



Mountain Valley Pipeline Project

Docket No. CP16-10-000

Migratory Bird Conservation Plan

May 2017

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1.0 Introduction

Mountain Valley Pipeline, LLC (MVP), a joint venture between EQT Midstream Partners, LP, NextEra Energy, Inc., WGL Holdings, Inc., Con Edison Gas Midstream, LLC, and RGC Midstream, LLC, is seeking a Certificate of Public Convenience and Necessity from the Federal Energy Regulatory Commission (FERC) pursuant to Section 7(c) of the Natural Gas Act (NGA) authorizing it to construct and operate the proposed Mountain Valley Pipeline Project (Project) located in 17 counties in West Virginia and Virginia. MVP plans to construct an approximately 488.3-kilometer (303.4-mi), 106.7-centimeter (42-in) diameter natural gas pipeline to provide timely, cost-effective access to the growing demand for natural gas for use by local distribution companies (LDCs), industrial users and power generation in the Mid-Atlantic and southeastern markets, as well as potential markets in the Appalachian region. Because the Project is proposed to cross the Jefferson National Forest, which is under the jurisdiction of the U.S. Forest Service (USFS), and the Weston and Gauley Bridge Turnpike Trail, which is under the jurisdiction of the U.S. Army Corps of Engineers (USACE), MVP is also seeking a right-of-way (ROW) grant from the Bureau of Land Management under the Mineral Leasing Act.

Project-related construction, operation, and maintenance activities occurring during the nesting season for migratory birds could result in direct and indirect effects on migratory birds.

The purpose of this Migratory Bird Conservation Plan (Plan) is to:

- Identify Project-specific Migratory Bird Species of Concern (MBSC),
- Evaluate potential impacts to Project-specific MBSC and their habitats,
- Assess forest fragmentation as a result of Project-construction and its implications for migratory birds,
- Outline strategies to avoid and minimize impacts to migratory birds and their habitats,
- Describe methods used to determine net ecological loss related to habitat impacts.

The Plan details MVP's responsibilities and voluntary commitments regarding migratory birds with potential to occur in the Project area (refers to Project's limit of disturbance [LOD]; however, commitments and responsibilities may extend beyond the LOD for certain species [e.g., bald and golden eagles]).

2.0 Regulatory Setting

MVP is required to comply with numerous federal statutes and state regulations, and each have been considered during Project design and planning. This section summarizes laws, regulations, and policies applicable to bird species of concern.

2.1 Federal Laws, Regulations, and Policies

2.1.1 Migratory Bird Treaty Act

The Migratory Bird Treaty Act of 1918 (16 U.S.C. 703-711; [MBTA]) affords protection to 1,026 birds listed in 50 CFR 10.13 (78 FR 65844 65864) including migratory game and non-game birds and most resident birds native to the United States. According to 50 CFR 10.12, a migratory bird is “any bird, regardless of its origin and whether or not raised in captivity, which is a mutation or a hybrid of any such species, including any part, nest, or egg of any such bird, or any product, whether or not manufactured, which consists, or is composed in whole or part, of any such bird or any part, nest, or egg thereof”. The MBTA prohibits the take of any migratory bird, part, nest, egg, or product. Take, as defined by the MBTA, includes by any means or in any manner any attempt at hunting, pursuing, wounding, killing, possessing, or transporting any migratory bird, nest, egg, or part thereof. The MBTA does not prohibit harassment, disturbance, or habitat removal and alterations. Thus, the MBTA prohibitions most relevant to pipeline construction involve direct killing of a nestling or egg through destruction of an active nest. Migratory birds and associated habitats of concern are discussed in more detail in Section 4.0.

2.1.2 Executive Order 13186 and Memorandum of Understanding

Under Executive Order 13186, federal agencies are directed to identify where unintentional take is likely to have a measurable negative effect on migratory bird populations and to avoid and minimize these adverse effects through enhanced collaboration with the USFWS. Executive Order 13186 states that emphasis should be placed on species of concern, priority habitats, and key risk factors. Particular focus should be given to addressing population-level impacts over individual impacts. On March 30, 2011, the USFWS and FERC, as required by Executive Order 13186, entered into a voluntary Memorandum of Understanding (MOU) that focuses on avoiding or minimizing adverse effects on migratory birds and their habitats, and strengthening migratory bird conservation beyond the MBTA through enhanced collaboration between the two federal agencies. As specified in the MOU, the USFWS and FERC must support the conservation intent of the MOU by:

- integrating bird conservation principles, measures, and practices into agency actions;

- avoiding or minimizing the take of migratory birds and adverse effects on their habitat;
- improving habitat conditions for migratory birds on lands affected by energy projects; and
- preventing or abating pollution detrimental to migratory birds and their habitats.

Under the MOU, FERC is obligated to require, as appropriate, applicants to mitigate negative impacts on migratory birds and their habitats by proposed actions. To do so, FERC directs the applicants, where appropriate, to jointly develop project-specific conservation measures with the USFWS during pre-filing or the early planning phases of projects, and provide copies of all inter-agency correspondence. The MOU specifies that the USFWS Ecological Field Services Offices serve as the primary contacts for technical assistance and environmental reviews involving migratory bird issues. Notably, the MOU does not authorize the take of migratory birds or waive legal requirements under MBTA, Bald and Golden Eagle Protection Act (BGEPA), Endangered Species Act (ESA), or any other statutes.

2.1.3 Bald and Golden Eagle Protection Act of 1940

In addition to the MBTA, bald and golden eagles (*Haliaeetus leucocephalus* and *Aquila chrysaetos*, respectively) are protected under the Bald and Golden Eagle Protection Act of 1940 (16 U.S. Code 668-688d; [BGEPA]). The BGEPA prohibits anyone without a permit issued by the Secretary of the Interior from taking bald and golden eagles, including their parts, nests, or eggs. Take, as defined by BGEPA, includes “pursue, shoot, shoot at, poison, wound, kill, capture, trap, collect, molest, or disturb” an eagle. Unlike MBTA, the BGEPA does prohibit harassment, disturbance, or habitat removal and alterations. Under 50 CFR 22.3, disturb is defined as “to agitate or bother a bald or golden eagle to a degree that causes, or is likely to cause, based on the best scientific information available: 1) injury to an eagle; 2) a decrease in its productivity, by substantially interfering with normal breeding, feeding, or sheltering behavior; or 3) nest abandonment, by substantially interfering with normal breeding, feeding, or sheltering behavior”. Unlike MBTA, permit programs are available to allow limited take of eagles when take is incidental to a lawful activity and cannot be reasonably avoided (50 CFR 22.26), or when intentional take of inactive eagle nests is necessary to alleviate a safety emergency for people or eagles (applied to both active or inactive nests), to ensure public health and safety, and when an activity or mitigation effort will provide a net benefit to eagles (50 CFR 22.27).

2.1.3.1 Endangered Species Act

In addition to laws specific to migratory birds, federally listed birds are protected under the Endangered Species Act (ESA) [16 U.S.C. 1531 et seq.] which provides for the listing, conservation, and recovery of these species. ESA prohibits take of listed

species. Take is defined by the ESA as, “to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect” [16 U.S.C. 1532(19)]. USFWS further defines harm as an act that actually kills or injures wildlife, including significant habitat modification or degradation [50 CFR §17.3].

Under Section 7 of the ESA, any federal agency must consult with USFWS when any action the agency carries out, funds, or authorizes may affect a federally listed endangered or threatened species, or species proposed for federal listing to ensure that the proposed federal action will not jeopardize the continued existence of a listed species.

The FERC, as the lead federal agency, is required to consult with the USFWS to determine whether any federally listed or proposed endangered or threatened species or their designated critical habitats would be affected by development of the Project. Based on consultations with the USFWS and results from field surveys conducted for the Project, a biological assessment (BA) was prepared to identify the nature and extent of adverse impacts to listed species. No federally listed bird species occur within the Project area and, therefore, none are included in the BA.

2.2 State and Local Laws

The Virginia Endangered Species Act (29.1-563 to 29.1-570) provides that Virginia Department of Game and Inland Fisheries (VDGIF) is the state regulatory authority over federally or state listed endangered or threatened fish and wildlife in the Commonwealth. State-listed species are provided protection per VDGIF Regulation 4 VAC 15-20-130. The law authorizes the Board of the VDGIF to adopt the federal list of endangered and threatened species, to declare by regulation that species not listed by the federal government are endangered or threatened in Virginia, and to prohibit by regulation the taking, transportation, processing, sale, or offer for sale of those species. Implementing regulations pursuant to this authority (4 VAC 15-20-130 through 140) defines “take” and other terms similarly to the federal ESA. In addition to these endangered species laws, protection is offered to all native birds and to their nests, eggs, and young by the Code of Virginia (§29.1-521) and VDGIF regulations (4 VAC 15-30-10).

West Virginia currently does not have state laws pertaining to threatened and endangered species. Rare species are assigned “State Ranks” by the West Virginia Natural Heritage Program (WVNHP) and range in value from S1 (critically imperiled) to S5 (Secure). Species with state ranks of S1, S2 (imperiled), and S3 (vulnerable) are tracked by the WVNHP.

2.3 Agency Coordination

Coordination with the USFWS Elkins and Gloucester Ecological Field Offices (EFO) began in September 2014. MVP also requested guidance from state agencies

including the West Virginia Division of Natural Resources (WVDNR), WVNHP, VDGIF, and Virginia Department of Conservation and Recreation – Division of Natural Heritage (VDCR-DNH) in October 2014. Each agency was contacted via letter, electronic mail, and phone and queried about known or potential occurrences, and survey recommendations regarding migratory birds, bald and golden eagles, and state-listed birds within the Project area. Correspondence between MVP and the aforementioned agencies related to avian species is provided in Appendix C.

3.0 Project Description

3.1 Location

The Project is a new pipeline designed to transport up to 2.0 MMDth/d of natural gas from the Appalachian Basin to growing markets in the Mid-Atlantic and southeastern United States. The 488.3-kilometer (303.4-mi) pipeline will extend from an interconnection with Equitrans' existing H-302 pipeline in Wetzel County, West Virginia and traverse south-southeast to the town of Chatham, Pittsylvania County, Virginia where the pipeline will terminate at Transco's compressor station 165 (Figure 1, Appendix A). Mileposts (MPs) and length (miles) of the Project in each county crossed are summarized in Table 1 (Appendix B).

Several criteria were used to select the proposed pipeline route, including the following:

- Avoiding or minimizing potential impacts on sensitive biological and cultural resources, protected lands, wetlands and waterbodies, floodplains, sensitive soils, disruption to mineral resources, environmental hazards (e.g., hazardous landfills) and geologic/topographic hazards to the extent possible;
- Avoiding, when possible, residential or high density population areas;
- Existing ROWs; transportation features and utility crossings; land uses (i.e., both existing and planned); potential impacts (i.e., both positive and negative) to local communities and landowners (e.g., increase tax revenue, short-term disruptions due to construction activities); and
- Engineering, construction, and cost feasibility (i.e., including route length, topography implications, side slopes and trenchless crossing location(s)).

3.2 Timeline

The Project schedule is dependent upon obtaining all necessary authorizations, which will then dictate when Project tree-clearing activities can begin. MVP will begin tree-clearing activities as soon as allowed, which could be as early as November 2017. In that case, the majority of clearing will be completed by March 31, 2018. However, because of uncertainty associated with the project's dependency on authorizations, and in order to estimate potential impacts as realistically as possible, the following clearing schedule is assumed for preparation of impact assessments:

- January to March 2018 – 167 miles
- April to May 2018 – 101 miles
- August to November 2018 – 32 miles

This schedule is based on the following assumptions: a clearing rate of 762 linear meters (2,500 feet) per day and clearing crews working 6 days per week with no clearing on standard federal holidays. If clearing begins earlier than January, then a greater portion of the Project will be cleared during winter 2018, meaning that actual impacts to migratory birds will be less than assumed for this discussion. In addition, MVP is committed to the following clearing restrictions for identified areas along the Project:

- Areas within 8 kilometers (5 miles) of Indiana bat hibernacula or within 0.4 kilometer (0.25-mile) of northern long-eared bat hibernacula will be cleared before March 31, 2018 or after November 15, 2018,
- Identified loggerhead shrike suitable habitat will be cleared before March 31, 2018 or after July 31, 2018, and
- No clearing of any areas along the Project will occur between June 1 and July 31.

Pipeline construction will be completed by December 2018 with a target in-service date for the Project of December 2018.

MVP developed a Restoration and Rehabilitation Plan that outlines measures that will be implemented following construction activities (Appendix D). Restoration will begin immediately following pipeline installation throughout the construction process and continue until vegetation is successfully established.

MVP currently has no plans for either future expansion or abandonment of the facilities. Market forces will determine the timing and need for future expansions.

3.3 Land Requirements for the Project

Land required for the construction of the pipeline ROW is approximately 2,575.52 hectares (6,364.26 ac). The operational footprint is 856.77 hectares (2,117.13 ac), resulting in the permanent conversion of 647.02 hectares (1,598.82 ac) of forest to herbaceous land cover. Two thirds of the land impacts (1,718.75 ha [4,247.13 ac])

are associated only with construction (i.e., the “temporary ROW”) and are expected to recover to forested (Table 2, Appendix B).

Additional temporary workspace and contractor yards needed during construction of the Project total an additional 335.8 hectares (829.8 ac). Of this, approximately 366.6 hectares (905.8 ac) are required for the construction of access roads, and 60.3 hectares (149.0 ac) are required to construct aboveground facilities. Mainline block valve sites will be entirely contained within the pipeline ROW and will therefore not require any additional land disturbance. Land required for the Project is summarized in Table 2 (Appendix B).

3.4 Impacts to Habitat

The 2011 National Land Cover Database (NLCD) (Jin et al. 2013, Homer et al. 2015) was used for a desktop habitat evaluation of general vegetation community types and suitability of habitat within the Project area (Table 3, Appendix B). Detailed habitat assessments for federally listed bat species were completed along portions of the Project area within protective bat buffers. Furthermore, wetlands and waterbodies were field-delineated for many areas of the Project. Land cover types collected in the field and later geo-referenced in these areas are used in place of the corresponding NLCD cover types, as the field collected data are presumed to be more accurate. Analysis of the NLCD and field data identified 11 distinct land cover types within the Project Area (Table 3, Appendix B). The largest land cover type disturbed by the Project is deciduous forest (1,585.72 ha [3,918.40 ac]) followed by pasture/hay fields (406.16 ha [1,003.65 ac]). Impacts to habitat are further discussed in Section 4.8.

4.0 Project-specific Migratory Bird Species of Concern

In letters dated April 3, 2015 and April 23, 2015, the USFWS Gloucester EFO and Elkins EFO, respectively, expressed concern for potential impacts to migratory birds as a result of the Project. To better understand potential impacts to migratory birds, this document identifies Project-specific Migratory Bird Species of Concern (MBSC) and discusses implications of modifications to migratory bird-habitat along the proposed Project route.

The Project-specific MBSC were determined using the USFWS Information for Planning and Conservation (IPaC) planning tool and through coordination with federal and state natural resource agencies. The IPaC planning tool provided Birds of Conservation Concern (BCC) lists for Bird Conservation Regions (BCRs) crossed by the Project. The BCC list for each BCR includes priority species known to winter, nest, or migrate through the Project area. However, the Project-specific MBSC list

contains only those species known to breed and nest in the Project area because nesting birds are likely to be most affected by construction and maintenance of the Project. The Virginia Fish and Wildlife Information Service, eBird (ebird.org), and 1994 West Virginia Breeding Bird Atlas were used to identify breeding records within counties intersected by the Project. One species that does not nest in the region where the Project area occurs was included (i.e., golden eagle). In addition to the BCC list, additional species were added to the Project-specific MBSC list based on comments and coordination with agencies.

Twenty-eight MBSC with breeding ranges overlapping the Project area were identified through consultations with federal and state natural resource agencies and review of BCC lists. Project-specific MBSC occur in both West Virginia and Virginia. A list of 28 Project-specific MBSC, associated potential breeding habitat for each species, primary nesting season, states in which a species occurs along the Project route, and reason for inclusion on the Project-specific list is provided in Table 4 (Appendix B). Species identified as possible MBSC but that are not known to breed within the geographic region where the Project area occurs, were excluded from the Project-specific MBSC list. These species include American bittern (*Botaurus lentiginosus*), Bachman's sparrow, Bewick's wren (*Thryomanes bewickii*), black rail (*Laterallus jamaicensis*), brown-headed nuthatch, fox sparrow (*Passerella iliaca*), rusty blackbird (*Euphagus carolinus*), sedge wren (*Cistothorus platensis*), and short-eared owl (*Asio flammeus*).

4.1 USFWS Birds of Conservation Concern

The BCRs, as defined by the North American Bird Conservation Initiative (NABCI), are ecologically distinct regions in North America with similar bird communities, habitats, and resource management issues (NABCI 2000c). The BCRs are based on a hierarchical framework of nested ecological units originally delineated by the Commission for Environmental Cooperation. An amendment to the Fish and Wildlife Conservation Act of 1980 requires USFWS to "identify species, subspecies, and populations of all migratory nongame birds that, without additional conservation actions, are likely to become candidates for listing" under ESA. Thus, the USFWS created BCC lists for each BCR that represent high priority avian species for protection and proactive management.

The Project traverses two BCRs (Figure 2, Appendix A): BCR 28 – Appalachian Mountains and BCR 29 – Piedmont (NABCI 2000b). The Project crosses BCR 28 – Appalachian Mountains beginning at the northern terminus of the route to approximately milepost 253; approximately 83.54% of the Project. This BCR is characterized by its forested, rugged terrain with high elevation areas dominated by combinations of pine (*Pinus* spp.), hemlock (*Tsuga* spp.), spruce (*Picea* spp.), and fir (*Abies* spp.) whereas lower elevations are oak-hickory (*Quercus-Carya*) or other deciduous forest types (NABCI 2000a). Forest types crossed by the Project match

those described; however, the Project does not cross elevations high enough to support spruce and fir forest communities. Non-forested, level terrain is predominately used for agriculture. BCR 28 contains headwaters of several major river systems and large wetland complexes used as migratory stopovers by various waterfowl species. Example priority bird species for this region include cerulean warbler (*Setophaga cerulea*), golden-winged warbler (*Vermivora chrysoptera*), and Henslow's sparrow (*Ammodramus henslowii*). Each of these species has potential of occurring within the Project area and, therefore, are included as Project-specific MBSC. A total of 20 priority species from BCR 28 are included in the Project-specific MBSC list.

The remainder of the Project (approximately 16.46%) is in BCR 29 – Piedmont, beginning at milepost 253 in Virginia and ending at the Project's southern terminus. This BCR is a transition zone from high, mountainous Appalachians to the flat coastal plain and is dominated by pine and mixed southern hardwoods (NABCI 2000a). Suburban sprawl and forest fragmentation continues to increase within this region and presents challenges to bird conservation. Example priority bird species within this BCR include the red-cockaded woodpecker (*Picoides borealis*), Bachman's sparrow (*Peucaea aestivalis*), and brown-headed nuthatch (*Sitta pusilla*); however, none of these species occur in the Project area. A total of 10 priority species from BCR 29 are included in the Project-specific MBSC list. It should be noted that all 10 species are considered priority species in BCR 28 as well.

4.2 Bald and Golden Eagles

The USFWS Elkins EFO recommended evaluation of the Project area for potential impacts to bald and golden eagle habitat (i.e., bald eagle nests, bald and golden eagle roosts). The USFWS Elkins EFO recommended focusing surveys on eagle nest buffers in Summers, Greenbrier, and Monroe Counties, West Virginia. Exact locations of eagle nest buffers were not provided. On October 13, 2015, MVP provided the USFWS Elkins EFO with proposed methods for eagle nest surveys along sections of Greenbrier River, Meadow River, and Indian Creek intersected by the Project. The length of the survey segment associated with the Greenbrier River is 1.93 kilometers (1.20 mi), Meadow River is 2.88 kilometers (1.79 mi), and Indian Creek is 4.10 kilometers (2.55 mi). On November 3, 2015, the USFWS Elkins EFO issued concurrence for the proposed survey methods. Survey results are discussed in Section 6.2.1.1.1. A report detailing survey locations, survey methods, and results to date is provided in Appendix E.

On March 24, 2016, the USFWS Gloucester EFO requested pedestrian searches for eagles and aerial surveys for eagle nests along the entire Project area within Virginia. On March 30, 2016 in an email to USFWS Gloucester EFO, Environmental Solutions and Innovations (ESI), on behalf of MVP, proposed completion of pedestrian and aerial surveys for eagles and nests along the entire length of the Project in Virginia.

As suggested by the USFWS Gloucester EFO, ESI contacted Dr. Todd Katzner with the U.S. Geological Survey on April 13, 2016 to request additional occurrence data on golden eagles in the vicinity of the Project. On May 6, 2016, Dr. Katzner provided a map depicting spring, fall, and winter telemetry locations of 33 migrating golden eagles that he and his research group have collected since 2006. Data suggest golden eagles regularly use the forested ridges during winter and migration events in Giles and Craig Counties, Virginia. While the Project may pose a risk if important roost areas supporting large congregations of golden eagles are disturbed, this is not expected and the species is not likely to be impacted. Sections 6.2.1 and 6.2.6.2 further address surveys that have been and will be completed to identify if such roosts/congregations are present within the Project area.

MVP survey results are discussed in Section 6.2.1.1.2. A report detailing survey locations, survey methods, and results is provided in Appendix E.

4.3 Loggerhead Shrike

During consultations with state natural resource agencies, the VDGIF and VDCR expressed concern for impacts to state-threatened loggerhead shrike in potentially suitable habitat in Giles, Craig, Montgomery, and Roanoke (north of Spring Hollow Reservoir) Counties. The VDGIF recommended following a time of year restriction (TOYR) for loggerhead shrike by not conducting habitat clearing activities between April 1 and July 31. If MVP is unable to adhere to this restriction, the VDGIF recommended completion of habitat assessments to determine the presence of suitable habitat along the Project. Because MVP does plan to complete some construction activities during nesting, habitat studies along 13.57 kilometers (8.43 mi) of potential habitat in Giles, Craig, Montgomery, and Roanoke Counties were completed. Also, habitat studies of one pipe yard located in the Project area that includes potentially suitable habitat (9.24 ha [22.84 ac]) were completed. Off-season tree and shrub clearing is proposed for areas with suitable habitat. Habitat assessment results are summarized in Section 6.2.2.1. A habitat assessment report was submitted on November 15, 2016 and is provided in Appendix E. The VDGIF recommended that five additional areas (2.71 km [1.69 mi]) along the Project be assessed for suitable habitat. These assessments were completed in spring 2017; all were deemed suitable.

In the event that MVP cannot complete clearing outside the nesting season, MVP will complete occupancy surveys in accordance with the VDGIF's protocol within all suitable habitat where construction activities may occur.

4.4 Peregrine Falcon

Coordination with the VDGIF and records contained within its Wildlife Environmental Review Map Service (WERMS) indicate the Project is within two miles of a known peregrine falcon occurrence near Doe Creek in Giles County, Virginia. However, Mr.

Sergio Harding, the VDGIF Nongame Bird Conservation Biologist, indicated this record was an incidental observation by a VDGIF biologist from February 25, 1997, and the observation was not associated with any known breeding activity. Thus, Mr. Harding dismissed the record and indicated surveys for peregrine falcons were unnecessary at the time.

On September 3, 2015, MVP contacted Mr. Harding for more information regarding recent (spring 2015) sightings of peregrine falcons near Ripplemead in Giles County, Virginia. Mr. Harding indicated an individual was observed along the New River just west of Ripplemead on March 31, April 9, and May 15, 2015. The closest observation was approximately 1.77 kilometers (1.10 mi) from the proposed Project workspace. Mr. Harding explained this individual falcon was not likely paired and, thus, not currently breeding within the area. Due to the solitary nature of the falcon and that the Project will not cross the New River, the VDGIF indicated surveys are not required. Mr. Harding stated that surveys for peregrine falcon would be completed in the general area of the sighting in 2016. On behalf of MVP, ESI contacted the VDGIF and made an inquiry regarding 2016 surveys on October 10, 2016. In an email response on October 12, 2016, Mr. Harding, indicated surveys completed in 2016 were negative for peregrine falcon along the New River.

On December 20, 2016 the VDGIF provided additional comments regarding concern for noise associated with blasting near the New River due to the presence of suitable nesting habitat. The VDGIF stated that they did not expect the Project to result in nest abandonment of any breeding peregrine falcons, but recommended that MVP coordinate with the VDGIF on proposed location and timing of blasting activities. MVP incorporated this recommendation into the Project Blasting Plan. Also on this date, Mr. Harding provided details regarding a historic peregrine falcon nesting location, Barney's Wall, in Giles County, Virginia. This record was not mentioned in previous correspondence between the VDGIF and MVP regarding peregrine falcon occurrence near the Project (within 2 miles). Mr. Harding stated that the site is not known to be occupied, but has not been surveyed in over a decade; no action was recommended.

4.5 USFS Avian Species

The U.S. Forest Service (USFS) reviewed the Threatened, Endangered, or Sensitive Species Occurrence Analysis Results (OAR) for the Project, and provided comments concerning avian species on April 7, 2015. Four species were included in the table: peregrine falcon, bald eagle, loggerhead shrike, and Appalachian Bewick's wren (*T. b. altus*). USFS recommended completion of habitat assessments for each species in portions of the Project area that cross the Jefferson National Forest (JNF) (approximately 5.66 kilometers [3.52 mi] of centerline and 10.86 kilometers [6.75 mi] of access roads). Survey results are discussed in Section 6.2.4.

On August 6, 2015 the USFS provided a list of locally rare species occurring where the Project crosses the JNF and recommended documentation of observations for eleven avian species included in the list (Cooper's hawk [*Accipiter cooperii*], sharp-shinned hawk [*A. striatus*], golden eagle, Swainson's thrush [*Catharus ustulatus*], brown creeper [*Certhia americana*], alder flycatcher [*Empidonax alnorum*], red crossbill, cerulean warbler, Blackburnian warbler [*S. fusca*], yellow-bellied sapsucker [*Sphyrapicus varius*], and golden-winged warbler). Surveyors were asked to document any incidental observations of eleven locally rare avian species while completing other field surveys in the JNF; however, none were observed.

4.6 Species of Greatest Conservation Need in West Virginia and Virginia

As a response to the October 2016 submittal of a previous version of the MVP MBGP, the VDGIF recommended that the MBGP emphasize the top two tiers of Species of Greatest Conservation Need (SGCN) from the agency's Wildlife Action Plan (2015). The MBGP has been modified to include SGCN that are not currently included as priority bird species in the two BCRs crossed by the Project. It was noted by the VDGIF that the list of bird species for BCR 28 is currently being updated. A total of 10 Tier I and II Virginia SGCN are included in the Project-specific MBSC list.

The VDGIF placed a particular emphasis on the following species: golden-winged warbler, cerulean warbler, Swainson's warbler (*Limnothlypis swainsonii*), loggerhead shrike, black-billed cuckoo (*Coccyzus erythrophthalmus*), northern saw-whet owl (*Aegolius acadicus*), and peregrine falcon. As of July 14, 2015, all of these species, except for the northern saw-whet owl, are considered Priority 1 species in the 2015 West Virginia State Wildlife Action Plan. For this reason, records were obtained for the aforementioned species using eBird throughout the entire Project area in West Virginia and Virginia.

In an email dated December 22, 2016, Mr. Harding provided a list of observations relevant to this list of species. Shape files were provided that contained golden-winged warbler records within two miles of the Project. Records referenced in the email related to other species were obtained by Mr. Harding using eBird. To obtain geospatial data for purposes of the Plan, eBird was referenced and records were filtered from January 1, 2005 to January 1, 2017 for the aforementioned SGCN, as well as golden eagle, a Tier 1a species in Virginia and Priority 1 species in West Virginia. The records were further refined to identify observations within 3.22 kilometers (2.00 mi) of the Project in West Virginia and Virginia. A total of 114 entries were identified with a total of 220 observations of the aforementioned species (Table 5, Appendix B). The majority (71.36%) of observations were of cerulean warbler in West Virginia ($n = 136$) and Virginia ($n = 21$). Figure 3 (Appendix A) provides these locations as well as locations of golden-winged warblers provided by the VDGIF.

4.7 Important Bird Areas

The Important Bird Areas (IBA) Program is a global initiative developed through Birdlife International to identify and conserve critical areas associated with birds and other biodiversity. In the United States, the National Audubon Society serves as the U.S. Partner of Birdlife International to administer the IBA Program. The Audubon's IBA online mapping application was used on March 9, 2015 to determine whether the Project intersected any IBAs.

From Project mileposts 0.0 to 141.26, the Project traverses approximately 137.69 kilometers (85.56 mi) of the globally recognized Southern Allegheny Plateau Forest Block Complex and Allegheny Mountains Forest Block Complex IBAs in West Virginia, as identified through forest block analysis completed by the Eastern Forest Project of the National Audubon Society in 2013 (Figure 4, Appendix A). These IBAs are recognized for the significant amount of contiguous forest each contains, an important feature for a number of forest-dependent neotropical migrants, including the cerulean warbler, a SGCN in West Virginia (Priority 1) and Virginia (Tier 2a).

The Project is also in close proximity, but does not cross, two additional IBAs. Specifically, it is within approximately 3.33 kilometers (2.07 mi) of the Lewis Wetzel Wildlife Management Area (WMA) (an IBA) in Wetzel County, West Virginia and within 1.08 kilometers (0.67 mi) of the Virginia Piedmont Forest Block Complex IBA in Franklin and Pittsylvania Counties, Virginia. The National Audubon Society identified the Lewis Wetzel WMA as a Global IBA for its significant population of cerulean warbler. The diversity of forest habitat type, age, and structure helps support a variety of neotropical migrants. In addition to cerulean warbler, several other Project-specific MBSC nest within the Lewis Wetzel WMA, including the wood thrush (*Hylocichla mustelina*), Kentucky warbler (*Geothlypis formosa*), worm-eating warbler (*Helmitheros vermivorum*), and Louisiana waterthrush (*Parkesia motacilla*).

4.8 Migratory Bird Habitat

Construction of the proposed pipeline, associated facilities, and access roads involve clearing of forest and other vegetation potentially resulting in indirect impacts to migratory birds via habitat loss and fragmentation, and potential direct impacts including mortality and nest abandonment. Habitat impacts are quantified by comparing the amount of each land cover type present along the Project route before and after construction, and following recovery of temporarily disturbed areas.

Of the total 2,575.52 hectares (6,364.26 ac) within the project footprint, 800.08 hectares (1,977.04 ac) of potential migratory bird habitat (forest, grasslands, pasture, scrub shrub, and wetlands) are within the operational ROW and will be maintained as grassland/herbaceous in perpetuity. Of this, 655.72 hectares (1,620.31 ac) will be permanently converted from a wooded habitat type to a herbaceous one. Migratory bird habitat within the "temporary ROW" associated with construction activities will,

over time, return to a habitat similar to what it was pre-construction totaling 1,535.84 hectares (3,795.15 ac) (Table 3, Appendix B). Regeneration of vegetation varies based on habitat type with early seral habitat (e.g., grassland/herbaceous; pasture/hay), returning to pre-construction conditions sooner, often after only a few growing seasons, than forests, which can take decades.

Impacts to Project-specific MBSC are dependent on the clearing and modification of land cover. Preferred breeding/nesting habitat of Project-specific MBSC is provided in Table 6 (Appendix B). Impacts to migratory bird habitat are further discussed below.

4.8.1 Forest Habitat

The majority of the Project-specific MBSC (17 of 28) rely on forested habitat for breeding and nesting. Forest is the predominant land cover impacted by the Project with approximately 1,802.11 hectares (4,453.12 ac) affected by construction (70.00% of Project-specific impacts). Of that total, 647.02 hectares (1,598.82 ac) will be permanently converted to either grassland/herbaceous or shrub/scrub habitat within the operation ROW. It is worth noting that although forested areas will regenerate, where “interior forest” areas are impacted, regeneration will be to “edge forest” so these recovered areas will not provide the same functional value.

4.8.1.1 Forest Availability in the Vicinity of the Project

Total forest within a landscape can provide insight regarding potential impacts to forest birds. Robinson (1995) found that landscapes exceeding 70 percent forest cover provided forest interior bird-habitat less vulnerable to edge effects associated with forest fragmentation. Total forest cover was assessed in and within 10 kilometers (6.21 mi), the distance used in the Robinson et al. paper, of the Project’s LOD. Total forest is estimated at 663,921.61 hectares (1,640,586.03 ac), 78.11 percent of total land cover in and within 10 kilometers of the Project (*hereafter*, ‘landscape’). Following tree removal for construction, total forest within the landscape is estimated to decrease to 662,119.50 hectares (1,636,132.91 ac), 77.90 percent of total land cover. Regeneration of temporarily removed forest will result in a lower long-term, net impact to forest. Overall, the construction and operation of the Project will result in an estimated net decrease of 0.08 percent (647.02 ha [1,598.82 ac]) in forest cover within the landscape. Permanent alterations to land cover associated with the Project’s operation ROW ultimately results in forest cover decreasing to 663,274.59 hectares (1,638,987.21 ac), 78.03 percent of total land cover. These estimates suggest that available forest cover/habitat will remain relatively similar within the landscape following the Project’s construction and subsequent operation.

Furthermore, within the two IBAs crossed by the Project (Southern Allegheny Plateau Forest Block Complex and Allegheny Mountains Forest Block Complex), forest is the dominant land cover (90.62%; 257,793.62 ha [637,021.90 ac]). Potential impacts to forest within the Southern Allegheny Plateau Forest Block Complex involves

approximately 278.21 hectares (687.48 ac) of forest cleared for construction and 103.36 hectares (255.40 ac) that will remain permanently cleared for operation of the Project. Potential impacts to forest within the Allegheny Mountains Forest Block Complex involves approximately 300.46 hectares (848.33 ac) of forest cleared for construction and 121.59 hectares (343.31 ac) that will remain permanently cleared for operation of the Project. The net loss of forest within the Southern Allegheny Plateau Forest Block Complex and Allegheny Mountains Forest Block Complex is estimated to be 0.08 percent and 0.09 percent, respectively. The decrease in forest associated with the Project does not appear to threaten the availability of habitat for forest birds within the IBAs.

Forest fragmentation associated with the Project is discussed further in Section 5.0.

4.8.2 Grassland and Herbaceous Habitat

The grasslands/herbaceous and pasture/hay NLCD classes are often similar in vegetation types, structure, and function. Thus, pastures and hayfields are commonly used by grassland birds as surrogate habitat. Four MSBC, upland sandpiper (*Bartramia longicauda*), Henslow's sparrow, loggerhead shrike, and peregrine falcon, select grassland habitat types. Upland sandpipers and Henslow's sparrows nest in large patches of contiguous grass-dominated landscapes, often exceeding 101.17 hectares (>250 ac). Loggerhead shrikes also nest in this habitat when suitable nesting trees/shrubs are available. Shrikes and peregrine falcons both use these habitats for hunting.

Approximately 406.16 hectares (1,003.65 ac) of pasture/hay and 73.96 hectares (182.76 ac) of grassland/herbaceous habitat are proposed for clearing for construction (combined 18.64% of Project-specific impacts). While vegetation in these areas will return to similar conditions, approximately 113.27 hectares (279.90 ac) of pasture/hay and 22.15 hectares (54.74 ac) of grassland/herbaceous habitat will be maintained as the permanent, operation ROW.

Short-term impacts include the loss of nesting and foraging habitat. Grassland habitat clearing is unlikely to have any long-term impacts due to proposed replanting of cleared areas and the relatively fast growth and recovery of herbaceous vegetation. Furthermore, it is expected that the permanent ROW associated with operation of the Project will be managed in a grassland/herbaceous state. It is estimated that this will result in approximately 655.72 hectares (1,620.31 ac) of new grassland/herbaceous habitat being created. Although the linear nature of the Project ROW is less optimal for area-sensitive grassland birds, the newly created habitat may serve as a travel corridor between grassland habitats and provide nesting and foraging areas for birds that use grasslands and other early successional habitats. However, the creation of corridors dominated by early seral vegetation (e.g., grass; forbs) may increase the risk of nest predation and brood parasitism for forest-nesting species.

4.8.3 Shrub/scrub Habitat

An estimated 28.90 hectares (71.41 ac) of shrub/scrub habitat will be cleared during construction (1.12% of Project-specific impacts). Of this, 8.70 hectares (21.49 ac) will be permanently removed (1.02% of Project-specific impacts). The remaining area will be replanted with native vegetation. Likewise, across the length of the line, as woody vegetation begins to regenerate in impacted forest areas outside the operational row, substantial shrub/scrub habitat (1,155.09 ha [2,854.30 ac]) will exist during the interim time period before those areas fully recover into mature forest. This area can provide nesting and foraging habitat for a number of migratory birds, such as blue-winged warbler and prairie warbler that prefer shrub/scrub habitat and the forest-edge interface.

Shrub/scrub and early successional forest habitat provides potential nesting habitat for seven of the Project-specific MBSC. Of these, at least four species (i.e., blue-winged warbler, golden-winged warbler, prairie warbler, and loggerhead shrike) are dependent on these habitat types. The creation of new shrub/scrub habitat resulting from Project-construction may provide some benefits for these species.

