison of Alternative Sites for Compressor Station 563

Environmental Factor	Proposed Site	Alternative Site 1	Alternative Site 2	Alternative Site 3	Alternative Site 4	Alternative Site D1	Alternative Site D2	Alternative Site R1	Alternative Site R2	Alternative Site R3	Alternative Site R4	Alternative Site C1	Alternative Site C2
County	Davidson	Davidson	Davidson	Davidson	Davidson	Davidson, Sumner	Davidson	Robertson	Robertson	Robertson	Robertson	Cheatham	Cheatham
Site Area (acres)	43.2	40.6	13.0	40.3	40.4	42.2	43.8	42.0	42.2	42.4	41.0	43.2	42.5
Length of Associated Pipeline (miles)	N/A	N/A	N/A	N/A	N/A	3.8	5.6	N/A	0.4	N/A	N/A	N/A	0.6
Pipeline Construction Footprint (acres) [a]	N/A	N/A	N/A	N/A	N/A	69.5	102.6	N/A	6.5	N/A	N/A	N/A	11.0
NWI Wetlands crossed (acres)	0.0	0.5	0.0	0.0	0.0	3.4	0.2	0.0	0.0	0.0	0.0	0.0	0.0
Perennial Waterbodies Crossed	0	0	1	0	0	2	1	0	0	0	0	0	0
Intermittent Waterbodies Crossed	0	0	0	0	0	0	0	0	0	1	3	1	0
Ponds and Lakes Crossed	0	0	0	0	1	1	1	0	0	0	1	0	0
Wells within 150 feet	1	0	1	1	0	0	0	0	0	0	0	0	0
Floodplains Crossed (acres)	0.0	0.0	0.0	0.0	0.0	33.8	1.4	0.0	0.0	0.0	0.0	0.0	0.0
Prime Farmland (acres)	23.6	33.0	7.1	19.6	15.6	40.5	14.4	25.1	5.6	15.0	10.9	0.7	0.0
Steep Slopes or Extreme Topography (acres)	29.3	10.9	5.1	25.5	31.7	7.9	36.7	9.9	36.8	26.5	25.2	41.4	40.7
Karst Areas/ Sinkholes/ Subsidence (acres)	42.9	40.6	13.0	40.3	40.4	0.0	43.5	41.8	42.0	42.2	41.0	42.0	42.2

Table 3-4

Comparison of Alternative Sites for Compressor Station 563

Environmental Factor	Proposed Site	Alternative Site 1	Alternative Site 2	Alternative Site 3	Alternative Site 4	Alternative Site D1	Alternative Site D2	Alternative Site R1	Alternative Site R2	Alternative Site R3	Alternative Site R4	Alternative Site C1	Alternative Site C2
Faults or High Seismicity areas within 10 miles	2	1	1	1	1	0	1	1	1	1	1	0	1
NRHP-eligible Sites within 0.5 mile	2	0	0	0	1	0	0	0	0	0	0	0	0
Critical Habitat for Wildlife (acres)	0.0	0.0	0.0	0.0	0.0	4.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Impacts on Forested Lands (Deciduous, Evergreen, and Mixed Forests) (acres)	42.8	4.2	7.2	39.6	24.0	6.1	28.9	13.0	18.4	20.0	13.5	33.8	39.8
Residential Structures within 0.5 mile (number)	25	41	36	44	43	41	239	67	81	83	62	13	26
Parks and Recreation Areas within 0.5 mile	1	1	1	1	1	0	0	1	0	0	0	0	0

[a] Assumes a 150-foot-wide construction right-of-way; approved right-of-way width would likely be less

3.6 Compressor Unit Alternatives

Tennessee proposes to use natural gas-fired compressor units for the Project. We evaluated the alternative of using electric motor-driven compressor units. Electric-motor driven compression is generally used at locations where low-cost, high voltage electric power is available nearby. The advantage to electric motor-driven compressor units is that they have lower emissions. However, the dominant source of electricity in the region of the Project is coal-fired power plants (EIA, 2015). Production of the electricity needed to power the compressor units would indirectly create more NO_x, SO_2, and CO_2 than would the proposed natural gas-fired compressor units. Furthermore, construction of the high voltage power lines needed to deliver electricity to the compressor station sites would have environmental impacts on resources that could include vegetation, soils, wetlands, cultural resources, wildlife, and surface water. For these reasons, we conclude that use of electric motor-driven compressor units would not provide an environmental advantage over using natural gas-fired compressor units for the Project.

4.0 STAFF'S CONCLUSIONS AND RECOMMENDATIONS

We conclude that approval of the Broad Run Expansion Project would not constitute a major federal action significantly affecting the quality of the human environment. This finding is based on the above environmental analysis, Tennessee's application and supplements, and implementation of Tennessee's proposed and our recommended mitigation measures. We recommend that the Commission's Order contain a finding of no significant impact and that the following mitigation measures be included as conditions of any Certificate the Commission may issue.

1. Tennessee shall follow the construction procedures and mitigation measures described in its application and supplements (including responses to staff data requests) and as identified in the EA, unless modified by the Order. Tennessee must:

    a. request any modification to these procedures, measures, or conditions in a filing with the Secretary;

    b. justify each modification relative to site-specific conditions;

    c. explain how that modification provides an equal or greater level of environmental protection than the original measure; and

    d. receive approval in writing from the Director of the OEP **before using that modification**.

2. The Director of OEP has delegated authority to take whatever steps are necessary to ensure the protection of all environmental resources during construction and operation of the Project. This authority shall allow:

    a. the modification of conditions of the Order; and

    b. the design and implementation of any additional measures deemed necessary (including stop-work authority) to assure continued compliance with the intent of the environmental conditions as well as the avoidance or mitigation of adverse environmental impact resulting from Project construction and operation.

3. **Prior to any construction**, Tennessee shall file an affirmative statement with the Secretary, certified by a senior company official, that all company personnel, EIs, and contractor personnel will be informed of the EIs' authority and have been or will be trained on the implementation of the environmental mitigation measures appropriate to their jobs **before** becoming involved with construction and restoration activities.

4. The authorized facility locations shall be as shown in the EA. **As soon as they are available, and before the start of construction**, Tennessee shall file with the Secretary any revised detailed survey maps/sheets at a scale not smaller than 1:6,000 with station positions for all facilities approved by the Order. All requests for modifications of environmental conditions of the Order or site-specific clearances must be written and must reference locations designated on these maps/sheets.

    Tennessee's exercise of eminent domain authority granted under NGA Section 7(h) in any condemnation proceedings related to the Order must be consistent with these authorized facilities and locations. Tennessee's right of eminent domain granted under

NGA Section 7(h) does not authorize it to increase the size of its natural gas pipelines or aboveground facilities to accommodate future needs or to acquire a right-of-way for a pipeline to transport a commodity other than natural gas.

5. Tennessee shall file with the Secretary detailed maps/sheets and aerial photographs at a scale not smaller than 1:6,000 identifying all facility relocations, staging areas, warehouse/storage yards, new access roads, and other areas that would be used or disturbed and have not been previously identified in filings with the Secretary. Approval for each of these areas must be explicitly requested in writing. For each area, the request must include a description of the existing land use/cover type, documentation of landowner approval, whether any cultural resources or federally listed threatened or endangered species would be affected, and whether any other environmentally sensitive areas are within or abutting the area. All areas shall be clearly identified on the maps/sheets/aerial photographs. Each area must be approved in writing by the Director of OEP **before construction in or near that area**.

   This requirement does not apply to extra workspace allowed by our Plan, and/or minor field realignments per landowner needs and requirements which do not affect other landowners or sensitive environmental areas such as wetlands.

   Examples of alterations requiring approval include all route realignments and facility location changes resulting from:

   a. implementation of cultural resources mitigation measures;

   b. implementation of endangered, threatened, or special concern species mitigation measures;

   c. recommendations by state regulatory authorities; and

   d. agreements with individual landowners that affect other landowners or could affect sensitive environmental areas.

6. **Within 60 days of the acceptance of the Certificate and before construction begins**, Tennessee shall file an Implementation Plan with the Secretary for review and written approval by the Director of OEP. Tennessee must file revisions to the plan as schedules change. The plan shall identify:

   a. how Tennessee will implement the construction procedures and mitigation measures described in its application and supplements (including responses to staff data requests), identified in the EA, and required by the Order;

   b. how Tennessee will incorporate these requirements into the contract bid documents, construction contracts (especially penalty clauses and specifications), and construction drawings so that the mitigation required at each site is clear to onsite construction and inspection personnel;

   c. the number of EIs assigned, and how the company will ensure that sufficient personnel are available to implement the environmental mitigation;

d. company personnel, including EIs and contractors, who will receive copies of the appropriate material;

e. the location and dates of the environmental compliance training and instructions Tennessee will give to all personnel involved with construction and restoration (initial and refresher training as the Project progresses and personnel change);

f. the company personnel and specific portion of Tennessee's organization having responsibility for compliance;

g. the procedures (including use of contract penalties) Tennessee will follow if noncompliance occurs; and

h. for each discrete facility, a Gantt or PERT chart (or similar project scheduling diagram), and dates for:

(1) the completion of all required surveys and reports;

(2) the environmental compliance training of onsite personnel;

(3) the start of construction; and

(4) the start and completion of restoration.

7. Tennessee shall employ at least four EIs for the Project. The EIs shall be:

a. responsible for monitoring and ensuring compliance with all mitigation measures required by the Order and other grants, permits, certificates, or other authorizing documents;

b. responsible for evaluating the construction contractor's implementation of the environmental mitigation measures required in the contract (see condition 6 above) and any other authorizing document;

c. empowered to order correction of acts that violate the environmental conditions of the Order, and any other authorizing document;

d. a full-time position, separate from all other activity inspectors;

e. responsible for documenting compliance with the environmental conditions of the Order, as well as any environmental conditions/permit requirements imposed by other federal, state, or local agencies; and

f. responsible for maintaining status reports.

8. Beginning with the filing of its Implementation Plan, Tennessee shall file updated status reports with the Secretary on a **biweekly basis until all construction and restoration activities are complete**. On request, these status reports will also be provided to other federal and state agencies with permitting responsibilities. Status reports shall include:

a. an update on Tennessee's efforts to obtain the necessary federal authorizations;

b. the construction status of the Project, work planned for the following reporting period, and any schedule changes for stream crossings or work in other environmentally sensitive areas;

c. a listing of all problems encountered and each instance of noncompliance observed by the EI during the reporting period (both for the conditions imposed by the Commission and any environmental conditions/permit requirements imposed by other federal, state, or local agencies);

d. a description of the corrective actions implemented in response to all instances of noncompliance, and their cost;

e. the effectiveness of all corrective actions implemented;

f. a description of any landowner/resident complaints which may relate to compliance with the requirements of the Order, and the measures taken to satisfy their concerns; and

g. copies of any correspondence received by Tennessee from other federal, state, or local permitting agencies concerning instances of noncompliance, and Tennessee's response.

9. **Prior to receiving written authorization from the Director of OEP to commence construction of any Project facilities**, Tennessee shall file with the Secretary documentation that it has received all applicable authorizations required under federal law (or evidence of waiver thereof).

10. Tennessee must receive written authorization from the Director of OEP **before placing the Project facilities into service**. Such authorization will only be granted following a determination that rehabilitation and restoration of the Project sites and other areas affected by the Project are proceeding satisfactorily.

11. **Within 30 days of placing the authorized facilities in service**, Tennessee shall file an affirmative statement with the Secretary, certified by a senior company official:

    a. that the facilities have been constructed and installed in compliance with all applicable conditions, and that continuing activities will be consistent with all applicable conditions; or

    b. identifying which of the Certificate conditions Tennessee has complied with or will comply with. This statement shall also identify any areas affected by the Project where compliance measures were not properly implemented, if not previously identified in filed status reports, and the reason for noncompliance.

12. **Prior to construction of Compressor Stations 118A and 119A,** Tennessee shall file a blasting plan with the Secretary, for review and written approval by the Director of OEP.

13. **Prior to abandonment or construction activities at Compressor Station 106**, Tennessee shall file with the Secretary, for review and written approval by the Director of

OEP, a plan for handling potential PCB-affected groundwater at Compressor Station 106 developed in coordination with KYDEP.

14. **Prior to construction of Compressor Stations 118A and 119A**, Tennessee shall consult the WVDEP and file with the Secretary designs for culverts that would be constructed at Compressor Stations 118A and 119A and any WVDEP comments on the designs.

15. **Prior to construction,** Tennessee shall consult with the Kentucky Field Office of the FWS regarding impacts to potential habitat for Indiana bat or northern long-eared bat and file with the Secretary, for review and written approval by the Director of OEP, the results of the consultation and any additional bat surveys or mitigation measures required by the FWS.

16. Tennessee shall not clear trees outside the window of August 16 to March 31 in Project workspaces in Tennessee or outside the window of November 15 to March 31 in Project workspaces in West Virginia, or until:

    a. the staff completes consultation with the FWS; and

    b. Tennessee has received written notification from the Director of OEP that construction may begin.

17. Tennessee shall file a noise survey with the Secretary **no later than 60 days** after placing each compressor station into service. If a full power load condition noise survey is not possible, Tennessee shall provide an interim survey at the maximum possible power load and provide a full power load survey **within 6 months**. If the noise attributable to the operation of the Project equipment under interim or full power load exceeds an L_{dn} of 55 dBA at any nearby NSA, Tennessee shall:

    a. file a report on what changes are needed;

    b. install additional noise controls to meet the level **within 1 year** of the in-service date; and

    c. confirm compliance with this requirement by filing a second full power noise survey with the Secretary **no later than 60 days** after it installs the additional noise controls.

18. **Prior to any abandonment activities at Compressor Stations 106 and 114,** Tennessee shall file the following information with the Secretary for review and written approval by the Director of OEP:

    a. identification of any equipment, including compressor units and piping, proposed for abandonment that may be contaminated with PCBs;

    b. verification that the appropriate PCB testing would be conducted on this equipment, and discussion of how any abandoned PCB-contaminated facilities would be properly disposed of; and

    c. measures to be implemented to provide adequate worker safety for handling PCB-contaminated materials.

19. **Prior to any abandonment or construction activities at Compressor Stations 106 and 114**, Tennessee shall file the following information with the Secretary for review and written approval by the Director of OEP:

    a. identification of any known facilities to be abandoned or disturbed having ACMs;

    b. protocols to comply with the appropriate requirements to identify ACMs that might be encountered;

    c. if facilities with ACMs would be abandoned or disturbed, methods to separate the ACMs for proper disposal; and

    d. protocols for worker protection and proper disposal of ACMs.

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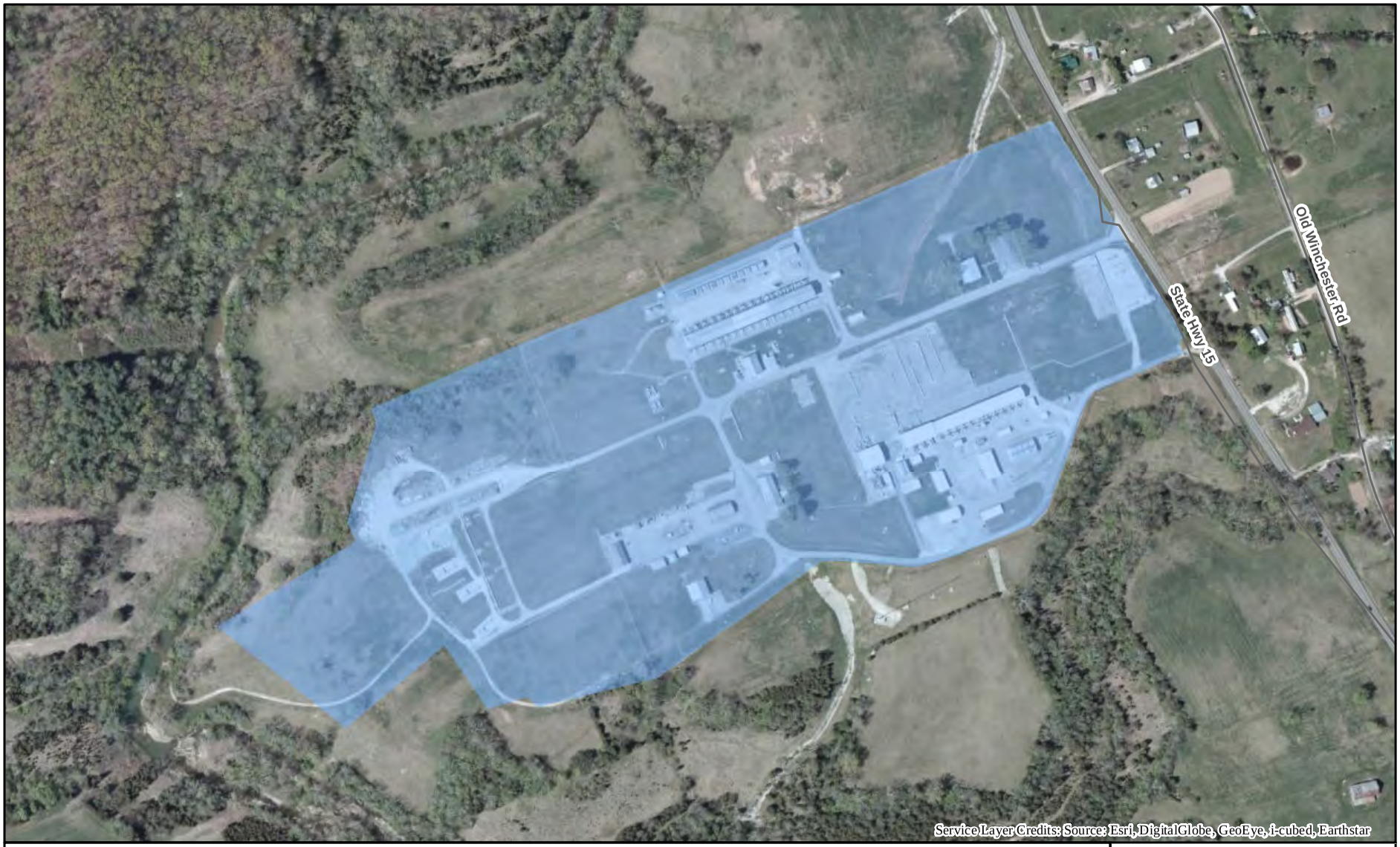
Appendix A

Maps of the Proposed Facilities



Legend

Streets

Construction Footprint

Powell County, Kentucky

N
W E
S

0 200 400
Feet

Figure A-1
Construction
Footprint CS 106

Broad Run
Expansion Project

Legend

Streets

Operational Footprint

Powell County, Kentucky

N
W E
S

0 200 400
Feet

Figure A-2
Operational Footprint
CS 106

Broad Run
Expansion Project

Legend

Streets

Construction Footprint

Boyd County, Kentucky

N
W E
S

0 200
Feet

Figure A-3
Construction
Footprint CS 114

Broad Run
Expansion Project

Legend

Streets

Operational Footprint

Boyd County, Kentucky

N
W E
S

0 200
Feet

Figure A-4
Operational Footprint
CS 114

Broad Run
Expansion Project

Legend

Streets

Construction Footprint

Kanawha County, West Virginia

N
W E
S

0 200 400 600
Feet

Figure A-5
Construction Footprint
CS 118A

Broad Run
Expansion Project

Legend

Streets

Operational Footprint

Kanawha County, West Virginia

N
W E
S

0 200 400 600
Feet

Figure A-6
Operational Footprint
CS 118A

Broad Run
Expansion Project

Legend

Streets

Construction Footprint

Kanawha County, West Virginia

N
W E
S

0 200 400 600
Feet

Figure A-7
Construction Footprint
CS 119A

Broad Run
Expansion Project

Legend

Streets

Operational Footprint

Kanawha County, West Virginia

N
W E
S

0 200 400 600

Feet

Figure A-8
Operational Footprint
CS 119A

Broad Run
Expansion Project

Legend

- Streets
- Railroad
- Construction Footprint

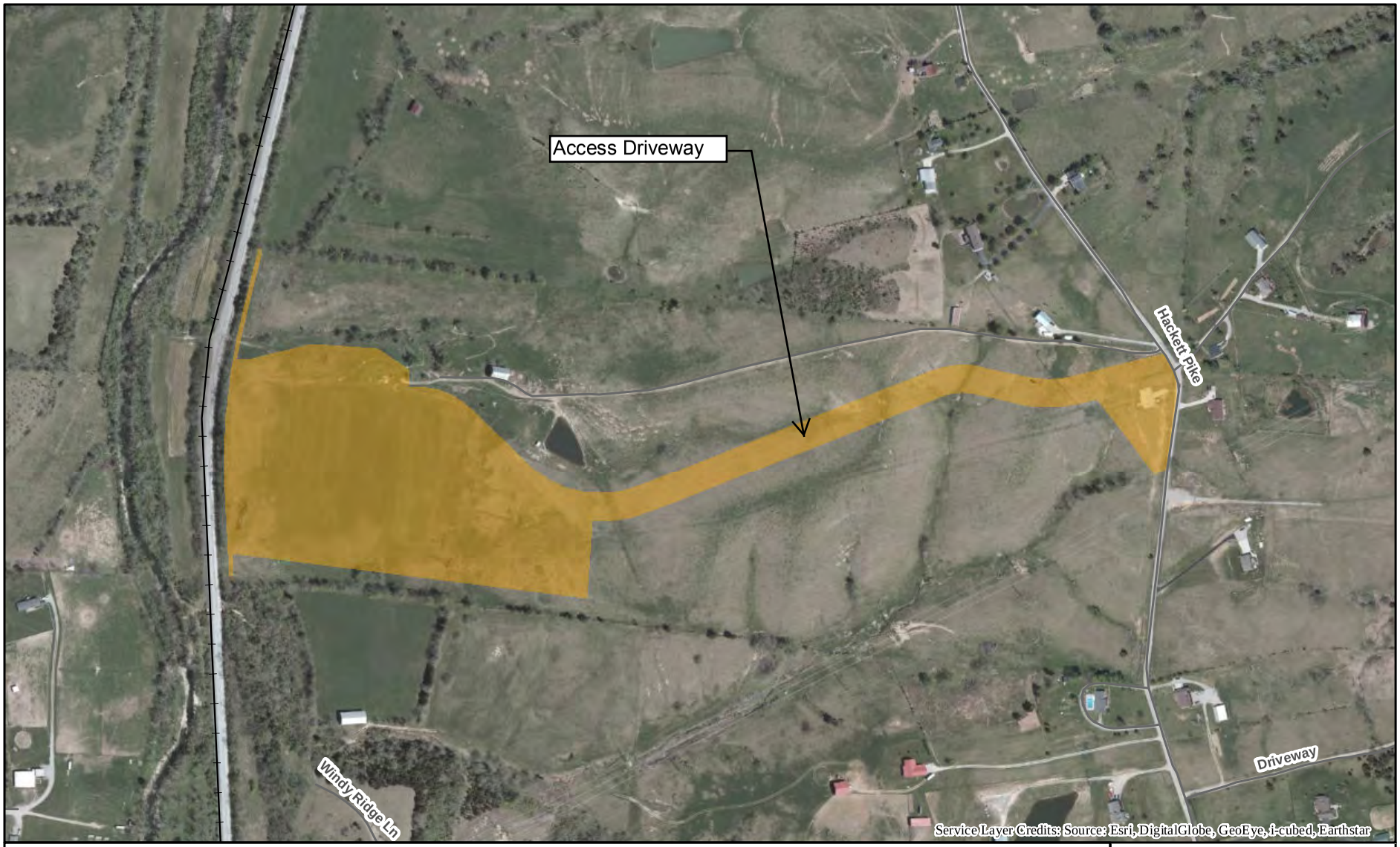
Madison County, Kentucky

N
W E
S

0 200 400
Feet

Figure A-9
Construction Footprint
CS 875

Broad Run
Expansion Project



Legend

- Streets
- Railroad
- Operational Footprint

Madison County, Kentucky

N
W E
S

0 200 400
Feet

Figure A-10
Operational Footprint
CS 875

Broad Run
Expansion Project

Legend

Streets

Construction Footprint

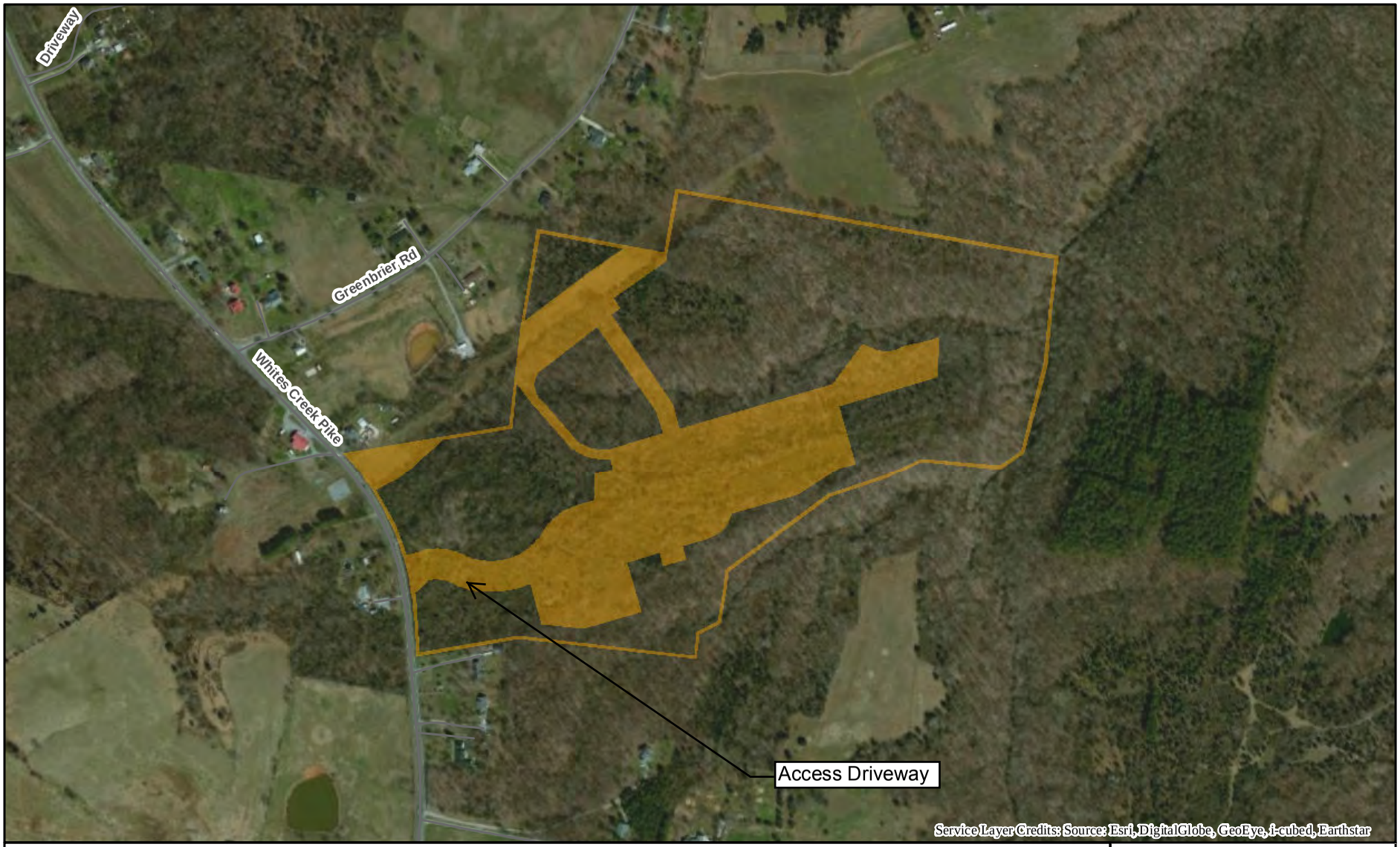
Davidson County, Tennessee

N
W E
S

0 200 400 600
Feet

Figure A-11
Construction Footprint
CS 563

Broad Run
Expansion Project



Legend

Streets

Operational Footprint

Davidson County, Tennessee

N
W E
S

0 200 400 600
Feet

Figure A-12
Operational Footprint
CS 563

Broad Run
Expansion Project

Appendix B

Existing or Proposed Projects Evaluated for Potential Cumulative Impacts

Appendix B

Existing or Proposed Projects Evaluated for Potential Cumulative Impacts

Cumulative Action Name	Project Location and Description	Potential Area of Surface Disturbance	Applicable Compressor Station	Resources Potentially Affected	Anticipated Construction Date
OIL & GAS					
Non-jurisdictional facilities associated with the Broad Run Expansion Project (see table 1-3)	WV and KY Power and telephone utilities outside the operational footprint of new compressor stations	25 acres	CS 118A CS 119A CS 875	Geology and Soils Water Resources and Wetlands Vegetation, Fisheries, and Wildlife Threatened, Endangered, and Special Status Species Land Use, Recreation, and Visual Resources Socioeconomics Cultural Resources Air Quality Noise	Concurrent with Broad Run Expansion Project
Abandonment and Capacity Restoration Project, Tennessee Gas Pipeline Company, LLC FERC Docket No. CP15-88-000	LA, AR, MS, TN, KY, and OH The Abandonment and Capacity Restoration Project (ACRP) would abandon by sale about 964 miles of natural gas pipeline in LA, AR, MS, TN, KY, and OH. Natural gas service would be maintained by building four new compressor stations in OH, constructing 7.7 miles of new pipeline in KY, and adding compression to two compressor stations in KY (Note: one station is CS 875, which would be constructed as part of the Broad Run Expansion Project). ACRP would also include modifications at CS 106 and CS 114. The proposed future use of the pipeline, the UMTP Project, is described below.	500 acres	CS 106 CS 114 CS 875 CS 563	Geology and Soils Water Resources and Wetlands Vegetation, Fisheries, and Wildlife Threatened, Endangered, and Special Status Species Land Use, Recreation, and Visual Resources Socioeconomics Cultural Resources Air Quality Noise PCB Contamination (CS 106 and CS 114 only)	2016 to 2018
Utica Marcellus Texas Pipeline (UMTP) Project Tennessee Gas Pipeline Company, LLC	TX, LA, AR, MS, TN, KY, and OH Purchase of 964 miles of pipeline and associated facilities abandoned during ACRP and conversion to transport natural gas liquids (NGL). Construction of 202 miles of new pipeline between Louisiana and Texas. Lateral pipelines totaling about 160 miles in length would be constructed in PA, WV, and OH. Twelve NGL pump stations would be built along the pipeline and 11 pump stations would be built at existing compressor stations. Construction of NGL storage facility in OH.	3,500 acres	CS 106 CS 114 CS 875 CS 563	Geology and Soils Water Resources and Wetlands Vegetation, Fisheries, and Wildlife Threatened, Endangered, and Special Status Species Land Use, Recreation, and Visual Resources Socioeconomics Cultural Resources Air Quality Noise PCB Contamination (CS 106 only)	Unknown; subsequent to ACRP

Appendix B

Existing or Proposed Projects Evaluated for Potential Cumulative Impacts

Cumulative Action Name	Project Location and Description	Potential Area of Surface Disturbance	Applicable Compressor Station	Resources Potentially Affected	Anticipated Construction Date
Access South Project, Adair Southwest Project and Lebanon Extension Project FERC Docket No. CP16-3-000	KY, TN Construction of 19.9 miles of 36-inch-diameter pipeline looping segments, new tie-in and launcher/receiver facilities, and modifications to existing compressor stations. Cumulative actions within this project include modifications to the Owingsville Compressor Station in Bath County, KY and to the Gladeville Compressor Station in Wilson County, TN.	n/a (existing facility)	CS 106 CS 563	Air Quality	March to November 2017
Big Sandy Plant	Louisa, KY Conversion of 278-MW coal-fired unit to natural gas and associated Columbia Gas Transmission natural gas pipeline	Unknown	CS 114	Air Quality	Scheduled for completion in summer 2016
Broad Run Connector Project FERC Docket No. CP15-12-000	Kanawha County, WV Abandonment through removal of an existing, natural gas-fired 3,000-horsepower reciprocating engine and installation of an 8,000-horsepower electric motor driven compressor and appurtenant facilities	n/a (existing facility)	CS 118A CS 119A	Socioeconomics Air Quality	Complete
Charleston Area Improvements Projects	Charleston, WV Rebuild of approximately 5 miles of transmission line, expansion of two substations, and construction of a new segment of transmission line and a new substation in the downtown area	Unknown	CS 118A CS 119A	Socioeconomics Air Quality	Late 2016 through 2019
Clendenin Compressor Station Modifications FERC Docket No. CP14-541-000	Kanawha County, WV Replacement of two existing natural gas-fired engines with electric motors, uprate the horsepower of five units, and conversion of one unit from base load to standby mode	n/a (existing facility)	CS 118A CS 119A	Socioeconomics Air Quality	Completed June 2015
Elm Hill Pike	Davidson County, TN Installation of 851 linear feet of 4-inch-diameter natural gas pipeline via horizontal direction drill	Unknown	CS 563	Socioeconomics Air Quality	Unknown
Interconnect Pipeline Project FERC Docket No. CP14-101-000	Todd County, Kentucky and Montgomery County, TN Construction of 20.8 miles of 12-inch-diameter natural gas pipeline along with associated valves and appurtenant facilities	280 acres	CS 563	Air Quality	Scheduled for 2016

Appendix B Existing or Proposed Projects Evaluated for Potential Cumulative Impacts					
Cumulative Action Name	**Project Location and Description**	**Potential Area of Surface Disturbance**	**Applicable Compressor Station**	**Resources Potentially Affected**	**Anticipated Construction Date**
E System Project FERC Docket No. CP15-160-000	Bath, Bracken, Menifee, Montgomery, Nicholas, and Robertson Counties, KY Construction of 22 miles of 20-inch-diameter pipeline and abandonment in place of corresponding loop segment (E-Loop Pipeline), approximately 1,900 feet of 20-inch-diameter pipeline across the Licking River to replace existing crossing, approximately 2,000 feet of 14-inch-diameter pipeline across the Licking River to replace existing crossing, approximately 1,500 feet of 14-inch-diameter pipeline across the North Fork Licking River to replace existing crossing, bidirectional pig launcher/receiver facilities, and modifications to an existing meter station	426 acres	CS 106 CS 875	Air Quality	Construction began February 2016
Gulf Markets Expansion Project FERC Docket No. CP15-90-000	OH, KY, TN, MS, LA, and TX Modifications at eight existing compressor stations, as well as modifications to an existing pig launcher facility and two measurement and regulating stations. Cumulative actions within this project include station piping modifications at the existing Owingsville Compressor Station in Bath County, KY.	n/a (existing facility)	CS 106	Air Quality	Scheduled to begin March 2016
Broad Run Flexibility Project Section 2.55(a) & (b) and/or blanket activities Tennessee Gas Pipeline Company, LLC	OH, WV, KY, TN, and MS Modifications of appurtenant facilities, including modification of pig launcher/receiver traps, in two phases at six existing compressor stations: CS 200; CS 114; CS 110, CS 106, CS 96, and CS 871. Cumulative actions within this project include work to be conducted at CS 200, CS 114, and CS 106. The Broad Run Flexibility Project and the Broad Run Expansion Project both include activities at CS 106 and CS 114.	n/a (existing facilities)	CS 106 CS 114	Water Resources and Wetlands Vegetation, Fisheries, and Wildlife Threatened, Endangered, and Special Status Species Cultural Resources Socioeconomics Geology and Soils Land Use, Recreation, and Visual Resources Air Quality Noise PCB Contamination	Phase I completed in 2015; Phase II scheduled for November 2016

Appendix B Existing or Proposed Projects Evaluated for Potential Cumulative Impacts					
Cumulative Action Name	**Project Location and Description**	**Potential Area of Surface Disturbance**	**Applicable Compressor Station**	**Resources Potentially Affected**	**Anticipated Construction Date**
Lawrence County Expansion Project FERC Docket No. CP15-19-000	Wayne County, WV and Lawrence County, KY Construction of approximately 3 miles of new 16-inch steel natural gas transmission line, a point of delivery meter at the Kentucky Power Company's Big Sandy Plant, a hot tap at the Line P tie-in location, a suction header dump regulation at the existing Kenova Compressor Station, and a dump regulator site at the existing Line P/SM-102 crossing	57 acres	CS 114	Air Quality	Construction began June 2015; currently conducting final cleanup and restoration activities.
Leach Xpress Project FERC Docket No. CP15-514-000	WV, PA, and OH Construction of two new natural gas pipelines, two new natural gas looping pipelines, and related facilities, and abandonment-in-place of a segment of existing natural gas pipeline. Cumulative actions within this project include construction of 2.8 miles of new 36-inch-diameter pipeline loop and modifications at the existing Ceredo Compressor Station in Wayne County, WV.	37 acres (pipeline)	CS 114	Air Quality	Scheduled for Q4 2016 to November 2017
Monroe-Cornwell Project FERC Docket No. CP15-7-000	Doddridge, Wetzel, and Kanawha Counties, WV Modifications to existing compressor stations. Cumulative actions within this project include installation of a new measurement and regulation station at the existing Cornwell Compressor Station in Kanawha County, WV.	n/a (existing facility)	CS 118A CS 119A	Socioeconomics Air Quality	Began construction February 2016 – scheduled to complete November 2016
Ohio Backhaul Flex	Greenup County, KY Modifications to CS 200 to reverse flow	n/a (existing facility)	CS 114	Air Quality	Scheduled for completion in January 2015
Rayne Xpress Expansion FERC Docket No. CP15-539-000	Carter, Menifee, and Montgomery Counties, KY Construction of two new compressor stations. Cumulative actions within the project include construction of a new 15,400 horsepower compressor station in Menifee and Montgomery Counties.	Unknown	CS 106 CS 875	Air Quality	Scheduled for Q4 2016 to November 2017
Utica Access Pipeline FERC Docket No. CP15-87-000	Kanawha and Clay Counties, WV Construction of approximately 4.8 miles of new 24-inch natural gas pipeline, four new bidirectional pig launcher/receivers, new mainline valve and tap, and modifications at existing compressor stations	119 acres	CS 118A CS 119A	Socioeconomics Air Quality	Construction began February 2016

Appendix B

Existing or Proposed Projects Evaluated for Potential Cumulative Impacts

Cumulative Action Name	Project Location and Description	Potential Area of Surface Disturbance	Applicable Compressor Station	Resources Potentially Affected	Anticipated Construction Date
WB Express Project FERC Docket No. CP16-38-000	WV and VA Construction of approximately 28.7 miles of various diameter pipeline, modifications to seven existing compressor stations, construction of two new compressor stations, and uprating the maximum allowable operation pressure on various segments of the existing natural gas transmission pipeline system. Cumulative actions include construction of a new natural gas-driven 31,800 horsepower compressor station adjacent to Columbia's existing Cobb Compressor Station, approximately 0.9 mile of 36-inch pipeline, a new receiver site, and modifications to an existing regulator station in Kanawha County, WV.	29 acres	CS 118A CS 119A	Socioeconomics Air Quality	Scheduled for January 2017 to November 2018
West Virginia State University Wells #2 and 3	Institute, WV Two shallow, natural gas production, Devonian shale wells within 128-acre lease	18 acres	CS 118A CS 119A	Vegetation, Fisheries, and Wildlife Threatened, Endangered, and Special Status Species Socioeconomics Air Quality	Permitting
COAL					
Acid Mine Drainage Plants (2)	Kanawha County, WV Two acid mine drainage plants	Unknown	CS 118A CS 119A	Socioeconomics Air Quality	Permitting
Cabin Creek	Kanawha County, WV Prospecting	4 acres	CS 118A CS 119A	Socioeconomics Air Quality	Permitting
Coal Surface Mine	Kanawha County, WV Surface mine, including auger contour, haul road, highwall miner, and storm water	598 acres	CS 118A CS 119A	Socioeconomics Air Quality	Permitting
Laurel Fork Prospect	Kanawha County, WV Prospecting	1 acre	CS 118A CS 119A	Socioeconomics Air Quality	Permitting
Mine No. 14	Kanawha County, WV Underground mining	14 acres	CS 118A CS 119A	Socioeconomics Air Quality	Permitted
Port Amherst Coal Loading Facility	Charleston, WV Coal loading facility	Unknown	CS 118A CS 119A	Socioeconomics Air Quality	Permitted

Appendix B Existing or Proposed Projects Evaluated for Potential Cumulative Impacts					
Cumulative Action Name	**Project Location and Description**	**Potential Area of Surface Disturbance**	**Applicable Compressor Station**	**Resources Potentially Affected**	**Anticipated Construction Date**
Red Warrior II Prospect	Kanawha County, WV Prospecting	2 acres	CS 118A CS 119A	Socioeconomics Air Quality	Permitting
Three Mile Extension Mine	Kanawha County, WV Surface mine extension	107 acres	CS 118A CS 119A	Socioeconomics Air Quality	Permitting
UTILITIES (ELECTRIC)					
Chemical-Turner Transmission Rebuild Project	Dunbar and Charleston, WV Rebuild of approximately 6.3 miles of 46-kV transmission line with higher voltage lines and modern tower structures to allow for future upgrades and capacity growth without additional construction	Unknown	CS 118A CS 119A	Vegetation, Fisheries, and Wildlife Threatened, Endangered, and Special Status Species Socioeconomics Air Quality	Spring 2015 through spring 2016
Danville Replacement Project FERC Docket No. CP15-37-000	Madison County, KY Replace/upgrade 2,960 feet of 30-inch-diameter Line No. 10; 3,060 feet of 30-inch-diameter Line No. 15; 658 feet of 30-inch-diameter Line No. 25; and 1,903 feet of 36-inch-diameter Line No. 25 due to encroachment; construction to occur within and adjacent to the existing Texas Eastern pipeline right-of-way	15 acres	CS 106 CS 875	Vegetation, Fisheries, and Wildlife (CS 875 only) Threatened, Endangered, and Special Status Species (CS 875 only) Socioeconomics (CS 875 only) Air Quality	Completed September 2015
Kanawha Valley Area Transmission Reinforcement Project	Putnam County and Kanawha County, WV Rebuild of 30 miles of 138 kV transmission line in two sections: John Amos Power Plant to North Charleston and Tuner Substation to Cabin Creek; all work will occur within existing except for section from Hernshaw to Cabin Creek which will be in new right-of-way	Unknown	CS 118A CS 119A	Water Resources and Wetlands (CS 119A only) Vegetation, Fisheries, and Wildlife Threatened, Endangered, and Special Status Species Socioeconomics Air Quality	Scheduled for completion in spring 2017
Marathon Refinery Boiler Addition	Catlettsburg, KY Installation of a new 321 MMBtu/hr (HHV) boiler (Boiler #15) to fire refinery fuel gas, designed with low-NOx burners and selective catalyst reduction for NOx emission control	n/a (existing facility)	CS 114	Socioeconomics Air Quality	Permitting

Appendix B Existing or Proposed Projects Evaluated for Potential Cumulative Impacts					
Cumulative Action Name	**Project Location and Description**	**Potential Area of Surface Disturbance**	**Applicable Compressor Station**	**Resources Potentially Affected**	**Anticipated Construction Date**
TEAM 2014 Project FERC Docket CP13-84-000	Construction, operation, modification, and abandonment of facilities in PA, WV, OH, KY, TN, AL, and MS. Cumulative actions within this project include bidirectional flow modifications at the Owingsville Station, Danville Station, Meter and Regulating Station 70315, and Gladeville Station	n/a (existing facility)	CS 106 CS 875 CS 563	Socioeconomics (CS 875 only) Air Quality	Construction completed in 2014
UTILITIES (WATER/SEWER)					
Belle Sanitary Wastewater Treatment Facilities Improvements	Belle, WV Replacement of facility with a large package plant consisting of a single 71-foot-diameter by 17-foot-high tank package treatment system with two new aeration basins, an aerobic digester, and a clarifier	Unknown	CS 118A CS 119A	Socioeconomics Air Quality	Permitting
Elk Valley Wastewater System Improvements Phase II	Kanawha County, WV Installation of 4.5 miles of sewer line to 265 residences	Unknown	CS 118A CS 119A	Socioeconomics Air Quality	Construction bid issued August 2014
Nitro Regional Wastewater Utility Wastewater System Improvements	Nitro, WV Sewer line extension, replacement sewer lines, and pump station modifications	Unknown	CS 118A CS 119A	Socioeconomics Air Quality	Permitting
Nitro Riverfront	Kanawha County, WV 780 feet of bank stabilization and a 15-acre park	15 acres	CS 118A CS 119A	Socioeconomics Air Quality	Planning
Porter's Hollow Sanitary Sewer Replacement and Rehab Project	Charleston, WV Improvements to sewer shed area, which generally includes 42,000 linear feet of replacement sanitary sewer and 5,000 linear feet of sanitary sewer lining	Unknown	CS 118A CS 119A	Socioeconomics Air Quality	Construction scheduled to begin June 2015
Sherwood Forest and Nottingham Road Sewer Upgrade	Charleston, WV Sewer lines upgrades	Unknown	CS 118A CS 119A	Socioeconomics Air Quality	Under construction

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Existing or Proposed Projects Evaluated for Potential Cumulative Impacts

Cumulative Action Name	Project Location and Description	Potential Area of Surface Disturbance	Applicable Compressor Station	Resources Potentially Affected	Anticipated Construction Date
Simsonsville Drive and Sugarcreek Drive Sewer Upgrade	Charleston, WV Sewer lines upgrades	Unknown	CS 118A CS 119A	Water Resources and Wetlands (CS 118A only) Fish, Wildlife, and Vegetation (CS 118A only) Threatened, Endangered, and Special Status Species (CS118A only) Socioeconomics Air Quality	Under construction
Storm Drain and Sanitary Sewer Project	Winchester, KY Rehabilitation of approximately 1,550 feet of storm sewer and 1,100 feet of sanitary sewer line to eliminate private sanitary sewer systems serving approximately 23 residences	Unknown	CS 106 CS 875	Air Quality	Approved October 2013
Wastewater Collection System Extension	Marmet, WV Wastewater collection system extension to serve 602 new customers in Town of Marmet's Lens Creek and Upper Witcher Creek areas	Unknown	CS 118A CS 119A	Socioeconomics Air Quality	Construction was scheduled to begin December 2014
Water Storage Tank	Madison County, KY 100,000-gallon storage tank, including approximately 920 feet of 8-inch polyvinylchloride water transmission main and appurtenances, and modifications to an existing pump station	Unknown	CS 106 CS 875	Socioeconomics Air Quality	Permitting
Water Street Storm Drainage Project	Clay City, KY Extend storm drain from Irvine Street to Otter Creek	Unknown	CS 106 CS 875	Water Resources and Wetlands Fish, Wildlife, and Vegetation Socioeconomics Air Quality	Under construction
TRANSPORTATION					
I-75 Pavement Rehabilitation	Madison County, KY Pavement rehabilitation of approximately 10.4 miles	n/a (existing facility)	CS 875 CS 106	Water Resources and Wetlands (CS 875 only) Fish, Wildlife, and Vegetation (CS 875 only) Threatened, Endangered, and Special Status Species (CS 875 only) Socioeconomics (CS 875 only) Air Quality	Design scheduled to occur in 2015