4.8.4 Wetlands

For this analysis, impacts to wetlands include the following wetland types: palustrine emergent, palustrine scrub-shrub, and palustrine forest. According to data from the NLCD, construction will result in the clearing of approximately 17 hectares (42 ac) of all wetland types crossed by the Project (0.65% of Project-specific impacts). All impacted areas will be replanted with native wetland vegetation; temporary wooded wetland impacts will be replanted by hand. While approximately one quarter of the ROW within wetlands will be periodically maintained via mowing, the remaining areas within the construction ROW will be left to grow and return to pre-construction conditions. Clearing in wetlands may temporarily reduce nesting habitat for wetland birds. The least bittern, requires dense emergent wetland vegetation and the prothonotary warbler (*Protonotaria citrea*) depends on cavities in trees in and/or near standing water. Due to the limited temporal and spatial extent of disturbance and proposed wetland restoration measures (Appendix D), Project impacts are not likely to jeopardize regional populations of wetland birds.

4.8.5 Other Habitat Types

The developed areas intersected by the Project total 203.93 hectares (503.92 ac). Only one Project-specific MBSC, peregrine falcon, selects developed areas as a type of preferred nesting habitat. The peregrine falcon may nest on buildings and skyscrapers in highly developed areas; however, the developed areas associated with the Project are mostly areas with low intensity development and do not contain the aforementioned man-made structures to promote nesting. Therefore, construction impacts to developed areas are unlikely to have any short-term or long-term impacts on migratory birds.

Total impacts associated with open water amount to less than one percent (0.31% of Project impacts) of the Project area (8.03 ha [19.85 ac]). Project-specific MBSC commonly associated with open water include pied-billed grebe (*Podilymbus podiceps*), least bittern, and bald eagle. These species forage/hunt in ponds, lakes, and other open water. While disturbance of this small amount of area within these habitat types may temporarily reduce overall habitat availability for foraging and other activities, the relatively small scale of disturbance and replanting of shoreline vegetation, makes significant impacts to migratory birds unlikely.

Two NLCD classes (i.e., barren land; cultivated crops) do not provide the preferred nesting habitat of any Project-specific MBSC, thus impacts to these areas are unlikely to affect Project-specific MBSC.

5.0 Forest Fragmentation Analysis

Forest is the predominant land cover type crossed by the Project. In some areas, the Project will intersect large, contiguous patches of forest with varying degrees of anthropogenic fragmentation (e.g., roadways; utility right-of-ways). Forests with minimal fragmentation have relatively more forest interior than forests of comparable size that have a higher degree of fragmentation. Forest interior habitat supports ecological attributes and functions, such as providing habitat for interior-dependent flora and fauna, not offered by forests along the forest-periphery, or edge.

As stated in Section 4.8.1, the majority of Project-specific MBSC require forested habitat during their breeding season, with some species preferring to nest deep within the interior of large, continuous tracts of forest. Anthropogenic disruptions fragmenting large tracts of forest increases the ratio of forest edge to interior, and can lead to increased predation and brood parasitism of insular forest nesting migratory birds (Chalfoun et al. 2002), as well as alter habitat characteristics that influence avian communities.

An analysis was completed to identify large, contiguous patches of forest crossed by the Project and estimate direct (i.e., tree clearing and removal) and indirect forest impacts (i.e., loss of forest interior through creation of new edge and subsequent “edge effect”). The analysis also assesses fragmentation of the large forest blocks by estimating changes in area and number of fragments created. The methods and data sources used to analyze forest fragmentation are described below.

5.1 Data Sources and Methods

The data sources described below place an emphasis on large, contiguous blocks of forest. It should be noted that the data derived and used for the forest fragmentation analysis does not include all forest, rather the focus of the analysis is on assessing impacts to blocks of forest containing a relatively high proportion of forest interior (versus forest edge) that provide the ecological functions necessary to support a variety of forest interior birds. The available data sets utilized for the fragmentation analysis are dated (2001 for Virginia and 2011 for West Virginia), which results in the overestimation of fragmentation by the Project. The analysis assumes that land cover, including forest, has remained unchanged since the creation of the data. It is highly unlikely that this is the case, with habitat types increasing in some areas and decreasing in others. Changes in forest cover between the time datasets were created and now potentially resulted in omission of some forest fragmentation during the analyses. . The analyses also assume that all areas spatially defined as Core Forest Areas lack fine-scale canopy gaps or forest interruptions that may exacerbate effects of fragmentation in previously fragmented areas. Datasets were not developed in a manner to capture fine scale anthropogenic disruptions and natural disturbances to forests, therefore, some areas crossed by the Project may already have some degree of fragmentation that is not represented.

An example of such limitations is the omission of some major transportation corridors in portions of Core Forest Areas. A comparison of the datasets to recent aerial imagery (2015) revealed some interstates, state routes, and railroads were not included as sources of fragmentation. Further comparisons of aerial imagery to Core Forest Areas revealed that other sources of fragmentation exist that are not captured in the datasets (e.g., electric transmission corridors, maintained forest openings, logged areas).

While calculations are used to estimate forest interior loss and the extent of forest fragmentation, it is difficult to estimate the severity of local impacts to forest interior birds with limited data that are available. Many factors can play a role in the severity of impacts to interior forest birds, including but not limited to width of corridor, juxtaposition of other habitat types, and presence of existing nest predators and/or brood parasites. Impacts vary spatially and are not uniform from the edge of disturbance (e.g., tree clearing) to the interior of a forest.

5.1.1 Core Forest Areas, West Virginia

Impacts to large patches of contiguous forest in West Virginia were analyzed using West Virginia state forest fragmentation data produced by the Natural Resource Analysis Center (NRAC) at West Virginia University (2011). The dataset was created using the Landscape Fragmentation Tool (LFT) Version 2.0 produced by the Center for Land Use Education and Research at the University of Connecticut. NRAC's dataset ranks stands of forested land in West Virginia and classifies forests based on

area of continuous habitat and a specified edge width (100 meters [328 ft]). Forest interior cores are grouped by cores with forest interior greater than 202.34 hectares (>500 ac; large cores), 101.17 to 202.24 hectares (250-500 ac; medium cores), and less than 101.17 hectares (<250 ac; small cores). Other forest associated with the forest cores is classified as 'patch' (completely degraded by edge effect), 'perforated' (interior edges associated with small gaps in cores), or 'edge' (exterior periphery of cores). Because cores arguably will face the most severe impacts in regards to fragmentation, the analysis focused on identifying small, medium, and large cores intersected by the proposed Project. These cores were then buffered by 100 meters (328 ft) to account for forest edge. Any cores that had overlapping forest edge were merged together to create a *Forest Complex*. These are cores that are connected via forest edge and, therefore, belong to the same forest patch. Distinguishing this within the analysis helps provide information concerning forest patch size requirements for various area-sensitive forest birds.

MVP proposes to traverse approximately 268.73 kilometers (166.98 mi) within 38 Core Forest Areas within 21 Forest Complexes in West Virginia (Figure 5, Appendix A; Table 7, Appendix B). Based on the NRAC dataset, the proposed route is expected to intersect 12 large cores, 1 medium core, and 25 small cores with 1,145,511.19 hectares (2,830,619.79 ac), 119.51 hectares (295.31 ac), and 477.27 hectares (1,179.35 ac) of forest interior, respectively. Approximately 18.43 percent (258,915.93 ha [639,795.19 ac]) of forest within the Core Forest Areas crossed in West Virginia is considered forest edge.

One core, WV Core-20, Complex T (the southernmost Core Forest Area exceeding 500 acres along the Project in West Virginia), is split between West Virginia and Virginia. Because an independent analysis concerning fragmentation was completed for Virginia, forest assessed for WV Core-20 is limited to West Virginia. Impacts to forest within this Core Forest Area in Virginia are assessed in the Virginia-portion of the analysis.

5.1.2 Ecological Core Areas, Virginia

Data from the Virginia Natural Landscape Assessment (VaNLA) (VDCR 2007) were used to assess Project-specific fragmentation in large patches of contiguous forest. The VaNLA is a landscape-scale geospatial analysis used to identify, prioritize, and link natural lands within Virginia. Large patches of natural land (i.e., forests, forested wetlands, shrublands, marshes, beaches, and dunes) with a minimum of 40.47 hectares (100 ac) of interior cover and associated habitat fragments providing connectivity between large patches are collectively referred to as Ecological Core Areas (ECA). Each ECA is classified as a habitat fragment (4.05 to 40.06 ha [10 to 99 ac]), or a small (40.47 to 404.28 ha [100 to 999 ac]), medium (404.69 to 4,046.45 ha [1,000 to 9,999 ac]), or large (>4,046.86 ha [>10,000 ac]) core. Each ECA also is

classified based on an ecological integrity index. For the purpose of this document, the focus remains on the size classes of each ECA.

Cores and habitat fragments are used in our analysis of forest fragmentation and loss of forest interior in Virginia. A total of 81.27 kilometers (50.50 mi) of the Project is expected to cross 54 ECAs in Virginia. Based on the VaNLA dataset, the Project is expected to intersect 11 habitat fragments (239.19 hectares [591.06 ac]), 26 small cores (3,482.76 hectares [8,606.09 ac]), 14 medium cores (18,535.62 hectares [45,802.52 ac]), and 3 large cores containing (23,175.84 hectares [57,268.74 ac]) of forest interior (Figure 6, Appendix A; Table 8, Appendix B). Approximately 25.49 percent (15,539.47 ha [38,398.86 ac]) of forest within the ECAs crossed by the Project is considered forest edge.

As described in Section 5.1.1, one core, VA Core-1 (the northernmost ECA along the Project in Virginia), is split between West Virginia and Virginia. Because an independent analysis concerning fragmentation was completed for West Virginia, forest assessed within this ECA is limited to Virginia. Impacts to forest in West Virginia within this ECA are assessed in the West Virginia-portion of the analysis.

5.1.3 Forest Interior

Both datasets define interior forest beginning 100 meters (328 ft) from the forest edge (i.e., 100-m buffer along periphery of a forest patch). The justification being a 100-meter “buffer” represents the area where the habitat is “forest edge” rather than “forest interior” (Wickham et al. 2007, Riitters and Wickham 2012). MVP’s review of the NRAC dataset focused on identifying the forested cores that are delineated based on amount of forest interior cover; forest edge was excluded during this review. The VaNLA dataset delineates ECAs based on the entire forested area (forest interior and edge included). In West Virginia, in order to provide an estimate of impacts to existing forest edge versus interior, a 100-meter buffer was used to buffer the NRAC dataset out from the edge of the interior core to account for forest edge. Conversely, in Virginia, the VaNLA dataset was buffered by 100 meters inward from the edge of each ECA in order to account for forest edge. This was compared to aerial imagery for a subset of ECAs to validate the accuracy of this approach.

When forest is disrupted, impacts are not isolated to the area where trees are removed. Clearing forest can alter conditions in neighboring forests, including microclimate, amount of available sunlight, and, consequently, vegetation composition. Disruptions in or adjacent to forest interior can alter forest interior to the point that the defining characteristics of forest interior are no longer present and ecological function is diminished. These disruptions not only directly remove forest habitat, impacts associated with clearing result in the creation of new forest edge and loss of forest interior. Figure 7 (Appendix A) provides a visual representation of how forest interior loss in Core Forest Areas was estimated.

5.2 Results

A desktop analysis examining potential forest fragmentation resulting from Project construction was completed for West Virginia and Virginia, independently, using each aforementioned Core dataset specific to each state. The contiguous forests described within the datasets (i.e., Core Forest Areas and ECAs) are collectively referred to as Core Forest Areas throughout the remainder of the document. Impacts are summarized in Table 9 (Appendix B). Likewise, all impacts provided within this section are discussed, in the context of each of the applicable data sets reviewed.

5.2.1 Direct Impacts

Direct impacts refer to forest that is physically removed through the clearing of trees. Initial clearing of trees will result in the removal of forest habitat within the Project's construction footprint; however, the area that is not included in the operation footprint will return to forested conditions overtime through natural and assisted (e.g., planting of woody vegetation in specific locations) succession.

5.2.1.1 West Virginia

In West Virginia, based on the NRAC dataset, 1,366.58 hectares (3,376.90 ac) of forest will be cleared for construction in 38 Core Forest Areas within 21 Forest Complexes. Forest interior accounts for 1,010.85 hectares (2,497.86 ac) of the total Core Forest Areas cleared. Following forest regeneration in temporarily impacted portions of the construction footprint, a total of 472.33 hectares (1,167.15 ac) will remain permanently cleared from Core Forest Areas in West Virginia. The total amount of interior permanently removed is estimated at 360.87 hectares (891.73 ac).

5.2.1.2 Virginia

In Virginia, based on VaNLA dataset, 386.06 hectares (953.98 ac) of forest will be cleared for construction within the 54 Core Forest Areas. Forest interior accounts for 234.64 hectares (579.82 ac) of the total forest cleared. Following forest regeneration in temporarily impacted portions of the construction footprint, a total of 141.63 hectares (349.97 ac) will remain cleared. The total amount of forest interior permanently removed is estimated at 86.12 hectares (212.80 ac).

5.2.2 Indirect Impacts

In order to understand indirect impacts from the project, a 100-meter (328-ft) buffer was applied to the Project's construction and operation footprints. The area contained within the polygon created by the 100-meter buffer from the edge of the operational ROW out, is where permanent conversion of "interior forest" to "edge forest" will occur. The area contained within the polygon from the outer edge of the operational ROW buffer, to the outer edge of the construction ROW buffer (approximately 15-meters) represents area where interior forest will be temporarily converted to edge forest, until the temporary ROW fully regenerates, at which point this area will return to interior forest.

Analysis of the NRAC data set estimates the loss of forest interior resulting from construction in West Virginia associated with indirect impact at 5,152.8 hectares (12,732.8 ac). The loss of forest interior in Virginia associated with indirect impacts, based on the VaNLA data set is estimated at 908.0 hectares (2,421.7 ac).

5.2.3 Loss of Forest Interior

Forest edge increases from pre-impact conditions following construction by 5,708.15 hectares (14,105.16 ac), or 2.20 percent, in West Virginia, and by 1,278.67 hectares (3,159.67 ac), or 8.23 percent, in Virginia.

Following regeneration of forest in temporarily impacted forests in West Virginia, the analysis estimates the net loss of forest interior at 5,140.93 hectares (12,703.52 ac), a 0.45 percent decrease from pre-construction conditions. The net loss of forest interior in Virginia is estimated at 1,265.06 hectares (3,126.02 ac), a 2.78 percent decrease from pre-impact conditions. Conversely, forest edge increases from pre-impact conditions following construction by 6,615.05 hectares (16,346.15 ac), or 2.55 percent, in West Virginia, and by 1,575.32 hectares (3,892.70 ac), or 10.14 percent, in Virginia.

5.2.4 Forest Fragmentation

In addition to the direct loss of forest and indirect impacts to forest interior, clearing of forest alters the spatial configuration of forest habitat and leads to the fragmentation of contiguous blocks of forest. Fragmentation can reduce forest size to a point that some species may no longer select an area. Core Forest Areas greater than 101.17 hectares (>250 ac), arguably support the greatest ecological integrity and capacity for forest interior birds and wildlife. These large expanses provide habitat for even the most area-sensitive forest birds. A number of forest breeding birds, such as cerulean warblers and wood thrush, exhibit varying levels of area sensitivity (Robbins et al. 1989), some species require large patches of contiguous forest for reproduction and other essential life history activities. When habitat is below a certain area threshold, birds are less likely to be present. For example, Robbins et al. (1989) found that the occurrence probability of scarlet tanager (*Piranga olivacea*) and ovenbird (*Seiurus aurocapillus*), both considered forest interior species and require similar habitat to the Project-specific MBSC, in a 101.17-hectare (250-ac) forest to be approximately 70 and 65 percent, respectively. The occurrence probability drops to approximately 45 and 40 percent in a 10.12-hectare (25-ac) forest and approximately 15 and less than 10 percent in a 1.01-hectare (2.5-ac) forest. Therefore, this forest fragmentation analysis examines the number and size of fragments created by the Project with the goal being to identify if Core Forest Area are fragmented to the point that available forest interior within the largest fragment created is reduced below the 101.17 hectares (>250 ac) threshold.

The Project crosses 92 Core Forest Areas (38 in West Virginia and 54 in Virginia). Of these, nearly half (47.83%) exceed 101.17 hectares (250 ac). Table 10 (Appendix B) identifies the number of core forest fragments of each size class present before and after construction. The analysis shows that the majority of the Project intersections with Core Forest Areas occur along the periphery of the Core Forest Areas. While this results in fragment creation, it shows MVP's efforts to collocate and impact forest edges instead of interior as often as practicable in order to preserve the majority of the intact forest interior. Further, although construction initially results in fragment creation (Table 9, Appendix B), the regeneration of forest in temporarily impacted areas results in the forest edge shifting as succession occurs (Figure 7, Appendix A). This affects the size and configuration of fragments, connecting some of the fragments initially created by construction. Following regeneration, 47 of the fragments created are over 101.17 hectares (250 ac), thus these areas will continue to provide high quality habitat for migratory birds post construction. Likewise, fragmentation in forest patches over 101.17 hectares (250 ac) results in removal of about 1% of interior forest migratory bird habitat within these Core Forest Areas.

5.2.4.1 Forest Fragmentation in West Virginia

In West Virginia, no Core Forest Areas that exceeded 1,017.17 hectares (2,500 ac) or 101.17 hectares (250 ac) prior to construction ($n = 13$) have their largest fragment reduced below each Core's respective area-threshold. These are the largest blocks of contiguous forest and arguably support the greatest ecological integrity and capacity for forest interior birds and wildlife. While the Project does fragment these Core Forest Areas, reduction of forest interior to thresholds that may significantly compromise overall availability of habitat for forest interior birds is avoided.

Forest interior in two Core Forest Areas classified between 10.12 and 101.17 hectares (25-250 ac) prior to construction is reduced below 10.12 hectares (25 ac) in the largest fragments created by the Project. Both Core Forest Areas (WV Core-03B and WV Core-06D) are near this threshold prior to construction (10.28 ha and 13.49 ha [25.39 ac and 33.33 ac], respectively). These areas provide potential refuge and the ability to support populations of some area-sensitive forest interior-birds, such as wood thrush. Forests supporting this amount of forest interior can be integral in supporting forest interior birds in areas with low forest cover within the landscape. Within the vicinity of the Project (10 km), the landscape is predominantly forested (78.1%). Impacts within these Core Forest Areas are not likely to significantly diminish the availability of forest interior within the landscape.

Forest interior in three Core Forest Areas classified between 1.01 and 10.12 hectares (2.5-25 ac) prior to construction is reduced below 1.01 hectares (2.5 ac) in the largest fragments created by the Project. These Core Forest Areas (WV Core-09B, WV Core-11B, and WV Core-15B) are near this threshold prior to construction (2.75 ha, 1.08 ha, and 1.04 ha [6.81 ac, 2.67 ac, and 2.56 ac], respectively). As stated in

regards to the Core Forest Areas within the 10.12 and 101.17-hectare (25-250-ac) size class, although to a lesser degree, these blocks of forest interior can provide refuge and support sink populations of forest interior-birds, and potentially be important for forest edge species.

Prior to construction, 8 of the 38 Core Forest Areas crossed by the Project contain less than 1.01 hectares (2.5 ac) of forest interior. As a result of the Project, forest interior is completely converted to forest edge within the fragments of each Core Forest Area. In addition to these, forest interior in the largest fragment of one Core Forest Area within the 1.01 to 10.12 hectare (2.5-25 ac) size class (WV Core-08G) is converted to forest edge. While these areas see a reduction in forest interior as a result of fragmentation, the limited amount of forest interior existing prior to construction suggests that these Core Forest Areas already have limited capacity to support forest interior birds and other wildlife.

While some Core Forest Areas are reduced in size, and potentially in function, approximately 99.79 percent of forest interior (1,136,812.75 ha [2,809,125.48 ac]) is within Core Forest Areas that continue to provide large expanses of habitat for even the most area-sensitive forest birds (areas >101.17 ha [250 ac]).

5.2.4.2 Forest Fragmentation in Virginia

In Virginia, no Core Forest Areas that exceeded 1,017.17 hectares (2,500 ac) prior to construction ($n = 11$) have their largest fragment reduced below this area-threshold. These Core Forest Areas represent the largest blocks of contiguous forest and arguably support the greatest ecological integrity and capacity for forest interior birds and wildlife. While the Project does fragment these Core Forest Areas, reduction of forest interior to thresholds that may significantly compromise overall availability of habitat for forest interior birds is avoided.

Three Core Forest Areas within the 101.17 and 1,017.17-hectare (250-2,500-ac) size class prior to construction have forest interior within their largest fragment reduced below 101.17 hectares (250 ac). Two of these Core Forest Areas (VA Core-50 and VA Core-51) are near this threshold prior to construction (104.76 ha and 103.85 ha [258.86 ac and 256.63 ac], respectively). One (VA Core-10) is divided by the Project so that the largest fragment is reduced below the original area-threshold.

Four Core Forest Areas classified between 10.12 and 101.17 hectares (25-250 ac) prior to construction have forest interior reduced below 10.12 hectares (25 ac) in the largest fragments created by the Project. Two Core Forest Areas (VA Core-24 and VA Core-36) are near this threshold prior to construction (11.31 ha and 12.03 ha [27.96 ac and 29.73 ac], respectively). The two other Core Forest Areas (VA Core-05 and VA Core-39) have forest interior reduced by 58.09 and 66.69 percent, respectively, within the largest fragments created by the Project. Forests supporting

this amount of forest interior can be integral in supporting forest interior birds in areas with low forest cover within the landscape. Within the vicinity of the Project (10 km), the landscape is predominantly forested (78.1%). Impacts within these Core Forest Areas are not likely to significantly diminish the availability of forest interior within the landscape.

No Core Forest Areas in Virginia see forest interior in the largest fragment created by the Project reduced below 1.01 hectares (2.5 ac).

While some Core Forest Areas are reduced in size, and potentially in function, approximately 94.03 percent of forest interior (41,156.11 ha [101,698.96 ac]) is within Core Forest Areas that continue to provide large expanses of habitat for even the most area-sensitive forest birds (areas >101.17 ha [250 ac]).

6.0 Avoidance and Minimization Measures

MVP designed the Project to avoid and minimize impacts to the natural environment by selecting a route that avoids critical or sensitive habitats, national wildlife refuges, sensitive soils, disruption to mineral resources, environmental hazards, and geologic/topographic hazards to the extent possible. In addition to route selection, MVP is implementing best management practices (BMPs) for construction, operation, and maintenance of the Project to minimize impacts to wetlands, waterbodies, and associated riparian habitats. MVP also developed a Restoration and Rehabilitation Plan (Appendix D) to outline measures to ensure impacts that are not avoided are addressed.

These practices serve to minimize adverse effects on terrestrial and aquatic species associated with these habitats. BMPs and Project-wide conservation measures for the Project are listed in the following sections.

6.1 Project-wide Strategies

MVP will take measures to avoid and minimize impacts to sensitive resources within the Project area. Measures are described in the following subsections.

6.1.1 Environmental Training and Inspection

Prior to the start of construction and throughout the construction process, as needed, environmental training is provided for MVP and contractor personnel whose activities may impact the environment during pipeline and aboveground facility construction. The training program covers job-specific permit conditions, contaminated sediment and groundwater management, health and safety, company policies, cultural

resource procedures, threatened and endangered species restrictions, the Spill Prevention Control Plan, National Pollutant Discharge Elimination System, Stormwater Plan, and any other pertinent information related to the Project.

At least two Environmental Inspectors (EI) will be assigned to each construction spread during active construction and restoration of the Project. Any EI has the authority to stop activities that violate environmental conditions and to order corrective actions. In addition to EIs, all MVP personnel are expected to play an important role in ensuring strict compliance with all permit conditions to protect the environment during construction.

6.1.2 Collocation of Project

To reduce fragmentation to the maximum extent practical, the pipeline is aligned parallel to existing ROWs, including roads and utility corridors, along approximately 143.71 kilometers (89.30 mi) of the proposed route (Table 11, Appendix B).

6.1.3 Wetlands and Waterbodies

Measures MVP will implement to avoid or minimize potential impacts to wetlands and waterbodies include:

- Reducing the construction ROW width from 38.1 to 23 meters (125 to 75 ft) at stream and wetland crossings where possible.
- Expediting construction within any waterbody effectively reducing disturbance to the streambed and adjacent soils and the quantity of suspended sediments.
- Clearly marking wetland boundaries and buffers to be avoided in the field with signs and/or highly visible flagging until construction-related ground disturbing activities are complete.
- Avoiding removal of riparian canopy or stabilizing vegetation, if possible. Crushing or shearing streamside woody vegetation is preferable to complete removal.
- Stabilizing waterbody banks and installing sediment barriers (i.e., silt fence, silt logs) installed within 24 hours of completing in-stream construction activities. Sediment barriers will be left in place until the site has been stabilized with perennial vegetation (typically one full growing season after construction).
- Aligning crossings as close to perpendicular to the axis of the waterbody channel as engineering and routing conditions allow.
- Attempting to maintain, at minimum, a 4.6-meters (15-ft) section of undisturbed vegetation between the waterbody and construction ROW where the pipeline parallels a waterbody.

- Conducting construction at stream crossings during low flow conditions, to the maximum extent possible.
- Crossing streams using dry-ditch crossing methods by pumping or fluming water around if water is flowing at the time of construction.
- Conducting pipeline assembly in upland areas unless the wetland is dry enough to adequately support skids and pipe. Timber mats are used to cross wetlands.
- Minimizing the length of time that the trench is open, to the maximum extent practicable, especially within wetlands.
- Minimizing the amount of necessary construction equipment traffic to that which is needed to clear and grade the ROW, excavate the trench, install the pipeline, backfill the trench, and restore the construction ROW.
- Prohibiting construction equipment, vehicles, hazardous materials, chemicals, fuels, lubricating oils, and petroleum products from being parked, stored, or serviced within a 30.5-meter (100-ft) radius of any wetland or waterbody. All equipment will be inspected for leaks by an inspector at the beginning of the day. Operation will not commence or will cease until the spill is contained, cleaned up, and collected before operations continue. Leaking equipment will be removed or repaired the same day.
- Locating as many ATWS as possible at least 15.2 meters (50 ft) away from the water's edge. Storing trench spoil excavated from within a stream at least 3 meters (10 ft) from the top of the bank to minimize turbidity caused by erosion.
- Avoiding the use of herbicides and pesticides to maintain any portion of the Project ROW or aboveground facilities, unless requested by a land-management agency.
- Installing temporary equipment bridges within the ROW to reduce turbidity and sedimentation caused by construction and vehicular traffic.
- Minimizing crossing of the pipeline through forested wetlands to the maximum extent practicable. When forested wetlands are crossed, MVP will maintain no more than a 3-meter (10-ft) wide, herbaceous strip centered over the pipeline and only remove woody vegetation within a 9.1-meter (30-ft) wide strip centered over the pipeline.
- Allowing vegetation in wetlands to recover more rapidly by only removing tree stumps located directly over the trench line or where safety is a concern.

- Restoring each waterbody to its original configuration and contour to the maximum extent possible. Permanent stabilization of the banks of the waterbody and adjacent areas using erosion control measures and vegetative cover will occur as soon as possible after construction.
- Using native stone to the extent possible during stream bed restoration and stabilization.
- Promptly removing construction materials and related crossing structures from each waterbody after construction.
- Avoiding the use of surface water sources in Virginia for hydrostatic testing. Municipal source waters will be used instead.
- Avoiding the use of waterbodies supporting federally listed species as surface-water sources for hydrostatic testing to avoid potential impacts to federally listed aquatic species.
- Implementing sustainable water-use practices to ensure water resources and environmentally responsible stream-flows are maintained during water withdrawal activities. All water withdrawals will be performed in accordance with local, state and/or federal regulations to prevent the localized and downstream dewatering of streams. To prevent crushing, entrainment, or entrapment of mussels and fishes, floating, screened intakes will be used. The intake end of the pump will contain an appropriately sized screen (i.e., less than 4.7625 millimeters [0.1875 in] mesh size), and withdrawal rates will be reduced (i.e., screen approach velocity will be 0.1524 meter per second [0.5 ft /sec] or less).
- Discharging hydrostatic test water to the ground in upland, well-vegetated areas and not directly to surface waters.

6.2 Strategies to Avoid and Minimize Impacts to Migratory Birds of Concern

6.2.1 Bald and Golden Eagles

According to the most up-to-date available data and agency consultation, no documented bald eagle nests occur in the vicinity of any proposed Project facilities. The closest known bald eagle nest is in Craig County, Virginia approximately 16.42 kilometers (10.20 mi) from the proposed Project route. However, the USFWS Elkins EFO and Gloucester EFO requested completion of additional surveys for bald and golden eagles within the Project area due to a recent increase in regional observations of both resident and migratory eagles.

6.2.1.1 Field Surveys

Pedestrian searches and an aerial survey were conducted during leaf-off conditions to increase nest detectability. According to the National Bald Eagle Management

Guidelines, “Nest sites typically include at least one perch with a clear view of the water where eagles usually forage” (USFWS 2007). In West Virginia, pedestrian searches for eagle nests extended perpendicularly, away from the river to points on the landscape (i.e., nearest ridge top) where the river was no longer visible. An aerial survey was completed along the areas of interest in West Virginia. In Virginia, surveys were completed throughout the Project area by pedestrian searches and/or an aerial survey. The width of the survey corridor was 91.44 meters (300 ft); however, during pedestrian searches, binoculars were used to scan areas extending beyond the corridor.

6.2.1.1.1 West Virginia

On November 3, 2015, the USFWS Elkins EFO provided concurrence with bald eagle nest survey methods proposed by MVP on October 13, 2015. From November 9 to 11, 2015, surveys were completed along sections of the Meadow River, Greenbrier River, and Indian Creek intersected by the Project.

The length of the survey segment associated with the Greenbrier River is 1.93 kilometers (1.20 mi), Meadow River is 2.88 kilometers (1.79 mi), and Indian Creek is 4.10 kilometers (2.55 mi). Pedestrian surveys were completed along 1.93 kilometers (1.20 mi) of the Greenbrier River survey segment, 2.62 kilometers (1.63 mi) of the Meadow River survey segment and 1.20 kilometers (0.75 mi) of the Indian Creek survey segment. Bald eagle nests were not observed during these survey efforts. Bald eagles were encountered in two locations near Indian Creek: an observation of one juvenile eagle occurred approximately 43 meters (141 ft) from the Project LOD, and four other eagles were found outside the 91.44-meter (300-ft) survey corridor 1.27 kilometers (0.79 mi) from the LOD.

In addition to pedestrian surveys, on February 27, 2017, an aerial survey from helicopter was completed from the northernmost survey segment (Meadow River) south to where the Project crosses into Virginia, covering the remainder of the survey segments requiring surveys. No bald eagle nests were observed during this survey. Bald eagles were observed in two locations: one adult and one juvenile bald eagle were observed perched in a tree south of Meadow River (37.971293, -80.741958) approximately 285 meters (935 ft) from the Project’s LOD; and two juveniles (one perched and the other flying overhead) south of Indian Creek approximately 43 meters (141 ft) from the Project LOD, in the same location one juvenile bald eagle was observed in November 2015.

All survey segments associated with Meadow River, Greenbrier River, and Indian Creek have either been surveyed via pedestrian and/or aerial survey. Completed pedestrian surveys and aerial survey were negative for bald eagle nests in each survey segment identified by the USFWS Elkins EFO.

6.2.1.1.2 Virginia

Pedestrian searches were completed along 162.69 kilometers (101.09 mi) of the pipeline centerline and 88.29 kilometers (54.86 mi) of access roads from March 30 to April 7, 2016. Bald eagles, golden eagles, and several other raptors were observed (Appendix E). No nests were documented. Permission was not granted to survey the remaining 8.79 kilometers (5.46 mi) of the Project's centerline and 5.18 kilometers (3.22 mi) of associated access roads in Virginia during this field effort.

On April 5, 2016, an aerial survey was completed covering 171.48 kilometers (106.55 mi) of the centerline and 93.47 kilometers (58.08 mi) of access roads in Virginia. No nests or eagles were observed. On February 27, 2017, an aerial survey from helicopter was completed along the length of the Project in Virginia. No nests or eagles were observed during the flight.

The two observations of golden eagles flying near the Project, one in Giles County and one in Montgomery County, suggest that the species may use the area as a flight corridor and to potentially feed. No perched or roosting individuals were observed during field surveys.

6.2.1.2 Avoidance and Minimization

The National Bald Eagle Management Guidelines indicate buffering active eagle nests by 0.10 and 0.20 kilometer (0.063 and 0.125 mi) depending on the activity proposed and whether the nest is within line of sight from the proposed activity (USFWS 2007). MVP will notify USFWS regarding any nests located during the remaining surveys, and if found, comply with appropriate project set-backs identified in the guidelines to avoid impacts to birds or their eggs.

Additionally, MVP will follow the bald eagle guidelines set out by VDGIF for landowners in Virginia. The breeding season for bald eagles in Virginia is generally from December 15 to July 15, when bald eagles are considered most sensitive to disturbance. Therefore, during the breeding season, MVP will not conduct any clearing or construction activities within 201.17 meters (660 ft) of active bald eagle nests and will avoid blasting or use of any explosives within 0.81 kilometer (0.5 mi) of active nests or communal concentration areas. In open areas, MVP will avoid blasting within 1.61 kilometers (1.00 mi) of communal concentration areas. Any nest where activity by bald eagles is documented within the previous two years is considered an active bald eagle nest. Nests inactive for longer than two years are considered latent as described in the VDGIF guidelines for land owners in Virginia (VDGIF 2012).

6.2.2 Loggerhead Shrike

6.2.2.1 Field Surveys

Desktop habitat analysis identified 13.57 kilometers (8.43 mi) of potentially suitable habitat for loggerhead shrikes in Giles, Craig, Montgomery, and Roanoke counties, Virginia. Also, one pipe yard is located in the Project area that includes potentially suitable habitat (9.25 ha [22.85 ac]). The VDGIF provided recommendations that five additional areas (2.71 km [1.69 mi]) along the Project be assessed for suitable habitat where surveys were also completed. Potentially suitable habitat consists of open areas dominated by herbaceous vegetation with relatively low woody cover. Examples of habitat include grasslands, agricultural landscapes, roadsides with hedgerows and isolated shrubs and trees, orchards, and large forest openings.

Field habitat assessments are completed within the 100-meter (328-ft) corridor along the centerline to validate the desktop habitat analysis. To date, field habitat assessments are completed for all identified potentially suitable habitat. Of the completed habitat assessments, 15.45 kilometers (9.60 mi) provide suitable nesting and foraging habitat while 0.85 kilometer (0.53 mi) exhibits characteristics of suitable foraging habitat. The 9.25 hectare (22.85 ac) pipe yard provides suitable nesting and foraging habitat.

6.2.2.2 Avoidance and Minimization

MVP has elected to clear all suitable nesting substrate (i.e., trees and shrubs) from suitable habitat outside of the nesting season (April 1 to July 31). In the event that MVP cannot complete clearing during this window, MVP will complete occupancy surveys following the VDGIF's protocol in areas of suitable habitat where construction activities are planned during the nesting season. If a nest is located, geographic coordinates are collected and assigned a unique identification number. Nests receive a protective buffer (size determined following consultation with the VDGIF) and, if the buffer extends into the LOD, the EI on the construction spread is alerted to the location of the observed nest, signage is posted stating the presence of a protected species, and protective fencing is installed. The area within the nest buffer is cleared only after nestlings have fledged or the nest has failed. These actions will ensure that no birds or eggs are destroyed as a result of construction activities.

6.2.3 Peregrine Falcon

On December 20, 2016 the VDGIF provided additional comments regarding concern for noise associated with blasting near the New River due to the presence of suitable nesting habitat. The VDGIF stated that they did not expect the Project to result in nest abandonment of any breeding peregrine falcons, but recommended that MVP coordinate with the VDGIF on proposed location and timing of blasting activities. MVP will notify the VDGIF in regards to blasting activities within 3.22 kilometers (2 mi) of the New River.

6.2.4 USFS Avian Species

MVP conducted habitat assessments from the fall of 2015 and to the fall of 2016 for bald eagles, peregrine falcons, loggerhead shrikes, and Appalachian Bewick's wrens within a 91.44-meter (300-ft) wide corridor along approximately 5.66 kilometers [3.52 mi] of centerline and 10.86 kilometers [6.75 mi] of access roads crossing the JNF. Specifically the surveys included Peters Mountain, Sinking Creek Mountain, and Brush Mountain, each characterized as having a high degree of ecological integrity based on the VaNLA project (VDCR 2007).

No suitable nesting habitat was found for the four avian species during habitat assessments. The section of the JNF crossed by the Project consists of contiguous forest and lacks early successional, open habitat preferred by loggerhead shrikes and Appalachian Bewick's wrens. The lack of major surface water bodies and exposed cliff faces or other structures in the portion of the JNF traversed by the Project makes the area unsuitable for bald eagles and peregrine falcons. No other features were present that were indicative of suitable nesting habitat for any of the aforementioned species, thus the Project is not expected to impact individuals, nests, or eggs of these species on Forest Service lands.