Appendix B

Existing or Proposed Projects Evaluated for Potential Cumulative Impacts

Cumulative Action Name	Project Location and Description	Potential Area of Surface Disturbance	Applicable Compressor Station	Resources Potentially Affected	Anticipated Construction Date
Bridge over Elk River at Coonskin Park	Charleston, WV New 470-foot-long, single-span bridge over Elk River to provide new entrance to Coonskin County Park	Unknown	CS 118A CS 119A	Socioeconomics Air Quality	Scheduled for completion in fall 2015
Charleston I-64 Bridge Deck Preservation	Charleston, WV Rehabilitate 19 bridges along I-64, including replacement of expansion joints, application of a latex-modified concrete to bridge decks, repair of barrier walls, and replacement of a section of the cathodic protection system	Unknown	CS 118A CS 119A	Socioeconomics Air Quality	Scheduled for completion in October 2015
Concord Road Widening	Davidson and Williamson Counties, TN Widening 2.27 miles of highway on outskirts of metro area, including bridge installation over Mill Creek and Owl Creek	Unknown	CS 563	Socioeconomics Air Quality	Scheduled for completion in summer 2016
Eagle View	Charleston, WV 580 single-family luxury apartments and townhomes	70 acres	CS 118A CS 119A	Socioeconomics Air Quality	Under construction
Fast Fix 8	Nashville, TN Replacement of four twin bridges along I-40	Unknown	CS 563	Socioeconomics Air Quality	Construction completed
I-65 Interchange at SR 109	Robertson and Sumner Counties, TN New interchange and widening of highway to six lanes	Unknown	CS 563	Socioeconomics Air Quality	Conducting right-of-way acquisition
Interstate 65 Road Widening	Nashville, TN Highway widening from six to ten lanes between Trinity Lane and Dickerson Pike	Unknown	CS 563	Socioeconomics Air Quality	Scheduled for completion in October 2015
KY 627 Bridge Widening	Madison County, KY Reconstruction and widening of 0.1-mile-long KY 627 bridge over I-75 to five lanes	Unknown	CS 106 CS 875	Vegetation, Fisheries, and Wildlife (CS 875 only) Threatened, Endangered, and Special Status Species (CS 875 only) Socioeconomics (CS 875 only) Air Quality	Under construction; scheduled for completion in 2017
KY 974 Bridge Replacement	Clark County, KY Replace 0.1-mile-long KY 974 bridge over Dry Fork	Unknown	CS 106 CS 875	Air Quality	Under construction; scheduled for completion in 2016

Appendix B Existing or Proposed Projects Evaluated for Potential Cumulative Impacts					
Cumulative Action Name	**Project Location and Description**	**Potential Area of Surface Disturbance**	**Applicable Compressor Station**	**Resources Potentially Affected**	**Anticipated Construction Date**
Mill Creek Greenway, Thompson Lane	Davidson County, TN Construction of paved greenway and trailhead, including amenities and a 110-foot span pedestrian bridge	Unknown	CS 563	Socioeconomics Air Quality	Funded and under construction
Route 35 Bypass	Putnam and Mason Counties, WV New 34-mile-long, four-lane highway; 14.6 miles of widening from two to four lanes remains to be constructed	Unknown	CS 118A CS 119A	Air Quality	Under construction; scheduled for completion in 2018
SR-11 Nolensville Road Improvements	Davidson County, TN Widen 4 miles of Nolensville Road to five lanes with 10-foot-wide shoulders	Unknown	CS 563	Socioeconomics Air Quality	Planning
SR-65/US-431 Widening	Robertson County, TN 2.1 miles of road widening along SR-65/US-431	Unknown	CS 563	Air Quality	Scheduled for construction in fiscal year 2015
State Route 109 – Portland Bypass	Robertson and Sumner Counties, TN New highway to bypass city of Portland	Unknown	CS 563	Air Quality	Planning
State Route 112	Nashville, TN Widening of State Route 112 (Clarksville Highway) from two to four travel lanes with a continuous left turn, intersection improvements at Clarksville Pike and Ashland City Highway, replacement of structure over White's Creek; existing traffic signal upgrades at King's Lane and West Hamilton Road, and addition of bike lanes and sidewalks	Unknown	CS 563	Socioeconomics Air Quality	Planning
State Route 374 Project	Montgomery County, TN New 7-mile-long, 300-foot-wide travel corridor, including crossing of Cumberland River	255 acres	CS 563	Air Quality	Permitting
COMMERCIAL					
American Premium Metal	Louisa, KY 15,000 square foot building for metal roofing supplier	Unknown	CS 114	Air Quality	Under construction

Appendix B

Existing or Proposed Projects Evaluated for Potential Cumulative Impacts

Cumulative Action Name	Project Location and Description	Potential Area of Surface Disturbance	Applicable Compressor Station	Resources Potentially Affected	Anticipated Construction Date
Bayer Material Science – South Charleston Facility	South Charleston, WV Installation of an ethylene oxide storage tank, railcar unloading facilities, and associated equipment	Unknown	CS 118A CS 119A	Vegetation, Fisheries, and Wildlife (CS 118A only) Threatened, Endangered, and Special Status Species (CS 118A only) Socioeconomics Air Quality	Permitting
Beech Fork Lodge & Convention Center	Wayne County, WV 75-room lodge and convention center	Unknown	CS 114	Air Quality	Scheduled for completion in 2015
Commercial Building	Charleston, WV 12,600 square foot commercial building	Unknown	CS 118A CS 119A	Socioeconomics Air Quality	Under Construction
Commercial Building	Charleston, WV 30,000 square foot, four-story building	Unknown	CS 118A CS 119A	Vegetation, Fisheries, and Wildlife (CS 118A only) Threatened, Endangered, and Special Status Species (CS 118A only) Socioeconomics Air Quality	Under Construction
CVS	Charleston, WV 11,945 square foot retail store	Unknown	CS 118A CS 119A	Socioeconomics Air Quality	Under construction
Data Processing Center	Mount Sterling, KY 11,000 square foot data processing center	Unknown	CS 106 CS 875	Air Quality	Completed
Equestrian Center	Clark County, KY Construction of additional barns and arenas on 100 acres at an existing equestrian center	100 acres	CS 106 CS 875	Water Resources and Wetlands Vegetation, Fisheries, and Wildlife Threatened, Endangered, and Special Status Species Air Quality	Unknown
Heartland Intermodal Gateway Inland Port Terminal	Prichard, WV New intermodal terminal facility	Unknown	CS 114	Vegetation, Fisheries, and Wildlife Threatened, Endangered, and Special Status Species Air Quality	Scheduled for completion in December 2015
Hospital Expansion	Charleston, WV Two-story expansion of existing hospital to include 48 new beds	Unknown	CS 118A CS 119A	Socioeconomics Air Quality	Under construction

Appendix B

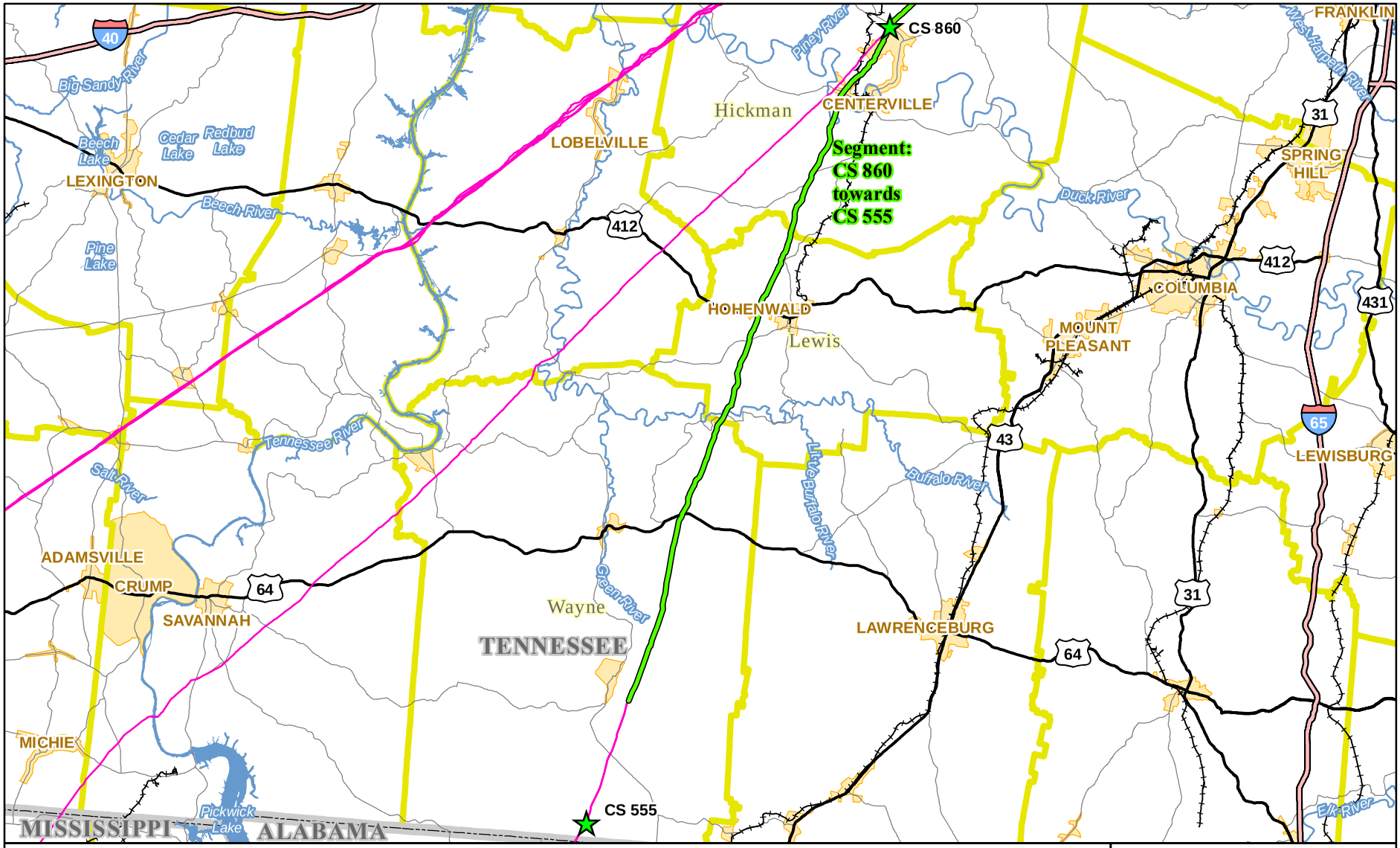
Existing or Proposed Projects Evaluated for Potential Cumulative Impacts

Cumulative Action Name	Project Location and Description	Potential Area of Surface Disturbance	Applicable Compressor Station	Resources Potentially Affected	Anticipated Construction Date
Lois M. DeBerry Special Needs Facility	Nashville, TN Installation of three natural gas-fired boilers and a diesel-fired engine for emergency power generation	n/a (existing facility)	CS 563	Socioeconomics Air Quality	Permitting
Manufacturing Facility	Winchester, KY 40,000 square foot manufacturing facility	Unknown	CS 106 CS 875	Air Quality	Completed
Manufacturing Facility Expansion	Winchester, KY 30,000 square foot expansion	Unknown	CS 106 CS 875	Air Quality	In planning
Manufacturing Plant	Richmond, KY 200,000 square foot appliance manufacturing facility	45 acres	CS 106 CS 875	Socioeconomics Air Quality	Under construction
Medical Office Building	Charleston, WV New three-story medical office building	Unknown	CS 118A CS 119A	Socioeconomics Air Quality	Under construction
Office Building	Boyd County, KY 24,000 square foot office building	Unknown	CS 114	Socioeconomics Air Quality	Under construction
Office Building	Charleston, WV 62,000 square foot office building	Unknown	CS 118A CS 119A	Socioeconomics Air Quality	Under construction
RNC Expansion	Whites Creek, TN Expansion of existing building by 15,000 square feet	Unknown	CS 563	Socioeconomics Air Quality	Permitting
RESIDENTIAL					
Apartment Building	Charleston, WV 32-unit apartment building	Unknown	CS 118A CS 119A	Socioeconomics Air Quality	Under construction
Double D Meadows Subdivision, Robbinsville Loop	Richmond, KY Three-phase single-family housing development with a total of 65 to 70 lots, with each home having at least 1,200 square feet of livable space	Unknown	CS 106 CS 875	Socioeconomics Air Quality	Phase 1 complete; Phases 2 and 3 are unknown
Residential Building	Charleston, WV 12,600 square foot, two-story building with 14 units	Unknown	CS 118A CS 119A	Socioeconomics Air Quality	Under Construction
The Ridges	Charleston, WV 189 single-family homes and townhomes	175 acres	CS 118A CS 119A	Socioeconomics Air Quality	Under Construction

Appendix B Existing or Proposed Projects Evaluated for Potential Cumulative Impacts					
Cumulative Action Name	**Project Location and Description**	**Potential Area of Surface Disturbance**	**Applicable Compressor Station**	**Resources Potentially Affected**	**Anticipated Construction Date**
Tire Manufacturing Facility	Clarksville, TN Automotive tire manufacturing facility	469 acres	CS 563	Air Quality	Scheduled for completion by 2016
OTHER					
Blue Grass Chemical Agent-Destruction Pilot Plant	Richmond, KY Facility to destroy nerve agents	Within the 15,000-acre Blue Grass Army Depot	CS 106 CS 875	Socioeconomics Air Quality	Under construction; scheduled for completion in 2018
Joelton Radio Site	Joelton, TN Installation of 50 kW propane-fired emergency generator	Unknown	CS 563	Water Resources and Wetlands Vegetation, Fisheries, and Wildlife Threatened, Endangered, and Special Status Species Socioeconomics Land Use, Recreation, and Visual Resources Air Quality Noise	Permitting

Appendix C

Alternatives Figures



Legend

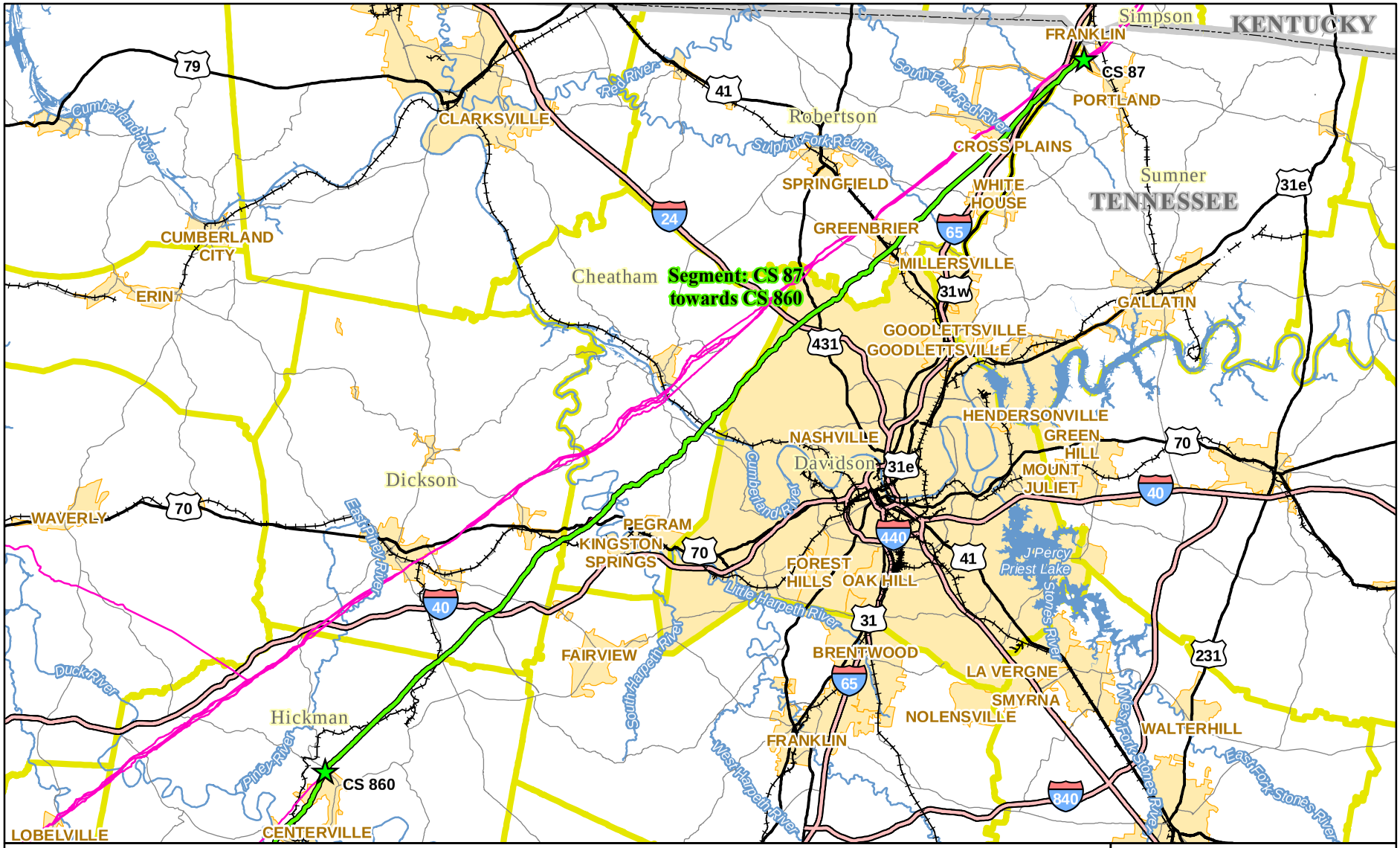
- Existing Tennessee Compressor Station
- Pipeline Looping Segment
- Tennessee Gas Pipeline System
- Interstate Highway
- US Highway
- State Highway
- Railroad
- State Boundary
- County Boundary
- City Boundary
- River
- Lake

N W E S

0 10
Miles

Figure C-1
Pipeline Only Alternative
(Page 1 of 6)

Broad Run
Expansion Project



Legend

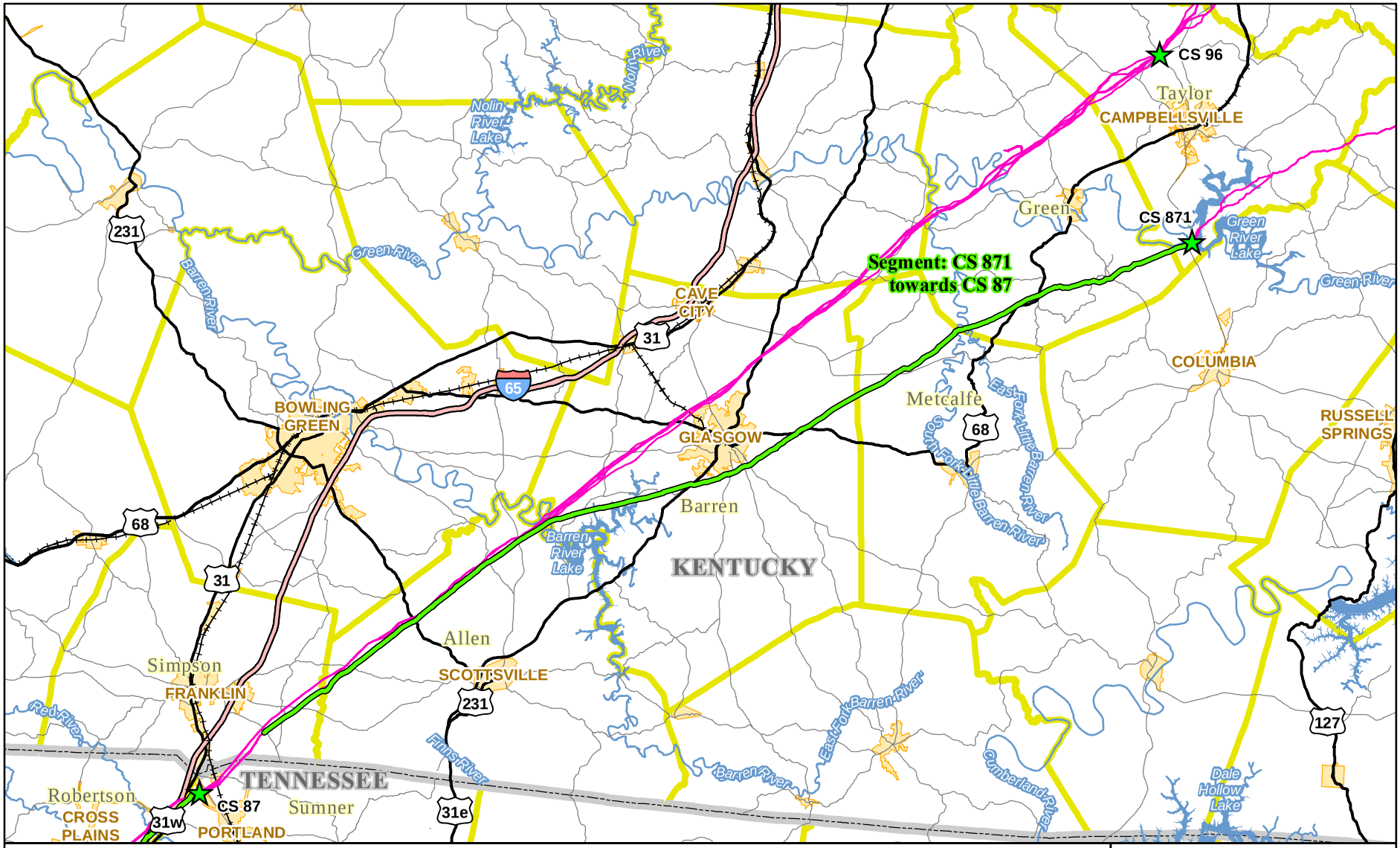
- Existing Tennessee Compressor Station
- Pipeline Looping Segment
- Tennessee Gas Pipeline System
- Interstate Highway
- US Highway
- State Highway
- Railroad
- State Boundary
- County Boundary
- City Boundary
- River
- Lake

N W E S

0 10 Miles

Figure C-1
Pipeline Only Alternative
(Page 2 of 6)

Broad Run
Expansion Project



Legend

- Existing Tennessee Compressor Station
- Pipeline Looping Segment
- Tennessee Gas Pipeline System
- Interstate Highway
- US Highway
- State Highway
- Railroad
- State Boundary
- County Boundary
- City Boundary
- River
- Lake

Figure C-1
Pipeline Only Alternative
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Broad Run
Expansion Project

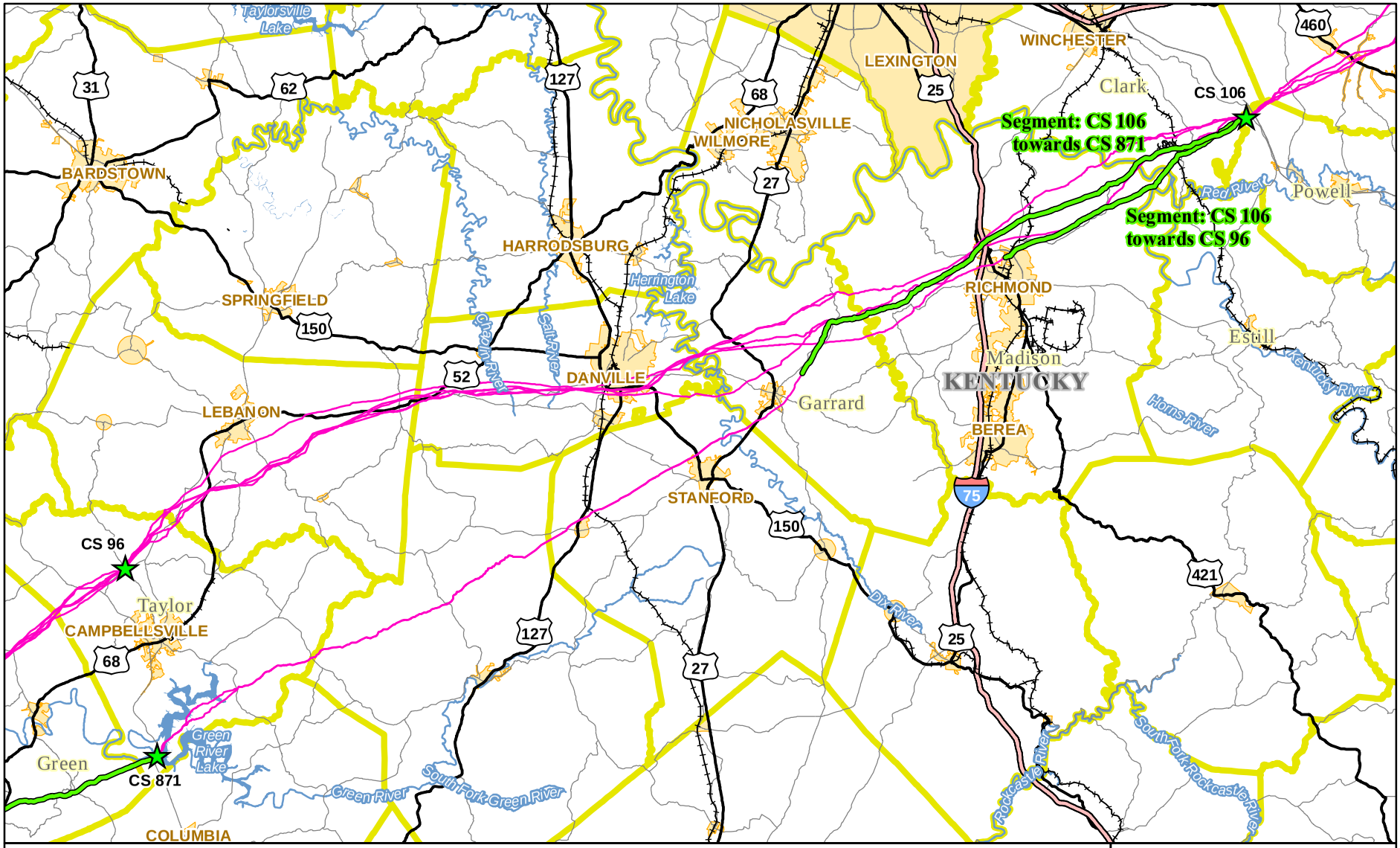


Figure C-1
Pipeline Only Alternative
(Page 4 of 6)

Broad Run
Expansion Project

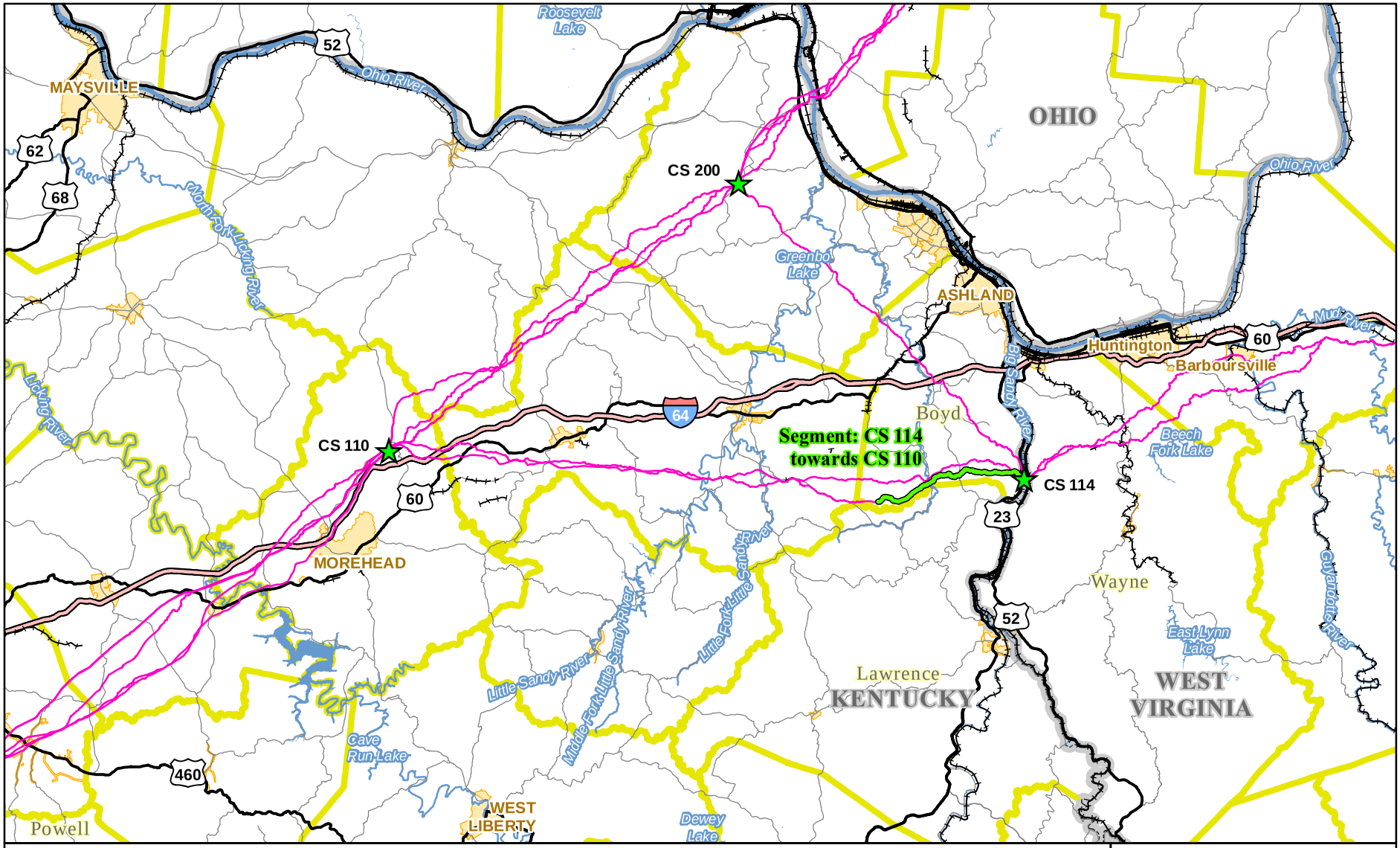
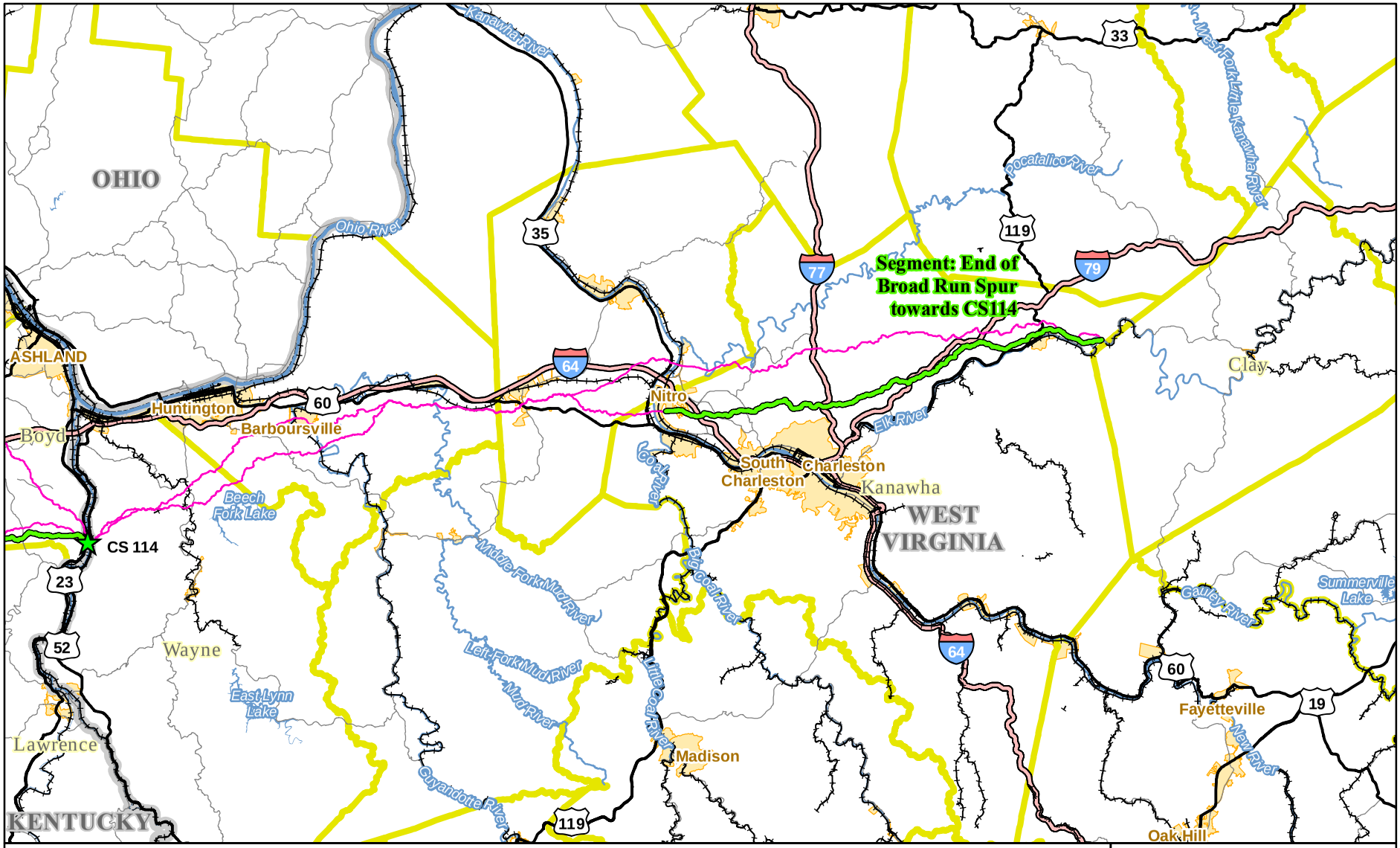


Figure C-1
Pipeline Only Alternative
(Page 5 of 6)

Broad Run
Expansion Project



Legend

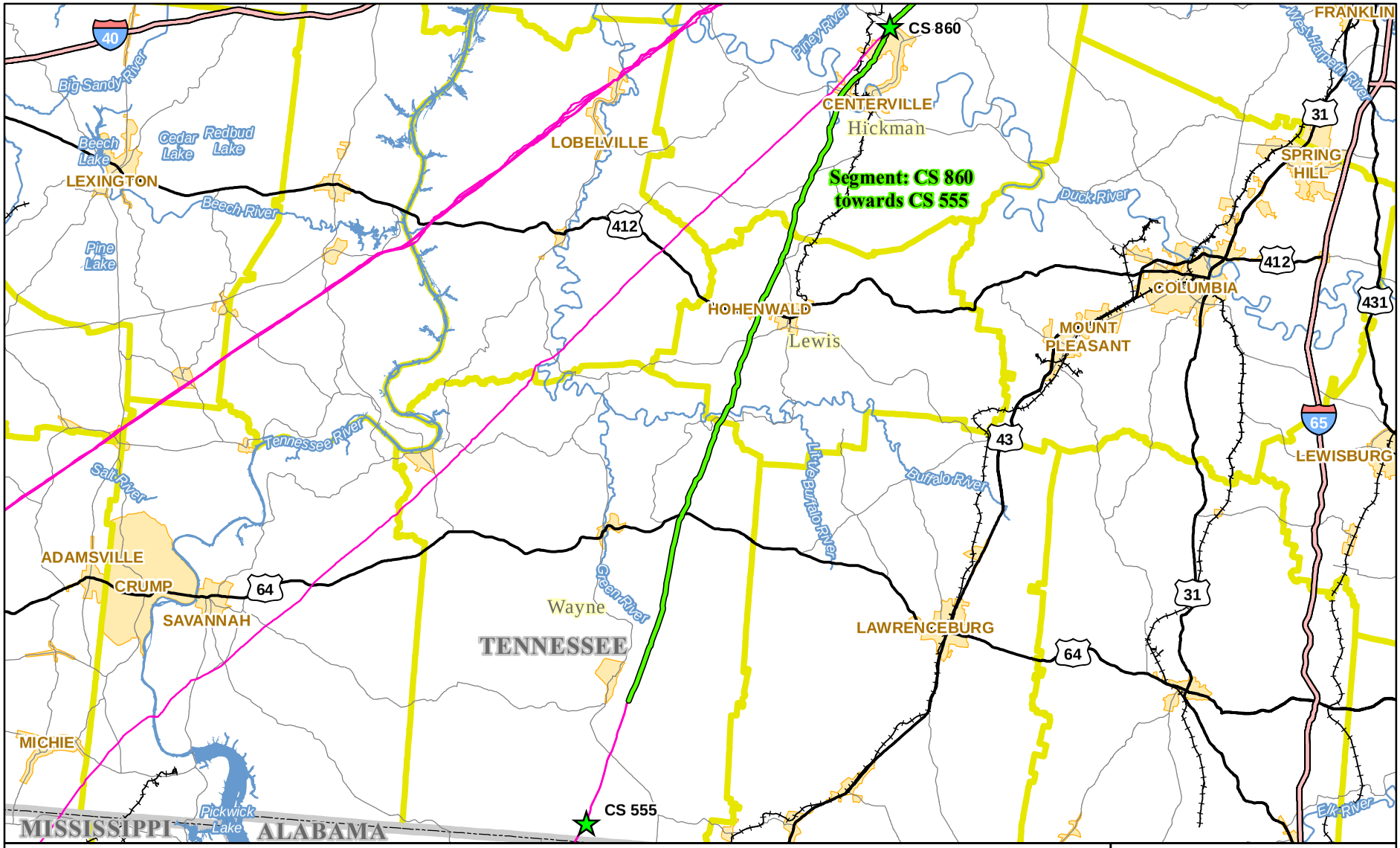
- Existing Tennessee Compressor Station
- Pipeline Looping Segment
- Tennessee Gas Pipeline System
- Interstate Highway
- US Highway
- State Highway
- Railroad
- State Boundary
- County Boundary
- City Boundary
- River
- Lake

N W E S

0 10
Miles

Figure C-1
Pipeline Only Alternative
(Page 6 of 6)

Broad Run
Expansion Project



Legend

- Existing Tennessee Compressor Station
- Pipeline Looping Segment
- Tennessee Gas Pipeline System
- Interstate Highway
- US Highway
- State Highway
- Railroad
- State Boundary
- County Boundary
- City Boundary
- River
- Lake

Figure C-2
Combined Compression and Pipeline Alternative
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Broad Run Expansion Project

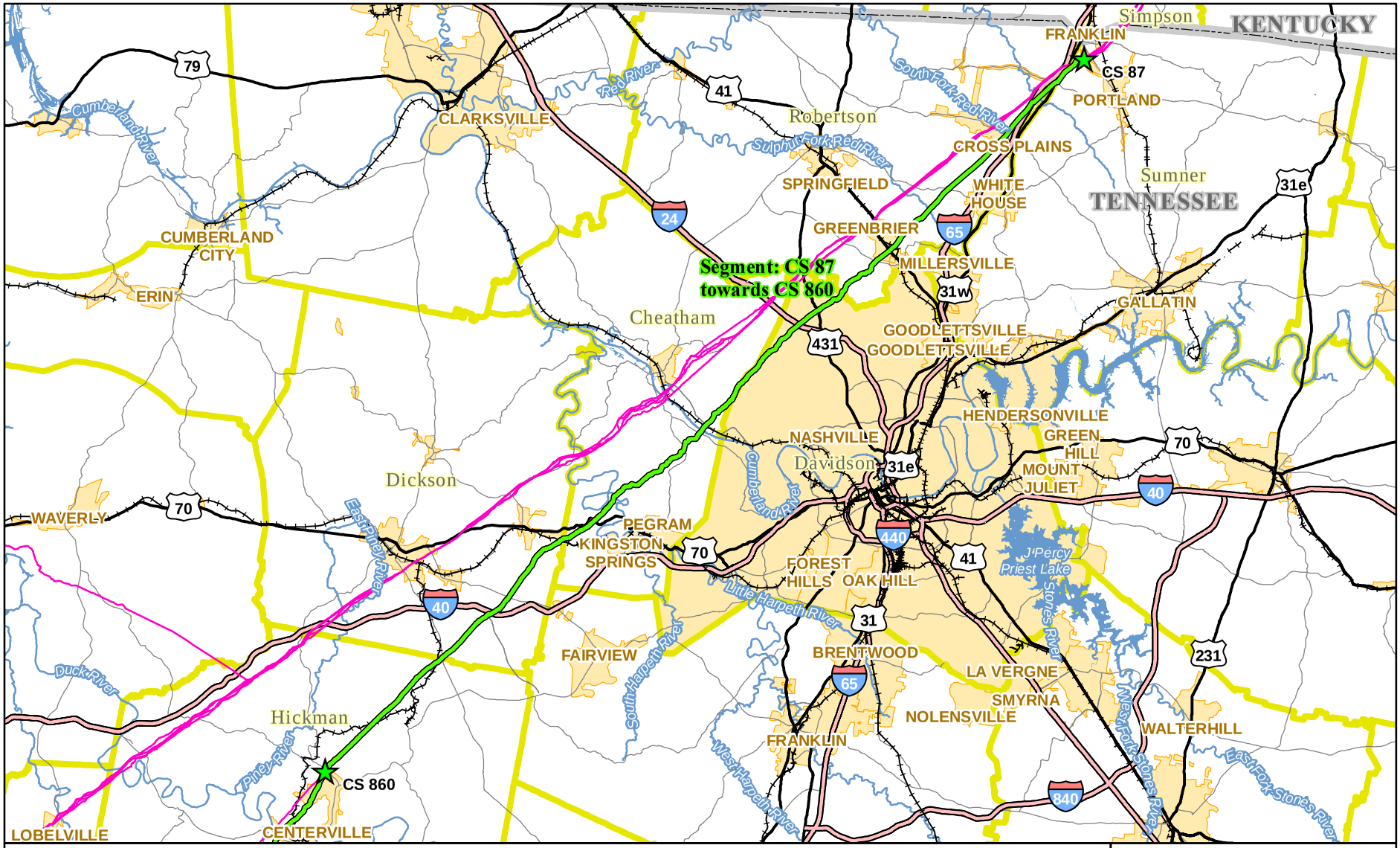
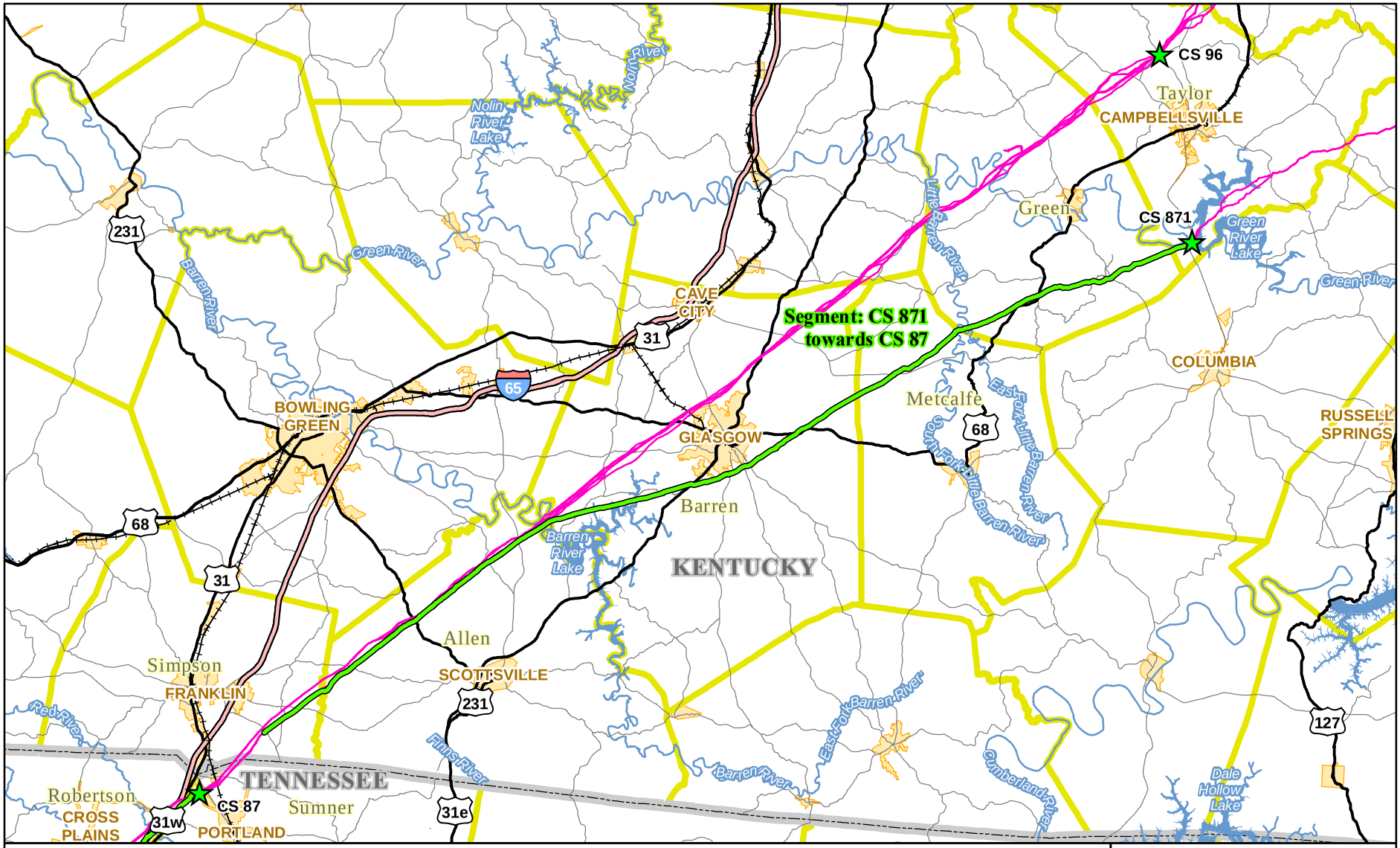


Figure C-2
Combined Compression and Pipeline Alternative
(Page 2 of 6)