6.2.5 Timing of Clearing and Construction

A major component of avoiding and minimizing impacts to migratory birds and nests involves understanding the schedule of clearing and construction activities by season in each habitat type. Thus, for forest interior birds, the key to avoiding impacts centers on the timing of clearing activities. Conversely, since clearing in grassland and scrub-shrub habitat tends to happen immediately preceding (i.e., concurrent with) construction activities, it is the timing of construction that is most relevant for birds nesting in these habitats.

To determine the clearing schedule, assumptions regarding the amount of work days in a month and amount of land cleared in a day were made. The schedule assumes that 762 linear meters (2,500 ft) are cleared per day and clearing crews working 6 days per week with no clearing on standard federal holidays. No clearing of any areas along the Project will occur between June 1 and July 31. Based on these assumptions 210.79 kilometers (130.98 miles) will potentially be cleared during the nesting seasons of Project-specific MBSC (i.e., April, May, and August). Of this, approximately 804.60 hectares (1,988.21 ac) of forest are expected to be cleared during the nesting season.

Primary nesting seasons for the Project's MBSC begin as early as December and some extend into September. However, the nesting seasons for the majority of the Project-specific MBSC (23 of 28) occur between April 1 and August 31. The five MBSC with nesting seasons outside of this time period (April 1–August 31) are American woodcock (*Scolopax minor*), bald eagle, peregrine falcon, pied-billed

grebe, and yellow-bellied sapsucker. Based on the proposed tree clearing schedule (January to March 2018 – 167 mi, April to May 2018 – 101 mi, and August to November 2018 – 32 mi), there may be potential for direct impacts to migratory birds (Table 4, Appendix B).

Approximately 56.34 percent of clearing spreads are planned for January to March 2018 and September to November 2018. The remaining portion of the Project (~101 mi) is proposed to be cleared from April to May 2018 and August 2018. An estimated 804.60 hectares (1,988.21ac; 44.65%) of forested habitat within the Project area is proposed for clearing within the nesting window for migratory birds. Clearing during the nesting season in 2018 (April, May, and August) could include 22.58 kilometers (14.03 mi) and 30.71 kilometers (19.08 mi) within the Southern Allegheny Plateau Forest Block Complex IBA and Allegheny Mountains Forest Block Complex IBA, respectively. A total of 82.18 hectares (203.07 ac) is proposed to be cleared from the Southern Allegheny Plateau Forest Block Complex and 156.05 hectares (385.61 ac) from the Allegheny Mountain Forest Block Complex during the nesting season.

6.2.6 Pre-construction Avian Surveys

MVP proposes to complete surveys for nesting Project-specific MBSC within the Project area prior to vegetation clearing (e.g., tree removal; grubbing; mowing) during the nesting season (April 1–August 31) within potential migratory bird habitat. An avian survey crew consisting of one lead biologist and one technician will complete surveys by walking within the survey corridor (100-m [328-ft] buffer of proposed centerline). Field surveys will entail pedestrian occupancy surveys. Proposed surveys will ensure that no birds or eggs are destroyed as a result of habitat removal activities.

6.2.6.1.1 Meander Surveys

Between April 1 and August 31, point count surveys are completed within areas of proposed clearing and/or construction to identify potential Project-specific MBSC that may be breeding/nesting within the Project area. The pedestrian survey route will be a meander throughout the ROW corridor centerline, access roads and associated work spaces. Surveys are completed half an hour before sunrise to three hours after sunrise. Surveys are not completed during periods of inclement weather (e.g., heavy precipitation; high wind [>3 Beaufort Scale]). Surveyors will have listening stations (i.e., survey location) as they deem appropriate, in no less than 150-meter (492-ft) intervals along the Project ROW in forested areas and 250-meter (820-ft) intervals in shrub/scrub and grassland/herbaceous habitats. Surveys will be conducted at listening stations for 3 to 10 minutes as determined most appropriate by the biologist on site. All birds detected, visually and audibly, are recorded. If any Project-specific MBSC is detected, efforts are made to collect data that will help determine nesting/breeding status, as well as any other data that may assist with locating nests. When moving between stations, avian survey crews remain vigilant of behavioral

cues of birds that may indicate breeding birds and/or nests are present. If a Project-specific MBSC is detected during a survey or at any other time, a follow-up occupancy survey will be completed to determine if the species is nesting in the Project area (see below). If no Project-specific MBSC is detected during surveys, then absence of nesting Project-specific MBSC is assumed and occupancy surveys are not required. Clearing of vegetation may occur within 7 days of a negative survey. If clearing is not completed within this time, another survey is required.

6.2.6.1.2 Occupancy Surveys

Occupancy surveys occur following the detection of a Project-specific MBSC during a point count survey or at any other time during field surveys (e.g., walking from one point count station to another). An avian survey crew systematically walks within the Project area where a target bird was detected. Each area (250-m intervals along Project area [125 m on either side of location of detection]) is surveyed for a minimum of 45 minutes (total survey effort of 90 minutes). Occupancy surveys focus on searching for nests and observing behavior of target birds (i.e., Project-specific MBSC) to determine the location of a nest. Target birds displaying any behaviors associated with nesting (e.g., carrying nesting material early in the season, carrying food/fecal sacs later in the season) are followed back to nests to the greatest extent possible. All observed breeding/nesting behavior is recorded. Any identified nests are documented, reported to the EI on the clearing/construction spread, and receive a protective buffer (see below). When nests are found within or near the survey corridor, biologists collect data, such as materials used to build the nest, nest height above the ground, whether the nest appears active or not, and the species likely using the nest. For nests found in forest habitat, data regarding species of tree, diameter at breast height (dbh), and the total height of the tree are collected. Surrounding habitat is described if a nest is located in shrub/scrub and grassland/herbaceous habitats.

Occupancy surveys are considered negative after an avian survey crew has searched for a minimum of 45 minutes (total survey effort of 90 minutes) with no detection of nests or nesting activity.

6.2.6.2 Early Season Nesters

On a conference call (December 21, 2016), the Gloucester EFO raised concerns for forest raptors that begin nesting earlier than April. As mentioned, for many migratory birds, the nesting season occurs between April 1 and August 31; however, some resident species that nest in forests, such as great-horned owls (*Bubo virginianus*), nest outside of this season with egg laying occurring as early as January. To minimize the risk of destroying active bird nests in forests, USFWS requested that MVP assign one avian survey crew per tree clearing spread in forested areas to search for nests of early nesting species ahead of tree-clearing crews within a 100-meter (328-ft) survey corridor from January 1 to March 31 in Virginia. In general,

early season nesters tend to be large birds, like great horned owls and bald eagles. These birds tend to build nests that are large and relatively visible during early spring before leaf out. As such, construction crews will receive specialized training and instruction to spot these nests. Documented nests will receive a 15-meter (50-ft) protective buffer where vegetation clearing is restricted until a bird biologist confirms all birds have left the nest or a nest has failed. Managing protection of a nest will follow same guidelines discussed in Section 6.2.6.3.

Also, during the December 21, 2016 call, additional concerns were raised regarding wintering golden eagles. If any roosts or golden eagles are located, the Gloucester EFO and the VDGIF will be notified. If roosts/congregations of golden eagles are identified within the Project area, the Gloucester EFO and the VDGIF will be consulted regarding necessary measures to avoid and minimize impacts to wintering eagles.

6.2.6.3 Protecting Nests

Avian survey crews will work closely with the lead EI within their respective spreads to determine where surveys are needed and to ensure surveys for an area are completed as close as possible to the date construction crews are scheduled to complete clearing efforts. Tree and vegetation clearing must occur within one week of completed nest surveys with negative results. If a surveyed area is not cleared within 7 days, a second point count survey must be completed (with subsequent occupancy survey, if necessary), and clearing must occur within 7 days after the subsequent survey.

If active nests are located during the pre-construction surveys, the EI on the clearing/construction spread is alerted to the location of each nest. Geographic coordinates are collected and each nest is assigned a unique identification number. Nests receive a protective buffer (10-m [33-ft] in shrub/scrub and grassland/herbaceous habitats and 15-m [50-ft] in forest habitat) and signage is posted stating the presence of a protected species. Clearing activities will not take place within protective buffers until young occupying identified nests have fledged or identified nests have failed. Either instance must be observed and confirmed by a qualified biologist before clearing may commence.

Applicable agencies (e.g., USFWS; VDGIF) are notified within 30 days of any identified nests. All identified nests are documented and summarized in a report following a nesting season.

7.0 Post-construction Restoration, Operation and Maintenance

As previously stated, MVP developed a Project-specific Restoration and Rehabilitation Plan (Appendix D) to address post-construction restoration, rehabilitation, and habitat mitigation activities. Specific measures to promote bird conservation are described below.

7.1 Restoration of Disturbed Areas

After applying a temporary cover crop for initial stabilization, MVP will use native seed mixes in disturbed areas (excluding agricultural areas that will be planted based on crop/cover type agreed upon between MVP and the landowner). MVP is partnering with the Wildlife Habitat Council (WHC), a nonprofit organization dedicated to assisting organizations and individuals with the restoration and enhancement of wildlife habitat. The WHC and MVP have identified seed mixes tailored to meet construction and restoration specifications and stakeholder desires while also providing habitat for wildlife. MVP will also incorporate principles of Integrated Vegetation Management into MVP's ROW maintenance. Integrated Vegetation Management incorporates seed mix selection, vegetation maintenance scheduling, and selection of mechanical vegetation maintenance techniques to encourage a low ground cover of native species that flower for a long duration of the growing season. MVP will consult state agencies about specific native seed mixes and ensure mixes are comprised of plant species that facilitate the restoration and enhancement of wildlife habitat. Further details can be found in MVP's Restoration and Rehabilitation Plan (Appendix D).

The planting of grasses and forbs in the permanent ROW will result in a net increase of approximately 655.72 hectares (1,620.31 ac) of grassland/herbaceous habitat. While grassland obligate birds, especially area-sensitive species like the upland sandpiper, prefer nonlinear habitat, the ROW may provide habitat for generalist grassland birds. Temporarily impacted forest areas will begin to regenerate following construction, increasing shrub/scrub habitat by approximately 1,155.09 hectares (2,854.30 ac) until areas mature into forest. Regenerating woody vegetation can increase habitat for migratory and resident birds that prefer early successional cover, such as blue-winged warbler and prairie warbler, both Project-specific MBSC.

7.2 Loggerhead Shrike Habitat Restoration and Enhancement

The Project is expected to impact a total of 57.04 hectares (140.95 ac) of habitat suitable for nesting and foraging, and 1.45 hectares (3.59 ac) of foraging habitat. Of this, 16.01 hectares (39.56 ac) of nesting and foraging habitat and 0.41 hectare (1.01 ac) of foraging habitat will be permanently impacted. Within the permanently impacted areas and temporarily impacted foraging habitat, a native herbaceous

vegetation seed mix or landowner-approved seed mix matching pre-construction conditions will be used for revegetation. For temporarily, disturbed areas that are considered suitable for nesting and foraging, either of the aforementioned seed mixes will be used for revegetation along with planting of native shrubs/trees. As recommended by the VDGIF, native shrubs/trees removed from suitable habitat will be replaced with the same native species (e.g., eastern red cedar [*Juniperus virginiana*] will be replaced with eastern red cedar). Nonnative shrubs/trees that provide suitable nesting substrate and are removed as a result of Project-related activities will be replaced with its native, functional counterpart (e.g., Osage orange [*Maclura pomifera*], which is a nonnative, thorny tree, should be replaced with hawthorn [*Crataegus* spp.]). In some cases, it may be beneficial to promote a diversity of shrub/tree species in disturbed areas. For example, if an area is heavily dominated by eastern red cedar, MVP may choose to plant a combination of another native species (e.g., hawthorn) along with red cedar to avoid the potential loss of all red cedar in the event of a pest-infestation or spread of pathogen that may result in death of entire stands of the species. This may also be advantageous in areas where impaling stations (e.g., thorny vegetation; barbed wire) are limited.

Based on field habitat assessments and review of aerial imagery, approximately 1,225 preferred broadleaf shrubs/trees and 1,100 preferred coniferous shrubs/trees will be planted within temporarily disturbed nesting and foraging habitat (41.04 ha [101.41 ac]) and adjacent area (4.52 ha [11.16 ac]) to compensate for the removal of 1,221 broadleaf and 1,085 coniferous shrubs/trees. Shrubs/trees will be planted following completion of construction activities in suitable habitat. While quantity and general assemblage of shrubs and trees planted will be similar to pre-construction conditions, spatial arrangement of plantings will vary from where trees were removed. Spatial arrangement of plantings will be dependent on site conditions (e.g., topography; existing vegetation), proximity to the permanent ROW and roadways, planting technique, and what will best promote habitat enhancement for loggerhead shrike. Shrub/tree-planting efforts may focus more on areas with higher landowner-interest and engagement, as well as areas recommended by the VDGIF.

Of the shrubs/trees proposed for removal in suitable habitat, approximately 63.49 percent are of the preferred shrubs/trees noted by the VDGIF (i.e., eastern red cedar; hawthorn; black locust; Osage orange). MVP is committed to improving habitat quality where feasible and, therefore, has agreed to replace all removed shrubs/trees in suitable habitat in order to enhance conditions for loggerhead shrike. Increasing the number of preferred shrubs/trees within areas containing suitable loggerhead shrike habitat will potentially enhance the overall quality of nesting habitat promoting the conservation of this state-threatened species.

7.2.1 Monitoring Habitat Restoration and Enhancement Measures

MVP will monitor habitat restoration and enhancement activities by evaluating survival of planted shrubs/trees.

Planted shrubs/trees will be monitored for at least two growing seasons following the initial planting. Planting efforts will be deemed successful with 70 percent survival of shrubs/trees initially planted. This threshold will ensure that there is a net gain in preferred shrubs/trees throughout the study area (i.e., Giles, Craig, Montgomery, and Roanoke counties, Virginia) to promote conservation of loggerhead shrike and other shrub-nesting birds. If survivability drops below this threshold between initial planting and the end of the second growing season, shrubs/trees will be replaced to meet the 70 percent threshold.

The purpose of shrub/tree planting is to promote shrub-nesting bird species, such as loggerhead shrike. Along with monitoring the survival of shrubs/trees, MVP will provide VDGIF with locations as well as pre-construction and post-planting photos of the restored areas so that VDGIF can conduct future surveys of the restored habitat areas.

7.3 Maintenance of Pipeline ROW

Following construction of the Project, MVP agrees to implement vegetation maintenance activities (e.g., mowing) outside of the primary nesting season for migratory birds (April 1 to August 31).

8.0 Net Ecological Impact

Direct impacts from construction of the project include the loss of functions and services that result from forest removal. There are a variety of metrics for understanding and quantifying ecological impacts associated with the MVP project. The intensity of direct impacts is a function of what type of habitat is being removed, where it is located in the context of the overall landscape, how it will ultimately be restored, and how long it will take for restoration to occur. Indirect impacts result from forest fragmentation leading to diminished functions and services in remaining forest habitat adjacent to the project footprint; sometimes referred to as “edge effects”.

8.1 Habitat Equivalency Analysis

In order to estimate the impacts of the Mountain Valley Pipeline on forest function and services, a service-to-service scaling approach known as a Habitat Equivalency Analysis (HEA) is used. The HEA approach assesses the loss of ecosystem services

from an action by comparing pre- and post-disturbance function levels of the system, and how these levels change with time due to disturbance and restoration. As a result, this analysis accounts for not only the immediate impacts of disturbance, but also temporal effects on ecosystem service. The HEA facilitates the quantification of impacts and determination of appropriate mitigation requirements. This approach is particularly well suited to the MVP project because the forest removal represents a total impact of less than 0.4% of forested land within 5 miles of the project footprint; thus the “value per unit of service” is independent of the change in service levels in the landscape.

The major components of an HEA are:

- Estimation of the extent of ecosystem service loss from disturbance over time,
- Estimation of the extent of service recovery from habitat restoration and enhancement over time, and
- Calculation of habitat replacement required to offset ecosystem service loss from project construction.

Because this analysis looks at impacts at present, and considers time to recover, implicit within the mechanics of the analysis is the temporal loss of system function. Thus a HEA facilitates quantification of impacts that are repeatable and comparable across projects (where resource impacts are similar in character, even if not in magnitude).

8.2 Functional Metrics

The success of a HEA in accurately determining impacts is a consequence of appropriateness of the functional metrics chosen to value ecosystem services and functions. Functional metrics are specific aspects of the ecosystem, which are assigned values, and become parameters of the HEA equation. The MVP Project HEA focuses on how construction will impact ecosystem services provided by migratory bird habitat. Accordingly, the functional metrics used in this model are:

- Runoff/sedimentation control services
- Carbon sequestration services
- Habitat quality relative to forested baseline
- Support of global biodiversity
- Recreational use and aesthetic value

These metrics were chosen because their veracity as indicators of ecosystem services provided by forests has already been established by forest service reports from the states of WV (2005) and VA (2016).

8.3 Habitat Service Value

Once the appropriate functional metric(s) has been determined, the next step in a HEA is to determine how particular landcover types compare to one another with regard to functional value. For example, interior deciduous forest is expected to provide higher quality habitat for a multitude of taxa than areas of shrub/scrub, which in turn is expected to provide higher quality habitat than areas of hay/pasture. To compare relative values of individual habitat types, a matrix is created with land cover types along one axis and functional metric value along the other. The values assigned within the matrix are designed to compare relative value of one landcover type to another, and in this case, relative to interior deciduous forest.

A comprehensive literature review was used to assign relative values for each metric to each land cover classification based on ecological principles. Because it was determined *a priori* that interior deciduous forest was the standard to which all other land cover classes were compared, assigned values are meant to be interpreted as the level of ecosystem services provided by a particular land cover relative to that provided by interior deciduous forest.

Given the multi-taxa nature of this habitat valuation and presupposed importance of interior forest, habitat comparisons were focused on fragmentation and edge effects, the importance of landscape heterogeneity, and how complex landscape mosaics influence wildlife diversity. Habitats providing a mixture of breeding, foraging, and sheltering opportunities for a diversity of wildlife, like wetlands or interior forest, were valued highly (Landres et al. 1999, Uezu et al. 2005). Habitats that tend to be characterized by more homogeneous cover, like hay/pasture, may provide specific benefits to wildlife (Benton et al. 2003). However, these are unlikely to be as critically important to a large number of taxa, and were therefore devalued as multi-taxa habitat relative to interior forest.

To account for influences of fragmentation and edge effects, such as increases in nest predation, exposure to non-native species, and changes in abiotic environments (e.g. soil moisture), edge forest was devalued relative to interior forest (Fahrig 2003, Batary and Baldi 2004, Banks-Leite et al. 2010). Intermediate quality values were assigned to those habitats that may serve as important areas for particular taxa or groups, such as open water providing for amphibians and water fowl (Semlitsch and Bodie 2003), or shrub/scrub providing for small mammals and loggerhead shrike (*Lanius ludovicianus*), but may not support the same level of diversity as wetlands or interior forest. Table 12, Appendix B shows the relative values assigned to each functional land cover type for the MVP project HEA.

A 0 to 10 scale is used to rank the value of ecosystem services provided by each land cover. It is important to note that in reality, all interior forests are not likely to perform as a 10, the highest level of functional value. An old growth deciduous

forest, for instance, may provide a greater variety of habitat types than will a younger, even-age monoculture. Thus, scoring all interior deciduous forests as 10 is a conservative approach to ensure that resource loss is not underestimated.

Once the functional metric values for each land cover type are determined, they are compared against the value for “interior deciduous forest” to calculate the number of “effective acres” (represented as b^A in subsequent calculations within this document). “Effective acres” is the fraction of ecosystem service a given land cover type provides, as compared to an acre of “interior forest”. For example, Table 13, Appendix B indicates that 1 acre of “edge deciduous forest” provides only 86% of the ecosystem services of 1 acre of “interior forest”. It is necessary to calculate “effective acres” because this provides a consistent unit of measurement for the analysis, rather than trying to compare land covers of varying habitat quality.

8.4 Define Baseline

In order to effectively quantify construction impacts, the baseline level of services provided by the area before disturbance is required. This is accomplished by assessing both the functional value of particular land covers and their prevalence within the landscape. The overall functional quality of the landscape and the amount of area impacted are then used to estimate service loss due to Project construction.

8.4.1 Project Footprint

Direct Impacts are those that occur within the project LOD. This includes all areas where ground disturbance will occur: permanent and temporary ROW, access roads, compressor stations and all ancillary facilities (Table 14, Appendix B).

8.4.2 Indirect Effects and Fragmentation

The main indirect impact associated with construction of the Project results from interior forest fragmentation as addressed in Section 7.3. It is generally accepted that “edge effects” from fragmentation extend approximately 100 meters (328 feet) inward from the forest boundary (Robbins 1988, Jones et al. 2000, Rodewald 2001). Thus, anywhere that the project footprint intersects an interior forest land class, a 100 meter buffer was placed around the footprint (Figure 7, Appendix A). The lateral dissipation of edge effects over the 100 meter buffer was assumed to be linear, resulting in a 1% decrease in impact per meter. Baseline effective acres of the indirect impact area are shown in Table 15, Appendix B.

MVP’s HEA addresses fragmentation with a conservative approach. As stated above, interior forest areas are not the same. Smaller Core Forest Areas do may have the same intrinsic values as larger Core Forest Areas. Therefore, when using the 0 to 10 scale to rank the value of ecosystem services provided, a larger Core Forest area is likely to perform as a 10, the highest level of functional value. Conversely, a smaller Core Forest Area may perform at a value lower than 10. Thus,

by scoring all interior deciduous forests as 10, MVP's HEA overvalue the forest resources, ensuring that resource loss is not underestimated. In addition, the HEA devalues edge forest compared to interior forest.

8.4.3 Pre-construction Service Level

The overall pre-construction service level of the impact areas is determined by multiplying the percentage of the impact area made up of a particular land cover by the functional value of that land cover. Summing the products for all land cover types in the impact area provides a weighted mean functional value. The weighted mean functional value represents the overall functional quality of the impact area. Mean functional value calculations are found in Table 16, Appendix B.

8.5 Recovery

To accurately determine the impacts of the project, the recovery of services provided by restoration efforts must be quantified. This is accomplished by evaluating the functional level provided by restoration actions and over what time period that functional level is achieved or maintained. The overall recovery of services is a function of the habitat value of particular restoration types and how large an area is restored.

8.5.1 Project Footprint

Sections 5 and 6 of this document define the landscape restoration activities MVP will undertake within the project area. Generally, restoration efforts include reseeding the permanent ROW with native vegetation, reseeding all temporary impact areas that occur within forest lands with woody seed mixes, and hand planting woody vegetation at 55 sensitive stream crossings, loggerhead shrike habitat, and forested wetlands. These activities are detailed in MVP's Restoration and Rehabilitation Plan (Appendix D). Due to these restoration efforts, the Project area will recover substantial functional value relative to initial loss due to construction.

Although the majority of the LOD will be restored in some fashion, be it with an herbaceous layer or a return to forest, ecological recovery takes time. The HEA captures this temporal difference in function loss and recovery by assessing functions and values at various points in time. While herbaceous vegetation is expected to recover in 3 years, and planted shrub/scrub within 5 years, woody vegetation is expected to take longer.

Oak trees, one of the dominant taxa within the Project area, may begin producing acorns and become an important food source in approximately 30 years (University of Missouri Extension 2013). With regard to habitat quality however, the impact of forest age can be highly variable. Mature trees with cavities, for example, may provide important nesting and shelter areas from some bird species. Based on estimated rotational ages of dominant species identified through detailed habitat

assessments, including oak, hickory, beech and maple, and the results from a biomass study within the region (Adams and Kochendenfer [sic] 2014), the MVP HEA estimates that woody vegetation grown from seed mixes will mature in approximately 80 years. Table 17, Appendix B, identifies recovery periods used within the MVP HEA for the various types of restoration planting types and methods proposed.

Where t represents time:

t_M is the time until the restoration area reaches full service value

t_L is the time when the restoration area no longer provides valued services. For the purposes of this analysis, it is assumed that the restored areas exist in their natural state in perpetuity, and end of the functions and services they provide coincides with the impact measurement period.

Functional value at each point in time is based on the rate of recovery (Table 17, Appendix B) and effective acres per acre of each land cover classification (Table 18, Appendix B). The combination of time and value allow an estimation of functional values at various points in time during recovery. Impacts and recovery over the course of the entire measurement period are in units of Effective Acre Years (EAY), which simply represents the amount of functional services provided by each habitat over time (Table 19, Appendix B). Overall, or composite recovery of the ROW is based on the weighted mean of services provided by the restoration types (Figure 20, Appendix B).

For clarity, and because effective acres in perpetuity are equal to effective acres at maturity, t_L has been omitted from the table.

8.5.2 Edge Habitats

Calculation of indirect impacts associated with edge effects are understood as a two-step process. First, at the boundary of the LOD, the forest interior habitat is converted to forest edge habitat, decreasing their functional values by approximately 14% (Table 12, Appendix B). However, edge effects dissipate as distance from the edge increases. For the purposes of this HEA, it is assumed that impairment of the forest due to edge effects decrease linearly by 1% per meter. As a result, the total reduction in services across 100 meters is roughly to equal to one half of the decrease from preconstruction baseline levels, or 0.7 effective acres. Secondly, after 80 years, temporary LOD areas will have recovered and 15 meters of the buffer farthest from the ROW will convert back to interior forest in year 80, the final year of measurement (Table 21, Appendix B).

Mathematical Calculations

The HEA analysis formula is as follows (NOAA 2000):

$$Ecological\ Loss = \left[\sum_{t=0}^L r_t * (b^A - x_t^A) / b^A \right] * A$$

$$Ecological\ Recovery = \left[\sum_{t=l}^L r_t * (x_t^p - b^p) / b^p \right] * B$$

Where:

t is time in years

t_0 is the time when disturbance takes place

t_l is the Initial time period when the restored area begins to provide services

t_L is the time when the restored area no longer provides services

x_t^A is the level of services per acre provided by the impacted area at the end of year t

b^A is the baseline level of services per acre of impacted habitat

x_t^p is the level of services per acre provided by the restored area at the end of year t .

b^p is the initial level of serves provided, per acre, in the restored area, at t_0

r_t is the rate of discount during year t ; for this analysis 3% is used based on [NOAA 1999].

A is acreage of disturbance

B is acreage of restoration

8.5.3 Ecological Loss Calculation

This portion of the HEA equation estimates the ecological service loss associated with project construction. The term $(b^A - x_t^j) / b^A$ represents the percent reduction in services per acre at the disturbed site relative to the baseline functional value during year t . This term does not account for service gains at the site resulting from primary restoration. This ratio is then multiplied by $[1 / (1.03^t)]$, where t is the number of years since disturbance to calculate future discount of services. This set of functions is completed for every year, from 0 to 80. Then all of those results are summed, and the result is multiplied by the number of acres impacted by construction, including both the direct and indirect impact area.

Example 1

For Permanent LOD conversion from Interior Deciduous Forest to Barren Land in Year 0:

$$Ecological\ Loss = \left[r_t * \frac{b^A - x_t^A}{b^A} \right] * A = \left[1 * \frac{1 - 0}{1} \right] * 667.5 = \mathbf{667.5\ EAY}$$

Example 2

For Permanent LOD conversion from Interior Deciduous Forest to Barren Land in Year 2:

$$Ecological\ Loss = \left[r_t * \frac{b^A - x_t^A}{b^A} \right] * A = \left[0.943 * \frac{1 - 0}{1} \right] * 667.5 = \mathbf{629.5\ EAY}$$

8.5.4 Ecological Recovery Calculation

This portion of the HEA equation estimates the ecological service gain associated with project restoration activities. The term $(x_t^p - b^p)/b^A$ represents the percent increase in services per acre of the restoration area relative to the baseline functional value of the impacted area during year t . This ratio is then multiplied by $[1/(1.03^t)]$, where t is the number of years since project initiation, to calculate future discount of services. This set of functions is completed for every year, from 0 to 80. Then all of those results are summed. This is completed for *each* restored land cover type within both the direct and indirect impact area. Recovery values for each restored land cover type are used to estimate the amount of restoration acres required to offset functional loss.

Example 1

For Permanent LOD restoration with native grass seeding in Year 1:

$$Ecological\ Recovery = \left[r_t * \frac{x_t^p - b^p}{b^A} \right] * B = \left[1 * \frac{0.193 - 0}{1} \right] * 1884.3 = \mathbf{363.7\ EAY}$$

Example 2

For Permanent LOD restoration with native grass seeding in Year 2:

$$Ecological\ Recovery = \left[r_t * \frac{x_t^p - b^p}{b^A} \right] * B = \left[0.971 * \frac{0.387 - 0}{1} \right] * 1884.3 \\ = \mathbf{708.1\ EAY}$$

8.5.5 Net Ecological Impact

Net Ecological Loss

$$= \left\{ \left[\sum_{t=0}^L r_t * (b^A - x_t^A)/b^A \right] * A \right\} - \left\{ \left[\sum_{t=1}^L r_t * (x_t^p - b^p)/b^A \right] * B \right\}$$

For the Permanent LOD over the entire Project area, the total net ecological loss is **10564.3 EAY**. For the Temporary LOD over the entire Project area, the total net ecological loss is **9880.3 EAY**. For the Indirect Impact area, the total net loss is **19008.7 EAY**.

Net ecological impact is a function of both Ecological Loss and Ecological Recovery, and varies with time. The response of the impact area to construction and restoration over time may be illustrated with recovery curves. The recovery curves for the entire Project are found in Figure 8, Appendix A while the curves separated by state are found in Figure 9, Appendix A.

It is important to note that this loss is represented as “effective acres”. Therefore, if the goal is convert this functional value loss to dollars, the appropriate unit conversion would be based on the cost of an acre of deciduous interior forest.

8.5.6 Replacement Habitat Size

Visual_HEA (Kohler and Dodge 2006) software was used to determine the replacement habitat size required to offset Project impacts. Estimated habitat replacement size in Virginia totals 1,270 acres, whereas estimated habitat replacement size in West Virginia totals 5,001 acres.

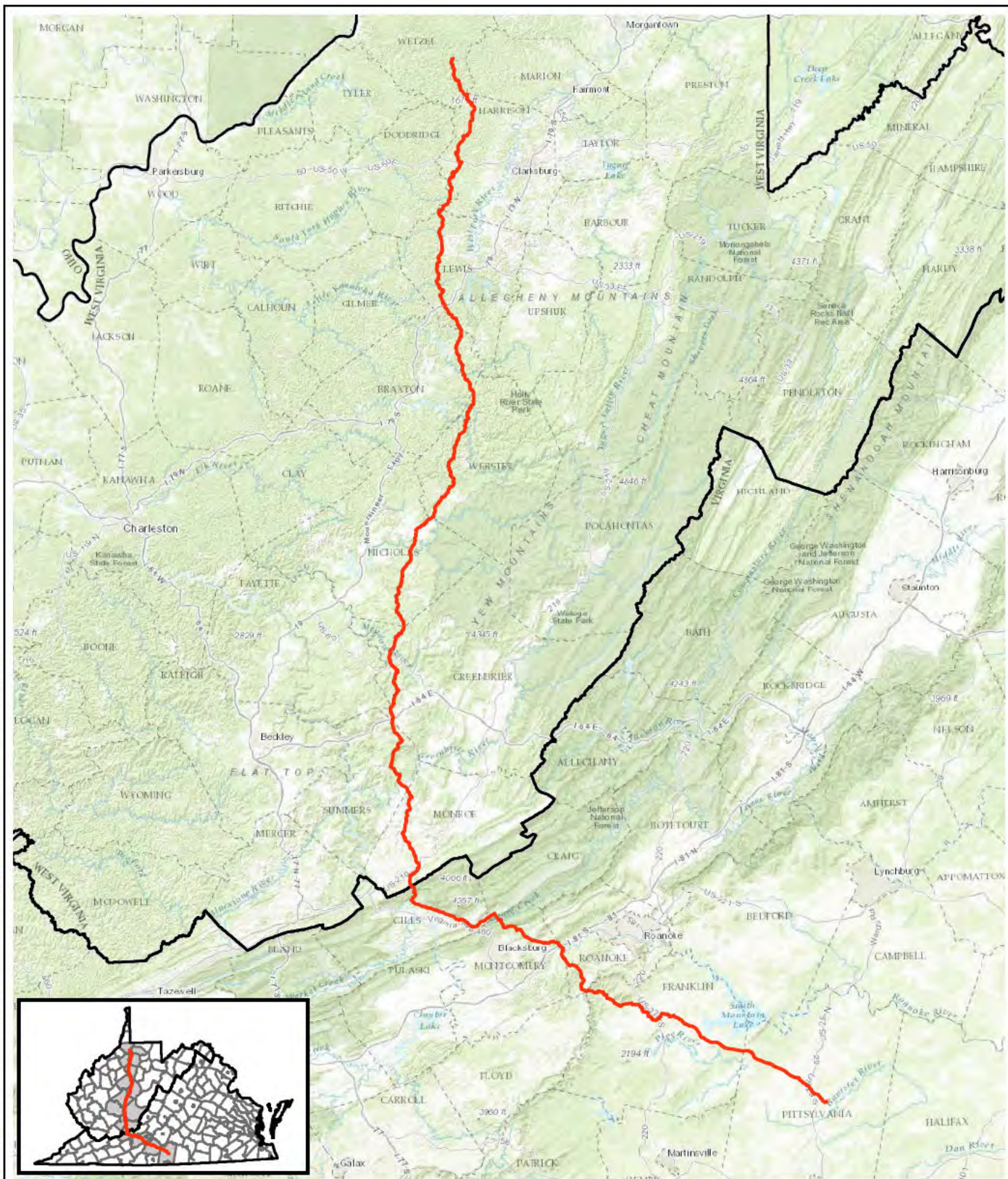
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APPENDIX A FIGURES



State Border Proposed Route

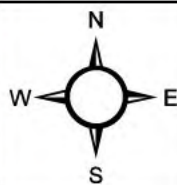


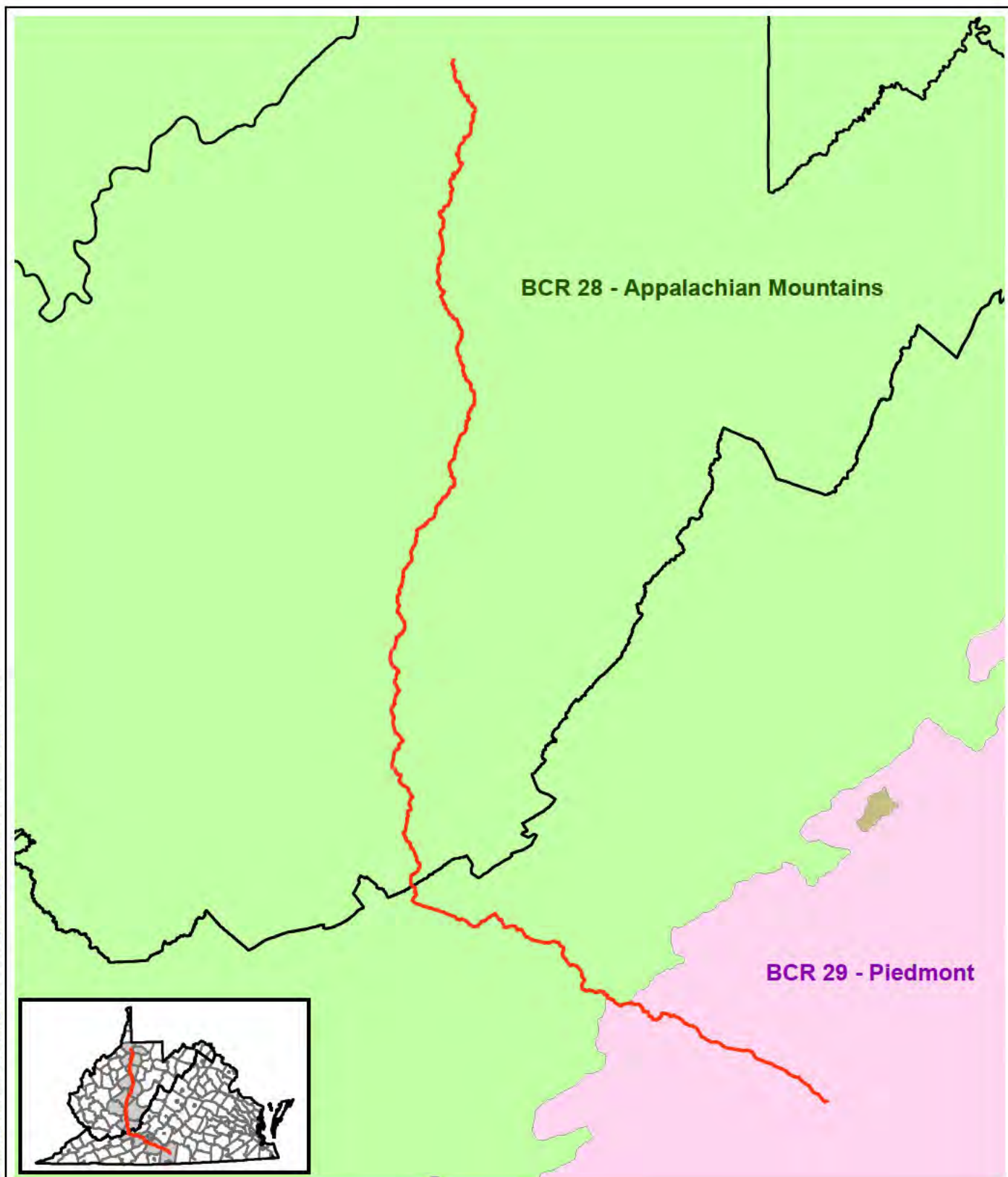
Figure 1. Location of the Mountain Valley Pipeline Project in West Virginia and Virginia (Revised December 2017).