Broad Run Expansion Project



Legend

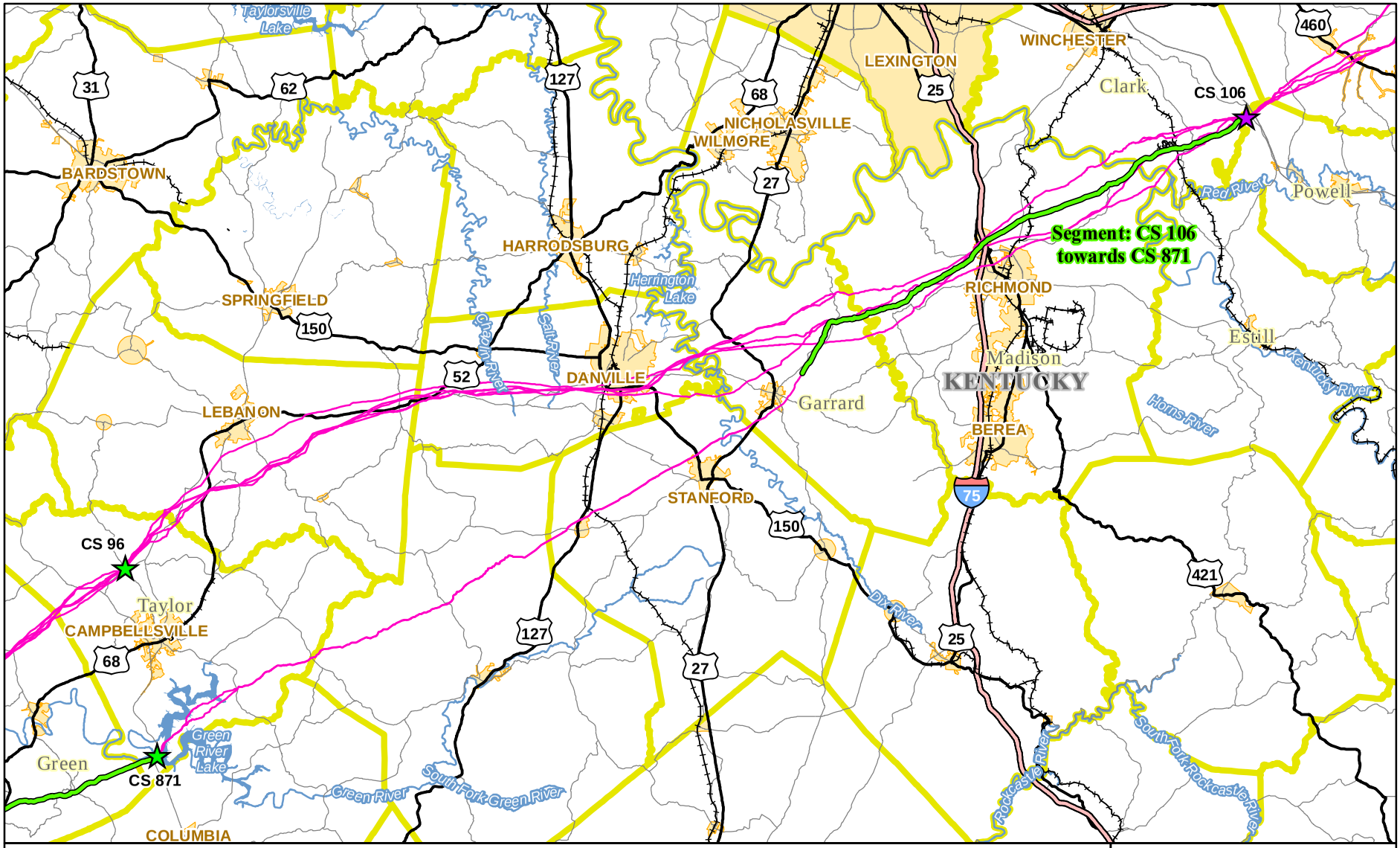
- Existing Tennessee Compressor Station
- Pipeline Looping Segment
- Tennessee Gas Pipeline System
- Interstate Highway
- US Highway
- State Highway
- Railroad
- State Boundary
- County Boundary
- City Boundary
- River
- Lake

N W E S

0 10 Miles

Figure C-2
Combined Compression and Pipeline Alternative
(Page 3 of 6)

Broad Run Expansion Project



Legend

- Proposed/Modified Tennessee Compressor Station
- Existing Tennessee Compressor Station
- Pipeline Looping Segment
- Tennessee Gas Pipeline System
- Interstate Highway
- US Highway
- State Highway
- Railroad
- County Boundary
- City Boundary
- River
- Lake

N W E S

0 10
Miles

Figure C-2
Combined Compression and Pipeline Alternative
(Page 4 of 6)

Broad Run Expansion Project

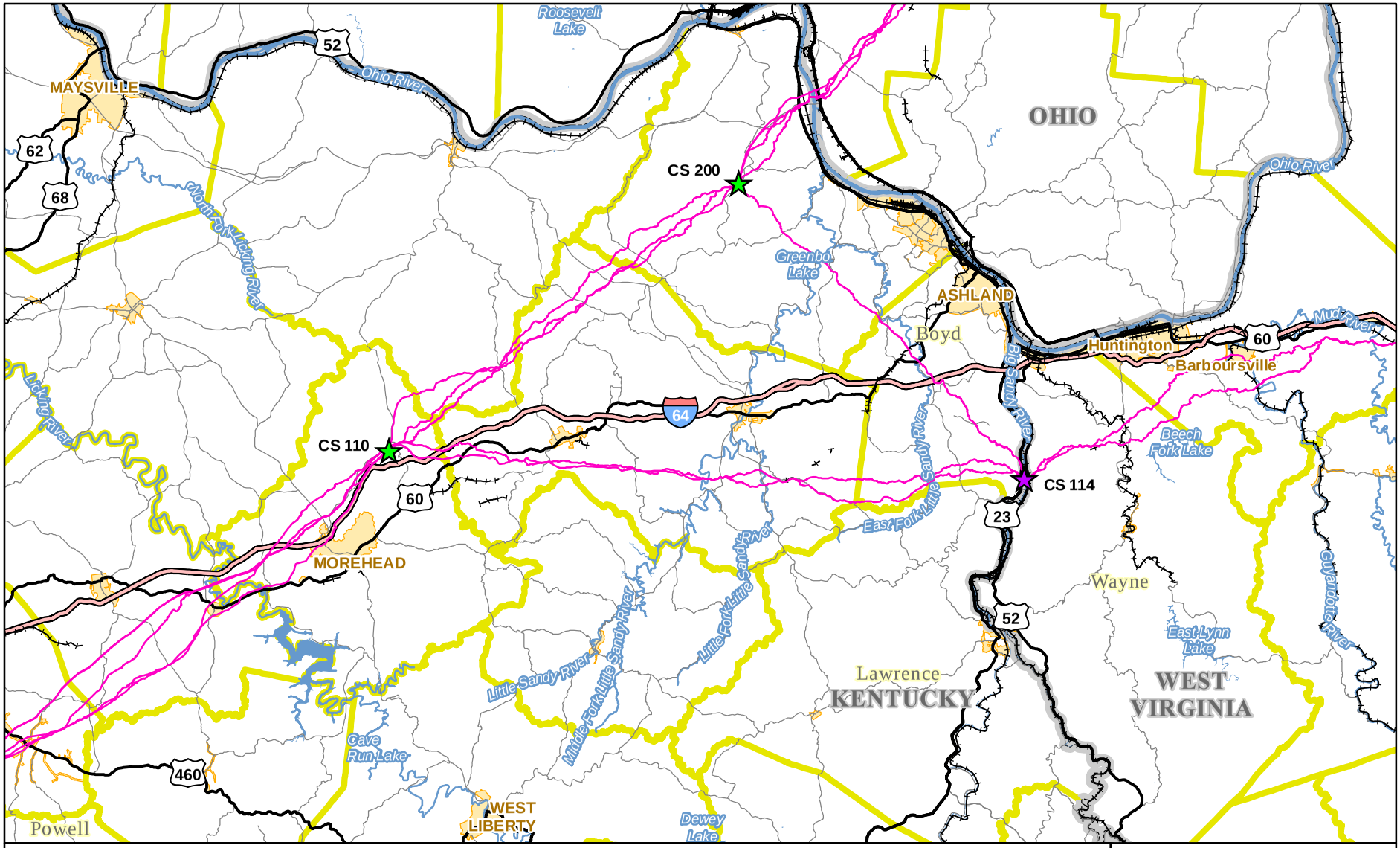
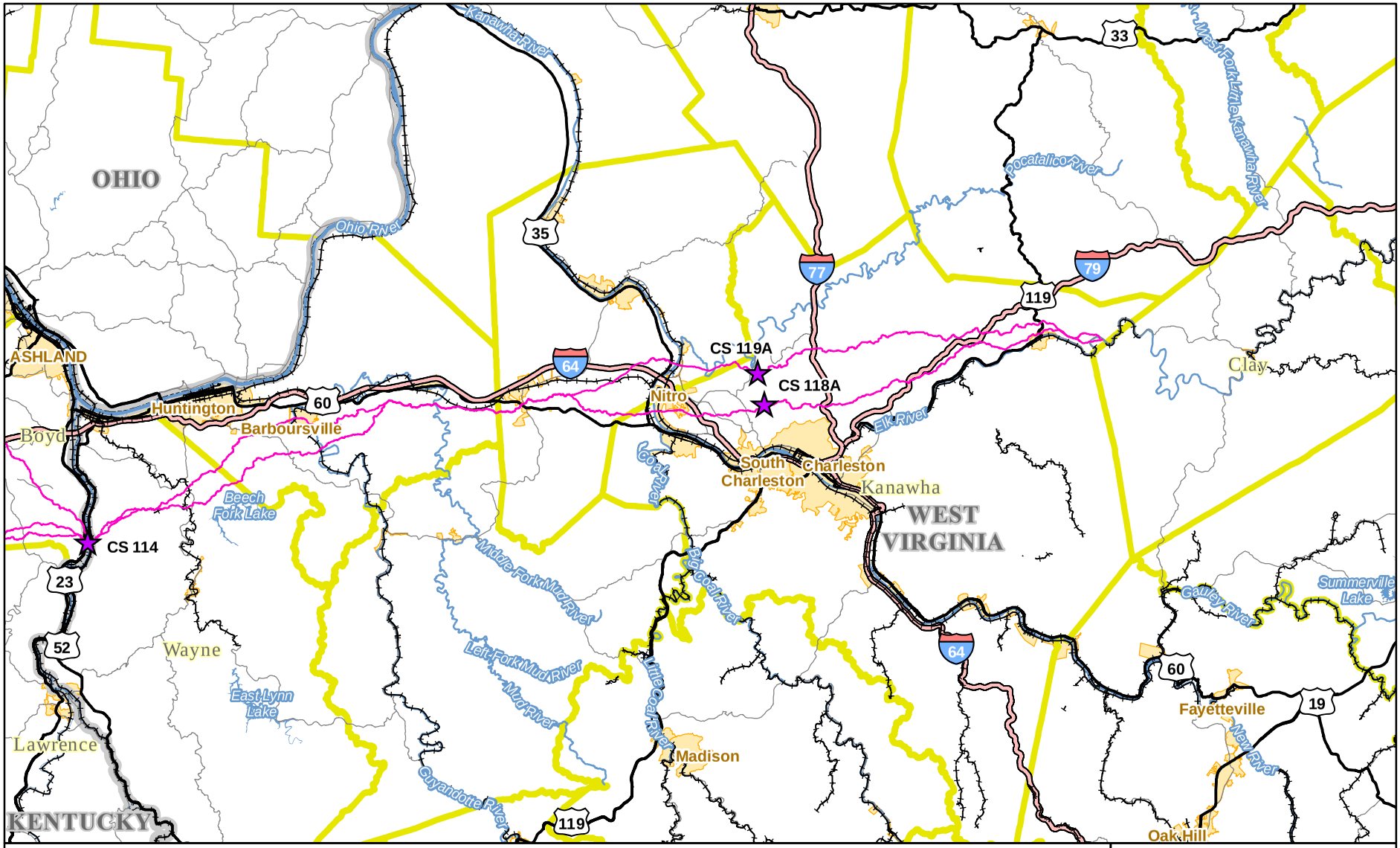


Figure C-2
Combined Compression and Pipeline Alternative
(Page 5 of 6)

Broad Run Expansion Project



Legend

- Proposed/Modified Tennessee Compressor Station
- Tennessee Gas Pipeline System
- Interstate Highway
- US Highway
- State Highway
- Railroad
- State Boundary
- County Boundary
- City Boundary
- River
- Lake

N W E S

0 10
Miles

Figure C-2
Combined Compression and Pipeline Alternative
(Page 6 of 6)

Broad Run Expansion Project

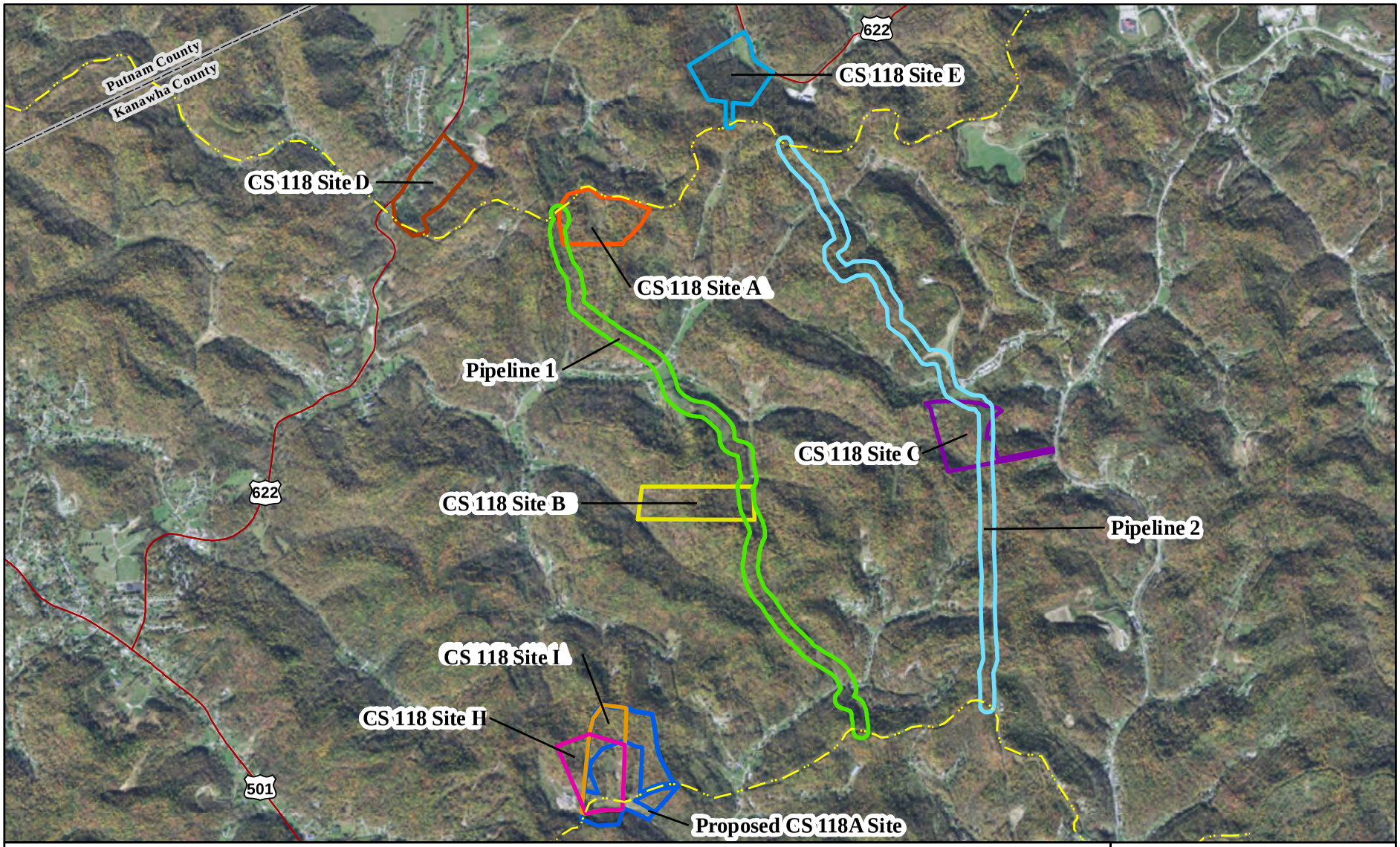
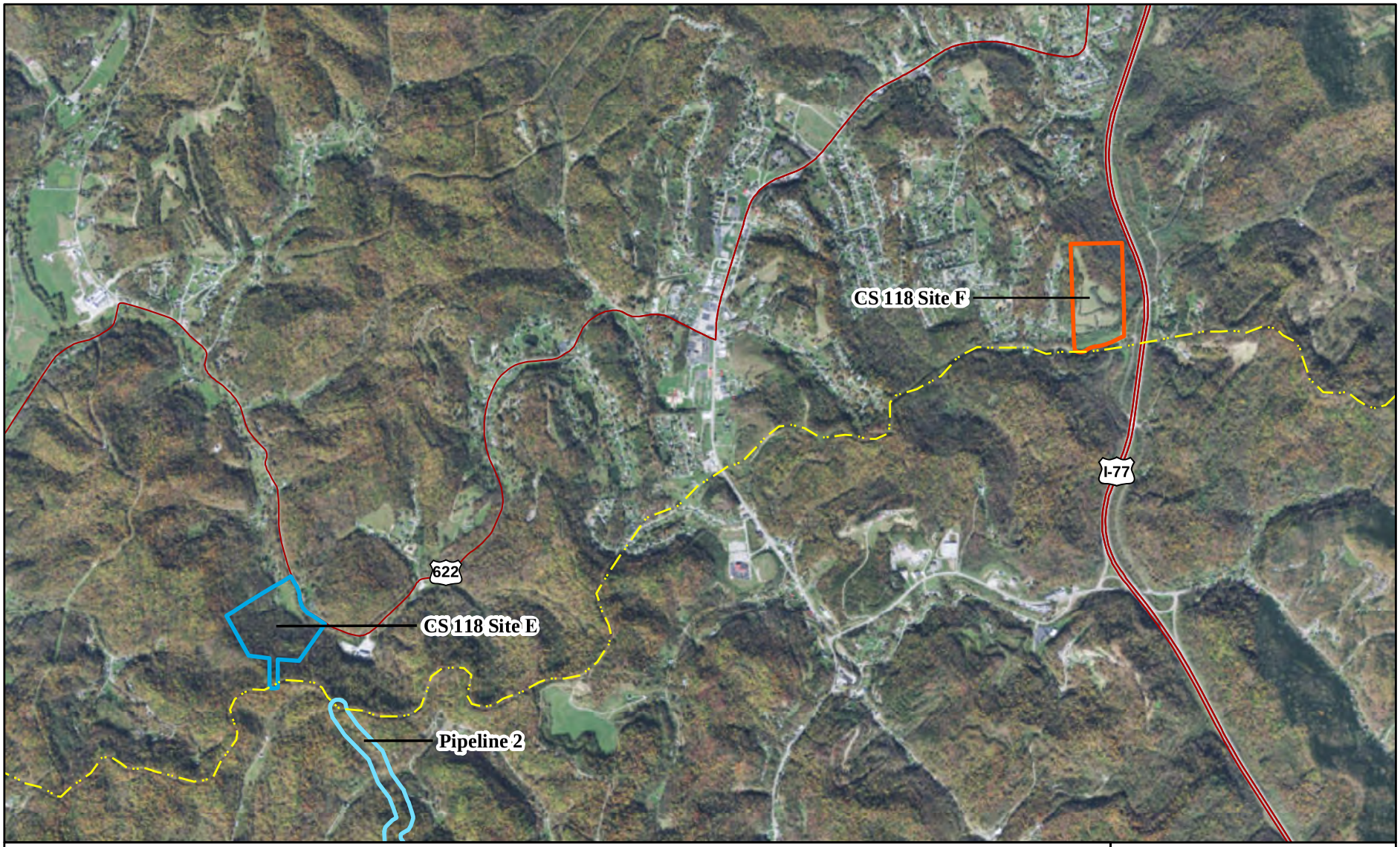


Figure C-3
Site Alternatives CS 118
(Page 1 of 3)

Broad Run
Expansion Project



Legend

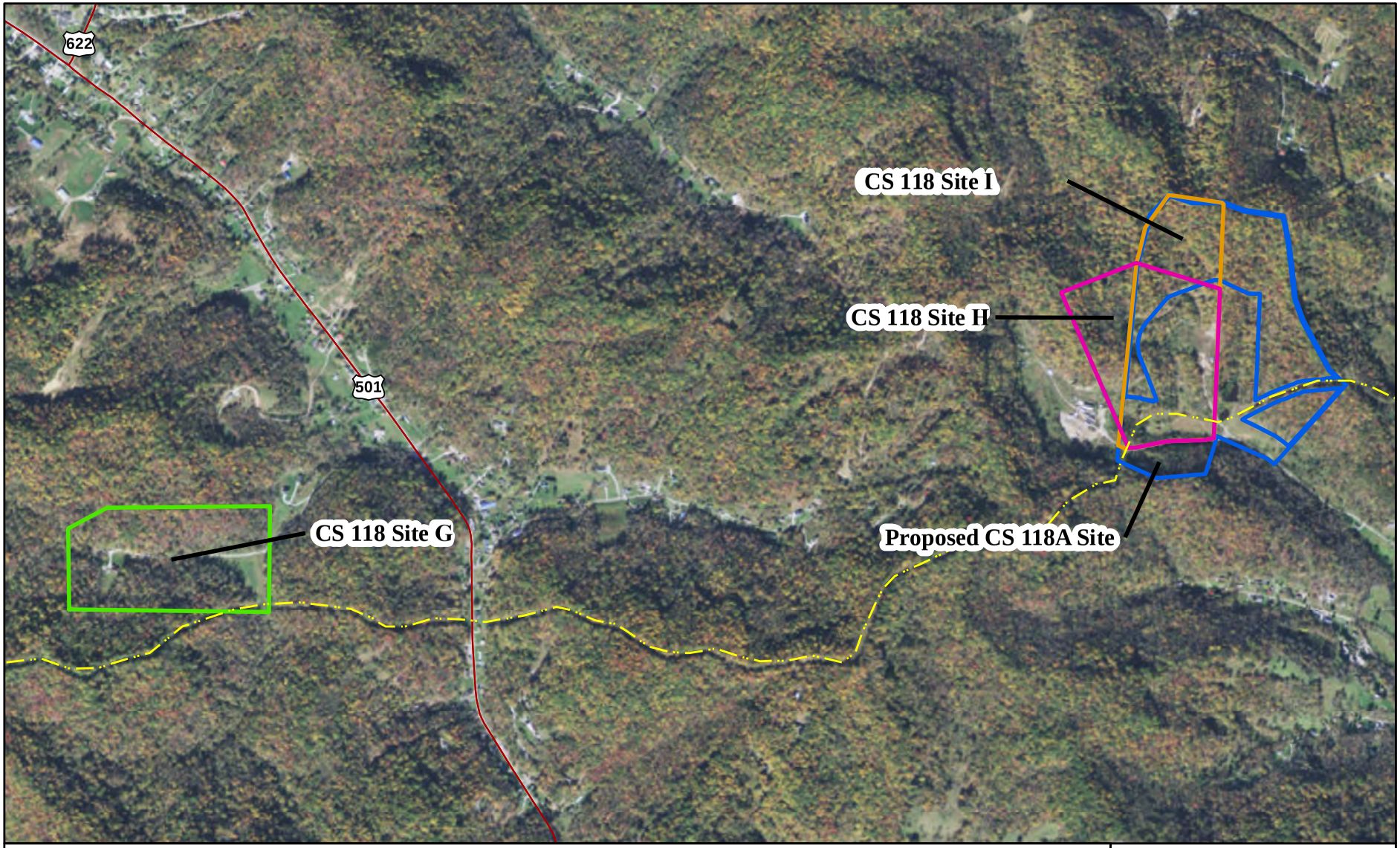
- Existing Tennessee Gas Pipeline
- Highway
- Pipeline 2 Study Area
- CS 118 Site E Study Area
- CS 118 Site F Study Area