Project No.
593.16

Miles
12.5 0 12.5 25



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State Border Proposed Route

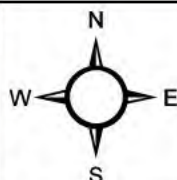


Figure 2. Bird Conservation Regions crossed by the Mountain Valley Pipeline Project in West Virginia and Virginia (Revised December 2017).

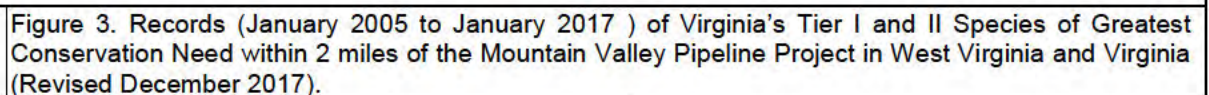
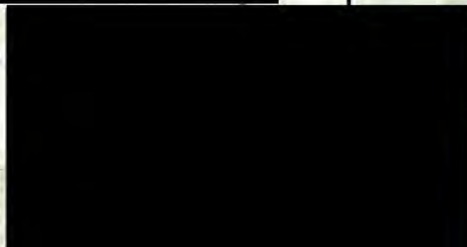
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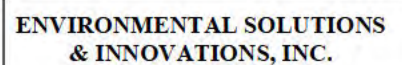
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Miles

A horizontal number line with tick marks at -12.5, 0, 12.5, and 25. The segments between these marks are colored alternately black and white, starting with black from -12.5 to 0, white from 0 to 12.5, black from 12.5 to 20, and white from 20 to 25.



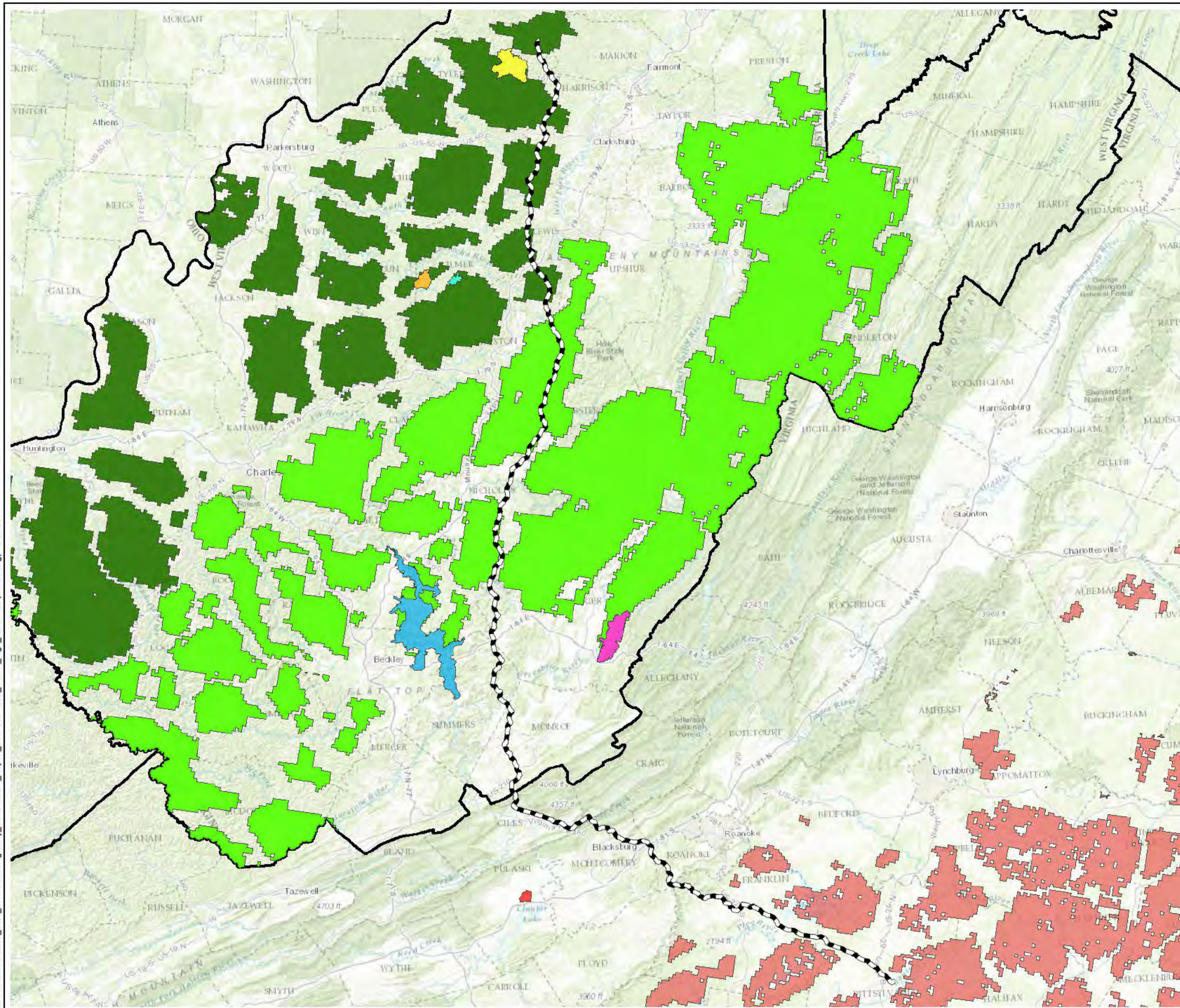


Figure 4. Important Bird Areas crossed by the and in close proximity to the Mountain Valley Pipeline Project in West Virginia and Virginia (Revised December 2017).

--- Proposed Route

— State Border

Important Bird Areas crossed by Proposed Route

Allegheny Mountains Forest Block Complex

Southern Allegheny Plateau Forest Block Complex

Important Bird Areas within 20 miles of Proposed Route

Cedar Creek State Park

Greenbrier River Drainage and Adjacent Mts.

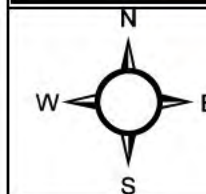
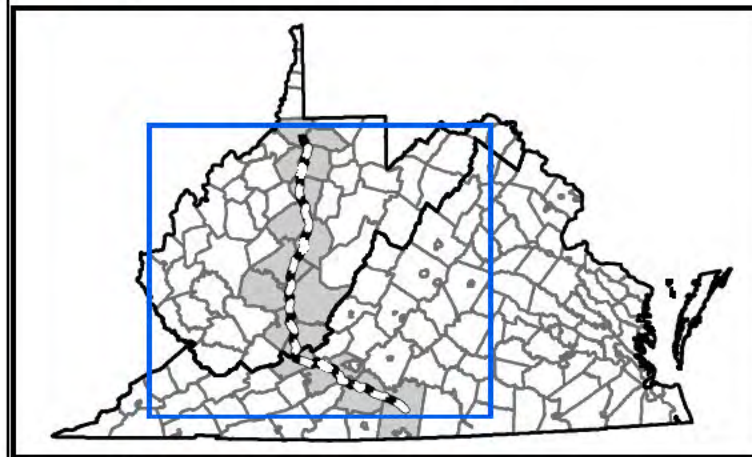
Lewis Wetzel Wildlife Management Area

New River Gorge - Garden Ground Mt. IBA

Radford Army Ammunition Plant

Stumptown Wildlife Management Area

Virginia Piedmont Forest Block Complex



Miles
10 0 10 20

Source: Portion of the ESRI ArcGIS Server Service named "World_Topo_Map"; accessed on 10/18/2015.



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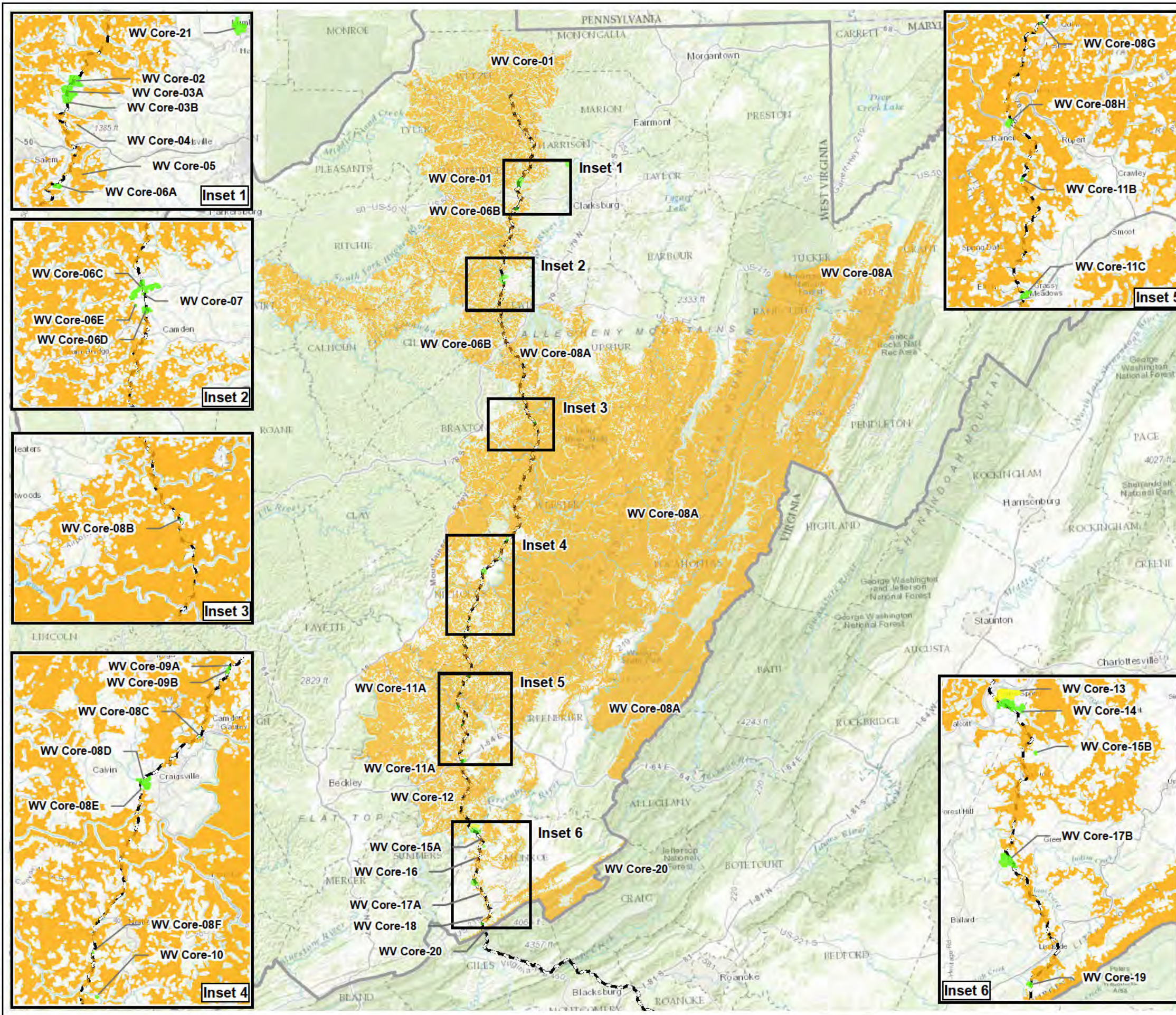
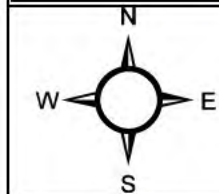
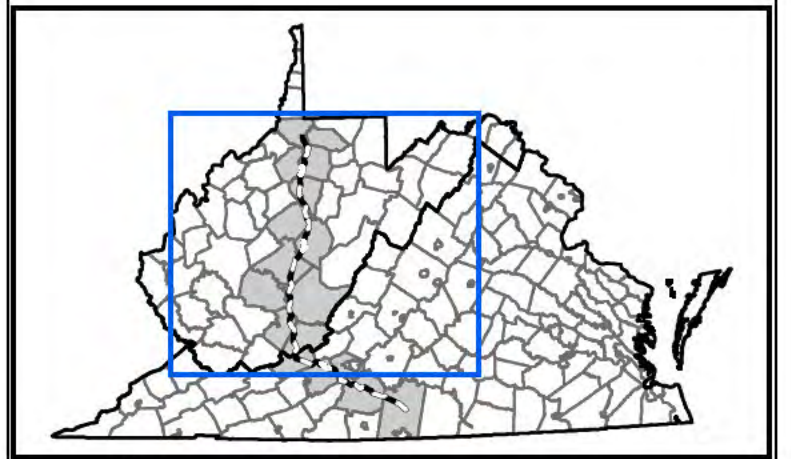


Figure 5. Core Forest Areas crossed by the Mountain Valley Pipeline Project in West Virginia (Revised December 2017).

- Proposed Route
□ State Border
- Core Forest Areas crossed by Proposed Route
- Small Core (<250 acres)
 - Medium Core (250-500 acres)
 - Large Core (>500 acres)



Miles
9 0 9 18

Source: Portion of the ESRI ArcGIS Server Service named "World_Topo_Map"; accessed on 10/18/2015.
Core Forest Areas from *Forest Fragmentation of West Virginia, 2011*, Natural Resource Analysis Center, West Virginia University.



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Path: G:\Current\593_EOT_MVP\WMD\Migratory_Birds\MBP_Report_20170321\593_MBCP_Fig6_VA_ECAs.mxd (mbrueing) - 3/30/2017

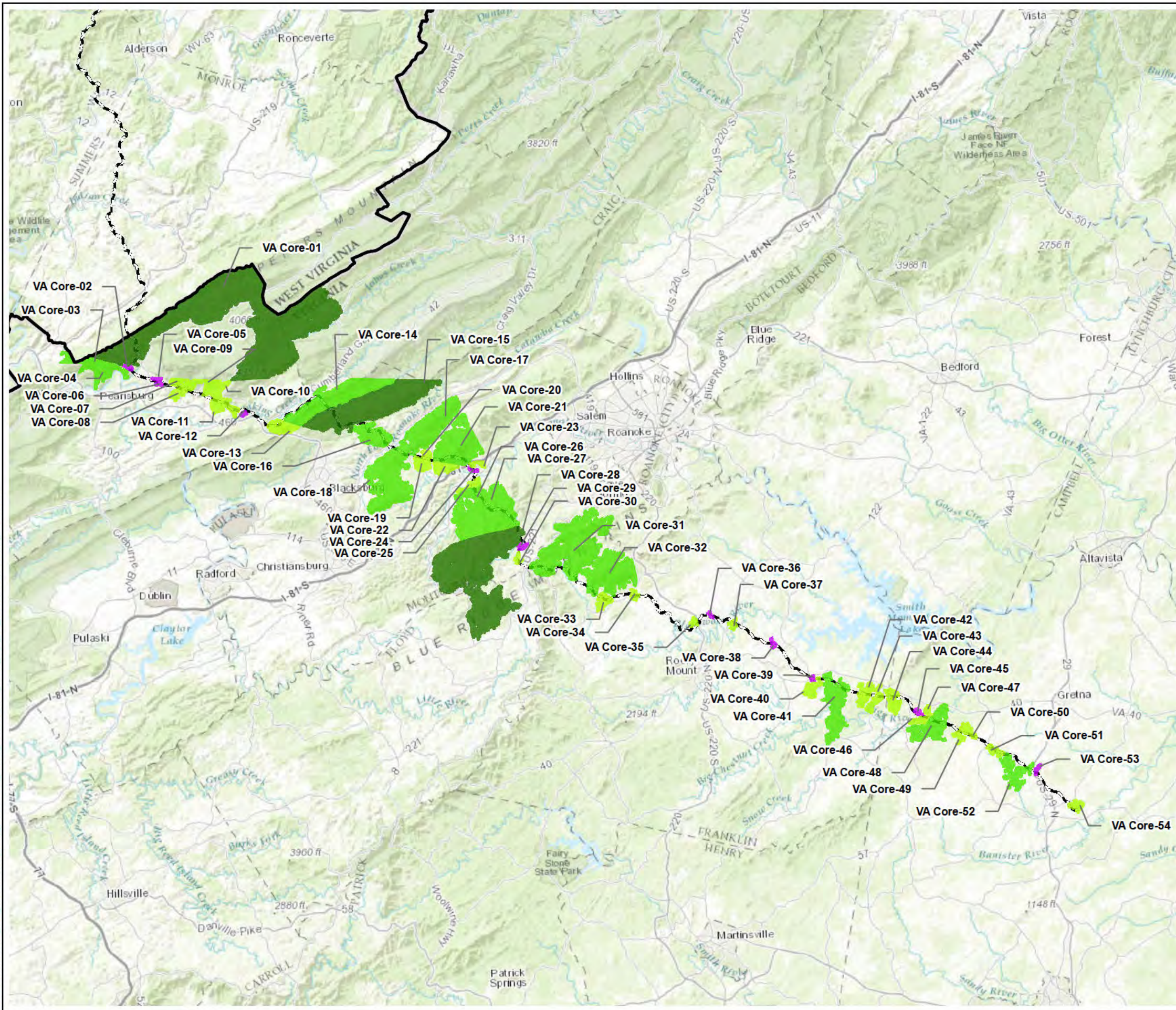


Figure 6. Ecological Core Areas crossed by the Mountain Valley Pipeline Project in Virginia (Revised December 2017).

--- Proposed Route

State Border

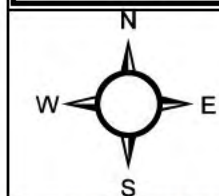
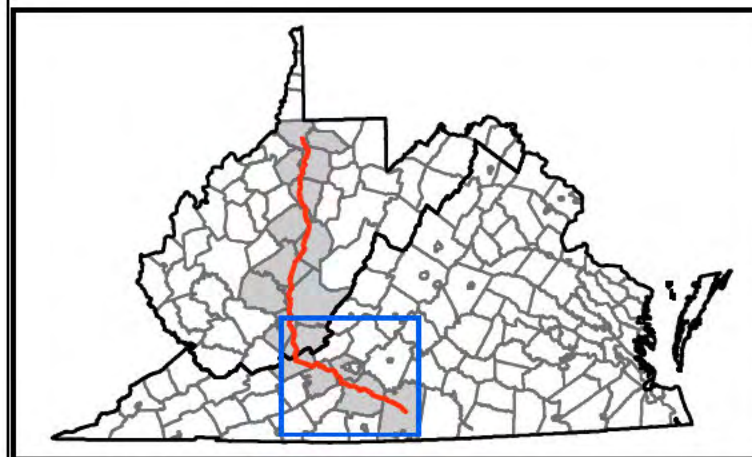
Ecological Core Areas crossed by Proposed Route

Habitat Fragment (10 – 99 ac)

Small Core (100 – 999 ac)

Medium Core (1,000 – 9,999 ac)

Large Core (>10,000 ac)



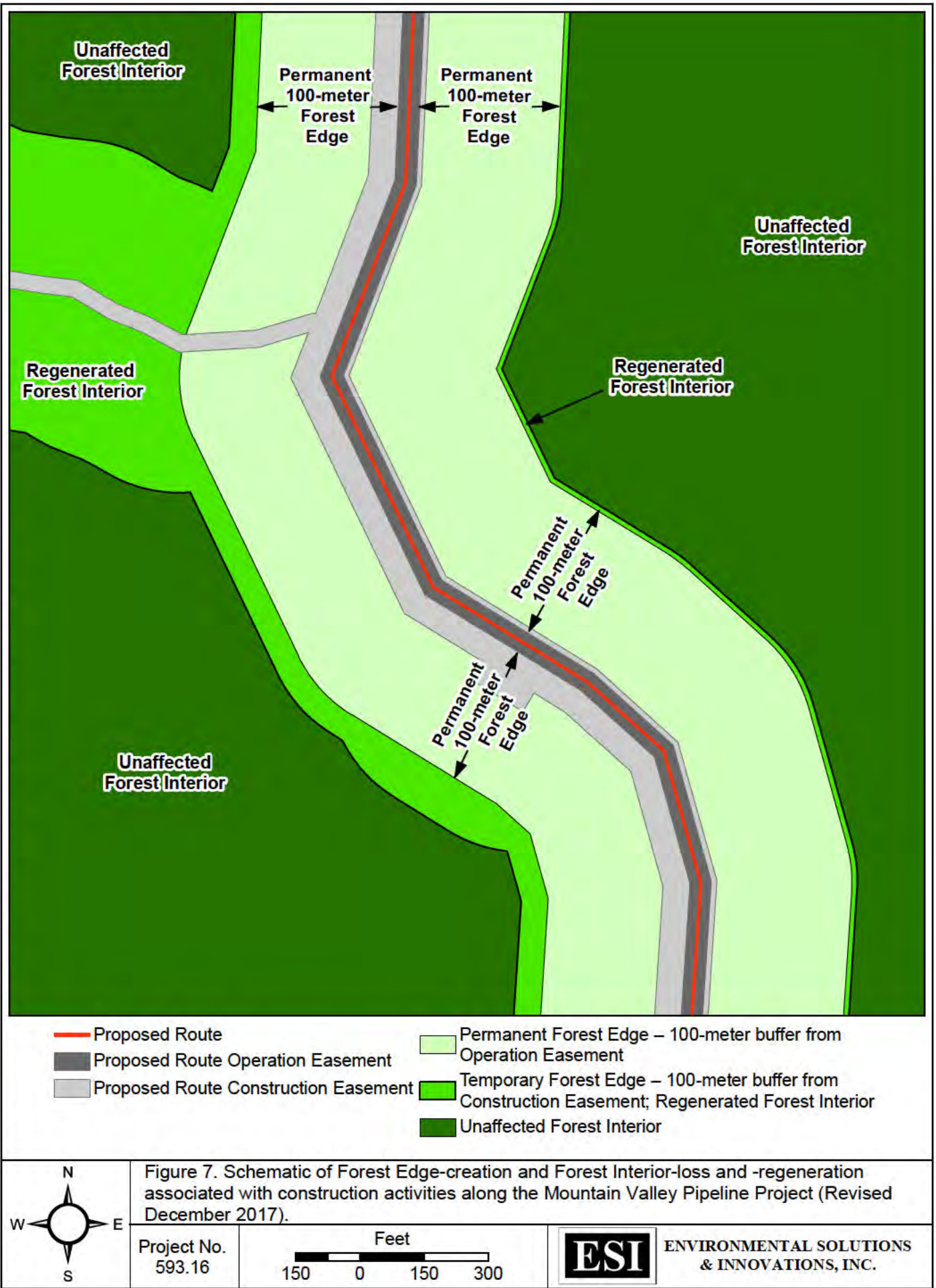
Miles
4 0 4 8

Source: Portion of the ESRI ArcGIS Server Service named "World_Topo_Map"; accessed on 03/28/2017.
A subset of data from the Virginia Natural Landscape Assessment, 2007, Virginia Department of Conservation and Recreation.



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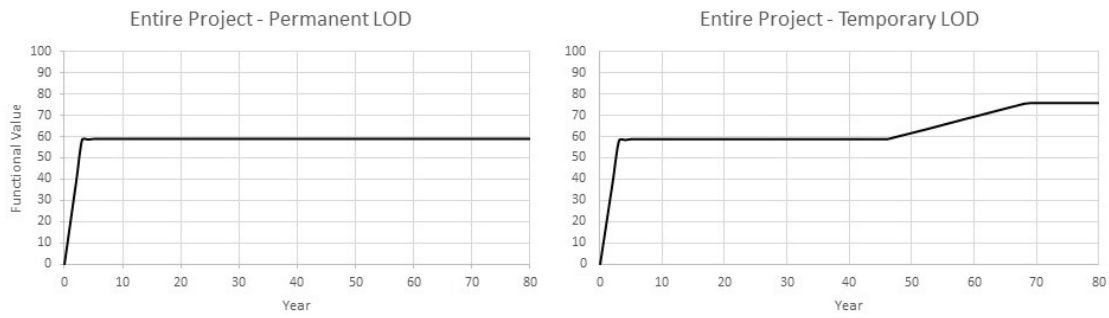


Figure 8. Habitat quality recovery curves for the Permanent and Temporary LOD over the entire Project area.

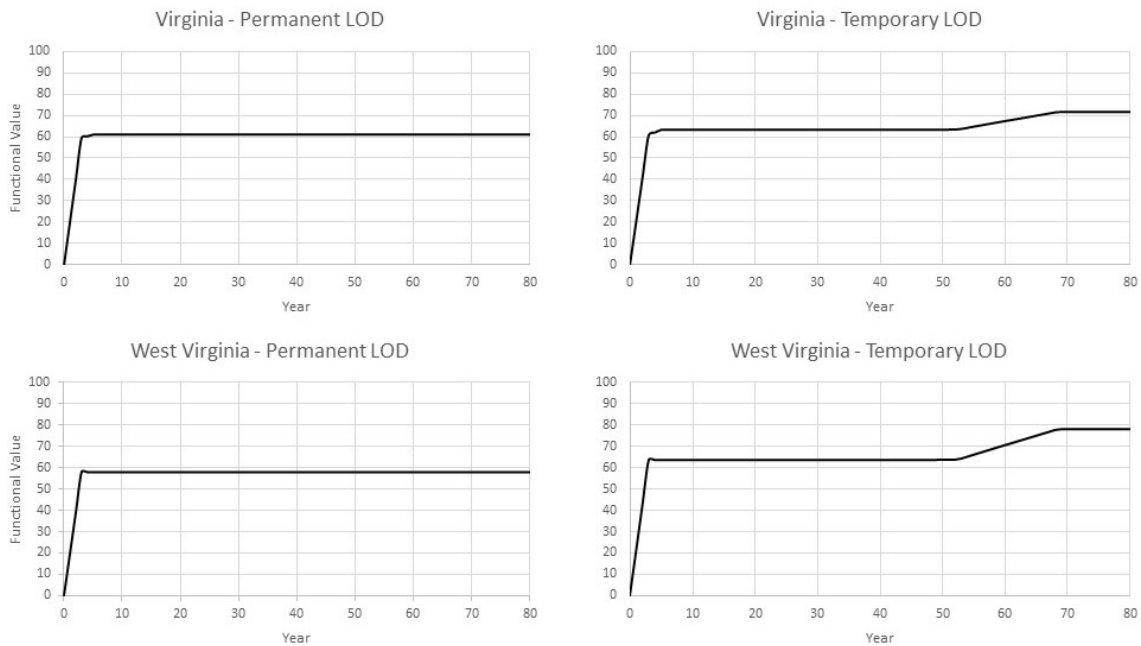


Figure 9. Habitat quality recovery curves for the Permanent and Temporary LOD for the states of Virginia and West Virginia.

APPENDIX B TABLES

Table 1. Length of proposed Mountain Valley Pipeline Project by county.

County, State	Milepost Range	Length (miles)
Wetzel, West Virginia	0.0 – 9.5	9.5
Harrison, West Virginia	9.5 – 31.5	23.7
	32.6 – 33.7	
	37.4 – 38.0	
Doddridge, West Virginia	31.5 – 32.6	4.8
	33.7 – 37.4	
	38.0 – 65.5	
Lewis, West Virginia	65.5 – 80.2	27.5
Braxton, West Virginia	80.2 – 110.8	14.7
Webster, West Virginia	110.8 – 135.3	30.4
Nicholas, West Virginia	135.3 – 154.2	24.8
Greenbrier, West Virginia	154.7 – 157.1	21.3
	154.2 – 154.7	
Fayette, West Virginia	157.1 – 174.3	0.5
Summers, West Virginia	174.3 – 196.3	17.1
Monroe, West Virginia	196.3 – 216.8	22.1
Giles, Virginia	216.8 – 218.5	20.4
Craig, Virginia	218.5 – 238.1	1.7
Montgomery, Virginia	238.1 – 246.5	19.6
Roanoke, Virginia	246.5 – 283.9	8.4
Franklin, Virginia	283.9 – 303.4	37.4
Pittsylvania, Virginia		19.5
Total		303.4

Table 2. Land requirements for the Mountain Valley Pipeline Project in West Virginia and Virginia.

Project Component	Land Affected During Construction Acres	Land Affected During Operation Acres
Pipeline Facilities		
Pipeline Right-of-Way	4,458.3	1,844.1
Additional Temporary Workspaces (ATWS)	659.4	0.00
Above Ground Facilities		
Mobley Interconnect	3.21	1.1
Bradshaw Compressor Station	36.5	6.3
Sherwood Interconnect	12.0	1.1
Harris Compressor Station	16.5	5.6
WB Interconnect	9.9	1.2
Stallworth Compressor Station	29.9	7.2
Transco Interconnect	41.0	2.7
Yards	170.4	0.0
Access Roads	905.8	237.6
Cathodic Protection Beds	17.7	9.6
Total	6,360.6	2,116.5

Table 3. Land cover types and acreages within the Project area as indicated by NLCD and field assessments.

Vegetative Land Cover Type ¹	Project Area			
	Construction		Operation	
	Hectares	Acres	Hectares	Acres
Deciduous Forest	1,585.72	3,918.40	570.64	1,410.08
Evergreen Forest	48.12	118.92	18.08	44.67
Mixed Forest	168.27	415.80	58.30	144.07
Wetlands ²	16.76	41.40	4.96	12.35
Shrub/Scrub	28.90	71.41	8.70	21.49
Grassland/Herbaceous	73.96	182.76	22.15	54.75
Pasture/Hay	406.16	1,003.65	113.27	279.90
Cultivated Crops	23.33	57.66	5.70	14.09
Developed ³	203.93	503.92	48.27	119.28
Open Water	8.03	19.85	3.98	9.84
Barren Land	12.34	30.49	2.72	6.72
Total⁴	2,575.52	6,364.26	856.77	2,117.13

¹ Vegetative cover types determined by field data collected when available and the 2011 NLCD otherwise.

² Wetlands include woody, scrub/shrub, and emergent herbaceous wetlands.

³ Developed includes Open Space, Low, Medium, and High Intensity.

⁴ Totals do not match Table 2 due to slight geographic overlaps of spatial data.

Table 4. Migratory bird species of concern with potential to nest along the Project route.

Species		Potential Breeding Habitat	Primary Nesting Season	Reason for inclusion ¹
Common	Scientific			
American woodcock	<i>Scolopax minor</i>	Habitat consists of young forests and abandoned farmland mixed with forested land. Generally considered an edge species.	March – Aug. 31	VA SGCN
bald eagle	<i>Haliaeetus leucocephalus</i>	Nests in trees among forests adjacent to large water systems	Dec.15 – July 15	BG, 28, 29
black-billed cuckoo	<i>Coccyzus erythrophthalmus</i>	Forest edges, tree groves, and thickets often adjacent streams or marshes; nests in shrub or low tree	June 1 – Aug.31	VA SGCN, IPaC
black-capped chickadee	<i>Poecile atricapillus</i>	Mixed and deciduous woods, willow thickets, groves, shade trees but avoids conifer stands; nests in tree cavities	April - June	28
blue-winged warbler	<i>Vermivora cyanoptera</i>	Brushy hillsides, bogs, overgrown pastures, stream and woodland edges; nests near or on the ground in clumps of vegetation	May 1 – June 30	28, 29
Canada warbler	<i>Cardellina canadensis</i>	Found in undergrowth of mature mixed hardwoods, preferably near streams and swamps; nests on or near ground in mossy logs, stumps, in bank cavities, or among roots of fallen trees	May 1 – June 30	28
cerulean warbler	<i>Setophaga cerulea</i>	Deciduous forests, especially on ridges and river valleys; nests on horizontal branch high in tree	May 1 – June 30	VA SGCN, 28, 29
eastern whip-poor-will	<i>Antrostomus vociferus</i>	Woodlands; no nest built, eggs laid on flat ground.	May 1 - July 31	28, 29
golden eagle	<i>Aquila chrysaetos</i>	Golden eagles can be found in a variety of habitats, including grasslands, tundra, shrub habitat, and forests. Forests are documented as the dominant land cover used by wintering birds in Appalachia	N/A	VA SGCN, BG
golden-winged warbler	<i>Vermivora chrysoptera</i>	Open woodlands, brushy clearings, undergrowth; nests on the ground at base of shrub or in a tussock of grass or sedge, usually hidden by foliage.	May 1 – June 30	VA SGCN, 28
Henslow's sparrow	<i>Ammodramus henslowii</i>	Large grasslands as well as working landscapes, such as pastures and hayfields; utilizes reclaimed strip mines; nests on ground in graminoid-dominated areas	May 1 – Aug.15	VA SGCN
Kentucky warbler	<i>Geothlypis formosa</i>	Prefers deep shaded woods with dense, humid thickets, bottomlands near creeks and rivers, ravines in upland deciduous woods, and edges of swamps; nests on ground or within a few inches of it	May 1 – July 31	28, 29
least bittern	<i>Ixobrychus exilis</i>	Fresh marshes, reedy ponds; nest is concealed in tall marsh growth.	May 15 – Aug. 15	IPaC
loggerhead shrike	<i>Lanius ludovicianus</i>	Semi-open country with lookout posts; wires, trees, scrub; Nest placed in a dense (and often thorny) tree or shrub, usually 5-30' above the ground, occasionally higher, in a spot well hidden by foliage.	April 1 – July 31	VA SGCN, 28, 29, ST

Species		Potential Breeding Habitat	Primary Nesting Season	Reason for inclusion ¹
Common	Scientific			
Louisiana waterthrush	<i>Parkesia motacilla</i>	Brooks, ravines, wooded swamps; Nest site is concealed in roots of upturned tree, near water, under overhanging banks of streams, or in hollow of rocky ravine.	May 1 - June 31	28
northern saw-whet owl	<i>Aegolius acadicus</i>	Forests, conifers, groves; Nest site is in cavity in tree, usually 15-60' above ground.	late April - June	VA SGCN, 28
peregrine falcon	<i>Falco peregrinus</i>	Open country, cliffs (mountains to coast); nests on cliffs, nest boxes or platforms, buildings, and bridges	March 1 – Aug, 31	VA SGCN, 28, 29, ST
pied-billed grebe	<i>Podilymbus podiceps</i>	Ponds, lakes, marshes; Nest a dense mass of plant material, floating or built up from bottom, anchored to standing vegetation.	March – Sept.	IPaC
prairie warbler	<i>Setophaga discolor</i>	Shrubby pastures, low pines; nest usually in a tree (such as pine, cedar, sweet-gum, oak), 1-45' above the ground	May 1 – July 31	28, 29
prothonotary warbler	<i>Protonotaria citrea</i>	Wooded swamps, wetlands, river bottom hardwoods; Nest site usually 5-10' up (sometimes 3-30' up), above standing water in hole in tree or stump.	May - June	IPaC
olive-sided flycatcher	<i>Contopus cooperi</i>	Mixed and coniferous forests; nest placed near tip of horizontal branch in tree; found in higher elevations in Appalachia	Mid-May – Aug.	28
red crossbill	<i>Loxia curvirostra</i>	Conifer forests and groves; Nests on a horizontal branch in conifer, often well out from trunk	June - July in VA, but active nests can sometimes be found year round	28
red-headed woodpecker	<i>Melanerpes erythrocephalus</i>	Groves, farm country, orchards, shade trees in towns, large scattered trees; nests in tree cavities	May 25 – Aug. 20	28
Swainson's warbler	<i>Limnithlypis swainsonii</i>	Forests; Nest site is usually at edge of dense growth of cane, vines, or rhododendron. Placed near or over water, or up to 4' above ground.	May 1 - July 31	VA SGCN, 28, 29
upland sandpiper	<i>Bartramia longicauda</i>	Grassy prairies, open meadows, fields; nest site is on ground among dense grass, typically well hidden, with grass arched above it.	April 1 - June 30	28, ST
wood thrush	<i>Hylocichla mustelina</i>	Mainly deciduous woodlands; nest placed in vertical fork of tree (usually deciduous) or saddled on horizontal branch, usually about 10-15' above the ground, sometimes lower, rarely as high as 50'.	May 25 – Aug.20	28, 29
worm-eating warbler	<i>Helmitheros vermivorum</i>	Deciduous woodlands; nest placed on ground, normally on hillside against a deciduous shrub or sapling, well concealed by dead leaves.	May 20 - July 20	28
yellow-bellied sapsucker	<i>Sphyrapicus varius</i>	Woodlands and aspen groves; nests in tree cavities	May 15 – Sept. 15	IPaC

¹Reason: VA SGCN = Tier I or II Species of Greatest Conservation Need (SGCN) in Virginia 2015 Wildlife Action Plan; 28 = BCR 28; 29 = BCR 29; BG = Bald and Golden Eagle Protection Act; IPaC = species not identified in the 2008 BCC list but identified by consulting USFWS online Information, Planning, and Conservation System; SE = Virginia state endangered; ST = Virginia state threatened.

Table 5. eBird records of the Virginia's Tier I and II Species of Greatest Conservation Need within two miles of the Mountain Valley Pipeline Project in West Virginia and Virginia^a.

Common Name	WV State Rank and Priority Status ¹	VA Tier/Conservation Opportunity Rank ²	eBird records		Number of observations ³	
			WV	VA	WV	VA
northern saw-whet owl	S2B	1b	1	1	1	1
Henslow's sparrow	S1B, Priority 1	1a	0	0	0	0
golden eagle	S3N, Priority 1	1a	5	0	7	0
black-billed cuckoo	S2B, Priority 1	2b	8	4	9	2
peregrine falcon	S2B, Priority 1	1a	0	1	0	1
loggerhead shrike	S1B, Priority 1	1a	0	1	0	1
Swainson's warbler	S3B, Priority 1	2c	4	0	3	0
American woodcock	S3B, Priority 1	2a	2	7	1	10
cerulean warbler	S2B, Priority 1	2a	52	8	136	21
golden-winged warbler	S1B, Priority 1	1a	5	15	3	24
Total			77	37	160	60

^aeBird records from January 1, 2005 to January 1, 2017.

¹West Virginia State Rank and Priority Status were found in the 2015 West Virginia State Wildlife Action Plan.

²Virginia Tier and Conservation Opportunity Rank were found in the 2015 Virginia Wildlife Action Plan.

³Some eBird records for species did not document the number of individuals observed (i.e., count): BBCU - five eBird records did not include a count; SWWA – one eBird record did not include a count; AMWO – one eBird record did not include a count; CERW – 10 eBird records did not include a count; GWWA – two eBird records did not include a count.

Table 6. Land cover and potential breeding habitat of migratory bird species of concern crossed by the Project in West Virginia and Virginia.

Land Cover	Class Definition	MBSC with Preferred Breeding Habitat in Class ¹	# of MBSC by NLCD Class	Project footprint ² (acres)	Percent of Project
Barren Land	Barren areas where vegetation accounts for < 15 % of total cover	None	0	30.49	0.48
Cultivated Crops	Areas used for annual crop production or actively tilled where crops are > 20% of total vegetation	None	0	57.66	0.91
Developed	Areas with a combination of constructed materials and vegetation, ranging from <20% to > 80% impervious surfaces	PEFA	1	503.92	7.92
Open Water	All areas of open water, with typically < 25% vegetation, soil, or other cover	PBGR, LEBI, BAEA	3	19.85	0.31
Wetland	Emergent herbaceous, shrub-scrub or woody wetlands where the soil or substrate is periodically saturated with or covered in water	LEBI, PROW, RHWO	3	41.40	0.65
Pasture/Hay	Areas of grasses, legumes, or grass-legume mixtures planted for livestock grazing or the production of seed or hay crops, typically on a perennial cycle.	HESP, UPSA, PEFA, LOSH	4	1,003.65	15.77
Grassland/Herbaceous	Areas with > 80% graminoid or herbaceous vegetation not intensively managed but potentially grazed	HESP, UPSA, PEFA, LOSH	4	182.76	2.87
Evergreen Forest	Areas dominated by trees > 5 meters tall, with > 20% total vegetation cover, and > 75% evergreen tree species	BCCH, CAWA, NSWOW, OSFL, RECR	5	118.92	1.87
Shrub/Scrub	Areas dominated by shrubs and trees, 5 meters tall with shrub canopy > 20% of total vegetation	AMWO, BBCU, BWWA, GWWA, KEWA, PRAW, LOSH	7	71.41	1.12
Deciduous Forest	Areas dominated by trees > 5 meters tall, with > 20% of total vegetation cover, and > 75% deciduous tree species	AMWO, BAEA, BBCU, BCCH, CERW, EWPW, KEWA, LOWA, RHWO, SWWA, WOTH, WEWA, YBSA,	13	3,918.40	61.58
Mixed Forest	Areas dominated by trees > 5 meters tall, with > 20% of total vegetation cover, and < 75% of both evergreen and deciduous tree species	AMWO, BAEA, BBCU, BCCH, CAWA, CERW, EWPW, KEWA, LOWA, NSWOW, OSFL, RHWO, SWWA, WOTH, WEWA, YBSA	16	415.80	6.53

¹ Four letter alpha codes for birds: AMWO – American woodcock; BAEA – bald eagle; BBCU – black-billed cuckoo; BCCH – black-capped chickadee; BWWA – blue-winged warbler; CAWA – Canada warbler; CERW – cerulean warbler; EWPW – eastern whip-poor-will; GOEA – golden eagle; GWWA – golden-winged warbler; KEWA – Kentucky warbler; LEBI – least bittern; LOSH – loggerhead shrike; LOWA – Louisiana waterthrush; NSWOW – northern saw-whet owl; PBGR – pied-billed grebe; PEFA – peregrine falcon; PRAW – prairie warbler; PROW – prothonotary warbler; RECR – red crossbill; RHWO – red-headed woodpecker; SWWA – Swainson’s warbler; UPSA – upland sandpiper; WEWA – worm-eating warbler; WOTH – wood thrush; YBSA – yellow-bellied sapsucker

² Amount of area within the Project’s construction-footprint. Area based on the NLCD and data collected during wetland surveys and detailed habitat assessments for federally listed bats.

Table 7. Core Forest Areas within construction and operation footprints of the Mountain Valley Pipeline Project in West Virginia.

Core Forest Area Type	Construction		Operation	
	Hectare	Acre	Hectare	Acre
1 - Patch	4.85	11.99	1.86	4.59
2 - Edge	105.89	261.65	31.90	78.81
3 - Perforated	332.71	822.14	106.66	263.55
4 - Core (<250 acre)	23.36	57.72	7.75	19.15
5 - Core (250-500 acre)	0.39	0.96	0.17	0.41
6 - Core (>500 acre)	982.41	2,427.60	352.95	872.17
Total	1,449.61	3,582.06	501.28	1,238.69

Table 8. Ecological Core Areas by core type and size within construction and operational footprints of the Mountain Valley Pipeline Project in Virginia.

Ecological Core Area (forest interior area)	Construction		Operation	
	Hectare	Acre	Hectare	Acre
Habitat Fragment (10 to 99 ac)	24.42	60.35	9.20	22.74
Small Core (100 to 999 ac)	130.91	323.48	43.95	108.60
Medium Core (1000 to 9,999 ac)	170.30	420.81	61.82	152.76
Large Core (>10,000 ac)	60.44	149.34	26.66	65.87
Total	386.06	953.98	141.63	349.97

Table 9. Impacts to Core Forest Areas intersected by the Mountain Valley Pipeline Project in West Virginia and Virginia.

Forest Complex ID	Core Forest Area ID	Forest Component	Centerline Enter Milepost	Centerline Exit Milepost	Centerline Miles	Pre-construction (ac)	Initial Impacts		Net Impacts ²		Forest Regenerated Post-construction	Number of Fragments	Post-construction Forest Complex ID	Post-construction Core Forest Area ID	Post-construction Fragment Size (ac)										
							Temp. Forest Cleared (ac)	Temp. Forest Interior Loss ¹ (ac)	Perm. Forest Cleared (ac)	Perm. Forest Interior Loss ³ (ac)															
A	WV Core-01	Forest Interior	0.07	20.47	17.04	234,041.71	334.85	1,899.94	119.60	1,552.86	562.35	27	A-1	WV Core-01-01	544.01										
													A-1	WV Core-01-02	0.72										
													A-1	WV Core-01-03	97.97										
													A-1	WV Core-01-04	1.10										
													A-1	WV Core-01-05	0.91										
													A-1	WV Core-01-06	158.54										
													A-1	WV Core-01-07	0.68										
													A-1	WV Core-01-08	1,125.77										
													A-1	WV Core-01-09	56.18										
													A-1	WV Core-01-10	313.13										
													A-1	WV Core-01-11	74.95										
													A-1	WV Core-01-12	0.30										
													A-1	WV Core-01-13	56.38										
													A-1	WV Core-01-14	17.74										
													A-1	WV Core-01-15	131,356.32										
													A-1	WV Core-01-16	97,477.84										
													A-2	WV Core-01-17	0.19										
													A-3	WV Core-01-18	128.15										
													A-4	WV Core-01-19	13.57										
													A-5	WV Core-01-20	14.79										
													A-6	WV Core-01-21	35.29										
													A-7	WV Core-01-22	182.53										
													A-8	WV Core-01-23	48.78										
													A-8	WV Core-01-24	0.33										
													A-8	WV Core-01-25	16.33										
													A-9	WV Core-01-26	4.46										
													A-9	WV Core-01-27	79.91										
		B	WV Core-02	Forest Edge	0.00	20.57	2.30	83,679.17	64.76	521.69	18.79		336.86	230.80	2	A-1	WV Core-01-Edge	85,514.35							
Forest Interior	20.87			21.47	0.59	109.43	10.39	40.69	3.60	41.02	6.46	B-1	WV Core-02-01	16.34											
												B-2	WV Core-02-02	42.01											
												B-1.1	WV Core-02-Edge	133.81											
												C-1	WV Core-03A-01	21.04											
												C-2	WV Core-03A-02	67.34											
C	WV Core-03A WV Core-03B	Forest Interior	21.65	22.11	0.36	121.57	5.36	27.82	2.20	27.53	3.45	5	C-3	WV Core-03B-01	1.60										
													C-4	WV Core-03B-02	6.34										
													C-2	WV Core-03B-03	2.43										
													C-4	WV Core-03-Edge	227.44										
													Forest Edge	21.59	22.58	0.53	195.12	9.45	58.83	4.07	57.20	7.00	D-1	WV Core-04-01	0.58
		D-1	WV Core-04-02	0.33																					
D-1	WV Core-04-03	9.51																							
D-2	WV Core-04-04	522.03																							
D-3	WV Core-04-05	0.64																							
D	WV Core-04	Forest Interior	23.08	25.71	1.77	880.44	40.29	207.69	12.10	157.04	78.85	8	D-4	WV Core-04-06	48.66										
													D-5	WV Core-04-07	43.16										
													D-4	WV Core-04-08	7.46										
													D-5	WV Core-04-Edge	889.03										
													Forest Edge	23.01	25.77	1.01	703.28	20.99	94.46	6.56	73.60	35.29	E-1	WV Core-05-01	11.36
																							E-2	WV Core-05-02	173.42
																							E-3	WV Core-05-03	5.24
																							E-3	WV Core-05-04	24.29
																							E-2	WV Core-05-05	0.19
		E	WV Core-05	Forest Interior	25.95	27.93	1.72	1,740.79	27.87	143.17	10.44		134.86	25.73	7	E-2	WV Core-05-06	1,352.39							
E-3	WV Core-05-07											2.87													
E-2	WV Core-05-Edge											1,143.55													
Forest Edge	25.87											28.30				0.35	1,011.92	11.54	58.93	2.19	43.99	24.29	E-2	WV Core-05-Edge	1,143.55

Forest Complex ID	Core Forest Area ID	Forest Component	Centerline Enter Milepost	Centerline Exit Milepost	Centerline Miles	Pre-construction (ac)	Initial Impacts		Net Impacts ²		Forest Regenerated Post-construction	Number of Fragments	Post-construction Forest Complex ID	Post-construction Core Forest Area ID	Post-construction Fragment Size (ac)
							Temp. Forest Cleared (ac)	Temp. Forest Interior Loss ¹ (ac)	Perm. Forest Cleared (ac)	Perm. Forest Interior Loss ³ (ac)					
F	WV Core-06A	Forest Interior	28.67	28.71	0.04	14.94	0.46	8.02	0.23	7.84	0.41	2	F-1	WV Core-06A-01	1.16
													F-1	WV Core-06A-02	5.30
	WV Core-06B	Forest Interior	28.94	60.03	20.67	275,202.78	350.50	1,985.33	133.03	1,755.56	447.24	35	F-1	WV Core-06B-01	479.99
													F-1	WV Core-06B-02	54.84
													F-1	WV Core-06B-03	0.40
													F-1	WV Core-06B-04	1.29
													F-10	WV Core-06B-05	2.48
													F-13	WV Core-06B-06	12.22
													F-14	WV Core-06B-07	0.19
													F-14	WV Core-06B-08	1.58
													F-15	WV Core-06B-09	5.87
													F-16	WV Core-06B-10	0.12
													F-17	WV Core-06B-11	17.17
													F-17	WV Core-06B-12	57.72
													F-17	WV Core-06B-13	9,577.45
													F-17	WV Core-06B-14	253.22
													F-18	WV Core-06B-15	62.89
													F-18	WV Core-06B-16	7.90
													F-19	WV Core-06B-17	46.58
													F-2	WV Core-06B-18	4.10
													F-2	WV Core-06B-19	27.51
													F-2	WV Core-06B-20	10.78
													F-2	WV Core-06B-21	0.34
													F-2	WV Core-06B-22	2.01
													F-2	WV Core-06B-23	7.35
													F-2	WV Core-06B-24	251,311.41
													F-20	WV Core-06B-25	1.15
													F-3	WV Core-06B-26	758.23
													F-4	WV Core-06B-27	3.37
													F-4	WV Core-06B-28	4,226.85
													F-4	WV Core-06B-29	184.17
													F-5	WV Core-06B-30	58.01
													F-6	WV Core-06B-31	5,266.97
													F-7	WV Core-06B-32	8.30
													F-8	WV Core-06B-33	35.06
													F-9	WV Core-06B-34	1.55
													F-9	WV Core-06B-35	377.72
	WV Core-06C	Forest Interior	44.84	45.24	0.27	138.17	3.96	23.70	1.65	20.30	5.71	3	F-10	WV Core-06C-01	3.40
													F-11	WV Core-06C-02	52.18
	WV Core-06D	Forest Interior	46.24	46.44	0.16	33.33	3.07	16.26	1.19	16.09	2.05	1	F-2	WV Core-06C-03	54.94
	WV Core-06E	Forest Interior	N/A	N/A	N/A	0.84	0.13	0.71	0.00	0.00	0.84	1	F-12	WV Core-06D-01	1.54
		Forest Edge	28.45	60.09	6.89	113,252.37	137.42	877.94	48.22	655.48	311.66		F-2	WV Core-06-Edge	115,148.85
G	WV Core-07	Forest Interior	N/A	N/A	N/A	0.14	0.00	0.14	0.00	0.00	0.14	1	N/A	N/A	N/A
		Forest Edge				10.49	0.74	9.46	0.00	2.26	7.94		G-1	WV Core-07-	9.89
H	WV Core-08A	Forest Interior	60.42	143.60	57.83	2,018,585.16	1,180.31	7,560.64	411.78	5,846.26	2,471.36	102	H-1	WV Core-08A-01	6.87
													H-1	WV Core-08A-02	0.13
													H-1	WV Core-08A-03	4.68
													H-1	WV Core-08A-04	28.13
													H-1	WV Core-08A-05	200.82
													H-1	WV Core-08A-06	0.44
													H-1	WV Core-08A-07	427.32
													H-1	WV Core-08A-08	11.19
													H-1	WV Core-08A-09	0.24
													H-1	WV Core-08A-10	9.26
													H-20	WV Core-08A-100	39.48

Forest Complex ID	Core Forest Area ID	Forest Component	Centerline Enter Milepost	Centerline Exit Milepost	Centerline Miles	Initial Impacts		Net Impacts ²		Forest Regenerated Post-construction	Number of Fragments	Post-construction Forest Complex ID	Post-construction Core Forest Area ID	Post-construction Fragment Size (ac)
						Pre-construction (ac)	Temp. Forest Cleared (ac)	Temp. Forest Interior Loss ¹ (ac)	Perm. Forest Cleared (ac)			Perm. Forest Interior Loss ³ (ac)		
												H-20	WV Core-08A-101	0.26
												H-10	WV Core-08A-104	6,407.49
												H-1	WV Core-08A-11	993.90
												H-1	WV Core-08A-12	701.30
												H-1	WV Core-08A-13	5.84
												H-1	WV Core-08A-14	7.56
												H-1	WV Core-08A-15	57.98
												H-1	WV Core-08A-16	1,425.65
												H-1	WV Core-08A-17	3.56
												H-1	WV Core-08A-18	2,422.48
												H-1	WV Core-08A-19	0.74
												H-1	WV Core-08A-20	1.12
												H-1	WV Core-08A-21	3.04
												H-2	WV Core-08A-22	2.42
												H-2	WV Core-08A-23	1,807,157.07
												H-2	WV Core-08A-24	56.40
												H-2	WV Core-08A-25	1,450.33
												H-3	WV Core-08A-26	1.22
												H-4	WV Core-08A-27	21.54
												H-5	WV Core-08A-28	10.07
												H-5	WV Core-08A-29	817.70
												H-5	WV Core-08A-30	678.30
												H-45	WV Core-08A-31	0.52
												H-45	WV Core-08A-32	9.17
												H-6	WV Core-08A-33	87.90
												H-6	WV Core-08A-34	15,561.28
												H-7	WV Core-08A-35	15.43
												H-8	WV Core-08A-36	2,214.51
												H-9	WV Core-08A-37	3.17
												H-9	WV Core-08A-38	4.54
												H-9	WV Core-08A-39	18.85
												H-11	WV Core-08A-40	377.31
												H-12	WV Core-08A-41	2,418.36
												H-13	WV Core-08A-42	78.12
												H-13	WV Core-08A-43	0.27
												H-13	WV Core-08A-44	0.13
												H-14	WV Core-08A-45	4.23
												H-15	WV Core-08A-46	86.80
												H-15	WV Core-08A-47	19.08
												H-15	WV Core-08A-48	61,140.62
												H-15	WV Core-08A-49	46,100.25
												H-16	WV Core-08A-50	112.87
												H-17	WV Core-08A-51	258.86
												H-18	WV Core-08A-52	58.21
												H-19	WV Core-08A-53	8.07
												H-20	WV Core-08A-54	3.51
												H-20	WV Core-08A-55	680.80
												H-20	WV Core-08A-56	477.32
												H-21	WV Core-08A-57	0.10
												H-22	WV Core-08A-58	0.12
												H-23	WV Core-08A-59	952.54
												H-24	WV Core-08A-60	6.54
												H-24	WV Core-08A-61	89.15
												H-24	WV Core-08A-62	0.45
												H-24	WV Core-08A-63	207.65
												H-24	WV Core-08A-64	13,307.07
												H-25	WV Core-08A-65	54.15
												H-26	WV Core-08A-66	6.87

Forest Complex ID	Core Forest Area ID	Forest Component	Centerline Enter Milepost	Centerline Exit Milepost	Centerline Miles	Initial Impacts			Net Impacts ²		Forest Regenerated Post-construction	Number of Fragments	Post-construction Forest Complex ID	Post-construction Core Forest Area ID	Post-construction Fragment Size (ac)
						Pre-construction (ac)	Temp. Forest Cleared (ac)	Temp. Forest Interior Loss ¹ (ac)	Perm. Forest Cleared (ac)	Perm. Forest Interior Loss ³ (ac)					
													H-27	WV Core-08A-67	1.94
													H-28	WV Core-08A-68	4.72
													H-28	WV Core-08A-69	6.12
													H-28	WV Core-08A-70	3.65
													H-28	WV Core-08A-71	1.34
													H-29	WV Core-08A-72	217.27
													H-30	WV Core-08A-73	1.12
													H-30	WV Core-08A-74	0.70
													H-31	WV Core-08A-75	3.87
													H-32	WV Core-08A-76	5.07
													H-33	WV Core-08A-77	0.61
													H-34	WV Core-08A-78	0.52
													H-34	WV Core-08A-79	0.15
													H-34	WV Core-08A-80	0.49
													H-34	WV Core-08A-81	0.50
													H-34	WV Core-08A-82	6.53
													H-34	WV Core-08A-83	0.14
													H-34	WV Core-08A-84	0.65
													H-34	WV Core-08A-85	42,056.27
													H-35	WV Core-08A-86	25.34
													H-36	WV Core-08A-87	3.51
													H-37	WV Core-08A-88	44.41
													H-38	WV Core-08A-89	16.95
													H-38	WV Core-08A-90	0.13
													H-38	WV Core-08A-91	62.40
													H-38	WV Core-08A-92	0.86
													H-38	WV Core-08A-93	4.96
													H-39	WV Core-08A-94	4.62
													H-39	WV Core-08A-95	4.70
													H-40	WV Core-08A-96	50.46
													H-41	WV Core-08A-97	4.46
													H-42	WV Core-08A-98	1.38
													H-42	WV Core-08A-99	0.23
	WV Core-08B	Forest Interior	78.56	78.57	0.02	0.85	0.30	0.55	0.09	0.76	0.00	N/A	N/A	N/A	N/A
	WV Core-08C	Forest Interior	N/A	N/A	N/A	0.06	0.01	0.06	0.00	0.06	0.00	N/A	N/A	N/A	N/A
	WV Core-08D	Forest Interior	114.31	114.42	0.11	74.71	1.43	11.05	0.66	10.21	1.61	2	H-22	WV Core-08A-102	7.20
	WV Core-08E	Forest Interior	114.77	114.78	0.01	0.01	0.01	0.00	0.01	0.00	0.00	N/A	N/A	N/A	N/A
	WV Core-08F	Forest Interior	124.50	124.51	0.01	0.33	0.31	0.02	0.07	0.26	0.00	N/A	N/A	N/A	N/A
	WV Core-08G	Forest Interior	137.02	137.03	0.01	2.87	0.21	2.66	0.02	2.61	0.24	N/A	N/A	N/A	N/A
	WV Core-08H	Forest Interior	143.98	143.98	0.00	38.53	1.01	7.68	0.23	7.08	1.38	1	H-36	WV Core-08A-105	29.84
		Forest Edge	60.13	144.05	16.31	355,391.32	422.74	2,863.78	126.88	1,980.53	1,166.90		H-1	WV Core-08-Edge	362,563.43
I	WV Core-09A	Forest Interior	105.62	105.66	0.04	1.61	0.69	0.92	0.24	1.37	0.00	1	N/A	N/A	N/A
J	WV Core-09B	Forest Interior	N/A	N/A	N/A	6.81	0.00	4.94	0.00	3.57	1.38	1	I-1	WV Core-09B-01	1.86
		Forest Edge	105.56	106.05	0.45	40.98	6.75	21.55	2.72	23.64	1.95		I-1	WV Core-09-Edge	40.10
	WV Core-10	Forest Interior	N/A	N/A	N/A	1.42	0.04	1.38	0.03	1.39	0.00	1	N/A	N/A	N/A
K	WV Core-11A	Forest Edge	N/A	N/A	N/A	16.30	0.66	11.44	0.46	11.44	0.20		J-1	WV Core-10-Edge	17.02
		Forest Interior	144.25	156.26	6.00	146,423.63	129.45	664.83	50.01	612.66	131.61	10	K-1	WV Core-11A-01	49.63
													K-1	WV Core-11A-02	6,048.91
													K-2	WV Core-11A-03	2.69

Forest Complex ID	Core Forest Area ID	Forest Component	Centerline Enter Milepost	Centerline Exit Milepost	Centerline Miles	Initial Impacts			Net Impacts ²		Forest Regenerated Post-construction	Number of Fragments	Post-construction Forest Complex ID	Post-construction Core Forest Area ID	Post-construction Fragment Size (ac)		
						Pre-construction (ac)	Temp. Forest Cleared (ac)	Temp. Forest Interior Loss ¹ (ac)	Perm. Forest Cleared (ac)	Perm. Forest Interior Loss ³ (ac)							
	WV Core-11B WV Core-11C	Forest Interior	148.33	148.35	0.02	2.67	0.27	1.15	0.10	1.10	0.22	1	K-2	WV Core-11A-04	438.33		
														K-3	WV Core-11A-05	137,526.32	
														K-4	WV Core-11A-06	7.62	
														K-5	WV Core-11A-07	1,118.29	
														K-6	WV Core-11A-08	2.18	
														K-7	WV Core-11A-09	421.96	
														K-8	WV Core-11A-10	13.41	
														K-3	WV Core-11B-01	1.25	
		Forest Interior	156.51	156.65	0.14	47.77	3.24	13.76	0.82	10.98	5.20	2	K-8	WV Core-11C-01	28.75		
			Forest Edge	144.16	156.71	3.03	35,675.88	62.22	399.70	20.86	355.54	85.52		K-9	WV Core-11C-02	2.01	
												K-3	WV Core-11-Edge	36,293.40			
L	WV Core-12	Forest Interior	156.90	170.96	9.23	71,619.50	177.06	1,149.81	61.45	867.43	397.99	7	L-1	WV Core-12-01	2.95		
														L-1	WV Core-12-02	36,304.34	
														L-1	WV Core-12-03	0.14	
														L-2	WV Core-12-04	0.45	
														L-2	WV Core-12-05	33,965.49	
														L-3	WV Core-12-06	1.05	
														L-3	WV Core-12-07	18.21	
														L-1	WV Core-12-Edge	26,316.68	
		Forest Edge	156.83	171.04	2.76	25,220.97	54.10	385.79	18.09	259.25	162.54						
			M	WV Core-13	Forest Interior	172.26	172.33	0.07	295.31	0.96	8.85	0.41	7.44	1.95	2	M-1	WV Core-13-01
														M-2	WV Core-13-02	283.78	
														M-1.1	WV Core-13-Edge	179.10	
Forest Edge	172.19	172.52				0.26	174.63	4.38	24.55	1.64	18.56	8.73					
	N	WV Core-14															
Forest Interior		172.72				173.53	0.49	212.15	7.89	35.12	2.95	37.10	2.96	3	N-1	WV Core-14-01	0.37
															N-1	WV Core-14-02	14.34
															N-2	WV Core-14-03	154.40
Forest Edge	172.65	173.59			0.38	215.34	5.95	41.52	2.36	32.46	12.66			N-3	WV Core-14-Edge	244.51	
	O	WV Core-15A			Forest Interior	174.86	176.83	1.34	6,353.45	23.31	133.36	8.36	107.61	40.70	3	O-1	WV Core-15A-01
													O-2	WV Core-15A-02	5,332.54		
													O-3	WV Core-15A-03	40.94		
													O-3	WV Core-15B-01	0.15		
Forest Edge			174.4884	176.8962	0.3618	2,330.02	10.49	87.52	2.20	46.02	49.80		O-3.1	WV Core-15-Edge	2,455.17		
			P	WV Core-16	Forest Interior	177.41	181.95	3.95	19,758.88	69.49	368.50	24.46	320.61	92.91	4	P-1	WV Core-16-01
														P-1	WV Core-16-02	1,619.10	
														P-2	WV Core-16-03	26.02	
														P-2	WV Core-16-04	17,649.09	
Forest Edge	177.28	182.03			0.36	9,215.60	8.34	81.99	2.58	61.53	26.23		P-2	WV Core-16-Edge	9,575.76		
	Q	WV Core-17A			Forest Interior	182.83	191.24	3.58	2,050.87	60.95	343.79	22.68	307.42	74.63	12	Q-8	WV Core-17A-01
														Q-1	WV Core-17A-02	10.05	
														Q-2	WV Core-17A-03	679.05	
														Q-3	WV Core-17A-04	202.24	
														Q-3	WV Core-17A-05	184.56	
														Q-3	WV Core-17A-06	41.46	
														Q-3	WV Core-17A-07	497.09	
														Q-4	WV Core-17A-08	10.02	
														Q-5	WV Core-17A-09	10.30	
														Q-6	WV Core-17A-10	130.64	
														Q-7	WV Core-17A-11	92.27	
														Q-8	WV Core-17A-12	0.12	
Forest Interior			184.42	185.18	0.66	211.53	10.52	43.47	3.98	42.63	7.39	1	Q-4	WV Core-17B-01	157.46		
			Forest Edge	182.77	191.30	2.07	2,137.29	35.16	270.47	13.81	223.32	68.50		Q-8	WV Core-17-Edge	2,488.41	
				R	WV Core-18												
			Forest Interior		192.09	194.44	2.35	936.23	35.35	176.34	14.17	177.31	20.20	3	R-1	WV Core-18-01	1.92
																R-1	WV Core-18-02
															R-2	WV Core-18-03	487.21
														R-2	WV Core-18-Edge	557.48	
S	WV Core-19	Forest Edge	192.03	194.50	0.13	383.84	2.69	19.60	0.83	17.58	3.89						
		Forest Interior	194.67	194.76	0.10	22.66	1.78	9.07	0.58	8.82	1.45	1	S-1	WV Core-19-01	11.82		

Forest Complex ID	Core Forest Area ID	Forest Component	Centerline Enter Milepost	Centerline Exit Milepost	Centerline Miles	Pre-construction (ac)	Initial Impacts		Net Impacts ²		Forest Regenerated Post-construction	Number of Fragments	Post-construction Forest Complex ID	Post-construction Core Forest Area ID	Post-construction Fragment Size (ac)
							Temp. Forest Cleared (ac)	Temp. Forest Interior Loss ¹ (ac)	Perm. Forest Cleared (ac)	Perm. Forest Interior Loss ³ (ac)					
T	WV Core-20	Forest Edge	194.56	194.88	0.23	41.71	3.58	13.97	1.36	13.91	2.27	3	S-1.2	WV Core-19-Edge	47.20
		Forest Interior	195.59	196.34	0.67	53,026.36	9.75	55.04	4.09	54.75	6.48		T-1	WV Core-20-01	1,850.85
		Forest Edge	195.51	195.88	0.15	9,859.01	1.92	12.32	0.92	11.30	2.02		T-2	WV Core-20-02	51,109.77
													T-3	WV Core-20-03	0.42
U	WV Core-21	Forest Interior	N/A	N/A	N/A	109.01	5.43	11.20	0.00	0.00	16.63	2	T-1	WV Core-20-Edge	9,912.32
		Forest Edge	N/A	N/A	N/A	142.53	10.89	14.51	0.00	0.00	25.40		U-1	WV Core-21-01	0.29
													U-1	WV Core-21-02	92.09
													U-1	WV Core-21-Edge	142.84
A	VA Core-01	Forest Interior	196.34	199.43	2.58	33,157.28	62.99	499.19	31.54	501.54	29.18	8	A-1	VA Core-01-01	1,089.09
		Forest Edge	198.75	199.49	0.55	3,563.70	12.71	81.34	4.21	64.34	25.50		A-2	VA Core-01-Edge_1	302.23
														VA Core-01-02	13,535.74
														VA Core-01-05	6.67
														VA Core-01-06	39.71
														VA Core-01-07	16,818.93
														VA Core-01-08	0.54
		Forest Interior	199.74	200.06	0.23	59.85	3.14	16.28	1.38	15.62	2.42		A-3	VA Core-01-Edge_2	3,307.80
														VA Core-01-03	1,099.75
														VA Core-01-Edge_3	390.31
														VA Core-01-04	4.58
														VA Core-02-01	35.96
														VA Core-02-Edge_1	82.28
B	VA Core-02	Forest Interior	199.74	200.06	0.23	59.85	3.14	16.28	1.38	15.62	2.42	2	B-1	VA Core-02-01	35.96
		Forest Edge	199.62	200.23	0.38	106.63	6.50	31.17	2.29	25.85	9.53		B-2	VA Core-02-Edge_1	82.28
														VA Core-02-02	4.47
														VA Core-02-Edge_2	34.14
C	VA Core-03	Forest Interior	N/A	N/A	N/A	634.80	0.98	18.92	0.61	18.69	0.60	5	C-1	VA Core-03-01	61.06
		Forest Edge	N/A	N/A	N/A	430.78	2.44	36.42	1.57	36.64	0.65		C-2	VA Core-03-Edge_3	109.88
														VA Core-03-02	0.82
														VA Core-03-03	345.46
														VA Core-03-04	195.08
														VA Core-03-05	12.47
		VA Core-03-Edge_4	337.39												
D	VA Core-04	Forest Interior	N/A	N/A	N/A	1,161.29	2.87	46.22	1.80	46.29	1.01	3	D-1	VA Core-04-01	127.15
		Forest Edge	N/A	N/A	N/A	610.66	1.11	18.50	0.72	18.37	0.53		D-2	VA Core-04-Edge_1	140.62
														VA Core-04-02	914.97
														VA Core-04-03	70.07
														VA Core-04-Edge_2	515.15
		E	VA Core-05	Forest Interior	N/A	N/A	N/A	50.67	0.68	12.56	0.00		0.50	12.73	2
Forest Edge	202.71			202.85	0.13	100.70	3.01	26.07	0.82	15.56	12.71	VA Core-05-02	21.24		
												VA Core-05-Edge_1	110.24		
F	VA Core-06	Forest Interior	N/A	N/A	N/A	51.23	0.00	2.25	0.00	0.93	1.31	1	F-1	VA Core-06-01	48.98
		Forest Edge	202.49	202.63	0.14	73.02	2.52	17.57	0.86	16.22	3.01		VA Core-06-Edge_1	72.75	
G	VA Core-07	Forest Interior	204.04	204.09	0.05	244.72	0.34	9.01	0.23	8.25	0.88	1	G-1	VA Core-07-01	235.37

Forest Complex ID	Core Forest Area ID	Forest Component	Centerline Enter Milepost	Centerline Exit Milepost	Centerline Miles	Pre-construction (ac)	Initial Impacts		Net Impacts ²		Forest Regenerated Post-construction	Number of Fragments	Post-construction Forest Complex ID	Post-construction Core Forest Area ID	Post-construction Fragment Size (ac)
							Temp. Forest Cleared (ac)	Temp. Forest Interior Loss ¹ (ac)	Perm. Forest Cleared (ac)	Perm. Forest Interior Loss ³ (ac)					
		Forest Edge	203.64	204.27	0.52	173.38	6.35	22.47	3.15	24.96	0.71			VA Core-07-Edge_1	176.04
H	VA Core-08	Forest Interior	N/A	N/A	N/A	342.95	2.22	40.86	0.00	0.73	42.35	3	H-1	VA Core-08-01	289.84
														VA Core-08-Edge_1	170.36
														VA Core-08-02	1.29
														VA Core-08-03	8.75
		Forest Edge	204.49	204.85	0.27	196.72	6.55	35.28	1.64	22.02	18.17			VA Core-08-Edge_2	60.67
I	VA Core-09	Forest Interior	206.66	206.66	0.00	659.03	0.62	9.10	0.05	7.70	1.96	1	I-1	VA Core-09-01	649.32
		Forest Edge	204.93	206.80	0.47	531.47	6.41	40.11	2.78	36.34	7.41			VA Core-09-Edge_1	534.15
J	VA Core-10	Forest Interior	N/A	N/A	N/A	419.15	3.55	66.29	0.00	2.18	67.65	4	J-1	VA Core-10-01	88.09
														VA Core-10-02	191.99
														VA Core-10-Edge_1	309.80
													J-2	VA Core-10-03	45.24
														VA Core-10-Edge_2	94.39
													J-3	VA Core-10-04	23.99
		Forest Edge	208.36	208.73	0.36	409.27	7.75	62.50	2.19	31.60	36.46				VA Core-10-Edge_3
K	VA Core-11	Forest Interior	208.87	209.89	0.86	533.72	15.50	111.39	5.21	67.50	54.17	5	K-1	VA Core-11-01	331.78
														VA Core-11-Edge_1	275.03
													K-2	VA Core-11-02	7.12
														VA Core-11-03	0.51
													K-3	VA Core-11-Edge_2	60.77
														VA Core-11-04	21.41
														VA Core-11-Edge_3	85.23
													K-4	VA Core-11-05	46.02
		Forest Edge	207.49	209.98	0.76	414.94	16.14	88.11	4.58	65.68	33.99				VA Core-11-Edge_4
L	VA Core-12	Forest Interior	N/A	N/A	N/A	46.36	0.34	6.38	0.00	0.00	6.72	1	L-1	VA Core-12-01	39.64
		Forest Edge	N/A	N/A	N/A	90.56	1.09	19.05	0.00	0.00	20.15			VA Core-12-Edge_1	95.85
M	VA Core-13	Forest Interior	213.08	214.34	0.71	777.93	13.03	82.22	5.42	75.24	14.59	5	M-1	VA Core-13-01	629.28
														VA Core-13-02	12.61
														VA Core-13-Edge_1	389.14
													M-2	VA Core-13-03	0.24
														VA Core-13-Edge_2	32.82
													M-3	VA Core-13-04	21.77
														VA Core-13-Edge_3	57.31
		M-4	VA Core-13-05	18.78											
Forest Edge	213.01		214.41	0.42	465.02	8.48	57.86	2.90	41.20	22.25			VA Core-13-Edge_4	59.49	
N	VA Core-14	Forest Interior	216.89	219.44	1.08	5,465.94	17.94	109.24	6.53	85.47	35.18	3	N-1	VA Core-14-01	1.40
														VA Core-14-Edge_1	24.14
													N-2	VA Core-14-02	1,636.64