N
W E
S

0 0.5
Miles

Figure C-3
Site Alternatives CS 118
(Page 2 of 3)

Broad Run
Expansion Project



Legend

- Existing Tennessee Gas Pipeline
- Highway
- CS 118 Site G Study Area
- CS 118 Site H Study Area
- CS 118 Site I Study Area
- Proposed CS 118A Site

N
W E
S

0 0.25
Miles

Figure C-3
Site Alternatives CS 118
(Page 3 of 3)

Broad Run
Expansion Project

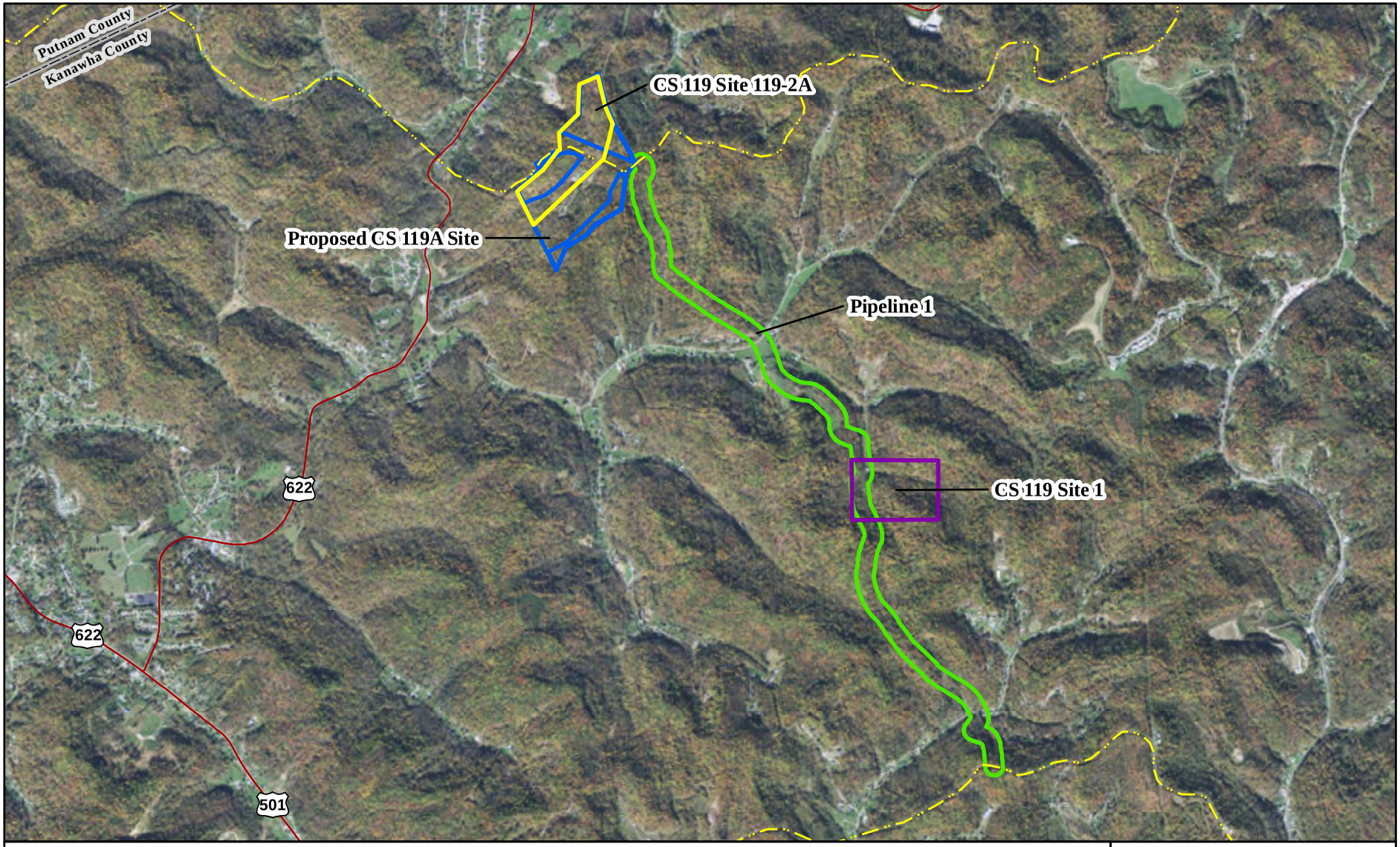
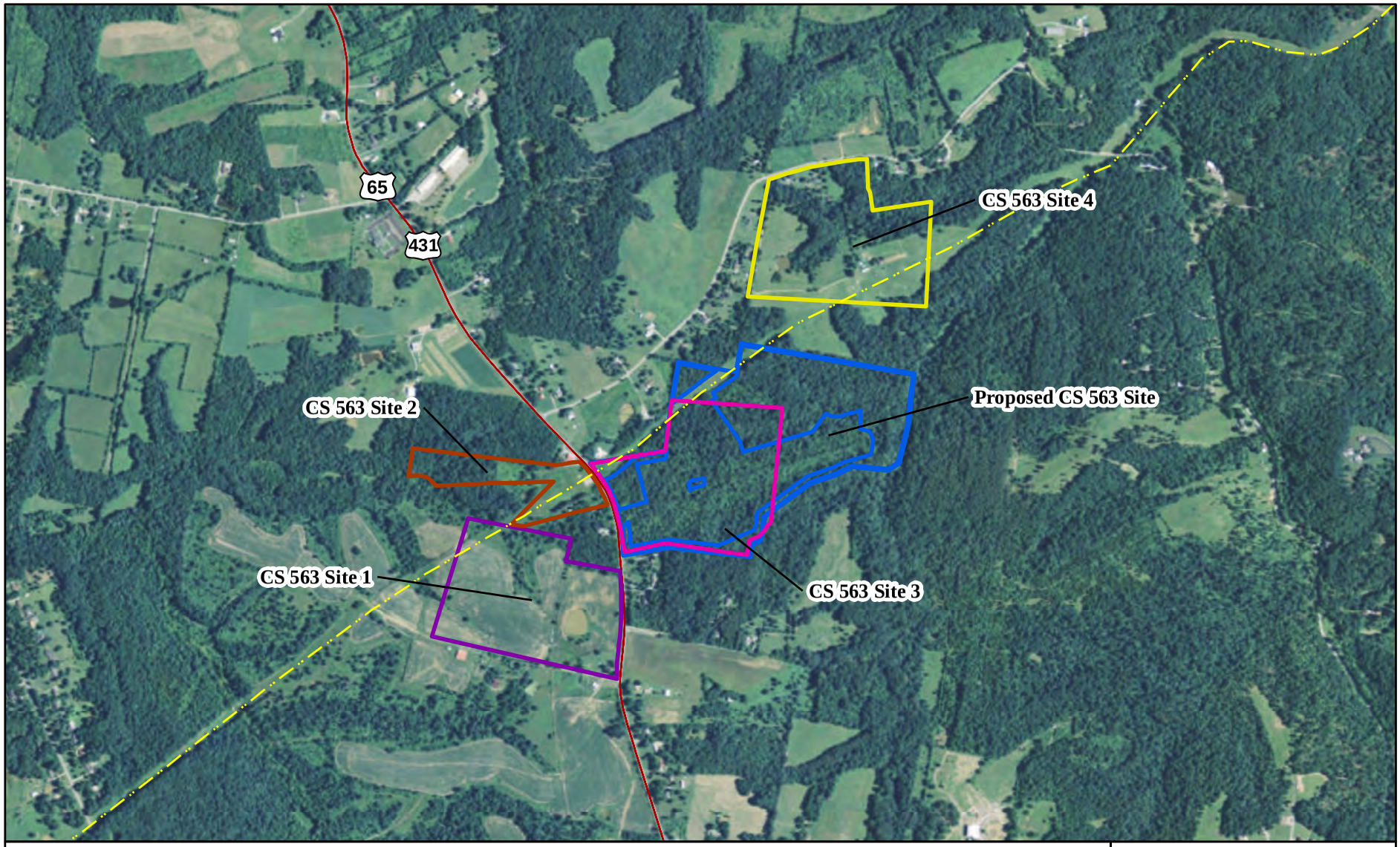


Figure C-4
Site Alternatives CS 119

Broad Run
Expansion Project



Legend

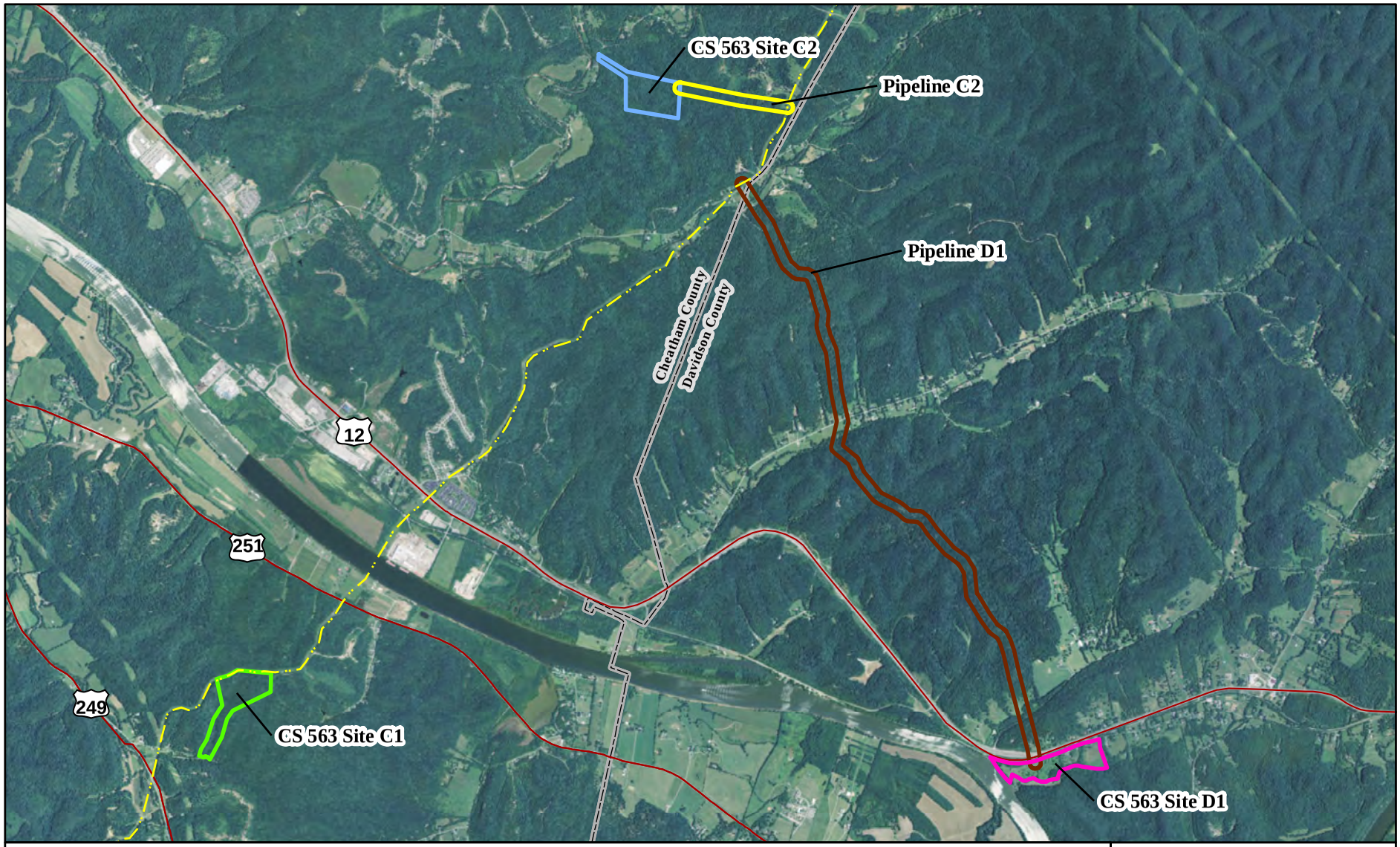
- Existing Tennessee Gas Pipeline
- Highway
- CS 563 Site 1 Study Area
- CS 563 Site 2 Study Area
- CS 563 Site 3 Study Area
- CS 563 Site 4 Study Area
- Proposed CS 563 Site

N
W E
S

0 0.25
Miles

Figure C-5
Site Alternatives CS 563
(Page 1 of 4)

Broad Run
Expansion Project



Legend

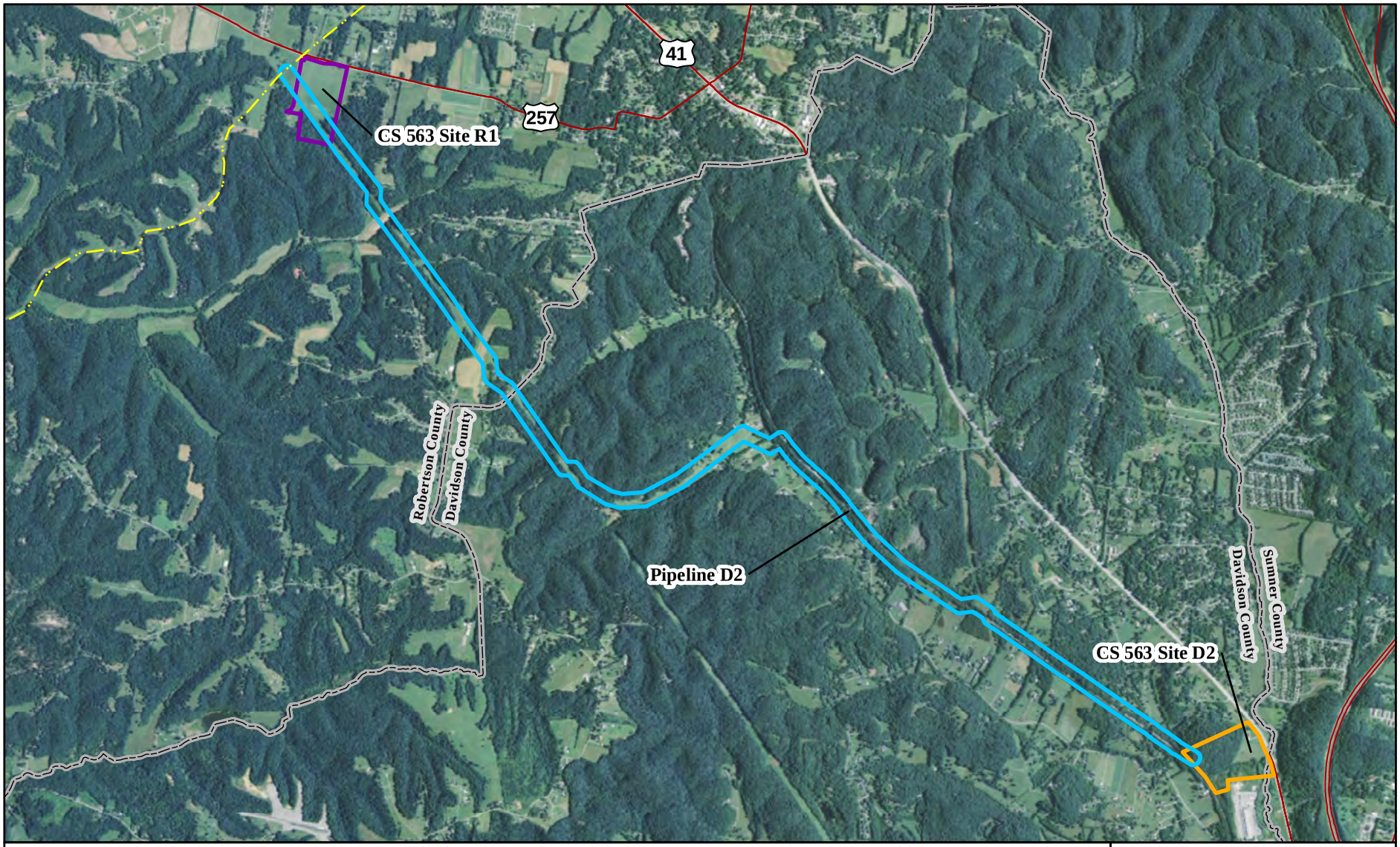
- Existing Tennessee Gas Pipeline
- Highway
- CS 563 Site C1 Study Area
- Pipeline C2 Study Area
- CS 563 Site C2 Study Area
- CS 563 Site D1 Study Area
- Pipeline D1 Study Area
- County Boundary

N
W E
S

0 0.25 0.5 0.75
Miles

Figure C-5
Site Alternatives CS 563
(Page 2 of 4)

Broad Run
Expansion Project



Legend

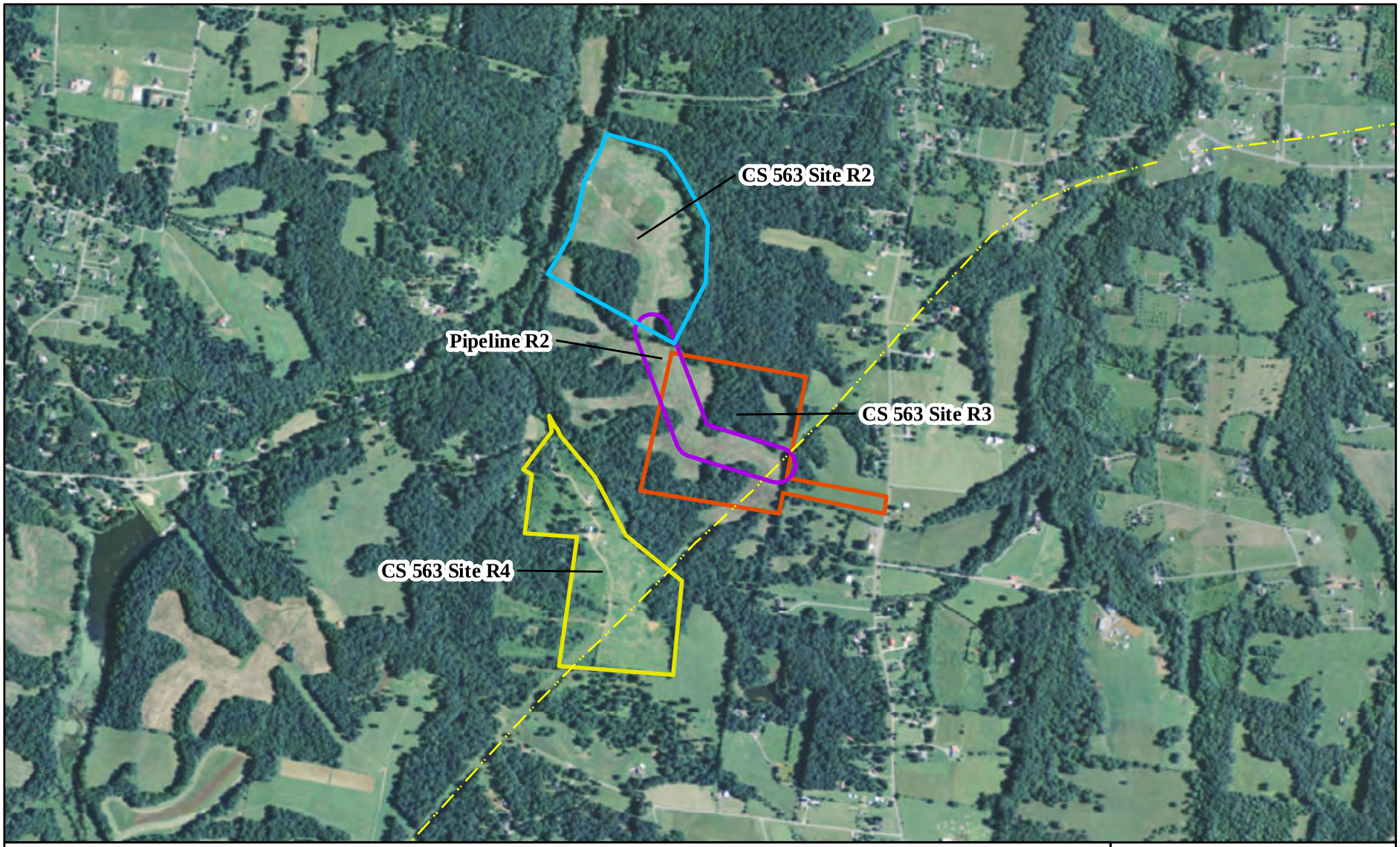
- Existing Tennessee Gas Pipeline
- Highway
- CS 563 Site R1 Study Area
- CS 563 Site D2 Study Area
- Pipeline D2 Study Area
- County Boundary

N
W E
S

0 0.25 0.5
Miles

Figure C-5
Site Alternatives CS 563
(Page 3 of 4)

Broad Run
Expansion Project



Legend

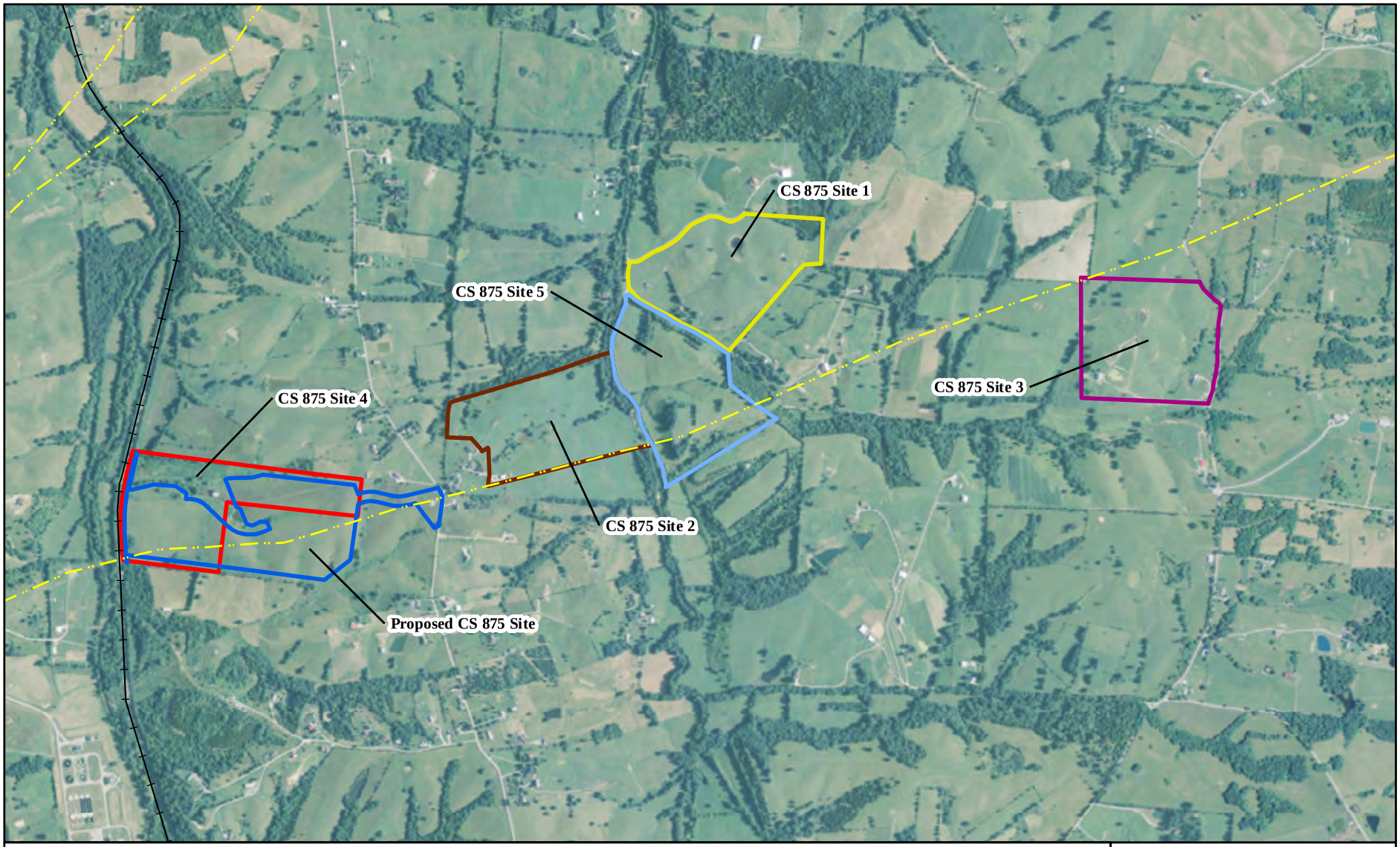
- Existing Tennessee Gas Pipeline
- CS 563 Site R2 Study Area
- Pipeline R2 Study Area
- CS 563 Site R3 Study Area
- CS 563 Site R4 Study Area

N
W E
S

0 0.25
Miles

Figure C-5
Site Alternatives CS 563
(Page 4 of 4)

Broad Run
Expansion Project



Legend

- Railroad
- Existing Tennessee Gas Pipeline
- CS 875 Site 1 Study Area
- CS 875 Site 2 Study Area
- CS 875 Site 3 Study Area
- CS 875 Site 4 Study Area
- CS 875 Site 5 Study Area
- Proposed CS 875 Site

N
W E
S

0 0.25
Miles

Figure C-6
Site Alternatives CS 875

Broad Run
Expansion Project

Appendix D

References

Barber, J.R., K.R. Crooks, and K.M. Fristrup. 2009. The costs of chronic noise exposure for terrestrial organisms. Trends in Ecology and Evolution: 180–189.

Beranek, L. 1988. Noise and Vibration Control, Chapter 7 – Sound Propagation Outdoors. Institute of Noise Control Engineering, Washington, DC.

Big Sandy Water District (BSWD). 2014. Big Sandy Water District Water Quality Report for year 2014. Available online at: http://www.krwa.org/2012ccr/bigsandy.pdf. Accessed November 2015.

Boyd County. 2014. Personal communication with Valerie Smith, Economic and Community Development Director (606-739-0010), November 4, 2014.

Braun, E. Lucy. 1950. Deciduous Forests of Eastern North America. The Blackburn Press, Caldwell, New Jersey. 533 p.

Caceres, M.C. and R. Barclay. 2000. Mammalian Species. *Myotis septentrionalis*. The American Society of Mammalogists. May 2000. No. 634, pp. 1–4.

CDI L. R. Kimball (CDI). 2014a. Geotechnical Data Summary Report for Station 106. November 2014.

_____. 2014b. Geotechnical Exploration and Foundation Engineering Report for Broad Run Flexibility Project Station 114. October 2014.

Cowardin, D.M., V. Carter, F.C. Golet, and E.T. La Roe. 1979. Classification of Wetlands and Deepwater Habitats of the United States. United States Department of the Interior, Fish and Wildlife Service. Publication No. FWS/OBS-79/31. Washington, D.C. Available online at: http://www.fws.gov/wetlands/Documents/Classification-of-Wetlands-and-Deepwater-Habitats-of-the-United-States.pdf.

Council on Environmental Quality (CEQ). 1997. Considering Cumulative Effects Under the National Environmental Policy Act. Council on Environmental Quality, Executive Office of the President. January 1997. Available online at: http://www3.epa.gov/environmentaljustice/resources/policy/ej_guidance_nepa_ceq1297.pdf. Accessed July 2015.

_____. 2014. Draft Guidance of Green House Gas Emissions. December 2014. Available online at: https://www.whitehouse.gov/administration/eop/ceq/initiatives/nepa/ghg-guidance. Accessed July 2015.

Decher, J. and J. Choate. 1995. Mammalian Species. *Myotis grisescens*. The American Society of Mammalogists. October 1995. No. 510, pp. 1–7.

DeGregorio, B.A., Weatherhead, P.J., and Sperry J.H. 2014. Power lines, roads, and avian nest survival: effects on predator identity and predation intensity. Ecology and Evolution 4(9):1589–1600.

Dickson, J.G. 2004. Wildlife and Upland Oak Forests. Gen. Tech. Rep. SRS-73. Asheville, NC: U.S. Department of Agriculture, Forest Service, Southern Research Station. Pp. 106–115.

eBird. 2015. eBird: An Online Database of Bird Distribution and Abundance. Available online at http://www.ebird.org. Accessed July 2015.

Faaborg, J., M.C. Brittingham, T.M. Donovon, and J.G. Blake. 1995. Habitat Fragmentation in the Temperate Zone. In: Matin, T.E., and D.M. Finch, editors. Ecology and Management of Neotropical Migratory Birds: a Synthesis and Review of Critical Issues. Oxford University Press, Oxford, United Kingdom.

Floyd, M.A. 2014. Endangered Species Act Basics – with a Focus on Kentucky. Kentucky Woodlands Magazine, Vol. 9 (1):5–9.

Francis, C.D. and J.R. Barber. 2013. A Framework for Understanding Noise Impacts on Wildlife: An Urgent Conservation Priority. Ecological Society of America, Frontiers in Ecology and the Environment. DOI: 10.1890/120183.

Harriman, V. 2003. "Myotis grisescens." Animal Diversity Web. Available online at: http://animaldiversity.org/accounts/Myotis_grisescens/. Accessed July 2015.

Harper, K.A, MacDonald, S.E., Burton, P.J., Chen J., Brosofske, K.D., Saunders, S.C., Euskirchen, E.S., Roberts, D., Jaiteh, M.S., and Esseen, P. 2005. Edge influence on forest structure and composition in fragmented landscapes. Conservation Biology 19:3(768–782).

Harris, L.D. 1984. The Fragmented Forest, Island Biogeographic Theory and the Preservation of Biotic Diversity. University of Chicago Press, Chicago and London.

Indiana University. 2015a. St. Louis Limestone. Available online at: https://igs.indiana.edu/compendium/comp5qck.cfm. Accessed December 14, 2015.

_____. 2015b. New Albany and Ohio Shales: An Introduction. Available online at: http://www.indiana.edu/~sepm04/PDF/JS-G4-SEPM%20Guidebook-strat-overview.pdf. Accessed December 14, 2015.

Kanawha County, West Virginia (Kanawha County). 2014a. Personal communication with John Luoni, County Engineer (304-357-0568). October 14, October 23, and October 24, 2014.

_____. 2014b. Twenty-twenty Vision: A Comprehensive Development Plan for Kanawha County, West Virginia. May 2014. Available online at: http://kanawha.us/county-commission/planning-development/. Accessed July 10, 2015.

Kentucky Department of Fish and Wildlife Resources (KDFWR). 2008. Kentucky Terrestrial Nuisance Species Management Plan. Available online at: http://fw.ky.gov/Fish/Documents/kyterrestrialnuisancespeciesplan.pdf. Accessed July 10, 2015.

_____. 2014a. Kentucky's smallmouth streams. Available online at: http://fw.ky.gov/Fish/Pages/Kentuckys-Smallmouth-Streams.aspx. Accessed July 31, 2015.

_____. 2014b. Fish consumption advisories. Available online at: http://fw.ky.gov/Fish/Pages/Fish-Consumption-Advisories.aspx. Accessed July 31, 2015.

_____. 2014c. Kentucky's Wildlife Management Areas. Available online at: http://trailsrus.com/wmas/index.html. Accessed July 10, 2015.

_____. 2014d. Mussel CWCS Species. Available online at: http://fw.ky.gov/WAP/Documents/MUSSEL%20CWCS%20SPECIE.pdf. Accessed July 2015.

Kentucky Department of Environmental Protection (KYDEP). 2011. Designation of Uses of Surface Waters. 401 Kentucky Administrative Regulations (KAR) 10:026. Available online at: http://www.lrc.ky.gov/kar/401/010/026.htm. Accessed July 2015.

_____. 2013. Division of Water, Designation of uses of surface water. Table B: Surface Water Intakes for Domestic Water Supply Use. Available online at: http://water.ky.gov/Documents/Regulations/10%20026%20clean.pdf. Accessed November 2015.

_____. 2014. Division of Water, Wellhead Protection. Energy and Environment Cabinet. Department for Environmental Protection. Available online at: http://water.ky.gov/groundwater/Pages/WellheadProtection.aspx. Accessed November 2015.

Kentucky Geological Survey (KGS). 2004. Groundwater Resources of Boyd County, Kentucky. Available online at: http://www.uky.edu/KGS/water/library/gwatlas/Boyd/Boyd.htm. Accessed November 2015.

_____. 2006a. Generalized Geologic Map for Land-Use Planning: Madison County, Kentucky. Available online at: http://kgs.uky.edu/kgsweb/olops/pub/kgs/mc72_12.pdf. Accessed August 28, 2015.

_____. 2006b. Generalized Geologic Map for Land-Use Planning: Clark County, Kentucky. 2006. Available online at: http://kgs.uky.edu/kgsweb/olops/pub/kgs/mc148_12.pdf. Accessed August 28, 2015.

_____. 2006c. Generalized Geologic Map for Land-Use Planning: Powell County, Kentucky. 2006. Available online at: http://kgs.uky.edu/kgsweb/olops/pub/kgs/mc153_12.pdf. Accessed August 28, 2015.

_____. 2008. Oil and Gas Data. Available online at: http://kgs.uky.edu/kgsweb/DataSearching/oilsearch.asp. Accessed June 25, 2015.

_____. 2014a. Physiographic Map of Kentucky. Available online at: http://www.uky.edu/KGS/geoky/physiographic.htm. Accessed June 25, 2015.

_____. 2014b. Kentucky Groundwater Data Repository. University of Kentucky. Available online at: http://www.uky.edu/KGS/water/research/gwreposit.htm. Accessed November 2015.

_____. 2015a. Kentucky Groundwater Data Repository. University of Kentucky. Kentucky Well Inspection Form 00042697. Available online at: http://kgs.uky.edu/kgsmap/kgsgeoserver/viewer.asp?mapRecs=true&dataType=waterwells&pwater=true&ggeol=true. Accessed January 6, 2015.

_____. 2015b. Kentucky Groundwater Data Repository. University of Kentucky. Kentucky Well Inspection Form 00042696. Available online at: http://kgs.uky.edu/kgsmap/kgsgeoserver/viewer.asp?mapRecs=true&dataType=waterwells&pwater=true&ggeol=true. Accessed January 6, 2015.

Kentucky Department of Revenue. 2013. Supplementary Information to the Kentucky Comprehensive Annual Financial Report for the Fiscal Year Ended June 30, 2013. Available online at: http://revenue.ky.gov/NR/rdonlyres/682F82AC-DEF2-4B11-9D03-6598D556B042/0/20132014AnnualReport_WEB.pdf. Accessed January 3, 2015.

_____. 2014. Kentucky Sales & Use Tax. Available online at: http://revenue.ky.gov/business/salesanduse.htm. Accessed October 28, 2014.

Kentucky Infrastructure Authority. 2014. Drinking Water System information for Powell Valley Water District. Available online at: http://wris.ky.gov/Portal/DwSysData/KY0990357. Accessed November 2015.

Kentucky State Nature Preserves Commission. 2014. Kentucky State Nature Preserves and State Natural Areas. Available online at: http://naturepreserves.ky.gov/naturepreserves/Documents/PreservesMap_85x11.pdf. Accessed June 30, 2015.

Kentucky State Parks. 2014a. Kentucky State Parks Maps. Available online at: http://parks.ky.gov/maps/default.aspx. Accessed June 30, 2015.

_____. 2014b. Camping & RV. Available online at: http://parks.ky.gov/places_to_stay/camping.aspx. Accessed June 30, 2015.

Keyser, Amber J., Geoffrey E. Hill, and Eric C. Soehren. 1997. Effects of Forest Fragment Size, Nest Density, and Proximity to Edge on the Risk of Predation to Ground-Nesting Passerine Birds. Department of Genetics, Life Sciences Building, University of Georgia, Athens (Keyser), Department of Zoology and Wildlife Science, Auburn University, Alabama (Hill), and Natural Heritage Section, State Lands Division, Department of Conservation and Natural Resources, Montgomery, Alabama (Soehren).

King, David I., Mariko Yamasaki, Richard M, DeGraaf, and Christine A. Costello. 2010. Three decades of avian research on the Bartlett Experimental Forest, New Hampshire, U.S.A. In Forest Ecology and Management, 262 (2011) 3–11.

Kinlaw, A. 1995. Mammalian Species. *Spilogale putorius*. The American Society of Mammalogists. October 1995. No. 511, pp. 1–7.

Kunz, T. and R. Martin. 1982. Mammalian Species. *Plecotus townsendii*. The American Society of Mammalogists. June 1982. No. 175, pp. 1–6.

Lariviere, S. 2001. Mammalian Species. *Ursus americanus*. The American Society of Mammalogists. January 2001. No. 647, pp. 1–11.

Lessing, Peter, Byron R. Kulander, Bruce D. Wilson, Stuart L. Dean, and Stanley Woodring. 1976. West Virginia Landslide Map. Appalachian Regional Commission Contract 75-179A.

Madison County. 2010. The Comprehensive Plan for Madison County, Kentucky 2010. Available online at: http://www.madisoncountyky.us/index.php/comprehensive-plan. Accessed June 30, 2015.

_____. 2015. Email communication with Bert Thomas, Madison County Planning and Development Buildings and Codes Inspector (bert.thomas@madisoncountyky.us), October 26, 2015.

Madison County Utilities District (MCUD). 2014. Water Quality Report. Available online at: http://www.madisoncountyutilities.com/ccr/MCUD%202013%20Water%20Quality%20Rpt.pdf. Accessed November 2015.

Matlack, G.R. 1993. Microenvironment variation within and among forest edge sites in the eastern United States. Biological Conservation 66:185–194.

Metro Government of Nashville and Davidson County (Metro Government). 2014a. Personal communication with Kathryn Withers, Manager of Community Plans and Design Studio (615-862-7193). October 16, 2014.

_____. 2014b. Nashville Parks Finder. Available online at: http://maps.nashville.gov/NashvilleParksFinder/. Accessed June 30, 2015.

_____. 2014c. Nature Centers and Natural Areas. Available online at: http://www.nashville.gov/Parks-and-Recreation/Nature-Centers-and-Natural-Areas.aspx. Accessed June 30, 2015.

_____. 2015a. Code of Ordinances Section 17.08.020. Available online at: https://www.municode.com/library/tn/metro_government_of_nashville_and_davidson_county/codes/code_of_ordinances. Accessed September 30, 2015.

_____. 2015b. The Code of the Metropolitan Government of Nashville and Davidson County, Tennessee, Section 17.28.090 – Noise. Available online at: https://www.municode.com/library/tn/metro_government_of_nashville_and_davidson_county/codes/code_of_ordinances?nodeId=CD_TIT17ZO_CH17.28ENOPPEST_ARTIIOPPEST_17.28.090NO.

Metro Water Services (MWS). 2014. Metro Water Services of the Metropolitan Government of Nashville and Davidson County. Available online at: http://www.nashville.gov/Water-Services/About-Us.aspx. Accessed November 2015.

Minnesota Department of Natural Resources (MNDNR). 2014a. Rare species guide. Northern Brook Lamprey. Available online at: http://www.dnr.state.mn.us/rsg/profile.html?action=elementDetail&selectedElement=AFBAA01030. Accessed July 2015.

Montana Natural Heritage Program (MNHP). 2014. Montana Field Guide: Northern Leopard Frog. Available online at: http://fieldguide.mt.gov/speciesDetail.aspx?elcode=AAABH01170. Accessed July 2015.

Moseley, K.R., Ford, W.M., Edwards, J.W. 2009. Local and landscape scale factors influencing edge effects on woodland salamanders. Environmental Monitoring and Assessment. 1 51:425–435.

Motzkin G, Wilson GP, Foster DR, Arthur A. 1999. Vegetation patterns in heterogeneous landscapes: the importance of history and environment. J. Veg. Sci., 10, 902–920.

Murcia, C. 1995. Edge Effects in Fragmented Forests: Implications for Conservation. TREE. 2:58–62.

National Park Service (NPS). 2011. Nationwide Rivers Inventory. Available online at: http://www.nps.gov/ncrc/programs/rtca/nri/index.html. Accessed November 2015.

_____. 2014. National Trails System Map. Available online at: http://www.nps.gov/nts/maps.html. Accessed June 30, 2015.

National Recreational Trails. 2014. National Recreation Trails Database. Available online at: http://www.americantrails.org/NRTDatabase/search.php. Accessed June 30, 2015.

Natural Resources Conservation Service (NRCS). 1993. Soil Survey of Powell and Wolfe Counties, Kentucky. Available online at: http://www.nrcs.usda.gov/Internet/FSE_MANUSCRIPTS/kentucky/KY634/0/powellwolfe.pdf.

_____. 2014a. Web Soil Survey. Powell and Wolfe Counties, Kentucky. Available online at: http://websoilsurvey.sc.egov.usda.gov/App/WebSoilSurvey.aspx. Accessed June 29, 2015.

_____. 2014b. Web Soil Survey. Boyd and Greenup Counties, Kentucky. Available online at: http://websoilsurvey.sc.egov.usda.gov/App/WebSoilSurvey.aspx. Accessed June 29, 2015.

_____. 2014c. Web Soil Survey. Kanawha County, West Virginia. Available online at: http://websoilsurvey.sc.egov.usda.gov/App/WebSoilSurvey.aspx. Accessed June 29, 2015.

_____. 2014d. Web Soil Survey. Madison County, Kentucky. Available online at: http://websoilsurvey.sc.egov.usda.gov/App/WebSoilSurvey.aspx. Accessed June 29, 2015.

_____. 2014e. Web Soil Survey. Davidson County, Tennessee. Available online at: http://websoilsurvey.sc.egov.usda.gov/App/WebSoilSurvey.aspx. Accessed June 29, 2015.

_____. 2015. Prime Farmland Definitions. Available online at: http://www.nrcs.usda.gov/wps/portal/nrcs/detailfull/pr/soils/?cid=nrcs141p2_037285. Accessed June 29, 2015.

NatureServe. 2015. NatureServe Explorer: An online encyclopedia of life [web application]. Version 7.1. NatureServe, Arlington, Virginia. Available online at: http://explorer.natureserve.org. Accessed July 2015.

National Wild and Scenic Rivers System. 2014. A National System. Available online at: http://www.rivers.gov. Accessed November 2015.

North American Bird Conservation Initiative (NABCI). 2014. Bird Conservation Regions. Available online at: http://www.nabci-us.org/. Accessed July 10, 2015.

Ohio Department of Natural Resources (ODNR). 2014. Nature Preserves. Globe beaked-rush. Available online at: http://naturepreserves.ohiodnr.gov/portals/dnap/pdf/Rare_Plant_Abstracts/Rhynchospora_recognita.pdf. Accessed July 2015.

Powell Valley Water District (PVWD). 2014. Water Quality Report. Available online at: http://www.pvwd.org/service/. Accessed November 2015.

Public Service Commission of Kentucky. 2015. Big Sandy Water District. Rate, Rules and Regulations for Furnishing Water Service at South Wester[n] Portion of Boyd County and Eastern Portion of Carter County. Effective 2014. Available online at: http://psc.ky.gov/tariffs/water/districts,%20associations,%20&%20privately%20owned/Big%20Sandy%20Water%20District/Tariff.pdf. Accessed November 2015.

Sheets, J.J, Whitaker, J.O. Jr, Brack, V Jr, Sparkes, D.W. 2013. Bats of the hardwood ecosystem experiment before timber harvest: assessment and prognosis. In: Swihart, R.K, Saunders, M.R., Kalb, R.A., Haulton, G.S., Michler, C.H., eds. 2013. The Hardwood Ecocystem Experiment: a framework for studying responses to forest management. Gen. Tech. Rep. NRS-P-108. Newtown Square, PA: U.S. Department of Agriculture, Forest Service, Northern Research Station.

Sheffield, S. and C. King. 1994. Mammalian Species. *Mustela nivalis*. The American Society of Mammalogists. June 1994. No. 454, pp. 1–10. Available online at: http://www.science.smith.edu/msi/pdf/i0076-3519-454-01-0001.pdf.

Skole D.L. and C.J. Tucker. 1993. Tropical deforestation and habitat fragmentation in the Amazon; satellite data from 1978 to 1988. Science 260(5116):1905–1910.

Tennessee Association of RV Parks and Campgrounds. 2014. Camp in Tennessee. Available online at: http://www.campintennessee.com/. Accessed June 30, 2015.

Tennessee Department of Agriculture (TNDOA). 2014. Division of Plant Industries. Chapter 0080-06-24 Pest Plant Regulations. Available online at: https://www.tn.gov/assets/entities/agriculture/attachments/TIFRAWPS.pdf. Accessed July 10, 2015.

Tennessee Department of Environment and Conservation (TDEC). 2003. Division of Water Supply. Tennessee Source Water Assessment Report, August 2003. Available online at: http://www.tn.gov/assets/entities/environment/attachments/source_water_assessment_epa_report_aug_2003.pdf. Accessed July 2015.

_____. 2007. Rules of Tennessee Department of Environment and Conservation. Division of Water Pollution Control. Chapter 1200-4-4: Use Classifications for Surface Waters. Available online at: http://www.state.tn.us/sos/rules/1200/1200-04/1200-04-04.pdf. October, 2007 (revised).

_____. 2013. Permitted Oil and Gas Wells in Tennessee. Spreadsheet available online at http://repository.stategeothermaldata.org/repository/resource/cc54f15894222c91e71e4530dc036712/. Accessed June 25, 2015.

_____. 2014a. Wellhead Protection Plan Approval. Available online at: https://tn.gov/environment/article/permit-water-wellhead-protection-plan-approval. Accessed July 2015.

_____. 2014b. Tennessee Source Water Assessment Program Submittal. Available online at: https://www.tn.gov/assets/entities/environment/attachments/tswafinl.pdf. Accessed July 2015.

_____. 2015. Personal communication with Scotty D. Sorrells, Division of Water Resources, Drinking Water Unit, Ground Water Management Section (615-532-9224). January 5, 2015.

Tennessee Department of Revenue. 2014a. Statistics/Collections: Comparative Statement of Collected Revenues. Available online at: http://www.tn.gov/revenue/article/revenue-collections-spreadsheets-by-fiscal-year. Accessed January 3, 2015.

_____. 2014b. State sales and use tax information. Available online at: http://www.tn.gov/revenue/article/sales-and-use-tax-due-dates-and-tax-rates. Accessed October 29, 2014.

_____. 2014c. Local sales and use tax information. Available online at: http://www.tn.gov/assets/entities/revenue/attachments/taxlist.pdf. Accessed October 29, 2014.

Tennessee Ground Water. 1986. National Water Summary. Available online at: http://www.ngwa.org/Professional-Resources/state-info/Documents/GWQ_Tennessee.pdf. Accessed November 2015.