Forest Complex ID	Core Forest Area ID	Forest Component	Centerline Enter Milepost	Centerline Exit Milepost	Centerline Miles	Pre-construction (ac)	Initial Impacts		Net Impacts ²		Forest Regenerated Post-construction	Number of Fragments	Post-construction Forest Complex ID	Post-construction Core Forest Area ID	Post-construction Fragment Size (ac)																					
							Temp. Forest Cleared (ac)	Temp. Forest Interior Loss ¹ (ac)	Perm. Forest Cleared (ac)	Perm. Forest Interior Loss ³ (ac)				VA Core-14-Edge_2	539.23																					
O	VA Core-15	Forest Interior	219.81	222.83	2.52	9,971.26	36.94	202.75	15.30	200.11	24.28	5	O-1	VA Core-14-03	3,700.72																					
														VA Core-14-Edge_3	879.27																					
														VA Core-15-01	8,416.81																					
		Forest Edge												219.55	223.32	1.16	1,774.12	19.38	91.80	7.05	78.94	25.18	O-2	VA Core-15-Edge_1	1,131.35											
																								VA Core-15-02	1,113.34											
																								VA Core-15-03	173.06											
		Forest Interior																						224.06	226.93	2.54	1,633.74	9.03	70.01	2.86	32.18	43.99	7	P-1	VA Core-15-Edge_2	714.21
																																			VA Core-15-04	13.14
																																			VA Core-15-Edge_3	71.20
Forest Edge	223.98	227.01	0.48	685.73	44.96	295.41	15.38	205.19	119.79	P-2	VA Core-15-05	15.22																								
											VA Core-15-Edge_4	37.29																								
											VA Core-16-01	1,005.94																								
Forest Interior											227.84	228.22	0.22	4,111.98	3.54	17.17	1.34	17.39	1.99	3	Q-1	VA Core-16-Edge_1	533.20													
																						VA Core-16-02	72.25													
																						VA Core-16-Edge_2	82.19													
Forest Edge																						227.75	229.56	0.81	1,670.50	10.22	58.49	5.01	53.22	10.48	P-3	VA Core-16-03	0.49			
																																VA Core-16-04	0.45			
																																VA Core-16-05	22.23			
Forest Interior	228.67	228.83	0.17	4,798.48	4.74	37.33	1.01	13.87	27.20	13																						R-1	VA Core-16-Edge_3	103.62		
																																	VA Core-16-06	37.79		
																																	VA Core-16-Edge_4	83.87		
Forest Edge											228.67	228.83	0.17	4,798.48	4.74	37.33	1.01	13.87	27.20	13	R-1												VA Core-16-07	154.22		
																																	VA Core-16-Edge_5	169.23		
																																	VA Core-17-01	0.30		
Forest Interior																						227.84	228.22	0.22	4,111.98	3.54	17.17	1.34	17.39	1.99	3		Q-2	VA Core-17-Edge_1	40.00	
																																		VA Core-17-02	19.03	
																																		VA Core-17-03	4,071.94	
Forest Edge	227.75	229.56	0.81	1,670.50	10.22	58.49	5.01	53.22	10.48	R-1																						VA Core-17-Edge_2		1,637.46		
																																VA Core-18-01		4,670.57		
																																VA Core-18-02		0.56		
Forest Interior											228.67	228.83	0.17	4,798.48	4.74	37.33	1.01	13.87	27.20	13	R-1											VA Core-18-03		6.87		
																																VA Core-18-04		42.33		
																																VA Core-18-05		0.35		
Forest Edge																						228.67	228.83	0.17	4,798.48	4.74	37.33	1.01	13.87	27.20	13	R-1	VA Core-18-06	1.95		
																																	VA Core-18-07	14.40		
																																	VA Core-18-08	13.41		
Forest Interior	228.67	228.83	0.17	4,798.48	4.74	37.33	1.01	13.87	27.20	13																							R-1	VA Core-18-09	0.14	

Forest Complex ID	Core Forest Area ID	Forest Component	Centerline Enter Milepost	Centerline Exit Milepost	Centerline Miles	Pre-construction (ac)	Initial Impacts		Net Impacts ²		Forest Regenerated Post-construction	Number of Fragments	Post-construction Forest Complex ID	Post-construction Core Forest Area ID	Post-construction Fragment Size (ac)
							Temp. Forest Cleared (ac)	Temp. Forest Interior Loss ¹ (ac)	Perm. Forest Cleared (ac)	Perm. Forest Interior Loss ³ (ac)					
		Forest Edge	228.57	229.02	0.27	2,428.23	4.60	27.77	1.64	18.96	11.78		R-2	VA Core-18-10	5.21
														VA Core-18-11	0.20
														VA Core-18-Edge_1	2,433.95
														VA Core-18-12	0.14
														VA Core-18-13	0.30
														VA Core-18-Edge_2	27.01
S	VA Core-19	Forest Interior	N/A	N/A	N/A	434.72	0.91	19.60	0.00	0.00	20.51	1	S-1	VA Core-19-01	414.20
		Forest Edge	N/A	N/A	N/A	333.47	0.31	25.07	0.00	12.73	12.65			VA Core-19-Edge_1	352.76
T	VA Core-20	Forest Interior	N/A	N/A	N/A	151.20	0.00	2.27	0.00	1.61	0.66	1	T-1	VA Core-20-01	148.93
		Forest Edge	230.21	230.74	0.41	123.10	4.09	22.52	2.45	23.82	0.34			VA Core-20-Edge_1	121.27
U	VA Core-21	Forest Interior	231.31	234.29	2.63	4,679.99	55.34	380.90	16.75	221.25	198.24	4	U-1	VA Core-21-01	189.34
														VA Core-21-Edge_1	138.65
													U-2	VA Core-21-02	327.62
														VA Core-21-Edge_2	218.61
													U-3	VA Core-21-03	3,719.49
														VA Core-21-04	7.29
V	VA Core-22	Forest Edge	231.19	234.38	0.57	1,043.59	15.88	97.30	4.11	53.30	54.94			VA Core-21-Edge_3	1,038.33
													V-1	VA Core-22-01	354.27
														VA Core-22-Edge_1	270.39
													V-2	VA Core-22-02	132.01
														VA Core-22-Edge_2	128.54
W	VA Core-23	Forest Interior	N/A	N/A	N/A	143.34	0.00	0.80	0.00	0.74	0.06	2	W-1	VA Core-23-01	39.78
														VA Core-23-02	102.76
														VA Core-23-Edge_1	167.17
X	VA Core-24	Forest Interior	N/A	N/A	N/A	27.96	0.00	3.58	0.00	2.43	1.16	2	X-1	VA Core-24-01	18.80
														VA Core-24-Edge_1	66.56
													X-2	VA Core-24-02	5.58
														VA Core-24-Edge_2	26.35
Y	VA Core-25	Forest Interior	N/A	N/A	N/A	200.98	5.85	28.60	2.50	30.07	1.88	4	Y-1	VA Core-25-01	84.98
														VA Core-25-02	5.29
													Y-2	VA Core-25-Edge_1	158.95
														VA Core-25-03	45.50
														VA Core-25-04	30.76
														VA Core-25-Edge_2	171.32
Z	VA Core-26	Forest Interior	237.15	238.35	1.03	2,358.38	15.26	86.41	6.24	82.66	12.76	3	Z-1	VA Core-26-01	2,123.96
													Z-2	VA Core-26-02	42.83
													Z-3	VA Core-26-03	89.92
AA	VA Core-27	Forest Interior	238.54	242.09	2.95	5,096.79	51.52	298.43	18.75	253.50	77.69	7	AA-1	VA Core-27-01	2,926.38

Forest Complex ID	Core Forest Area ID	Forest Component	Centerline Enter Milepost	Centerline Exit Milepost	Centerline Miles	Pre-construction (ac)	Initial Impacts		Net Impacts ²		Forest Regenerated Post-construction	Number of Fragments	Post-construction Forest Complex ID	Post-construction Core Forest Area ID	Post-construction Fragment Size (ac)			
							Temp. Forest Cleared (ac)	Temp. Forest Interior Loss ¹ (ac)	Perm. Forest Cleared (ac)	Perm. Forest Interior Loss ³ (ac)				VA Core-27-Edge_1	783.91			
		Forest Edge	238.47	242.17	0.66	1,307.86	12.36	77.76	4.29	58.76	27.08	5	AA-2	VA Core-27-02	1,422.57			
														VA Core-27-Edge_2	480.33			
														AA-3	VA Core-27-03	151.12		
															VA Core-27-04	0.08		
															VA Core-27-Edge_3	110.87		
														AA-4	VA Core-27-05	238.54		
		VA Core-27-Edge_4	146.87															
		AA-5	VA Core-27-06	0.65														
			VA Core-27-Edge_5	28.60														
			AA-6	VA Core-27-07	7.51													
				VA Core-27-Edge_6	35.81													
			BB	VA Core-28	Forest Interior	242.32	243.07	0.37	14,140.19	5.79	38.09	2.51	37.89	3.48	5	BB-1	VA Core-28-01	2.50
			Forest Interior	242.32	243.07	0.37	14,140.19	5.79	38.09	2.51	37.89	3.48	5	BB-1	VA Core-28-Edge_1	34.17		
		BB-2													VA Core-28-02	0.13		
															VA Core-28-03	13,998.78		
															VA Core-28-04	0.11		
		BB-3													VA Core-28-Edge_2	4,373.18		
															VA Core-28-05	94.79		
			VA Core-28-Edge_3	79.40														
		CC	VA Core-29	Forest Interior	244.42	244.45	0.03	69.96	0.59	8.50	0.21	5.52	3.36	3	CC-1	VA Core-29-01	17.84	
				Forest Interior	244.42	244.45	0.03	69.96	0.59	8.50	0.21	5.52	3.36	3	CC-1	VA Core-29-Edge_1	43.03	
																CC-2	VA Core-29-02	41.73
																	VA Core-29-Edge_2	76.15
																	CC-3	VA Core-29-03
VA Core-29-Edge_3	26.89																	
Forest Edge	244.31															244.64		0.29
				Forest Interior	244.91	245.73	0.47	93.49	7.32	35.43	2.94	36.04	3.78	4	DD-1	VA Core-30-02	3.01	
																DD-2	VA Core-30-Edge_1	57.79
																	VA Core-30-03	40.95
																	DD-3	VA Core-30-Edge_2
																VA Core-30-04		2.52
																VA Core-30-Edge_3		41.45
		Forest Edge	244.71	245.80	0.61	154.34	9.78	54.08	3.85	49.38	10.64	10	EE-1	VA Core-31-01	6,345.07			
				Forest Interior	246.80	251.81	2.75	7,076.60	45.56	264.17	19.03	267.12	23.58	10	EE-1	VA Core-31-02	7.84	
																VA Core-31-03	16.76	
																VA Core-31-04	57.11	
																VA Core-31-Edge_1	3,347.71	

Forest Complex ID	Core Forest Area ID	Forest Component	Centerline Enter Milepost	Centerline Exit Milepost	Centerline Miles	Pre-construction (ac)	Initial Impacts		Net Impacts ²		Forest Regenerated Post-construction	Number of Fragments	Post-construction Forest Complex ID	Post-construction Core Forest Area ID	Post-construction Fragment Size (ac)											
							Temp. Forest Cleared (ac)	Temp. Forest Interior Loss ¹ (ac)	Perm. Forest Cleared (ac)	Perm. Forest Interior Loss ³ (ac)																
		Forest Edge	246.72	251.89	1.43	3,556.31	23.27	140.44	9.78	140.69	13.24	7	EE-2	VA Core-31-05	9.24											
														VA Core-31-Edge_2	46.09											
														EE-3	VA Core-31-06	232.98										
															VA Core-31-Edge_3	166.91										
														EE-4	VA Core-31-07	48.90										
															VA Core-31-Edge_4	68.61										
														EE-5	VA Core-31-08	15.99										
															VA Core-31-09	23.85										
														EE-6	VA Core-31-Edge_5	121.54										
															VA Core-31-10	9.14										
														VA Core-31-Edge_6	42.95											
FF	VA Core-32	Forest Interior	253.12	254.06	0.47	3,945.49	6.96	43.05	2.83	42.61	4.57	7	FF-1	VA Core-32-01	3,803.05											
														VA Core-32-02	19.07											
														VA Core-32-03	8.57											
														VA Core-32-04	5.19											
														VA Core-32-05	22.56											
														VA Core-32-Edge_1	2,014.80											
		FF-2											VA Core-32-06	2.11												
													VA Core-32-07	34.94												
													VA Core-32-Edge_2	100.01												
													Forest Edge	252.99	255.92	0.68	2,081.14	9.37	53.79	4.10	53.59	5.47	3	GG-1	VA Core-33-01	4.21
																									VA Core-33-Edge_1	35.49
GG-2	VA Core-33-02	253.17																								
	VA Core-33-Edge_2	270.56																								
GG-3	VA Core-33-03	69.18																								
	VA Core-33-Edge_3	98.92																								
HH	VA Core-34	Forest Interior	257.41	258.14	0.57	141.33	8.46	40.01	3.45	41.72	3.31	2	HH-1											VA Core-34-01	57.39	
																								VA Core-34-Edge_1	95.95	
		HH-2											VA Core-34-02											35.44		
													VA Core-34-Edge_2											103.27		
II	VA Core-35	Forest Interior	265.24	265.31	0.06	84.31	0.65	4.67	0.37	4.75	0.20	2	II-1											VA Core-35-01	64.62	
		Forest Edge	265.18	265.40	0.16	129.74	3.76	16.46	1.50	17.76	0.96	VA Core-35-02		14.37												
JJ	VA Core-36	Forest Interior	267.24	267.28	0.04	29.73	0.82	7.93	0.27	6.99	1.49	2	JJ-1	VA Core-36-01	20.83											
														VA Core-36-Edge_1	68.15											
		JJ-2											VA Core-36-02	0.14												
													VA Core-36-Edge_2	14.00												
KK	VA Core-37	Forest Interior	269.32	269.62	0.17	93.03	3.23	14.93	1.09	14.57	2.49	3	KK-1	VA Core-37-01	9.06											
														VA Core-37-Edge_1	30.91											

Forest Complex ID	Core Forest Area ID	Forest Component	Centerline Enter Milepost	Centerline Exit Milepost	Centerline Miles	Pre-construction (ac)	Initial Impacts		Net Impacts ²		Forest Regenerated Post-construction	Number of Fragments	Post-construction Forest Complex ID	Post-construction Core Forest Area ID	Post-construction Fragment Size (ac)
							Temp. Forest Cleared (ac)	Temp. Forest Interior Loss ¹ (ac)	Perm. Forest Cleared (ac)	Perm. Forest Interior Loss ³ (ac)					
		Forest Edge	269.24	269.70	0.29	157.49	4.92	39.56	1.82	27.63	15.03	2	KK-2	VA Core-37-02	18.99
														VA Core-37-Edge_2	51.07
													KK-3	VA Core-37-03	46.82
														VA Core-37-Edge_3	85.51
LL	VA Core-38	Forest Interior	273.32	273.58	0.26	80.84	3.36	24.14	1.56	23.54	2.40	2	LL-1	VA Core-38-01	27.73
														VA Core-38-Edge_1	51.40
		Forest Edge	273.10	273.66	0.31	108.33	4.11	17.49	1.88	18.30	1.42	LL-2	VA Core-38-02	25.57	
													VA Core-38-Edge_2	76.99	
MM	VA Core-39	Forest Interior	277.62	277.82	0.20	39.14	2.82	14.92	1.19	15.00	1.56	2	MM-1	VA Core-39-01	13.04
														VA Core-39-Edge_1	49.45
		Forest Edge	277.56	278.02	0.26	71.56	4.43	20.86	1.61	20.12	3.56	MM-2	VA Core-39-02	8.35	
													VA Core-39-Edge_2	32.60	
NN	VA Core-40	Forest Interior	278.24	278.30	0.06	518.68	0.66	6.72	0.35	6.48	0.55	3	NN-1	VA Core-40-01	0.31
														VA Core-40-Edge_1	23.88
		Forest Edge	278.07	278.38	0.25	296.66	3.84	16.83	1.53	15.17	3.97	NN-2	VA Core-40-02	1.60	
													VA Core-40-03	509.33	
OO	VA Core-41	Forest Interior	278.86	280.92	0.89	2,455.32	14.42	91.71	5.42	67.07	33.64	10	OO-1	VA Core-41-01	56.17
														VA Core-41-02	3.19
														VA Core-41-Edge_1	124.93
														VA Core-41-03	9.83
													OO-2	VA Core-41-04	2,184.50
														VA Core-41-05	5.22
														VA Core-41-06	15.24
														VA Core-41-Edge_2	1,300.98
		OO-3											VA Core-41-07	24.45	
													VA Core-41-08	1.66	
													VA Core-41-09	9.34	
													VA Core-41-Edge_3	111.71	
													OO-4	VA Core-41-10	39.61
														VA Core-41-Edge_4	59.53
PP	VA Core-42	Forest Interior	281.95	282.65	0.70	597.24	10.85	58.99	4.24	56.59	9.00	3	PP-1	VA Core-42-01	282.96
														VA Core-42-Edge_1	222.48
		Forest Edge	281.71	282.79	0.38	445.31	5.25	21.90	2.28	22.76	2.11	PP-2	VA Core-42-02	210.77	
													VA Core-42-03	33.67	
QQ	VA Core-43	Forest Interior	283.26	283.74	0.48	406.50	7.23	35.55	2.89	35.11	4.78	5	QQ-1	VA Core-42-Edge_2	276.57
														VA Core-43-01	334.68
														VA Core-43-Edge_1	210.31

Forest Complex ID	Core Forest Area ID	Forest Component	Centerline Enter Milepost	Centerline Exit Milepost	Centerline Miles	Pre-construction (ac)	Initial Impacts		Net Impacts ²		Forest Regenerated Post-construction	Number of Fragments	Post-construction Forest Complex ID	Post-construction Core Forest Area ID	Post-construction Fragment Size (ac)
							Temp. Forest Cleared (ac)	Temp. Forest Interior Loss ¹ (ac)	Perm. Forest Cleared (ac)	Perm. Forest Interior Loss ³ (ac)					
		Forest Edge	283.19	283.80	0.13	315.73	2.44	17.11	0.79	16.04	2.72	2	QQ-2	VA Core-43-02	12.27
														VA Core-43-03	0.07
														VA Core-43-04	0.35
														VA Core-43-05	16.34
														VA Core-43-Edge_2	138.52
RR	VA Core-44	Forest Interior	284.64	284.78	0.14	624.46	2.61	16.04	0.87	12.34	5.44	2	RR-1	VA Core-44-01	162.95
														VA Core-44-Edge_1	152.28
		Forest Edge	284.57	285.10	0.23	381.65	4.05	37.94	1.37	30.42	10.20		RR-2	VA Core-44-02	442.86
														VA Core-44-Edge_2	241.36
SS	VA Core-45	Forest Interior	287.31	287.39	0.09	67.23	1.01	9.47	0.52	9.28	0.68	1	SS-1	VA Core-45-01	56.75
		Forest Edge	286.91	287.70	0.37	106.61	4.95	32.62	2.30	31.96	3.32			VA Core-45-Edge_1	111.13
TT	VA Core-46	Forest Interior	N/A	N/A	N/A	172.23	0.00	0.27	0.00	0.15	0.12	1	TT-1	VA Core-46-01	171.96
		Forest Edge	287.97	288.11	0.11	253.69	2.18	18.04	0.73	11.87	7.62			VA Core-46-Edge_1	251.78
UU	VA Core-47	Forest Interior	N/A	N/A	N/A	135.50	0.01	2.61	0.00	1.86	0.77	2	UU-1	VA Core-47-01	26.35
														VA Core-47-02	106.53
		Forest Edge	288.17	288.34	0.18	136.15	2.63	9.79	1.04	10.22	1.17			VA Core-47-Edge_1	136.12
WW	VA Core-48	Forest Interior	288.59	289.74	0.78	1,375.15	15.77	76.37	4.76	64.36	23.03	7	WW-1	VA Core-48-01	677.74
														VA Core-48-02	43.75
														VA Core-48-03	11.01
														VA Core-48-04	186.56
														VA Core-48-05	9.17
														VA Core-48-Edge_1	1,068.15
													WW-2	VA Core-48-06	344.06
														VA Core-48-Edge_2	377.41
		Forest Edge	288.51	289.80	0.37	1,420.22	8.35	50.01	2.24	30.40	25.73		WW-3	VA Core-48-07	10.71
														VA Core-48-Edge_3	42.69
XX	VA Core-49	Forest Interior	N/A	N/A	N/A	129.46	0.00	0.83	0.00	0.66	0.17	1	XX-1	VA Core-49-01	128.63
		Forest Edge	290.93	291.06	0.13	215.10	2.08	7.48	0.80	8.11	0.65			VA Core-49-Edge_1	213.85
YY	VA Core-50	Forest Interior	291.50	292.45	0.61	258.86	9.98	52.31	3.73	48.73	9.83	3	YY-1	VA Core-50-01	177.95
														VA Core-50-02	6.30
														VA Core-50-Edge_1	271.84
		Forest Edge	291.24	292.58	0.60	279.77	10.61	43.66	3.60	44.65	6.02		YY-2	VA Core-50-03	12.32
														VA Core-50-Edge_2	49.65
ZZ	VA Core-51	Forest Interior	293.80	295.16	0.93	256.63	13.17	64.94	5.61	66.64	5.86	4	ZZ-1	VA Core-51-01	162.34
														VA Core-51-Edge_1	165.81
													ZZ-2	VA Core-51-02	0.34
														VA Core-51-03	0.43
														VA Core-51-04	15.40

Forest Complex ID	Core Forest Area ID	Forest Component	Centerline Enter Milepost	Centerline Exit Milepost	Centerline Miles	Pre-construction (ac)	Initial Impacts		Net Impacts ²		Forest Regenerated Post-construction	Number of Fragments	Post-construction Forest Complex ID	Post-construction Core Forest Area ID	Post-construction Fragment Size (ac)
							Temp. Forest Cleared (ac)	Temp. Forest Interior Loss ¹ (ac)	Perm. Forest Cleared (ac)	Perm. Forest Interior Loss ³ (ac)					
							Forest Edge	293.74	295.26	0.57					
AAA	VA Core-52	Forest Interior	297.67	297.95	0.28	1,008.56	4.30	30.38	1.69	27.82	5.17	4	AAA-1	VA Core-52-01	914.14
														VA Core-52-02	11.17
														VA Core-52-03	6.72
														VA Core-52-Edge_1	942.26
		Forest Edge	295.35	298.02	0.60	992.59	8.37	36.75	3.61	36.42	5.10		AAA-2	VA Core-52-04	41.85
														VA Core-52-Edge_2	72.34
BBB	VA Core-53	Forest Interior	298.43	298.53	0.10	68.10	1.53	10.87	0.61	10.70	1.09	2	BBB-1	VA Core-53-01	54.29
														VA Core-53-Edge_1	87.39
		Forest Edge	298.35	298.60	0.15	105.08	3.21	17.13	1.48	17.35	1.51		BBB-2	VA Core-53-02	1.41
														VA Core-53-Edge_2	25.34
CCC	VA Core-54	Forest Interior	302.36	303.67	0.46	233.55	42.72	64.74	9.07	69.11	29.28	3	CCC-1	VA Core-54-01	111.28
														VA Core-54-Edge_1	179.64
		Forest Edge	302.28	303.30	0.60	218.62	19.65	62.55	4.79	60.14	17.27		CCC-2	VA Core-54-02	14.40
														VA Core-54-Edge_2	43.94
													CCC-3	VA Core-54-03	0.39
														VA Core-54-Edge_3	40.13

¹ Estimated loss of forest interior in Core Forest Areas following tree-clearing.
² Refers to impacts following construction and regeneration of temporarily disturbed forest.
³ Estimated loss of forest interior in Core Forest Areas following the regeneration of forest in temporarily cleared forested areas within Project workspace. The regeneration of a forest vegetation will shift the “edge” increasing the interior cover within a forest.
* Associated with a proposed access road.

Table 10. Size class summary of Core Forest Areas prior to and following construction of the Mountain Valley Pipeline Project and regeneration of temporarily disturbed forest.

Forest Interior Size Class	West Virginia		Virginia	
	Pre-construction	Post-construction # of fragments per size class (acres)	Pre-construction	Post-construction
<2.5 acres	8 (5.25)	70 (56.94)	0 (0)	33 (23.25)
2.5 to 25 acres	6 (52.51)	70 (630.38)	0 (0)	64 (781.78)
25 to 250 acres	11 (1,121.59)	60 (5,157.15)	23 (2,414.18)	61 (5,650.04)
250 to 2,500 acres	5 (5,903.64)	34 (30,242.13)	20 (17,410.20)	25 (19,691.48)
>2,500 acres	8 (2,825,011.46)	21 (2,778,883.35)	11 (92,444.02)	11 (82,007.48)
Total	38 (2,832,094.45)	255 (2,814,969.96)	54 (112,268.40)	194 (108,154.030)

Table 11. Summary of collocated features along the Project route.

Collocation Type	Distance (miles)	Percent
Field Road Rights-of-Way	29.7	9.8
Underground Electric/Telephone Lines/Fiber Optics Rights-of-Way	0.9	0.3
Local Private/Public Road Rights-of-Way	0.8	0.3
Overhead Power Lines/Electric Transmission Line Rights-of-Way	26.2	8.6
Pipeline Rights-of-Way	9.4	3.1
Railroad Rights-of-Way	0.0	0.0
National/Field Trail Rights-of-Way	16.8	5.6
State/County Road Rights-of-Way	5.7	1.9
Total¹	89.5	29.6

¹Totals may not sum correctly due to rounding.

Note: Not all collocated features are directly adjacent to the pipeline.

Table 12. Functional Metric Values by Land Cover Classification.

Land Cover	Habitat Quality	Global Biodiversity	Runoff Prevention	Aesthetics/ Recreation	Carbon Sequestration	Total
Interior Deciduous Forest	10	10	10	10	10	50
Interior Evergreen Forest	6	6	10	10	9	41
Interior Mixed Forest	10	11	10	10	10	51
Edge Deciduous Forest	7	7	10	9	10	43
Edge Evergreen Forest	4	4	10	8	8	34
Edge Mixed Forest	7	8	10	9	10	44
Non-Forested						
Wetlands	10	11	10	10	9	51
Forested Wetlands	10	12	10	10	10	52
Hay/Pasture	3	3	5	4	6	21
Herbaceous	6	6	6	5	6	29
Open Water	6	7	8	7	6	34
Shrub/Scrub	7	6	8	6	6	33

Table 13. Effective Acres, per Acre, by Land Cover Classification

Land Cover	Total	Possible Total	Effective Acres <i>b</i> ^A
Interior Deciduous Forest	50	50	1
Interior Evergreen Forest	41	50	0.82
Interior Mixed Forest	51	50	1.02
Edge Deciduous Forest	43	50	0.86
Edge Evergreen Forest	34	50	0.68
Edge Mixed Forest	44	50	0.88
Non-Forested Wetlands	51	50	1.02
Forested Wetlands	52	50	1.04
Hay/Pasture	21	50	0.42
Herbaceous	29	50	0.58
Open Water	34	50	0.68
Shrub/Scrub	33	50	0.66

Table 14. Preconstruction Effective Acres for the Direct Impact Area.

Land Cover	Acres of Impact			Effective Acres per Acre	Effective Acres at Baseline		
	Virginia	West Virginia	Entire Project		Virginia	West Virginia	Entire Project
Interior Deciduous Forest	361.86	1410.89	1772.75	1.0	361.86	1410.89	1772.75
Interior Evergreen Forest	15.89	3.74	19.63	0.82	13.03	3.07	16.10
Interior Mixed Forest	36.96	125.05	162.01	1.02	37.70	127.55	165.25
Edge Deciduous Forest	679.98	1466.60	2146.58	0.86	584.78	1261.28	1846.06
Edge Evergreen Forest	78.48	20.80	99.28	0.68	53.37	14.14	67.51
Edge Mixed Forest	46.52	206.51	253.03	0.88	40.94	181.73	222.67
Non-Forested Wetlands	5.78	28.73	34.51	1.02	5.90	29.30	35.20

Land Cover	Acres of Impact			Effective Acres per Acre	Effective Acres at Baseline		
	Virginia	West Virginia	Entire Project		Virginia	West Virginia	Entire Project
Forested Wetlands	3.83	3.07	6.90	1.04	3.98	3.19	7.18
Hay/Pasture	579.96	423.72	1003.68	0.42	243.58	177.96	421.55
Herbaceous	122.74	60.03	182.77	0.58	71.19	34.82	106.01
Open Water	6.24	13.62	19.86	0.68	4.24	9.26	13.50
Shrub/Scrub	21.32	50.09	71.41	0.66	14.07	33.06	47.13

Table 15. Preconstruction Effective Acres, per Acre for the Indirect Impact Area.

Land Cover	Acres of Impact			Effective Acres per Acre	Effective Acres at Baseline		
	Virginia	West Virginia	Entire Project		Virginia	West Virginia	Entire Project
Interior Deciduous Forest	2542.63	9032.39	11575.02	1.0	2542.63	9032.39	11575.02
Interior Evergreen Forest	133.13	45.23	178.36	0.82	109.1666	37.09	146.26
Interior Mixed Forest	73.28	254.08	327.36	1.02	74.7456	259.16	333.91

Table 16. Weighted mean habitat value for the Permanent and Temporary LOD in Virginia and West Virginia.

Land Cover	Percentage of Impact Area				Effective Acres per Acre	Weighted Mean Habitat Value			
	Permanent		Temporary			Permanent		Temporary	
	Virginia	West Virginia	Virginia	West Virginia		Virginia	West Virginia	Virginia	West Virginia
Interior Deciduous Forest	0.209	0.406	0.171	0.352	1	0.209	0.406	0.171	0.352
Interior Evergreen Forest	0.010	0.001	0.007	0.001	0.82	0.008	0.001	0.006	0.001
Interior Mixed Forest	0.019	0.036	0.019	0.031	1.02	0.019	0.037	0.019	0.032
Edge Deciduous Forest	0.369	0.379	0.335	0.388	0.86	0.317	0.326	0.288	0.334
Edge Evergreen Forest	0.043	0.005	0.038	0.005	0.68	0.029	0.003	0.026	0.003
Edge Mixed Forest	0.025	0.053	0.023	0.055	0.88	0.022	0.047	0.020	0.048
Non-Forested Wetlands	0.005	0.005	0.002	0.009	1.02	0.005	0.005	0.002	0.009
Forested Wetlands	0.002	0.001	0.002	0.001	1.04	0.002	0.001	0.002	0.001
Hay/Pasture	0.253	0.083	0.319	0.126	0.42	0.106	0.035	0.134	0.053
Herbaceous	0.050	0.016	0.070	0.016	0.58	0.029	0.009	0.041	0.009
Open Water	0.005	0.005	0.002	0.003	0.68	0.003	0.003	0.001	0.002
Shrub/Scrub	0.010	0.011	0.011	0.014	0.66	0.007	0.007	0.007	0.009
Total						0.758	0.880	0.718	0.853

Table 17. Recovery Periods by Recovery Planting Type, in years.

Recovery Planting	Years Until Maturity	Years Until Service "End"
	t_M	t_L
Steep Slope Grasses – Seeded	3	80
Pollinator/Native Grasses – Seeded	3	80
Deciduous Woody – Seeded	80	80
Riparian Wooded – Planted	75	80

Recovery Planting	Years Until Maturity t_M	Years Until Service "End" t_L
Shrub/Scrub – Planted	5	80

Table 18. Future Condition Effective Acres per Acre by Land Classification, at Construction and Maturity.

Recovery Planting	Restored Land Cover	Services at x_0^p	Services at Maturity x_t^p
Steep Slope Grasses – Seeded	Herbaceous	$x_0^p = 0$	$x_3^p = 0.58$
Pollinator/Native Grasses – Seeded	Herbaceous	$x_0^p = 0$	$x_3^p = 0.66$
Deciduous Woody – Seeded	Edge Deciduous Forest	$x_0^p = 0$	$x_{80}^p = 0.86$
Riparian Wooded – Planted	Edge Deciduous Forest	$x_0^p = 0$	$x_{75}^p = 0.86$
Shrub/Scrub – Planted	Shrub/Scrub	$x_0^p = 0$	$x_5^p = 0.80$

Table 19. Total Post-Construction Future Condition Effective Acres, within the LOD, by Land Classification, at 2 Recovery Benchmarks.

Recovery Planting	Restored Land Cover	Acres Immediately Post Impact				Effective Acres per Acre	Total Effective Acres at Maturity			
		Permanent		Temporary			Permanent		Temporary	
		Virginia	West Virginia	Virginia	West Virginia		Virginia	West Virginia	Virginia	West Virginia
Steep Slope Grasses – Seeded	Herbaceous	526.69	1357.58	613.49	794.98	0.58	305.48	787.40	355.82	461.09
Pollinator/Native Grasses– Seeded	Herbaceous	161.8	32.99	90.2	9.8	0.66	106.79	21.77	59.53	6.47
Deciduous Woody – Seeded	Edge Deciduous Forest	0	0.10	567.57	2028.88	0.86	0.00	0.09	488.11	1744.84
Riparian Wooded – Planted	Edge Deciduous Forest	0	0	10.11	15.73	0.86	0.00	0.00	8.69	13.53
Shrub/Scrub – Planted	Shrub/Scrub	35.22	0	108.04	0	0.80	28.18	0.00	86.43	0.00

Table 20. Composite recovery for Permanent and Temporary LOD by state.

Impact Area	Measurement Period (years)	Composite Recovery Maximum			Composite Recovery Mean		
		Virginia	West Virginia	Entire Project	Virginia	West Virginia	Entire Project

Permanent LOD	80	0.609	0.582	0.591	0.593	0.568	0.576
Temporary LOD	80	0.719	0.781	0.761	0.639	0.657	0.624

Table 21. Total Future Condition Effective Acres, within the Buffer, by Land Classification, at 2 Recovery Benchmarks.

Land Cover	Services at x_{0-79}^p	Acres Immediately Post Impact		Services at Maturity x_{80}^p	Acres at Maturity	
		Virginia	West Virginia		Virginia	West Virginia
Edge Deciduous Forest	0.86	2542.63	9032.39	0.86	2161.24	7677.53
Edge Evergreen Forest	0.68	133.13	45.23	0.68	113.16	38.45
Edge Mixed Forest	0.88	73.28	254.08	0.88	62.29	215.97
Interior Deciduous Forest	0	0	0	1.0	381.39	1354.86
Interior Evergreen Forest	0	0	0	0.82	19.97	6.78
Interior Mixed Forest	0	0	0	1.02	11.0	38.11

APPENDIX C AGENCY CORRESPONDENCE



United States Department of the Interior

FISH AND WILDLIFE SERVICE



Virginia Field Office
6669 Short Lane
Gloucester, VA 23061

April 3, 2015

Ms. Valerie Clarkston
Environmental Solutions & Innovations, Inc.
4525 Este Avenue
Cincinnati, OH 45232

Re: Mountain Valley Pipeline, Virginia
Segments

Dear Ms. Clarkston:

The U.S. Fish and Wildlife Service (Service) has reviewed the project package for the referenced project. Mountain Valley Pipeline plans to construct a 42-inch diameter natural gas pipeline to allow producers and end-users a direct route to transport new gas supplies. The project will extend from the existing Equitrans transmission system near Mobley in Wetzel County, WV to Transcontinental Gas Pipeline Company's Zone 5 compressor station 165 in Pittsylvania County, VA. In Virginia, the pipeline is expected to cross Craig, Franklin, Giles, Montgomery, Pittsylvania, and Roanoke Counties. The following comments are provided under provisions of the Endangered Species Act of 1973 (16 U.S.C. 1531-1544, 87 Stat. 884), as amended, Bald and Golden Eagle Protection Act (16 U.S.C. 668-668c, 54 Stat. 250), as amended, and Migratory Bird Treaty Act of 1940 (16 U.S.C. 703-712, 40 Stat. 755).

Our recommendations are based on the route alignment provided on March 6, 2015. Once the action area of the project is finalized, an additional review that includes all attendant facilities, staging areas, etc. will be necessary. Action area refers to all areas directly or indirectly affected by the proposed action and not only the immediate area involved in the action.

Migratory birds are a Federal trust resource and are protected under the Migratory Bird Treaty Act. The project package did not include information on proposed impacts to migratory birds and their habitats. The Service will provide additional comments upon receipt of a plan that identifies and addresses impacts to migratory birds.

We recommend a detailed habitat assessment be conducted for the federally listed and proposed species below within the specified areas of potential habitat. An approved surveyor can conduct these habitat assessments in the action area to identify suitable habitat and survey for the species

if suitable habitat is identified. Surveys are not needed if the approved surveyor determines that no suitable habitat is present.

A table of optimal survey times for plants can be found on our website at:

http://www.fws.gov/northeast/virginiafield/pdf/endspecies/MISC/20120125_VIRGINIA_survey_time_frame_for_plants.pdf.

A list of qualified surveyors can be found on our website at:

<http://www.fws.gov/northeast/virginiafield/endspecies/surveyors.html>. This list does not include all individuals qualified or authorized to survey for these species. If you select someone not on the pre-approved surveyor list, provide the proposed surveyor's qualifications and proposed survey design to this office for review and approval prior to initiating the survey. Send copies of all habitat assessments and/or survey results to this office.

- James spinymussel (*Pleurobema collina*): federally listed endangered. We have reviewed the study plan entitled, "Freshwater mussel (Unionidae) site assessments, surveys, and relocations for the proposed Mountain Valley Pipeline in Virginia." Because this species has been documented in Craig, Johns, Little Oregon, and Dicks Creeks in Virginia, presence/absence surveys are not necessary in these streams. Habitat assessments are necessary for other perennial streams in the Craig Creek watershed in Craig County. We recommend that alternative routes be developed that avoid this watershed due to its importance to the conservation and recovery of this species. Formal consultation pursuant to the Endangered Species Act between the Service and Federal Energy Regulatory Commission is likely if this route or other routes in this watershed are pursued. Any relocation of federally listed mussels must be authorized by the Service prior to relocation. This species also occurs in South Fork Potts Creek in West Virginia and coordination with Service's West Virginia Field Office is necessary (see contact information below).
- Roanoke logperch (*Percina rex*): federally listed endangered. Because this species has been documented in the Pigg, Roanoke, and North Fork Roanoke Rivers, presence/absence surveys are not necessary in these rivers. Habitat assessments are necessary for other perennial streams in the Roanoke River watershed in Montgomery, Roanoke, Franklin, and Pittsylvania Counties.
- Northeastern bulrush (*Scirpus ancistrochaetus*): federally listed endangered. Potential habitat occurs in Craig and Giles Counties between points -80.237, 37.416 and -80.246, 37.42; -80.284, 37.387 and -80.287, 37.392; and -80.688, 37.392 and -80.693, 37.402.
- Smooth coneflower (*Echinacea laevigata*): federally listed endangered. Potential habitat occurs in Roanoke and Montgomery Counties between points -80.364, 37.275 and -80.329, 37.268; 80.242, 37.319 and -80.243, 37.316; -80.21, 37.246 and -80.202, 37.242; and 80.198, 37.229 and 80.197, 37.227.

- Mitchell's satyr butterfly (*Neonympha mitchellii mitchellii*): federally listed endangered. Potential habitat occurs in Franklin and Montgomery Counties.
- Bats
 - Surveys for potential hibernacula including cave openings and cave-like structures (e.g., abandoned or active mines, railroad tunnels) should be conducted following the guidance on page B3 of the Northern Long-Eared Bat Interim Conference and Planning Guidance within the action area of the proposed pipeline route. This guidance is available at:
<http://www.fws.gov/Midwest/endangered/mammals/nlba/pdf/NLEBinterimGuidance6Jan2014.pdf>.
 - In areas where tree removal will occur, surveys should be conducted by an approved surveyor following the most recent version of the Range-wide Indiana Bat Summer Survey Guidelines (available at:
<http://www.fws.gov/northeast/virginiafield/endangered/about.html>) for the following species in the areas specified below within suitable habitat.
 - Indiana bat (*Myotis sodalis*): federally listed endangered. Potential habitat occurs in Giles, Montgomery, Roanoke, and Craig Counties.
 - Northern long-eared bat (*Myotis septentrionalis*) (NLEB): federally proposed endangered (effective May 2, 2015 this species will be federally listed threatened with an interim 4(d) rule). Potential habitat occurs in Franklin, Giles, Montgomery, Pittsylvania, Roanoke, and Craig Counties.
 - The proposed route intersects with Tawneys Cave in Giles County, a known hibernaculum for Indiana and Northern long-eared bats. We recommend a minimum 5 mile buffer from the known hibernaculum opening and any mapped passages.
 - Specific comments on the revised study plan dated March 6, 2015:
 - Page 4 – Per page B5 of the NLEB Interim Conference and Planning Guidance, revise the description as follows, “a field survey, where access can be obtained, of all land within one-half mile of the edge of the project footprint and documentation (i.e., literature search) of all known caves and abandoned mine portals within 3 miles of the outside edge of the project footprint should be conducted.”
 - Page 5 – Per page B6 of the NLEB Interim Conference and Planning Guidance, if you plan to conduct spring portal/cave surveys they must be conducted between April 1 and April 21 and prior to any tree clearing. A minimum of three nights of sampling per week for three weeks (i.e., 9

nights of sampling) is required at each suitable entrance as determined by the Phase 1 Habitat Assessment. Your study plan proposes two evenings of sampling. Fall portal/cave surveys can be conducted rather than spring surveys. Per page B5 of the NLEB Guidance, surveys must be conducted between September 1 and October 31 and prior to any tree clearing. A minimum of two nights of sampling is required at each suitable entrance as determined by the Phase 1 Habitat Assessment.

- Page 5 - Per page B6 of the NLEB Interim Conference and Planning Guidance, harp traps and/or mist nets should be monitored for captured bats on 10-minute intervals. Your study plan states “traps are checked at least once per hour or continuously if the catch rate is greater than 25 bats per hour.” Change your plan to reflect the NLEB Interim Guidance.
- Address and incorporate comments the Service provided on November 26, 2014 on the study plan dated November 3, 2014. Specifically comments: SH10, SH11, SH12, and SH13.

To assist us in analyzing effects to federally listed and proposed species from the proposed action, provide the following information to this office:

- For proposed stream crossings where federally listed species are present, provide us an analysis that outlines all alternatives considered for that crossing, how the determination was made that the selected alternative was the least environmentally damaging, an analysis of effects to the stream anticipated due to the pipeline approaches to each side of the stream, and the proposed schedule/timing of the crossing. If boring or drilling is proposed, provide a best professional opinion on the likelihood that drilling fluids will escape through the bedrock to the stream.

To avoid and minimize impacts to federally listed and proposed species, incorporate the following conservation measures into the proposed project:

- To address impacts to summer bat habitat (see Appendix D of the NLEB Interim Conference and Planning Guidance): leave dead or dying trees standing (if not a safety hazard), maintain or improve forest patches and forested connections (e.g., hedgerows, riparian corridors) between patches, clearly demarcate trees to be protected vs. cut to help ensure contractors do not accidentally remove more trees than anticipated, avoid/minimize tree clearing that fragments large forested areas or tree lined corridors (e.g., route linear features along the edge of a woodlot instead of through the middle).

We recommend that you contact Liz Stout (West Virginia Field Office) at 304-636-6586 or elizabeth_stout@fws.gov to coordinate the portions of the project in West Virginia.

Once the action area of the project is finalized, an additional review that includes all attendant facilities, staging areas, etc. will be necessary. If habitat assessments and/or surveys determine that suitable habitat for listed or proposed species are present, this office will work with you to ensure that the project avoids or minimizes adverse impact to listed species and their habitats.

If you have any questions, please contact Kim Smith at (804) 824-2410 or via email at kimberly_smith@fws.gov.

Sincerely,

Cindy Schulz
Field Supervisor
Virginia Ecological Services

cc: FERC, Washington, D.C. (Attn: Paul Friedman)
Service, Elkins, WV (Attn: Liz Stout)
VDCR-DNH, Richmond, VA (Attn: Rene Hypes)
VDGIF, Richmond, VA (Attn: Amy Ewing)



DIVISION OF NATURAL RESOURCES

Wildlife Resources Section

Operations Center

P.O. Box 67

Elkins, West Virginia 26241-3235

Telephone (304) 637-0245

Fax (304) 637-0250

Earl Ray Tomblin
Governor

Robert Fala
Director

April 6, 2015

Ms. Valerie Clarkson
Environmental Solutions & Innovations, Inc.
4525 Este Avenue
Cincinnati, OH 45232

Dear Ms. Clarkson:


We have reviewed our files for information on rare, threatened and endangered (RTE) species and sensitive habitats for the area of the proposed Mountain Valley Pipeline project in Braxton, Doddridge, Fayette, Greenbrier, Harrison, Lewis, Monroe, Nicholas, Summers, Upshur, Webster and Wetzel counties, WV.

We have no known records of any RTE species or sensitive habitats within the project area; however, there are several streams crossings which will require mussel surveys. These streams are Salem Fork, Sand Fork, Oil Creek, Little Kanawha River (endangered mussel stream), Elk River, Laurel Creek, Gauley River, Hominy Creek, Meadow River, Greenbrier River and Indian Creek. The Wildlife Resources Section knows of no surveys that have been conducted in the area for rare species or rare species habitat. Consequently, this response is based on information currently available and should not be considered a comprehensive survey of the area under review.

The information provided above is the product of a database search and retrieval. This information does not satisfy other consultation or permitting requirements for disturbances to the natural resources of the state, and further consultation may be required. Additionally, any concurrence requirements for federally listed species must come from the US Fish and Wildlife Service.

Thank you for your inquiry, and should you have any questions please feel free to contact me at the above number, or barbara.d.sargent@wv.gov. Enclosed please find an invoice.

Sincerely,


Barbara Sargent
Environmental Resources Specialist
Wildlife Diversity Unit

enclosure

S:\Monthly\Barb\Invoices\ESI.doc



United States Department of the Interior

FISH AND WILDLIFE SERVICE

West Virginia Field Office
694 Beverly Pike
Elkins, West Virginia 26241



April 23, 2015

Ms. Valerie Clarkston
Environmental Solutions & Innovations, Inc.
4525 Este Avenue
Cincinnati, Ohio 45232

Re: EQT Corporation and NextEra Energy, Inc., Mountain Valley Pipeline Project, Braxton, Doddridge, Fayette, Greenbrier, Harrison, Lewis, Monroe, Nicholas, Summers, Upshur, Webster, and Wetzel Counties, West Virginia

Dear Ms. Clarkston:

This responds to your request of October 13, 2014, for information regarding the potential occurrence of federally listed endangered and threatened species and their designated critical habitats. Mountain Valley Pipeline, LLC (MVP), a joint venture of EQT Production (EQT) and a subsidiary of NextEra Energy, Inc., proposes to construct the Mountain Valley Pipeline Project through portions of Braxton, Doddridge, Fayette, Greenbrier, Harrison, Lewis, Monroe, Nicholas, Summers, Upshur, Webster, and Wetzel counties, West Virginia and Craig, Franklin, Giles, Montgomery, Pittsylvania and Roanoke counties, Virginia. MVP has identified multiple potential routes, but the final alignment will be approximately 300 miles. The total length of all potential routes is approximately 386.93 miles (216.98 miles in West Virginia and 169.95 miles in Virginia). These comments are provided pursuant to the Endangered Species Act (ESA) (87 Stat. 884, as amended; 16 U.S.C. 1531 *et seq.*), the Bald and Golden Eagle Protection Act (BGEPA) (16 U.S.C. 668-668c, as amended), and the Migratory Bird Treaty Act (MBTA) (16 U.S.C. 703-712).

The U.S. Fish and Wildlife Service (Service) has determined that 7 federally listed endangered species and 3 federally listed threatened species, respectively, are known to occur within the West Virginia portion of the proposed project area, and may be affected by the construction and operation of the proposed project. These are the endangered Indiana bat (*Myotis sodalis*), Virginia big-eared bat (*Corynorhinus townsendii virginianus*), clubshell mussel (*Pleurobema clava*), snuffbox mussel (*Epioblasma triquetra*), James spiny mussel (*Pleurobema collina*), shale barren rock cress (*Arabis serotina*), running buffalo clover (*Trifolium stoloniferum*), and the

threatened northern long-eared bat (*Myotis septentrionalis*), small whorled pogonia (*Isotria medeoloides*), and Virginia spiraea (*Spiraea virginiana*). Information to avoid impacts to these species is provided below.

Endangered and Threatened Bats

Known and potential habitat for Indiana and northern long-eared bats occurs within the proposed project alignment. The proposed alignment passes through potential summer habitat for Indiana and northern long-eared bats in Lewis, Braxton, and Summers Counties. In addition, it passes through summer capture, maternity, and hibernacula known-use areas in portions of Doddridge, Fayette, Greenbrier, Harrison, Monroe, Nicholas, Webster, and Wetzel counties.

MVP has decided to perform summer habitat surveys for portions of the alignment that lie outside of known-use areas. An Indiana Bat/Northern Long-Eared Bat Conservation Plan (plan guidelines attached) will need to be completed for sections of the proposed alignment that fall within known-use areas.

The presence of caves and mine portals, and their use by bats, must also be addressed. Suitable winter habitat (hibernacula) for Indiana bats and northern long-eared bats include underground caves and cave-like structures (e.g. abandoned or active mines, railroad tunnels). There may be other landscape features being used by northern long-eared bats during the winter that have yet to be documented. Generally, both species hibernate between November 15 and March 31, use caves and areas near caves for fall-swarming activity, and male Indiana bats have been known to use caves and portals as summer roosts. Virginia big-eared bats use caves or mine portals during any time of the year. Mine portals used by this species are known to occur in Fayette County.

The proposed pipeline should be surveyed for caves and mine portals. This survey can be performed by mining engineers, other field personnel, or biologists with experience identifying caves or mines. The survey should include a review of topographic, mining, karst occurrence, and environmental resources information maps; as well as actual field reviews of the entire proposed project area. For linear projects (e.g., transmission lines, natural gas pipelines, highways, and access roads), the field survey should include lands buffering the disturbance footprint of the proposed linear project, extending to 0.6 mile (1 km) on each side of the outer edges of the footprint.

Any caves and portals found should be evaluated for characteristics that may indicate potential use by bats. A Phase I Cave/Mine Portal Survey Data Sheet should be completed for each opening found. This data sheet is enclosed and results should be compared against the criteria listed in the Draft Protocol for Assessing Abandoned Mines/Caves for Bat Use. The data obtained from the survey should be provided to the Service for review and agreement before any federal permits are issued for this project and before a final decision on any alignment is made.

Any caves and portals determined not to exhibit potential habitat for bats, based upon the criteria referenced above, will not require any further assessments for the presence of federally listed bat species. If caves and/or portals at the proposed site appear to have suitable bat habitat characteristics, mist net surveys or trapping may be recommended. Guidelines for conducting these surveys are provided in the Draft Protocol for Assessing Abandoned Mines/Caves for Bat Use. However, due to concerns about the potential for mist netting and trapping at caves or portals to exacerbate the spread of white nose syndrome, please contact this office for the most current recommendations and protocols prior to conducting these activities. The results of any surveys should be provided to this office for review and agreement before any federal permits are issued for this project and before a final decision on any alignment is made. If federally listed bats are found using caves or portals in the project area, further consultation will be necessary.

It should be noted that adverse impacts to caves or mine portals that are used by endangered bat species may result in violation of section 9 of the ESA. Caves may also contain other sensitive species, and activities that may adversely affect cave passages and openings should generally be avoided to the maximum extent practicable.

No tree clearing on any portion of the project area should occur until consultation under section 7 of the ESA, between the Service and the Federal Energy Regulatory Commission (FERC), is completed. The Service needs to review the results of the habitat evaluations, mist net surveys, and the proposed conservation plan before making a determination on bat species.

Freshwater Mussels

The project proposes to cross Leading Creek and the Little Kanawha River, which support clubshell and snuffbox mussels, and to cross the South Fork of Potts Creek, which supports the James spinymussel.

The Service highly recommends that MVP select the route that does not cross the South Fork of Potts Creek. The South Fork of Potts Creek is a highly sensitive stream containing the only known population of the federally endangered James spinymussel in the state. This watershed should be avoided in its entirety if at all possible. If it cannot be avoided then justification for selecting that route needs to be provided and efforts to minimize impacts must be developed.

The Service highly recommends crossing Leading Creek and the Little Kanawha River via Horizontal Directional Drill methods (HDD) to avoid impacts to federally listed mussels. If open trench crossings are proposed, the Service will need explanation as to why an HDD crossing of these streams is infeasible as outlined in an HDD feasibility analysis that should be completed by an engineer.

If the South Fork of Potts Creek cannot be avoided and HDD cannot be used on Leading Creek and the Little Kanawha River, then additional coordination with our office will be needed and mussel surveys will need to be completed for the proposed crossing locations.

The Service is also concerned that construction activities for the proposed project could result in erosion, surface run-off, or subsequent introduction of sediment and/or pollutants into Leading Creek, the Little Kanawha River, and the South Fork of Potts Creek, potentially impacting the mussels, their habitat, and fish-host species. Therefore, the Service recommends the following measures be taken to address potential erosion and sedimentation issues at these locations: (1) Construct and install sediment barriers, catch basins, or implement other available methods to ensure that erosion and sedimentation resulting from construction of this project are minimized to the extent practicable; (2) Implement additional Best Management Practices to avoid any indirect impacts to the mussels downstream of the proposed project. These include minimizing vegetation-clearing, mulching and seeding disturbed areas immediately after completing each incremental stage of construction or within one day of a stop in operations, and revegetating any disturbed areas with native, non-invasive plant species; (3) Immediately notify this office if any deviations from the submitted project plans are anticipated, or if any significant erosion-control or sedimentation problems occur during construction of the project.

Plants

Potentially suitable habitat for running buffalo clover occurs within the proposed project alignment in Fayette, Greenbrier and Webster counties. Running buffalo clover occurs in mesic habitats of partial to filtered sunlight, where there is a prolonged pattern of moderate periodic disturbance, such as mowing, trampling, or grazing. It is most often found in regions underlain with limestone or other calcareous bedrock. In West Virginia, running buffalo clover seems to prefer old logging roads, off-road vehicle (ORV) trails, hawthorne thickets, grazed woodlands, jeep trails, railroad grades, game trails, and old fields succeeding to mesic woodlands. The Service recommends that surveys for running buffalo clover be completed along the proposed pipeline alignment prior to any construction.

Potentially suitable habitat for Virginia spiraea occurs along the Greenbrier, Gauley, Meadow River, Marsh Fork River, and the New River. Virginia spiraea is found along scoured banks of high gradient streams or on meander scrolls, point bars, natural levees, and braided features of lower stream reaches. We recommend that surveys for Virginia spiraea be conducted where the proposed alignment crosses the Greenbrier, Gauley, and Meadow Rivers.

Populations of the small whorled pogonia are known to occur in Greenbrier County. This species prefers to grow in upland mixed deciduous forest containing little to no understory clutter. We recommend that surveys for small whorled pogonia be completed in areas of Greenbrier County where suitable habitat is present.

Potentially suitable habitat for shale barren rock cress occurs in Greenbrier County. This plant occurs only in West Virginia and Virginia and is found on mid-Appalachian shale barrens of the Ridge and Valley Province of the Appalachian Mountains. The Service recommends that surveys for small whorled pogonia be completed in areas of Greenbrier County where suitable habitat is present.

Surveys for these species must be done during time periods when species are visible on the landscape, as listed in the attached Survey Periods for West Virginia's Federally Listed Plant Species. A list of approved Threatened and Endangered Plant Surveyors is also attached.

A survey report that summarizes the results of these surveys should be submitted to the Service for review and agreement before any federal permits are issued for this project and before a final decision on any alignment is made. If any federally listed species are found these populations should be avoided, and further coordination with this office will be required to develop measures that will avoid and minimize any potential impacts to these plants.

Bald and Golden Eagles

Bald and golden eagles receive Federal protection under the BGEPA and the MBTA. They are listed by the Service as Birds of Conservation Concern in the Appalachian Mountains Bird Conservation Region, within which the proposed project occurs.

The BGEPA provides for the protection of bald eagles and golden eagles by prohibiting, except under certain specified conditions, the taking, possession, and commerce of such birds. BGEPA prohibits anyone, without a permit issued by the Secretary of the Interior, from taking bald and golden eagles, including their parts, nests, or eggs. The BGEPA defines "take" as "pursue, shoot, shoot at, poison, wound, kill, capture, trap, collect, molest, or disturb." BGEPA provides civil and criminal penalties for persons who violate the law or regulations.

Under 50 Code of Federal Regulations (CFR) § 22.3, disturb is defined as "to agitate or bother a bald or golden eagle to a degree that causes, or is likely to cause, based on the best scientific information available: 1) injury to an eagle; 2) a decrease in its productivity, by substantially interfering with normal breeding, feeding, or sheltering behavior; or 3) nest abandonment, by substantially interfering with normal breeding, feeding, or sheltering behavior." The BGEPA's definition of disturb also addresses effects associated with human induced alterations at the site of a previously used nest during a time when eagles are not present. Upon an eagle's return, if such alterations agitate or bother an eagle to a degree that interferes with or interrupts normal breeding, feeding, or sheltering habits, and causes injury, death or nest abandonment, then this would constitute disturbance.

The Service recommends performing an assessment as to how this proposed project may affect bald and golden eagles. Although there are no known nests within 10 miles of the proposed right-of-way, additional surveys will need to be completed for bald eagles, which have been sighted more frequently in the area in recent years and are known to nest and migrate through West Virginia. Based on personal communications with Dr. Todd Katzner of West Virginia University, golden eagles are known to use the area for migration and winter habitat. Dr. Katzner and his team have tracked eagles through this area with radio telemetry. The results of these surveys will

assist us in developing recommendations to avoid and minimize, to the extent practicable, effects to bald and golden eagles. Our goal is to work with project proponents to develop measures which avoid the need for eagle permits.

The Service recommends evaluating the project area for potential impacts to eagle habitat (i.e., bald eagle nests, bald and golden eagle roosts). If bald eagles are found during this assessment, please refer to the National Bald Eagle Management Guidelines which can be viewed at the following link:

<http://www.fws.gov/northeast/ecologicalservices/pdf/NationalBaldEagleManagementGuidelines.pdf>

Migratory Birds

The MBTA implements protection of all native migratory game and non-game birds with exceptions for the control of species that cause damage to agricultural or other interests. According to 50 CFR § 10.12, a migratory bird means any bird, whatever its origin and whether or not raised in captivity, which belongs to a species listed in the Service's regulations, or which is a mutation or a hybrid of any such species, including any part, nest, or egg of any such bird, or any product, whether or not manufactured, which consists, or is composed in whole or part, of any such bird or any part, nest, or egg thereof. In total, 836 bird species are protected by the MBTA. For a complete list of birds protected by the MBTA visit this link

<http://www.fws.gov/migratorybirds/regulationspolicies/mbta/MBTANDX.HTML> .

The MBTA prohibits the take of any migratory bird, part, nest, egg or product. Take, as defined in the MBTA, includes by any means or in any manner any attempt at hunting, pursuing, wounding, killing, possessing, or transporting any migratory bird, nest, egg, or part thereof.

The MBTA does not explicitly include provisions for permits to authorize incidental take of migratory birds. While it is not possible to absolve individuals or companies from MBTA or the BGEPA liability, the Service's Office of Law Enforcement focuses its resources on investigating and prosecuting those who take migratory birds without identifying and implementing reasonable and effective measures to avoid take. The Service will regard a company's coordination and communication with the Service, as appropriate means of identifying and implementing reasonable and effective measures to avoid the take of species protected under the MBTA and BGEPA.

As such, the potential exists for avian mortality from habitat destruction and alteration within the project boundaries. Site-specific factors that should be considered in project siting to avoid and minimize risks to birds include avian abundance; the quality, quantity and type of habitat; geographic location; type and extent of bird use (e.g. breeding, foraging, migrating, etc.); and landscape features. We recommend minimization of land and vegetation disturbance during project design and construction and that all new activities be constrained to previously disturbed areas wherever possible (e.g., road and utility line rights-of-way, agricultural fields, previously mined areas, etc.).

Ms. Valerie Clarkston
April 23, 2015

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We offer the following additional recommendations to avoid and minimize impacts to migratory birds within and around the project area:

1. Due to the difficulty in assessing the entire project site for all bird nests, we recommend that the clearing of natural or semi-natural habitats (e.g., forests, woodlots, reverting fields, fencerows, shrubby areas) be carried out between September 1 and March 31, which is outside the nesting season for most native bird species. Without undertaking specific analysis of breeding species and their respective nesting seasons on the project site, implementation of this seasonal restriction will avoid direct take of most breeding birds, their nests, and their young (*i.e.*, eggs, hatchlings).
2. To conserve area-sensitive species, avoid fragmenting large, contiguous tracts of wildlife habitat, especially if habitat cannot be fully restored after construction. Maintain contiguous habitat corridors to facilitate dispersal. Where practicable, concentrate construction activities, infrastructure, and man-made structures (e.g., roads, parking lots, staging areas) on lands already altered or cultivated, and away from areas of intact and healthy native habitats. If not convenient, site construction activities and structures in fragmented or degraded habitats over relatively intact areas.
3. To reduce habitat fragmentation, co-locate roads, lay down areas, staging areas, and other infrastructure in or immediately adjacent to already-disturbed areas (e.g., existing roads, pipelines, agricultural fields). Where this is not possible, minimize roads and other infrastructure. To minimize habitat loss and fragmentation, cluster development features (e.g., lay down areas, staging areas, roads) where possible rather than distributing infrastructure broadly across the landscape.

Summary

When the additional information regarding listed species as requested above is provided, the Service will be able to provide further information on our determination of effects to Service trust resources. If you have any questions regarding this letter, please contact Tiernan Lennon of my staff at (304) 636-6586, Ext. 12, or tiernan_lennon@fws.gov, or at the letterhead address.

Sincerely,



John E. Schmidt
Field Supervisor

Ms. Valerie Clarkston
April 23, 2015

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Enclosures

Phase I Cave/Mine Portal Survey Data Sheet

Draft Protocol for Assessing Abandoned Mines/Caves for Bat Use

T&E Plant Surveyors

Survey Periods for West Virginia's Federally Listed Plant Species

Ms. Valerie Clarkston
April 23, 2015

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cc:

WVDNR –Janet Clayton

WVDNR – PJ Harmon

VAFO – Troy Andersen

FERC – www.ferc.gov

Project File

Reader File

ES:WVFO:TLennon:skd:4/23/2015

Filename: P:\Finalized Correspondence\T&E Requests\2015\April\Mountain Valley
Pipeline.doc



TELEPHONE / PERSONAL CONVERSATION REPORT

PROJECT NAME:	Mountain Valley Pipeline Project
MVP TEAM CALLER:	Valerie Clarkston
CONVERSATION WITH:	Tiernan Lennon
AGENCY:	USFWS Elkins Field Office
EMAIL ADDRESS:	Tiernan_Lennon@fws.gov
PHONE NUMBER:	304-636-6586
SUBJECT:	Eagle Surveys & NLEB
DATE AND TIME:	5/5/2015 at 3 PM

SUMMARY OF CONVERSATION:

Tiernan was returning Valerie's call regarding additional surveys for bald and golden eagles in WV. Tiernan indicated that additional surveys for eagles would not need to occur along the entire length of the Project in WV, but would need to be focused within eagle nest buffers recently developed by Liz Stout. Tiernan stated these buffers are not yet ready for release, but she expects them to be distributed to interested parties in the near future. Based on a physical map of these buffers and the counties crossed by MVP, Tiernan indicated surveys for eagle nests will likely be limited to Greenbrier, Summers, and Monroe counties – especially in areas the Projects intersects major river systems.

During the phone conversation, Tiernan forwarded Valerie the link to the USFWS Bald Eagle Management Guidelines and Conservation Measures (<http://www.fws.gov/northeast/ecologicalservices/eagleguidelines/constructionnesting.html>) and asked that these be used in the event that nests or eagles are documented within the Project area.

Since she had Tiernan on the line, Valerie asked how many NLEBs per mile USFWS is requiring to be radio-tagged and tracked. Tiernan indicated that the unofficial amount would be 2 bats for every 3 miles with preference given to females. Valerie asked if mist net KM blocks could be eliminated during the summer if they fall within 1.5 miles of a newly documented NLEB roost. Tiernan replied and said yes since the area within 1.5 miles of a roost would be considered known habitat, there would be no need to mist net. Instead, a detailed habitat assessment and subsequent conservation plan would need to be completed and submitted.

Contact Signature: _____

Valerie Clarkston

Subject: FW: Mountain Valley Pipeline - Eagle Nest Surveys

From: Valerie Clarkston
Sent: Tuesday, November 03, 2015 8:54 AM
To: Lennon, Tiernan
Cc: Daniel Judy; Taina Pankiewicz; mneylon@egt.com; Sean.Sparks@tetrattech.com
Subject: Re: Mountain Valley Pipeline - Eagle Nest Surveys

Thanks. The New River is not crossed by this project.

Valerie Clarkston
Scientist
Environmental Solutions & Innovations, Inc.
4525 Este Avenue
Cincinnati, Ohio 45232
Cell: (513-382-0925)
Office: (513-451-1777)

On Nov 3, 2015, at 8:25 AM, Lennon, Tiernan <tiernan_lennon@fws.gov> wrote:

Yes, that sounds good. The New River isn't being crossed for this project is it?

On Mon, Nov 2, 2015 at 8:26 AM, Valerie Clarkston <VClarkston@envsi.com> wrote:

Hi Tiernan,

Can you please confirm that you concur with the proposed survey methods discussed below?

Thank you,

Valerie

From: Valerie Clarkston
Sent: Tuesday, October 13, 2015 8:54 AM
To: Lennon, Tiernan (tiernan_lennon@fws.gov)
Cc: mneylon@egt.com; Sparks, Sean; Taina Pankiewicz; Daniel Judy
Subject: Mountain Valley Pipeline - Eagle Nest Surveys

Hi Tiernan,

Based on discussions during the 9/10/2015 meeting and our phone conversation from earlier this spring (attached), I have identified the following major river systems crossed by MVP and which necessitate surveys for bald eagle nests:

- Meadow River

- Greenbrier River
- Indian Creek

Searches are scheduled during leaf-off (late October through November) to increase nest detectability. According to the National Bald Eagle Management Guidelines, "Nest sites typically include at least one perch with a clear view of the water where eagles usually forage". Thus, searches for eagle nests will extend perpendicularly away from the river to points on the landscape (i.e., nearest ridge top) where the river is assumed to no longer be visible. The width of the survey corridor will be 300 feet, but biologists will use binoculars to scan areas extending beyond the corridor. All nests located within the survey corridor will be photographed and GPS coordinates recorded. If land access is granted, biologists will GPS and photograph nests occurring outside of the designated survey corridor. Results will be summarized in a report and submitted to your office for review.

Please advise if you concur with these proposed methods and survey areas or request that major river systems in other counties be included in this effort.

Thanks,

Valerie



TELEPHONE / PERSONAL CONVERSATION REPORT

PROJECT NAME:	Mountain Valley Pipeline Project
MVP TEAM CALLER:	Valerie Clarkston
CONVERSATION WITH:	Sergio Harding
AGENCY:	Virginia Department of Game and Inland Fisheries
EMAIL ADDRESS:	Sergio.Harding@dgif.virginia.gov
PHONE NUMBER:	804-367-0143
SUBJECT:	Loggerhead Shrikes
DATE AND TIME:	4/27/2015 at 11 AM

SUMMARY OF CONVERSATION:

Sergio was returning Valerie's call and email regarding guidance on loggerhead shrike surveys within the Project area. He indicated Ernie Aschenbach would be providing an email with more details, but wanted to give a brief summary in the meantime.

Sergio indicated that following Time of Year Restrictions (TOYR) is the preferred option VDGIF likes to see in terms of avoiding impacts to migratory birds such as loggerhead shrikes. If MVP agrees to TOYR, then surveys for loggerhead shrikes would not be required.

If TOYR are not feasible for the Project, then VDGIF normally requests that habitat assessments be conducted for loggerhead shrikes. For this Project, habitat assessments would need to be conducted in Craig, Montgomery, and Roanoke (north of Spring Hollow) counties. If suitable habitat is not found, then TOYR are not necessary for loggerhead shrikes. If suitable habitat exists, then VDGIF would request MVP to follow TOYR within that suitable habitat.

If TOYR are still not feasible, then VDGIF would ask MVP to conduct presence/absence surveys for loggerhead shrikes within all identified suitable habitat. These would be point-count surveys and VDGIF recommends playback calls.

Sergio indicated the specifics of their survey protocol for loggerhead shrikes will be provided in a follow-up email from Ernie.

Contact Signature:

A handwritten signature in blue ink that reads "Valerie Clarkston". The signature is written over a horizontal line that spans the width of the signature area.

Valerie Clarkston

From: ProjectReview (DGIF) <ProjectReview@dgif.virginia.gov>
Sent: Monday, May 11, 2015 4:19 PM
To: Valerie Clarkston
Cc: ProjectReview (DGIF); Harding, Sergio (DGIF); Dressler, Shirl (DGIF)
Subject: ESSLog 35246 Mountain Valley Pipeline avian survey protocol for ST loggerhead shrike...

Importance: High



Valerie Clarkston
Scientist

Environmental Solutions & Innovations, Inc.
4525 Este Avenue | Cincinnati, Ohio 45232 | USA
office: 513.451.1777 **direct:** 513.591.4315
fax: 513.451.3321 **cell:** 513.382.0925
vclarkston@envsi.com |

Per your request, we have provided the attached guidance pertaining to avian surveys for the state Threatened (ST) loggerhead shrike, known from the above-referenced project region. Please note, since avian surveys are “visual” (e.g., handling birds is not proposed) a DGIF collection permit is not required.

We reiterate that according to our records, the (ST) loggerhead shrike has been documented from the project area. This species is known to inhabit open country with scattered trees and shrubs. Typical breeding habitat includes closely grazed pastures with fencerows of shrubs and trees, as well as scattered shrubs and trees. In Virginia, eastern red cedars and hawthorns are often used as nest trees (along with Osage orange, multiflora rose, black walnut, locust and other densely foliated woody species, commonly adjacent to open habitats). We often find this species to inhabit agricultural areas. It appears that this type of habitat is found at the project site.

To clarify & serve as an intro to DGIF survey protocol that the customary “hierarchy” of our recommendations for avoiding and minimizing impacts to this avian species is:

- 1) Time of Year Restriction (TOYR): Our primary concern is to avoid disrupting breeding activities during construction work. The customary TOYR recommendation is to avoid clearing & tree removal from 1-April through 31-July of any given year.
- 2) Habitat assessment (Sergio has already helped identify potentially suitable habitat at the county level): If the applicant is unable to adhere to this TOYR recommendation, we typically recommend that a habitat assessment be performed for this species within the sections of the project site falling within **Montgomery County, Craig County and Roanoke County (north of Spring Hollow Reservoir)**. The assessment should include any area to be potentially altered or disturbed by construction, including the 125 foot construction right of way (ROW) and any access roads. The assessment area should be broadened to include areas where potential access roads may be placed, if such roads have not yet been designated due to the project still being in the preliminary planning phase.

If appropriate habitat is found on site, we recommend that a qualified biologist conduct surveys to determine the presence or absence of nesting shrikes. Ideally this would be a person with prior field experience with loggerhead shrike. We would also appreciate the opportunity to review the qualifications of biologists being considered for surveys prior to these surveys being conducted. Contact Sergio, as needed to discuss.

- 3) Surveys of areas where suitable habitat has been identified: Depending on survey report info – if shrikes are present, we would typically recommend adherence to the protective Time of Year Restriction (TOYR). Whereas, if shrikes are not present, then we would typically NOT recommend adherence to a TOYR.

We recommend the following survey protocol:

The surveys should be conducted between April 1 and July 31 (preferably by mid-July). In Virginia, shrikes nest in April and may re-nest following nest failure, or start a second nest, in late May/early June. If no shrikes are documented at the site during initial survey efforts, the survey should be repeated roughly two weeks later. If no shrikes are documented during this second survey, then a last survey is needed, also to be performed roughly two weeks later. Weather conditions should be dry with a wind of less than 10 mph. Surveys should be completed between dawn and 10 am. Areas that provide suitable nesting and/or foraging habitat for the species should be surveyed. During the surveys, the biologist should traverse the entire area slowly on foot, paying particular attention to perching structures and investigating potential sightings or vocalizations of loggerhead shrikes where detected. All potential perches (utility lines, fence lines, dead branches of live trees, stalks of robust herbaceous plants [ex. *Mullein*], brush piles, and the outer branches of shrubs and saplings) should be scanned with binoculars or spotting scope for perched shrikes. In addition to stopping periodically to scan, listen and watch for shrikes, the biologist should use vocalization playback* to increase the probability of detecting shrikes at occupied sites. All potential nesting trees and shrubs should be inspected for shrike presence. The location of any shrikes encountered should be recorded on a map of the area. In addition, fences and thorny trees and shrubs at the site should be examined for the presence of impaled prey items, which may include insects and small vertebrates.

* We recommend using a portable cassette, cd or mp3 player with portable speakers to broadcast playback. Playback should be delivered at a volume where a human observer could recognize the call at >250 meters under windless conditions. This should be tested in advance to determine appropriate volume but generally will mean that playback should be broadcast as loudly as possible without distortion. If possible, volume should be increased if survey conditions are windy. During playback, the speaker should be rotated so that sound would be broadcast towards all possible nesting or perching habitat. We recommend using playback during the "scanning" period described above and that it be performed at least once in every survey patch. It may be necessary to use playback more than one time over larger patches, roughly every 250 meters. A playback sound file consisting of 20 seconds each of song, begging and alarm vocalizations, each separated by one minute of silence, is available upon request.

Please call Sergio or me if you have further questions. Thanks again for your patience...

ERNIE

Ernie Aschenbach
Environmental Services Biologist
Virginia Dept. of Game and Inland Fisheries
~~P.O. Box 11104—~~
~~4010 West Broad Street~~
~~Richmond, VA 23230~~
~~FAX: (804) 367-2427~~
Phone: (804) 367-2733
Email: Ernie.Aschenbach@dgif.virginia.gov

We moved! Our new address is:

Physical
7870 Villa Park Dr, Suite 400
Henrico, VA 23233-6510

Mailing
P O Box 90778

Daniel Judy

From: Harding, Sergio (DGIF) <Sergio.Harding@dgif.virginia.gov>
Sent: Thursday, September 03, 2015 5:37 PM
To: Valerie Clarkston
Cc: Daniel Judy; Aschenbach, Ernie (DGIF)
Subject: RE: Peregrine Falcon activity near Ripplemead?

No confirmation of nesting or of a breeding pair. Only one individual was ever seen at one time, so we think it was likely an unpaired bird. More monitoring will take place at the site in 2016 with the hope that a pair will form.