Tennessee Natural Heritage Inventory Program (TNHIP). 2014. Interactive Rare Species Database. Davidson County. Available online at: http://environment-online.state.tn.us:8080/pls/enf_reports/f?p=9014:3:15440010731599. Accessed July 23, 2015.

Tennessee State Parks. 2014. Find a Park. Available online at: http://tnstateparks.com/about/find-a-park. Accessed June 30, 2015.

Tennessee Wildlife Resources Agency (TWRA). 2010. Wildlife Viewing Opportunities on Tennessee's Wildlife Management Areas. September. Available online at: https://www.tn.gov/assets/entities/twra/attachments/wildlifeviewingspots.pdf. Accessed July 10, 2015.

_____. 2014a. Wildlife Management Areas Region 2 Map. Available online at: http://www.tn.gov/twra/article/twra-region-ii. Accessed July 2015.

_____. 2014b. TWRA Lands. Downloadable Data. Available online at: http://www.tn.gov/twra/topic/download-data. Accessed June 30, 2015.

_____. 2014c. Waterfowl Hunting Mapper. Available online at: https://twra.maps.arcgis.com/apps/StorytellingTextLegend/index.html?appid=2b119294fd414a989003e748033aeb90. Accessed June 30, 2015.

_____. 2014d. Tennessee Public Hunting Areas. Available online at: http://www.tn.gov/twra/article/public-hunting-areas. Accessed June 30, 2015.

Terracon Consultants, Inc. (Terracon). 2014a. Draft Geotechnical Letter Report, Proposed Compressor Station 118A Charleston, West Virginia. November 2014.

_____. 2014b. Draft Geotechnical Letter Report, Proposed Compressor Station 119A Charleston, West Virginia. November 2014.

_____. 2014c. Draft Geotechnical Letter Report, Proposed Compressor Station 875 Richmond, Kentucky. October 2014.

_____. 2014d. Preliminary Geotechnical Data Report, Proposed Compressor Station 563 Joelton, Tennessee. November 2014.

_____. 2015a. Geotechnical Engineering Report, Broad Run Expansion Project Compressor Station 118A. January.

_____. 2015b. Geotechnical Engineering Report, Broad Run Expansion Project Compressor Station 119A. January.

_____. 2015c. Geotechnical Engineering Report, Broad Run Expansion Project Compressor Station 875 January.

_____. 2015d. Geotechnical Engineering Report, Broad Run Expansion Project Compressor Station 563. January.

_____. 2015e. Limited Site Investigation Broad Run Expansion/CS 118A Site. May 15, 2015.

_____. 2015f. Bedrock Groundwater Exploration Report, Broad Run Expansion/Proposed Station CS118A CDD Disposal Area.

Thomson, C. 1982. Mammalian Species. *Myotis sodalis*. The American Society of Mammalogists. May, 1982. No. 163, pp. 1–5.

United States Army Corps of Engineers (USACE). 2007. Regulatory Guidance Letter 07-01: Practices for Documenting Jurisdictional Determinations under Section 404 of the Clean Water Act (CWA) and Sections 9 and 10 of the Rivers and Harbors Act (RHA) of 1899. 17 p. Available online at: http://www.usace.army.mil/Portals/2/docs/civilworks/RGLS/rgl07-01.pdf.

_____. 2012. Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Eastern Mountains and Piedmont Region, Version 2.0. U.S. Army Engineer Research and Development Center. Vicksburg, Mississippi. Available online at: http://www.usace.army.mil/Portals/2/docs/civilworks/regulatory/reg_supp/EMP_Piedmont_v2b.pdf.

_____. 2014. Louisville District. Available online at: http://www.lrl.usace.army.mil/Missions/CivilWorks/WaterInformation.aspx. Accessed November 2015.

United States Census Bureau. 2015. State and County QuickFacts. Data derived from Population Estimates, American Community Survey, Census of Population and Housing, State and County Housing Unit Estimates, County Business Patterns, Nonemployer Statistics, Economic Census, Survey of Business Owners, Building Permits. Online resource. Available at: http://quickfacts.census.gov/qfd/states/47000.html. Accessed November 2015.

United States Department of Agriculture (USDA), Natural Resources Conservation Service. 2013. Web Soil Survey. Available online at: http://websoilsurvey.nrcs.usda.gov/app/WebSoilSurvey.aspx. Accessed July 10, 2015.

United States Energy Information Administration (EIA). 2015. Existing Nameplate and Net Summer Capacity by Energy Source, Producer Type and State (EIA-860), 2013. Available online at: http://www.eia.gov/electricity/data/state/. Accessed November 2015.

United States Environmental Protection Agency (EPA). 1971. Community Noise. NTID300.3 (N-96-01 IIA-231). Prepared by Wylie Laboratories. Available online at: http://nepis.epa.gov/Exe/ZyNET.exe/2000PKUG.TXT?ZyActionD=ZyDocument&Client=EPA&Index=Prior+to+1976&Docs=&Query=&Time=&EndTime=&SearchMethod=1&TocRestrict=n&Toc=&TocEntry=&QField=&QFieldYear=&QFieldMonth=&QFieldDay=&IntQFieldOp=0&ExtQFieldOp=0&XmlQuery=&File=D%3A%5Czyfiles%5CIndex%20Data%5C70thru75%5CTxt%5C00000001%5C2000PKUG.txt&User=ANONYMOUS&Password=anonymous&SortMethod=h%7C-&MaximumDocuments=1&FuzzyDegree=0&ImageQuality=r75g8/r75g8/x150y150g16/i425&Display=p%7Cf&DefSeekPage=x&SearchBack=ZyActionL&Back=ZyActionS&BackDesc=Results%20page&MaximumPages=1&ZyEntry=1&SeekPage=x&ZyPURL#.

_____. 1974. Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety. Office of Noise Abatement and Control. Publication EPA-550/9-74-004, March 1974. Available online at: http://nepis.epa.gov/Exe/ZyNET.exe/2000L3LN.TXT?ZyActionD=ZyDocument&Client=EPA&Index=Prior+to+1976&Docs=&Query=&Time=&EndTime=&SearchMethod=1&TocRestrict=n&Toc=&TocEntry=&QField=&QFieldYear=&QFieldMonth=&QFieldDay=&IntQFieldOp=0&ExtQFieldOp=0&XmlQuery=&File=D%3A%5Czyfiles%5CIndex%20Data%5C70thru75%5CTxt%5C00000001%5C2000L3LN.txt&User=ANONYMOUS&Password=anonymous&SortMethod=h%7C-&MaximumDocuments=1&FuzzyDegree=0&ImageQuality=r75g8/r75g8/x150y150g16/i425&Display=p%7Cf&DefSeekPage=x&SearchBack=ZyActionL&Back=ZyActionS&BackDesc=Results%20page&MaximumPages=1&ZyEntry=1&SeekPage=x&ZyPURL#.

_____. 1999. Consideration of Cumulative Impacts in EPA Review of NEPA Documents. U.S. Environmental Protection Agency, Office of Federal Activities (2252A). EPA 315-R-99-002/May 1999.

_____. 2004. 40 CFR 93.153(b)(1) & (b)(2). Available online at: http://www3.epa.gov/airquality/genconform/documents/40_CFR_93_153.pdf. Accessed October 2015.

_____. 2008. Clean Water Act Jurisdiction Following the U.S. Supreme Court's Decision in Rapanos v. United States & Carabell v. United States. Available online at: http://water.epa.gov/lawsregs/guidance/wetlands/upload/2008_12_3_wetlands_CWA_Jurisdiction_Following_Rapanos120208.pdf. Accessed July 2015.

_____. 2012. 40 CFR 81.64 – Huntington (West Virginia)-Ashland (Kentucky)-Portsmouth-Ironton (Ohio) Interstate Air Quality Control Region. Available online at: http://www.gpo.gov/fdsys/granule/CFR-2012-title40-vol18/CFR-2012-title40-vol18-sec81-64. Accessed October 2015.

_____. 2014a. Designated Sole Source Aquifers in EPA Region III. Available online at: http://www.epa.gov/safewater/sourcewater/pubs/qrg_ssamap_reg3.pdf. Accessed November 2015.

_____. 2014b. Designated Sole Source Aquifers in EPA Region IV. Available online at: http://www.epa.gov/safewater/sourcewater/pubs/reg4.pdf. Accessed November 2015.

_____. 2014c. Water Program Features. Available online at: http://water.epa.gov/scitech/datait/tools/waters/tools/waters_kmz.cfm. Accessed September and December 2014.

_____. 2014d. Watershed Assessment, Tracking, & Environmental Results. Available online at: http://ofmpub.epa.gov/tmdl/attains_watershed.control?p_huc=05100204&p_state=KY&p_cycle=2010&p_report_type=. Accessed December 2014.

_____. 2014e. National Ambient Air Quality Standards. Available online at: http://www3.epa.gov/ttn/naaqs/criteria.html. Accessed October 2015.

_____. 2014f. AirData. Available online at: http://www.epa.gov/airdata/. Accessed October 2015.

_____. 2014g. MOVES2014. Available online at: http://www3.epa.gov/otaq/models/moves/. Accessed October 2015.

_____. 2014h. Emissions Factors & AP 42, Compilation of Air Pollutant Emission Factors, USEPA. Available online at: http://www.epa.gov/ttn/chief/ap42/index.html. Accessed October 2015.

_____. 2014i. NONROAD2008a. Available online at: http://www3.epa.gov/otaq/nonrdmdl.htm. Accessed October 2015.

_____. 2014j. National Greenhouse Gas Emissions Data. Available online at: http://epa.gov/climatechange/ghgemissions/usinventoryreport.html. Accessed November 2015.

_____. 2014k. Overview of Greenhouse Gases. Available online at: http://epa.gov/climatechange/ghgemissions/gases.html. Accessed November 2015.

_____. 2014l. National Greenhouse Gas Emissions Data. Available online at: http://epa.gov/climatechange/ghgemissions/usinventoryreport.html. Accessed November 2015.

_____. 2014m. Overview of Greenhouse Gases – Methane. Available online at: http://epa.gov/climatechange/ghgemissions/gases/ch4.html. Accessed November 2015.

_____. 2014n. Inventory of U.S. Greenhouse Gas Emissions and Sinks. 1990-2012. EPA 430-R-14-003. April 15, 2014. Available online at: http://www.epa.gov/climatechange/Downloads/ghgemissions/US-GHG-Inventory-2014-Main-Text.pdf. Accessed November 2015.

United States Fish and Wildlife Service (FWS). 1993. White-haired Goldenrod Recovery Plan. USFWS, Atlanta, Georgia. 46 pp. Available online at: http://ecos.fws.gov/docs/recovery_plan/930928.pdf.

_____. 1997a. Pink Mucket (*Lampsilis orbiculata*) Fact Sheet. Available online at: http://www.fws.gov/midwest/endangered/clams/pinkm_fc.html. Accessed October 9, 2015.

_____. 1997b. Clubshell (*Pleurobema clava*) Fact Sheet. Available online at: http://www.fws.gov/midwest/endangered/clams/clubshell/clubs_fc.html. Accessed October 9, 2015.

_____. 1997c. Northern Riffleshell (*Epioblasma torulosa rangiana*) Fact Sheet. Available online at: http://www.fws.gov/midwest/endangered/clams/n-riffleshell.html. Accessed October 9, 2015.

_____. 1997d. Fanshell (*Cyprogenia stegaria*) Fact Sheet. Available online at: http://www.fws.gov/midwest/endangered/clams/fansh_fc.html. Accessed October 9, 2015.

_____. 2007. Indiana Bat (*Myotis sodalis*) Draft Recovery Plan: First Revision. U.S. Fish and Wildlife Service, Fort Snelling, Minnesota. 258 pp. Available online at: http://ecos.fws.gov/docs/recovery_plan/070416.pdf.

_____. 2008. Birds of Conservation Concern 2008. United States Department of Interior, Fish and Wildlife Service, Division of Migratory Bird Management, Arlington, Virginia. 85 pp. Available online at: http://www.fws.gov/migratorybirds/.

_____. 2011. Virginia big-eared bat (*Plecotus townsendii virginianus*). http://www.fws.gov/raleigh/species/es_virginia_big-eared_bat.html.

_____. 2014a. Biological opinion and incidental take statement for Indiana bat (*Myotis sodalis*) at the Cianci Builders-Young Explorers Daycare, Twinsburg, Summit County, Ohio. Ohio Ecological Services Field Office, Columbus. Available online at: http://www.fws.gov/midwest/endangered/mammals/inba/bos/14_OH_CianciBuilders_01Oct.pdf . Accessed October 15, 2015.

_____. 2014b. Endangered and Threatened Wildlife and Plants; Threatened Species Status for the Rufa Red Knot; Final Rule. Available online at: http://www.fws.gov/northeast/redknot/pdf/2014_28338_fedregisterfinalrule.pdf. Accessed July 2015.

_____. 2014c. Endangered Species Database. Available online at: http://www.fws.gov/endangered/. Accessed September 25, 2014.

_____. 2015a. Range-Wide Indiana Bat Summer Guidelines. Available online at: http://www.fws.gov/arkansas-es/docs/FINAL%202015%20Indiana%20Bat%20Summer%20Survey%20Guidelines%20(with%20blue%20revisions)%2004-01-2015.pdf. Accessed July 2015.

_____. 2015b. Gray bat (*Myotis grisescens*) Fact Sheet. Available online at: http://www.fws.gov/midwest/endangered/mammals/grbat_fc.html. Accessed July 2015.

_____. 2015c. Environmental Conservation Online System, Northern Long-eared Bat (*Myotis septentrionalis*). Available online at: http://ecos.fws.gov/speciesProfile/profile/speciesProfile.action?spcode=A0JE. Accessed July 2015.

_____. 2015d. Environmental Conservation Online System, Price's potato-bean (*Apios priceana*). Available online at: http://ecos.fws.gov/speciesProfile/profile/speciesProfile.action?spcode=B08X. Accessed July 2015.

_____. 2015e. Letter of Concurrence for Tennessee Gas Pipeline (Subsidiary of Kinder Morgan Energy Partners LP), Broad Run Expansion Project located in Madison, Powell, and Boyd Counties, Kentucky, Kanawha County, West Virginia, and Davidson County, Tennessee. Kentucky Field Office, FWS 2015-B-0189.

_____. 2015f. Indiana bat conservation memorandum of understanding between U.S. Fish and Wildlife Service and Tennessee Gas Pipeline Company, LLC.

_____. 2015g. White Nose Syndrome: Fact Sheet. Available online at: https://www.whitenosesyndrome.org/sites/default/files/wns_fact_sheet_2015_1.png. Accessed July 2015.

_____. Undated. Rufa Red Knot Ecology and Abundance, Supplement to Endangered and Threatened Wildlife and Plants; Proposed Threatened Status for the Rufa Red Knot (*Calidris canutus rufa*). Docket No. FWS-R5-ES-2013-0097; RIN 1018-AY17. Available online at: http://www.fws.gov/northeast/redknot/pdf/20130923_REKN_PL_Supplement02_Ecology%20Abundance_Final.pdf.

United States Forest Service (USFS). 1995. Description of Ecoregions of the United States. Available online at: http://www.fs.fed.us/rm/ecoregions/products/map-ecoregions-united-states/. Accessed July 2015.

_____. 2005. Delineating Focus Areas for Bird Conservation in the Central Hardwoods Bird Conservation Region. USDA Forest Service Gen. Tech. Rep. PSW-GTR-191. Available online at: http://www.fs.fed.us/psw/publications/documents/psw_gtr191/psw_gtr191_0192-0202_fitzgerald.pdf.

_____. 2014. Fire Effects Information System Database. Peachleaf Willow. Available online at: http://www.fs.fed.us/database/feis/plants/tree/salamy/all.html. Accessed July 2015.

United States Geological Survey (USGS). 1968. USGS Mineral Resources On-Line Spatial Data, West Virginia geologic map data. Available online at: http://mrdata.usgs.gov/geology/state/state.php?state=WV. Accessed June 25, 2015.

_____. 1995. Ground Water Atlas of the United States: Illinois, Indiana, Kentucky, Ohio, Tennessee. HA 730-K. Available online at: http://pubs.usgs.gov/ha/ha730/ch_k/index.html. Accessed November 2015.

_____. 1999. USGS and Central United States Earthquake Consortium State Geologists Soil Amplification /Liquefaction Potential Map. Available online at: http://www.cusec.org/publications/maps/cusecsgmap.pdf. Accessed August 28, 2015.

_____. 2005a. USGS Mineral Resources On-Line Spatial Data, Tennessee geologic map data. Available online at: http://mrdata.usgs.gov/geology/state/state.php?state=TN. Accessed June 25, 2015.

_____. 2005b. Mineral Resources Data System. Available online at: http://mrdata.usgs.gov/mrds/. Accessed June 25, 2015.

_____. 2006a. Earthquakes Hazards Program, Quaternary Fault and Fold Database of the United States. Available online at: http://earthquake.usgs.gov/hazards/qfaults/. Accessed August 28, 2015.

_____. 2006b. National Elevation Dataset. Available online at: http://ned.usgs.gov/. Accessed June 25, 2015.

_____. 2008. Seismic Investigations Map 3195, Seismic- Hazard Maps for the Conterminous United States. Available online at: http://pubs.usgs.gov/sim/3195/. Accessed June 25, 2015.

_____. 2012. Earthquake Hazards Program, Historic Earthquakes in the United States and its Territories. Available online at: http://earthquake.usgs.gov/earthquakes/states/historical.php. Accessed June 25, 2015.

_____. 2014a. Ground Water Atlas of the United States Delaware, Maryland, New Jersey, North Carolina, Pennsylvania, Virginia, West Virginia HA 730-L. Available online at: http://pubs.usgs.gov/ha/ha730/ch_l/L-text4.html. Accessed November 2015.

_____. 2014b. National Water Information System: Web Interface. Current Groundwater Conditions for Tennessee, Virginia, and Kentucky. Available online at: http://waterdata.usgs.gov/wva/nwis/current/?type=gw, http://waterdata.usgs.gov/ky/nwis/current/?type=gw&group_key=county_cd, and http://waterdata.usgs.gov/tn/nwis/current/?type=gw&group_key=county_cd. Accessed November 2015.

_____. 2015a. Tennessee Geologic Map Data. Available online at: http://mrdata.usgs.gov/geology/state/state.php?state=TN. Accessed August 28, 2015.

United States Global Change Research Program. 2014. Key Messages from the National Climate Assessment. Available online at: http://www.globalchange.gov/explore/southeast-caribbean. Accessed November 10, 2015.

University of Kentucky (UK). 2014a. Kentucky Geologic Map Information Service, Standard Geologic Map. Available online at: http://kgs.uky.edu/kgsmap/kgsgeoserver/viewer.asp. Accessed June 25, 2015.

_____. 2014b. Kentucky Geologic Map Information Service, Coal Information Map. Available online at: http://kgs.uky.edu/kgsmap/kgsgeoserver/viewer.asp. Accessed June 25, 2015.

_____. 2014c. Kentucky Geologic Map Information Service, Landslide Information Map. Available online at: http://kgs.uky.edu/kgsmap/kgsgeoserver/viewer.asp. Accessed June 25, 2015.

_____. 2014d. Kentucky Geologic Map Information Service, Karst Potential Map. Available online at: http://kgs.uky.edu/kgsmap/kgsgeoserver/viewer.asp. Accessed June 25, 2015.

University of Tennessee Knoxville. 2014. Waters and Geology of Tennessee. Available online at: http://google.tennessee.edu/search?btnG=Google+Search&client=utk_translate_frontend&output=xml_no_dtd&proxystylesheet=utk_translate_frontend&sort=date%3AD%3AL%3Ad1&entqr=3&oe=UTF-8&ie=UTF-8&ud=1&site=Knoxville&q=waters+and+geology. Accessed June 25, 2015.

Utah Geological Survey. 2004. New Guidelines for Evaluating Surface Fault Rupture Hazards in Utah. Available online at: http://geology.utah.gov/map-pub/survey-notes/new-guidelines-for-evaluating-surface-fault-rupture-hazards-in-utah/. Accessed August 28, 2015.

Watkins, Larry C. 1972. Mammalian Species. *Nycticeius humeralis*. The American Society of Mammalogists. November. No. 23:1–4. doi:10.2307/3503945.

West Virginia American Water (WVAW). 2014. Kanawha Elk River Water Treatment Plant, Water Quality Information. Available online at: http://www.amwater.com/ccr/kanawhavalley.pdf. Accessed November 2015.

West Virginia Conservancy. 2008. "Surface Mining in the Southern Counties of West Virginia." Available online at: http://www.wvhighlands.org/Pages/Maps_S_Coal.html. Accessed September 2015.

West Virginia Department of Environmental Protection (WVDEP). 2014. West Virginia Water Resources Management Plan. Available online at: http://tagis.dep.wv.gov/WVWaterPlan/. Accessed September 2014.

_____. 2015. Water Quality Standards: Listing for Tier 3 Streams and Reason for Inclusion. Available online: http://www.dep.wv.gov/WWE/Programs/wqs/Pages/default.aspx. Accessed July 2015.

West Virginia Geological and Economic Survey (WVGES). 2014a. West Virginia geology: Physiographic Provinces. Available online at: http://www.wvgs.wvnet.edu/www/geology/geolphyp.htm. Accessed June 25, 2015.

_____. 2014b. West Virginia Oil and Natural Gas Wells. Available online at: http://ims.wvgs.wvnet.edu/WVOG/viewer.htm. Accessed June 25, 2015.

_____. 2014c. Latest Earthquakes in the State. Available online at: http://www.wvgs.wvnet.edu/www/earthquakes/seismic.html. Accessed June 25, 2015.

_____. 2014d. West Virginia Earthquakes: Crustal Adjustments along the Rome Trough or Something Else? Available online at: http://www.wvgs.wvnet.edu/www/presentations/2014/WV-seismic_2014.pdf. Accessed August 28, 2015.

West Virginia Department of Health and Human Resources (WVDHHR). 2002. State of West Virginia Source Water Assessment and Protection Program, Source Water Assessment Report for Kanawha Valley. Available online at: http://www.wvdhhr.org/oehs/eed/swap/get.cfm?id=3302016j. Accessed November 2015.

West Virginia Division of Natural Resources (WVDNR). 2014. West Virginia Wildlife Management Areas. Available online at: http://www.wvdnr.gov/Hunting/WMAMap.shtm. Accessed June 30, 2015.

West Virginia Legislature (WV Legislature). 2014. West Virginia Code. Chapter 19. Agriculture. Article 12D. Available online at: http://www.legis.state.wv.us/WVCODe/Code.cfm?chap=19&art=12D. Accessed July 10, 2015.

West Virginia State Parks and Forests. 2014. Campgrounds. Available online at: http://www.wvstateparks.com/lodging/camping.htm. Accessed June 30, 2015.

West Virginia Department of Revenue. 2014. West Virginia State Budget Office. 2014. State of West Virginia Revenue Collections Fiscal Year 2015 (December 1, 2014). Available online at: http://www.budget.wv.gov/reportsandcharts/revenuereports/Documents/RGRnov14.pdf. Accessed January 3, 2015.

Wilde, L., J. Williamson, and C. Loos. 2013. Pipelines and Property Values: An Eclectic Review of the Literature. June. Available online at: http://www.gnarusllc.com/wp-content/uploads/2013/07/Kern_Emp_Paper_JRER_Forthcoming.pdf.

Yahner, R.H. 1998. Changes in Wildlife Communities near Edges. Conservation Biology 2(4):333–339.

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