From: Valerie Clarkston [mailto:VClarkston@envsi.com]
Sent: Thursday, September 03, 2015 5:35 PM
To: Harding, Sergio (DGIF)
Cc: Daniel Judy; Aschenbach, Ernie (DGIF)
Subject: Re: Peregrine Falcon activity near Ripplemead?

Thanks for your quick response and those details. Could they confirm that it was actually nesting? Or based on the frequency of sightings, do you assume it had a nest nearby?

Valerie Clarkston
Scientist
Environmental Solutions & Innovations, Inc.
4525 Este Avenue
Cincinnati, Ohio 45232
Cell: (513-382-0925)
Office: (513-451-1777)

On Sep 3, 2015, at 5:32 PM, Harding, Sergio (DGIF) <Sergio.Harding@dgif.virginia.gov> wrote:

Sorry, I meant 'A falcon, presumably the same bird, was also seen further downriver (~ 400 m upriver from [REDACTED]) on 3/31.'

From: Harding, Sergio (DGIF)
Sent: Thursday, September 03, 2015 5:17 PM
To: 'Valerie Clarkston'
Cc: Daniel Judy; Aschenbach, Ernie (DGIF)
Subject: RE: Peregrine Falcon activity near Ripplemead?

Hi Valerie,
Yes, we contracted with the Conservation Management Institute at Virginia Tech for peregrine falcon surveys in 2015 and they documented an adult falcon on 3 separate dates (3/31, 4/9, and 5/15) in the vicinity of a cliff face ([REDACTED]) along the New River, west of Ripplemead in Giles County. A falcon, presumably the same bird, was also seen further upriver (~ 400 m upriver from [REDACTED]) on 3/31.

Sergio

Sergio Harding | Nongame Bird Conservation Biologist | Virginia Department of Game and Inland Fisheries | 7870 Villa Park Dr, Suite 400, Henrico, VA 23228 | 804-367-0143 | www.dgif.virginia.gov | www.vabci.org

From: Valerie Clarkston [<mailto:VClarkston@envsi.com>]
Sent: Thursday, September 03, 2015 4:52 PM
To: Harding, Sergio (DGIF)
Cc: Daniel Judy; Aschenbach, Ernie (DGIF)
Subject: Peregrine Falcon activity near Ripplemead?

Hi Sergio,

I am hoping you can shed some light on a comment from the USFS on the Mountain Valley Pipeline's Resource Report 3 submitted to FERC back in the spring. The exact comment is as follows:

"Section 3.4.4 should include Peregrine falcons. Peregrine falcons are known to breed in eastern West Virginia and western Virginia. Recently verified peregrine falcon activity has been documented in spring 2015 in Ripplemeade, near the current proposed route. VDGI's avian biologist should be consulted for more specific information."

Do you have any idea about what they are referring to? If so, could I have more details so as to include this info within the next submission of this report?

Thanks,

Valerie

|
—<image001.jpg> **Valerie Clarkston**
Scientist
Environmental Solutions & Innovations, Inc.
4525 Este Avenue | Cincinnati, Ohio 45232 | USA
office: 513.451.1777 **direct:** 513.591.4315
fax: 513.451.3321 **cell:** 513.382.0925
vclarkston@envsi.com | www



TELEPHONE / PERSONAL CONVERSATION REPORT

PROJECT NAME:	Mountain Valley Pipeline Project
MVP TEAM CALLER:	Daniel Judy
CONVERSATION WITH:	Jesse Overcash
AGENCY:	USFS – Jefferson National Forest
EMAIL ADDRESS:	jovercash@fs.fed.us
PHONE NUMBER:	540.552.4641
SUBJECT:	OAR Table Review
DATE AND TIME:	7 April 2015 / 9:30 am

SUMMARY OF CONVERSATION:

After speaking last week regarding species surveys on Jefferson National Forest land with respect to the Biological Evaluation, Mr. Overcash reviewed the preliminary OAR Table (Sensitive USFS species) for the MVP project. Mr. Overcash provided an overview of each species and provided additional contacts to obtain more information. He indicated that based on preliminary review, avian species are unlikely to be an issue on JNF land. He also indicated that some species, such as Peter's Mountain-mallow, should be addressed to some extent even if they are not directly impacted by the alignment. For example, the nearest population of this plant is approximately 3 miles from the proposed alignment; however, public sensitivity will create an issue if we just write it off as being outside the project area. He stated Fred Huber (botanist and TES Program Manager) can provide more information. Additionally, he stated that they will be able to provide more detailed information once the official review has kicked off. He also mentioned the meeting with MVP on Wednesday, 7 April 2015 and recommended (not required) a meeting between the USFS and ESI regarding preparation of the biological evaluation and species surveys on JNF land.

Contact Signature: _____

A handwritten signature in black ink, appearing to be 'J. Judy', is written over a horizontal line.

From: Taina Pankiewicz
Sent: Monday, June 29, 2015 4:36 PM
To: Harding, Sergio (DGIF); ProjectReview (DGIF)
Cc: Valerie Clarkston; Daniel Judy
Subject: RE: Loggerhead Shrike Habitat Assessment for MVP

Hi Sergio,

We appreciate your feedback on our proposed Study Plan. We will incorporate all the revisions you have requested to our survey effort. We will also formalize this adoption by submission of a revised Study Plan for the habitat assessments in the next few days.

We understand that presence/absence surveys are required if the project is unable to comply with time of year restrictions. However, there are a variety of other environmental concerns that the project must address which have time of year restrictions, including but not limited to bats. For this reason, at this time, it is our intention to complete only a preliminary habitat screening. Then, depending on how various project aspects evolve, if potentially suitable habitat exists in areas where the project cannot meet time of year restrictions, presence/absence surveys will be conducted, according to the protocol, in spring 2016.

So, that all said, we have one point of inquiry. In your email, you mention "area searches". However the protocol for presence/absence surveys requests point count and playback surveys. Is your request for area searches related to presence/absence surveys or did you intend for that to be incorporated into the habitat assessment efforts?

Thank you much for your time and feedback!

Taina

From: Harding, Sergio (DGIF) [mailto:Sergio.Harding@dgif.virginia.gov]
Sent: Thursday, June 18, 2015 9:55 AM
To: Taina Pankiewicz; ProjectReview (DGIF)
Cc: Valerie Clarkston; Daniel Judy
Subject: RE: Loggerhead Shrike Habitat Assessment for MVP

Hello Taina,

I have reviewed the study plan and have the following comments:

- 1) I reviewed the maps of the proposed habitat assessments (Appendix B) and agree that you have correctly identified all open areas that merit investigation. If you are comfortable doing so, you should be able to more closely look at the aerial imagery for these identified open areas to determine whether shrubs that may be used for nesting are found within the pipeline corridor or within the vicinity of the pipeline corridor (~100 ft buffer on either side of the corridor). If shrubs are absent, on-the-ground habitat assessments are not necessary.
- 2) If shrike occupancy surveys are to be conducted at any of the sites where habitat assessments will be taking place, it is strongly recommended that such surveys be conducted as area searches as detailed in Appendix C, rather than as point counts as referenced in Appendix A (Telephone/Personal Conversation Report)
- 3) While I appreciate the literature reviews that led to the shrike habitat descriptions in the study plan, I will warn that shrikes can be found in a variety of contexts across their broader breeding range. As such, the **values** associated with the parameters specified in the study plan are not necessarily what you may find characterizing

shrike breeding habitat in Virginia. For a number of these parameters, these values have in fact not been determined for shrike breeding habitat in Virginia. I concur with your approach of visually estimating these various parameters (Appendix D) and reporting this information to us, along with your assessment of whether suitable habitat is present at a particular site. However, I disagree with the approach outlined in Appendix D of ceasing the habitat assessment at any particular site if certain threshold values are or are not met for the following parameters: herbaceous cover, bare ground/developed, perches within 50 ft of the survey area, mowing, and grazing. I do agree that a lack of trees, shrubs or perches contributes to unsuitability of a site for breeding and/or foraging.

- 4) Grass height: mowing and grazing to maintain bare ground/low grass height are considered conducive to shrike use of a site for breeding/foraging, such that I disagree with categorizing a site as unsuitable based on evidence of these activities
- 5) Grass height: for sites that are not mowed/grazed throughout the breeding season, grass height may be higher than what is ideally used by shrikes, especially if the site is surveyed later in the season. Shrikes may initially select a site for breeding early in the season on the basis of grass height (among other factors), and may have to contend with taller than ideal grasses as the breeding season progresses. Therefore, while grass height should be described for each site, the presence of tall grasses alone should not necessarily lead to the conclusion that the site is unsuitable for shrikes.
- 6) Survey areas: for each site to be surveyed, I recommend that the parameters listed in Appendix D be estimating within 1) the proposed pipeline corridor, and **separately** for 2) a buffer area around the pipeline corridor. For 2, the easiest approach would be estimating the parameters within line of sight from the pipeline corridor while standing within the corridor. If the topography is such that the line of sight is < 100 ft on either side of the corridor (ex. hilly terrain impeding view), I recommend that the hill/slope be climbed to offer a vantage point from which the visual parameter estimation may be better conducted.
- 7) Territory size: minimum area requirements have not been established for breeding shrikes in Virginia; therefore, I recommend disregarding the 10 acre minimum cited on p. 4 of the study plan
- 8) We agree that reference photos taken at each site where a habitat assessment is conducted are valuable and will help us in our evaluation of your results
- 9) In addition to the parameters listed in the data sheet, I recommend capturing the following information during the habitat assessments:
 - a. General land use description as row crop, pasture, development, other (specify)
 - b. Presence of the following potential nesting shrubs/trees, regardless of how dominant they are at a site: red cedar, locust, hawthorn, osage orange

If you have any questions or want to discuss, feel free to contact me at 804-350-6255. Thanks.

Sergio

Sergio Harding | Nongame Bird Conservation Biologist | Virginia Department of Game and Inland Fisheries | 7870 Villa Park Dr, Suite 400, Henrico, VA 23228 | 804-367-0143 | www.dgif.virginia.gov | www.vabci.org

From: Taina Pankiewicz [<mailto:TPankiewicz@envsi.com>]

Sent: Wednesday, June 17, 2015 1:25 PM

To: Aschenbach, Ernie (DGIF); Harding, Sergio (DGIF)

Cc: Valerie Clarkston; Daniel Judy

Subject: RE: Loggerhead Shrike Habitat Assessment for MVP

Ernie,

There are parcels for which MVP has obtained legal right of entry, on which we must conduct surveys during a specific time window. Those survey windows are starting within the next week or so. I know you are busy; we would be very grateful if you could pass us any comments that you have on our study plan as soon as possible.

Thank you,

T

From: Taina Pankiewicz
Sent: Friday, June 05, 2015 1:31 PM
To: Ernie.Aschenbach@dgif.virginia.gov; 'Sergio.Harding@dgif.virginia.gov'
Cc: Valerie Clarkston; Daniel Judy
Subject: Loggerhead Shrike Habitat Assessment for MVP

Hey Ernie,

Just checking in to confirm that you received the hardcopy of the Study Plan for loggerhead shrike habitat assessments?

T



Taina Pankiewicz

President, COO

Environmental Solutions & Innovations, Inc.
4525 Este Avenue | Cincinnati, OH 45232 | USA
office: 513.451.1777 **direct:** 513.591.4311
fax: 513.451.3321 **cell:** 513.910.1676
tpankiewicz@envsi.com | www

Daniel Judy

From: Overcash, Karen B -FS <kovercash@fs.fed.us>
Sent: Thursday, August 06, 2015 8:50 AM
To: Daniel Judy; Neylon, Megan (MNeylon@eqt.com)
Cc: Adams, Jennifer - FS
Subject: MVP Locally Rare List
Attachments: LOCALLY_RARE_List_MVP.xlsx

Follow Up Flag: Follow up
Flag Status: Completed

Good morning Daniel and Megan,

Here is the pared down list of species that should be pertinent to the MVP routes. Just let me know if there are any questions. Thanks, Karen



Karen Overcash
Acting Natural Resources Group Staff Officer

Forest Service
George Washington and Jefferson National Forests

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f: 540-265-5145

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5162 Valleypointe Parkway

Roanoke, VA 24019

www.fs.fed.us



Caring for the land and serving people

From: Croy, Carol H -FS
Sent: Wednesday, August 05, 2015 5:08 PM
To: Overcash, Karen B -FS; Kirk, Dawn -FS; Huber, Fred -FS; Croy, Steve -FS
Cc: Landgraf, Kenneth -FS; Overcash, Jesse L -FS
Subject: MVP Locally Rare List

Hey there, Dawn, Fred and I went through the list and provided the ones we thought they should look for in the proposed route areas. Worksheet 2 has the complete list for comparison. Thanks!

Carol



Carol Croy, PhD
Forest Wildlife Biologist

Forest Service
George Washington and Jefferson National Forests

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Caring for the land and serving people

Valerie Clarkston

Subject: FW: Mountain Valley Pipeline - Eagle Nest Surveys

From: Valerie Clarkston
Sent: Tuesday, November 03, 2015 8:54 AM
To: Lennon, Tiernan
Cc: Daniel Judy; Taina Pankiewicz; mneylon@egt.com; Sean.Sparks@tetrattech.com
Subject: Re: Mountain Valley Pipeline - Eagle Nest Surveys

Thanks. The New River is not crossed by this project.

Valerie Clarkston
Scientist
Environmental Solutions & Innovations, Inc.
4525 Este Avenue
Cincinnati, Ohio 45232
Cell: (513-382-0925)
Office: (513-451-1777)

On Nov 3, 2015, at 8:25 AM, Lennon, Tiernan <tiernan_lennon@fws.gov> wrote:

Yes, that sounds good. The New River isn't being crossed for this project is it?

On Mon, Nov 2, 2015 at 8:26 AM, Valerie Clarkston <VClarkston@envsi.com> wrote:

Hi Tiernan,

Can you please confirm that you concur with the proposed survey methods discussed below?

Thank you,

Valerie

From: Valerie Clarkston
Sent: Tuesday, October 13, 2015 8:54 AM
To: Lennon, Tiernan (tiernan_lennon@fws.gov)
Cc: mneylon@egt.com; Sparks, Sean; Taina Pankiewicz; Daniel Judy
Subject: Mountain Valley Pipeline - Eagle Nest Surveys

Hi Tiernan,

Based on discussions during the 9/10/2015 meeting and our phone conversation from earlier this spring (attached), I have identified the following major river systems crossed by MVP and which necessitate surveys for bald eagle nests:

- Meadow River

- Greenbrier River
- Indian Creek

Searches are scheduled during leaf-off (late October through November) to increase nest detectability. According to the National Bald Eagle Management Guidelines, "Nest sites typically include at least one perch with a clear view of the water where eagles usually forage". Thus, searches for eagle nests will extend perpendicularly away from the river to points on the landscape (i.e., nearest ridge top) where the river is assumed to no longer be visible. The width of the survey corridor will be 300 feet, but biologists will use binoculars to scan areas extending beyond the corridor. All nests located within the survey corridor will be photographed and GPS coordinates recorded. If land access is granted, biologists will GPS and photograph nests occurring outside of the designated survey corridor. Results will be summarized in a report and submitted to your office for review.

Please advise if you concur with these proposed methods and survey areas or request that major river systems in other counties be included in this effort.

Thanks,

Valerie



TELEPHONE / PERSONAL CONVERSATION REPORT

PROJECT NAME:	Mountain Valley Pipeline Project
MVP TEAM CALLER:	Valerie Clarkston
CONVERSATION WITH:	Tiernan Lennon
AGENCY:	USFWS – Elkins Field Office
EMAIL ADDRESS:	Tiernan.Lennon@fws.gov
PHONE NUMBER:	304-636-6586
SUBJECT:	Migratory Bird Plan & other reports
DATE AND TIME:	2/18/2016; 8:15 AM

SUMMARY OF CONVERSATION:

Valerie called Tiernan to ask whether the USFWS has reviewed the Migratory Bird Habitat Conservation Plan. Tiernan indicated she has received the plan but has yet to review it. She is planning on sending an official letter with comments after she is finished reviewing the other outstanding reports (portals and detailed habitat).

Valerie gave Tiernan a quick update on the BA and indicated a few aquatic issues were delaying its submission. Tiernan asked if ESI was still including the northern long-eared bat within the BA even after the finalization of the 4(d) rule. Valerie said yes since MVP will be removing timber and constructing within 0.25 mile of numerous occupied or potentially occupied hibernacula. Valerie indicated the BA is for the whole project and includes species impacts from both states. Tiernan acknowledged she would need to coordinate with the Gloucester Field Office on the BO.

Valerie asked Tiernan about the possibility of spring portal trapping from 1 to 21 April. Tiernan stated WV does not allow spring trapping due to the variability in bats' emergence from hibernacula. She also said she could not recall a time when the Elkins Field Office ever allowed spring portal sampling.

Contact Signature: _____



United States Department of the Interior

FISH AND WILDLIFE SERVICE



Virginia Field Office
6669 Short Lane
Gloucester, VA 23061

March 8, 2016

Ms. Valerie Clarkston
Environmental Solutions & Innovations, Inc.
4525 Este Avenue
Cincinnati, OH 45232

Re: Mountain Valley Pipeline, Virginia
Segments, Docket Number CP16-10

Dear Ms. Clarkston:

The U.S. Fish and Wildlife Service (Service) has reviewed survey reports received as of the date of this letter for the referenced project. Mountain Valley Pipeline, LLC (MVP) is a joint venture between affiliates of EQT Midstream Partners, LP, NextEra Energy, Inc., WGL Holdings, Inc., Vega Energy Partners, Ltd., and RGC Midstream, LLC. The proposed action is construction of the Mountain Valley Pipeline (Project), a 42-inch diameter natural gas pipeline, to allow producers and end-users a direct route to transport new gas supplies to meet the growing need for natural gas in the Appalachian, Mid-Atlantic, and Southeastern United States.

The Project will extend from the existing Equitrans transmission system near Mobley in Wetzel County, WV to Transcontinental Gas Pipeline Company's Zone 5 compressor station 165 in Pittsylvania County, VA. In Virginia, the pipeline is expected to cross Craig, Franklin, Giles, Montgomery, Pittsylvania, and Roanoke Counties. The following comments address the portion of the project within Virginia and are provided under provisions of the Endangered Species Act of 1973 (16 U.S.C. 1531-1544, 87 Stat. 884), as amended (ESA), Bald and Golden Eagle Protection Act (16 U.S.C. 668-668c, 54 Stat. 250), as amended, and Migratory Bird Treaty Act of 1940 (16 U.S.C. 703-712, 40 Stat. 755).

Our recommendations are based on the route alignment provided on December 17, 2015. Once the action area of the project is finalized, an additional review that includes the final route alignment, all attendant facilities, staging areas, etc. will be necessary. Action area refers to all areas directly or indirectly affected by the proposed action and not only the immediate area involved in the action.

Roanoke Logperch Habitat Assessments

We have reviewed the survey report entitled “Habitat assessments for Roanoke logperch (*Percina rex*) along the Proposed Mountain Valley Pipeline in Virginia,” dated and received November 13, 2015. This survey, conducted by an approved surveyor in 2015, found suitable habitat for the federally listed endangered Roanoke logperch. Based on the survey report, suitable habitat occurs at the Project site in the following streams: Bradshaw Creek¹, North Fork Blackwater River, Blackwater River², Magoddee Creek¹, Blackwater River³, and Harpen Creek¹. In addition, the Roanoke logperch is known to be present at the following Project stream crossings: North Fork Roanoke River¹, North Fork Roanoke River AR¹, Roanoke River, and Pigg River.

Several sites were not assessed due to access issues. For future assessments, we recommend a change in methodology. If desktop review indicates that suitable habitat may be present, habitat assessments are typically conducted 200 meters upstream and 800 meters downstream of each site on any stream that may be affected by the proposed Project either directly or through sedimentation and erosion. Abbreviated surveys (100 meters upstream and 400 meters downstream) can be conducted on sites where suitable habitat is not anticipated such as first and second order streams. We will review results of those assessments and provide comments upon receipt.

The Project, as proposed, is likely to adversely affect the Roanoke logperch. Therefore, formal consultation between the Federal Energy Regulatory Commission (FERC) and the Service is required pursuant to section 7 (50 CFR 402.14 [c]) of the ESA.

To enable us to further analyze effects to the Roanoke logperch, provide the following information for streams with suitable or known habitat for Roanoke logperch.

- An alternatives analysis that evaluates avoiding the proposed stream crossings.
- The analysis that supports the conclusion that open-cut/conventional lay of dry ditch crossings will have the least amount of impact.
- Details on any instream blasting or water withdrawals planned in these streams.
- An alternatives analysis that evaluates relocating any facility associated with the Project (staging areas, temporary work spaces, access roads, etc.) that is currently proposed adjacent to these streams. Any facilities near these streams should provide an adequate buffer to avoid impacts.

Freshwater Mussel Site Assessments

We have reviewed the survey report entitled “Freshwater mussel (*Unionidae*) site assessments and surveys for the Proposed Mountain Valley Pipeline in Virginia,” dated and received November 13, 2015. This survey, conducted by a surveyor approved for the Project, found suitable habitat for mussels, but no federally listed mussel species were identified. Based on that survey report, the federally listed endangered James spinymussel (*Pleurobema collina*) does not

currently occur in those areas surveyed in 2015. This survey is valid for 2 years. We support the relocation of any non-federally listed mussels and snails inhabiting the construction footprint prior to instream work using proper State protocols.

No mussels were found at the Craig Creek crossing; however, the James spinymussel occurs within this waterbody downstream of and may be adversely affected by the current Project alignment. We support the proposed time-of-year restriction from May 15 through July 31 of any year to minimize impacts to the James spinymussel. We have concerns about the proposed alignment across this creek and recommend that alternatives be evaluated to minimize impacts. The pipeline should cross the creek at a perpendicular angle, cross it once, and not parallel it. We recommend that blasting or water withdrawals from this waterbody be avoided and that any associated facilities proposed adjacent to this stream be relocated and an adequate buffer be provided to avoid impacts. Please address these concerns to enable us to determine affects to the James spinymussel.

Additional surveys are planned in areas pending access. We will review results of those surveys and provide comments upon receipt.

Rare Plants Survey

We have reviewed the survey report entitled “Surveys for rare plants along MVP’s Proposed Mountain Valley Pipeline Project in Craig, Franklin, Giles, Montgomery, Pittsylvania, and Roanoke Counties, Virginia,” dated and received November 13, 2015. In our letter dated April 3, 2015, we recommended surveys for 2 federally listed plants, Northeastern bulrush (*Scirpus ancistrochaetus*) and smooth coneflower (*Echinacea laevigata*). No federally listed plants were identified during the field survey conducted by an approved surveyor. Based on the survey report, the Northeastern bulrush does not currently occur at the Project site and therefore, the Project is not likely to adversely affect this species. The Northeastern bulrush survey is valid for 3 years and the smooth coneflower survey is valid for 2 years.

Additional surveys for smooth coneflower will be conducted in 2016. We will review results of those surveys and provide comments upon receipt.

Bat Surveys

We have reviewed the survey report entitled “Listed bat studies along MVP’s Proposed Mountain Valley Pipeline Project in Craig, Franklin, Giles, Montgomery, Pittsylvania, and Roanoke Counties, Virginia,” dated and received November 13, 2015. On January 14, 2016 the Service published the final 4(d) rule (81 Federal Register 1900-1922), effective February 16, 2016 for the federally listed threatened Northern long-eared bat (*Myotis septentrionalis*, NLEB). The Service published a programmatic biological opinion for the final 4(d) rule concurrent with the final listing.

In our letter dated April 3, 2015, we recommended surveys for federally listed bats. No federally

listed bats were captured in the sections surveyed for the proposed route. One NLEB was captured in the surveys for the alternate routes and sections of the initial proposed route that were modified or abandoned prior to completion of the 2015 summer mist net surveys. The captured NLEB was a lactating female and tracked to a single roost tree on June 20 and 21, 2015. This meets the criteria for a known maternity roost tree. Due to access limitations, the NLEB was not tracked to a roost the evenings of June 18 and 19, 2015. Per the final 4(d) rule, incidental take caused by tree removal is prohibited within a 150-foot radius of a known occupied maternity roost tree during the pup season (June 1 – July 31).

The proposed Project route intersects a NLEB hibernaculum, which was not in our database when we first consulted. A single Keen's bat (*Myotis keenii*) was documented in Canoe Cave, Giles County, VA. The Eastern North American populations of the Keen's bat were later reclassified as NLEB. The documented occurrence meets the criteria for known hibernacula per the final 4(d) rule. The rule prohibits incidental take caused by tree removal within 0.25 mile of a known hibernaculum at any time of year. The rule also prohibits incidental take that occurs within a hibernaculum that may disturb or disrupt hibernating bats when present as well as the physical or other alteration of the hibernaculum's entrance or environment when bats are not present if the results of the activity will impair essential behavioral patterns including sheltering. Based on the survey results and the additional information about the hibernaculum, we recommend the following:

- Continue coordination with the Service and with Wil Orndorff, Virginia Department of Conservation and Recreation Karst Protection Coordinator, to identify a route that will not cause incidental take in Canoe Cave.
- In addition to the avoidance measures you develop and agree to implement with Wil Orndorff around Canoe Cave, we encourage you to implement any applicable voluntary conservation measures, which can be found on our website http://www.fws.gov/northeast/virginiafield/endangered/projectreviews_step7b.html.

The Federal action agency, FERC, will need to provide written documentation if they intend to rely upon the NLEB programmatic biological opinion for the final 4(d) rule to provide compliance with section 7 of the ESA.

The proposed Project re-route may impact Tawney's Cave, a documented Indiana bat (*Myotis sodalis*) hibernacula. Therefore, we recommend the following:

- Continue coordination with the Service and with Wil Orndorff to ensure the alternative route will not impact the hibernaculum and cause incidental take of Indiana bats.
- In addition to the conservation measures you develop and agree to implement with Wil Orndorff for Tawney's Cave, we recommend a time-of-year restriction for tree clearing within 5 miles of Tawney's Cave from April 1 – November 15 of any year.

A time-of-year restriction for tree clearing is not necessary for sections of the route that had negative survey results and will not impact either Tawney's or Canoe cave. The bat survey is valid for 3 years.

Portal, cave, and abandoned mine surveys are continuing. We will review results of those surveys and provide comments upon receipt.

Karst Resources

The proposed Project route crosses karst areas containing surface and subsurface features. The location and extent of subsurface karst features are not well known and it is difficult to determine connectivity. Therefore, we recommend the following:

- Protect recharge areas of cave streams and other karst features by following relevant environmental maintenance and construction standards for stream and wetland crossings and spill prevention containment and control.
- Avoid all construction activities, including excavating, filling, or altering the hydrology of any existing sinkholes, fissures, or cave entrances.
- If new sinkholes form use an inverted filter to bridge the karst feature above the water table rather than filling it below.
- Implement sediment and erosion control measures such as silt fence and straw bales or other control measures that will provide equivalent level of protection, or better, around all karst features. Monitor and maintain all sediment and erosion control measures periodically and after precipitation events, as identified in an approved erosion and sedimentation control plan. Clean, repair, and replace structures as necessary.
- Maintain a 100-foot buffer or greater around all surface karst features when blasting, drilling, digging, or trenching. If a subsurface karst feature is located and cannot be avoided, contact the Service for specific guidance or alternatives.

Migratory Birds and Bald and Golden Eagles

The Project's Resource Report 3 – Fisheries, Vegetation and Wildlife dated October 2015 indicates that a Migratory Bird Habitat Conservation Plan (MBHCP) is being prepared and will be submitted to the agencies for review and comment. Resource Report 3 also indicates that field surveys for eagle nests in areas of suitable habitat traversed by the Project are scheduled for October 2015. Please provide us with the results of this field survey.

The MBHCP should address the following:

- Avoid vegetation clearing during the nesting season of native birds from March 1 through July 31 of any year.
- Avoid fragmentation of large contiguous blocks of habitat and ecologically important habitat areas.
- Locate attendant facilities (access roads, staging areas, etc.) in or adjacent to already disturbed areas.
- Avoid impacts to wintering golden eagles.
- Avoid removal of raptor nests.

Molly Joseph Ward
Secretary of Natural Resources

Clyde E. Cristman
Director



Rochelle Altholz
Deputy Director of
Administration and Finance

David C. Dowling
Deputy Director of
Soil and Water Conservation
and Dam Safety

Thomas L. Smith
Deputy Director of Operations

COMMONWEALTH of VIRGINIA
DEPARTMENT OF CONSERVATION AND RECREATION

March 14, 2016

Valerie Clarkston
Environmental Solutions & Innovations, Inc.
4525 Este Avenue
Cincinnati, Ohio 45232

Re: CP16-10 (previously PF 15-3) Mountain Valley Pipeline- Surveys, Resource Report 10 and Karst

Dear Ms. Clarkston:

The Virginia Department of Conservation and Recreation (DCR) provided comments on the Rare, Threatened and Endangered Survey reports on January 4th, 2016. These comments included information about natural heritage resources which are defined as the habitat of rare, threatened, or endangered plant and animal species, unique or exemplary natural communities, and significant geologic formations tracked by the DCR-Division of Natural Heritage (DCR-DNH). DCR staff would like to offer the following additional comments at this time. Additional comments appear in bold italics.

Rare Plant Survey

DCR has reviewed the "Surveys for Rare Plants Along MVP's Proposed Pipeline Project in Craig, Franklin, Giles, Montgomery, Pittsylvania, and Roanoke Counties, Virginia" dated November 13, 2015. According to John Townsend, DCR botanist, the Small whorled pogonia (*Isotria medeoloides*, G2?/S2/LT/LE) survey was conducted during the wrong time of year (August 5-12 and September 24-October 1). The preferred recommended time for counties south of Caroline County for any given year in Virginia is May 25-July 15 as indicated on the United States Fish and Wildlife –Virginia Field Office website: http://www.fws.gov/northeast/virginiafield/pdf/endangeredspecies/20120125_VIRGINIASurveytimeframeforplans.pdf.

Due to the legal status of Small whorled pogonia, DCR recommends continued coordination with USFWS to ensure compliance with protected species legislation.

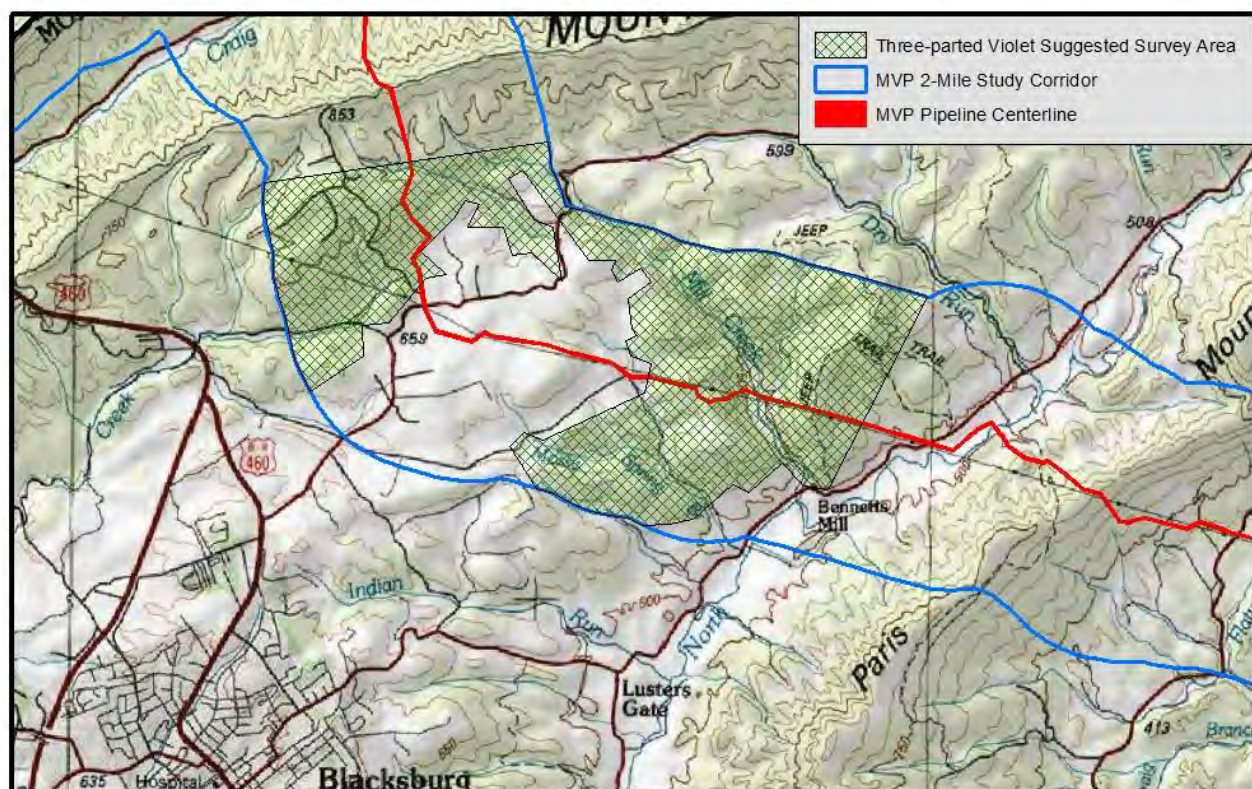
In addition, DCR-DNH biologists have identified potential habitat for Three-parted violet (*Viola tripartita*, G5TNR/S1/NL/NL) within a half mile of the proposed centerline (see Figure 1).

Three-parted Violet is a perennial wildflower that grows to 4 decimeters tall with short, delicately woody rhizomes and obvious above ground stems appearing singly or in pairs. This species is similar to many other violets in its production of both chasmogamous flowers (showy and open-pollinated) as well as cleistogamous flowers (unopened and self-pollinating). The familiar chasmogamous flowers are yellow and prominently displayed near the top of the stem; the inconspicuous cleistogamous flowers emanate from the base of the stem and resemble unopened flower buds. This species flowers in April and May like most other violets in our flora. The species name "tripartita" refers to the 3-lobed leaves found in many populations, but Virginia plants

discovered thus far have unlobed leaves and may be referred to as *Viola tripartita* var. *glaberrima*. In Virginia the plant is rare, found in mesic forests over calcareous or mafic rocks in the southwestern mountains (Weakley et al., 2012). As of 2016, 3 extant occurrences of this state rare plant were documented in Virginia by the Virginia Natural Heritage Program. Like so many of Virginia's rare plants, the major threats to this species are being out-competed by non-native invasive plant species which occur in the same habitat or loss of habitat altogether due primarily to development/conversion.

DCR recommends an inventory for the Three-parted violet in the study area. With the survey results we can more accurately evaluate potential impacts to natural heritage resources and offer specific protection recommendations for minimizing impacts to the documented resources.

Figure 1. Suggested Three-parted violet survey areas.



Suggested Survey Area

0 0.5 1 2 Miles



Map created by DCR-DNH, February 2015; Basemap-National Geographic 2002 Quads 100K

Loggerhead Shrike Survey

DCR has reviewed the "Field Surveys for the Loggerhead Shrike Along the Mountain Valley Pipeline in Craig, Montgomery, and Roanoke Counties, Virginia" dated November 13, 2015 and requests copies of any occupancy surveys and additional habitat assessments conducted in 2016 as noted in the report. **DCR recommends extending**

the Loggerhead shrike survey area to include the area between mile posts 214.1-215.2 on Rev 4.0. Due to the legal status of the Loggerhead shrike (*Lanius ludovicianus*, G4/S2B,S3N/NL/LT), DCR recommends continued coordination with VDGIF, Virginia's regulatory authority for the management and protection of this species to ensure compliance with the Virginia Endangered Species Act (VA ST §§ 29.1-563 – 570).

Rare Bat Survey

DCR has reviewed the “Listed Bat Studies Along MVP’s Proposed Mountain Valley Pipeline Project in Craig, Franklin, Giles, Montgomery, Pittsylvania, And Roanoke Counties, Virginia” dated November 13, 2015. The survey report on page 4 states there is a maternity colony for Indiana bats in Lee County. However, according to Chris Hobson, DCR zoologist, there is not a maternity colony in Lee County. This is a repetition of a false assumption that because a juvenile male Indiana bat was caught in Lee County during a 1992 graduate study program mist net survey conducted by current DCR zoologist, Chris Hobson, there is an Indiana bat maternity colony in this county, which according to our files does not exist.

The report lists a dead red pine as the roost tree (Roost 482-1) for the Northern long-eared bat (Bat 482) that was radio tagged. Red pine is a non-native in Virginia, according to DCR botanist John Townsend. There are some planted stands of Red pine in the Allegheny Highlands. Please verify the identification of this tree species.

DCR requests additional information including a shapefile of documented occurrences of the Eastern small-footed myotis (*Myotis leibii*, G3/S2/NL/NL) identified during the mist net survey along the pipeline corridor. DCR tracks this state rare bat and would like to update our files with these new occurrences.

DCR recommends coordination with VDGIF for information regarding bat hibernacula as requested by ESI and due to the state listing of endangered status of both the tri-colored bat (*Perimyotis subflavus*) and the little brown bat (*Myotis lucifugus*), effective April 1, 2016. Any cave along the pipeline corridor has a significant likelihood of hosting rare bat species.

New Record for Northern long-eared bat-Giles County

DCR staff and volunteers visited Canoe Cave on November 30, 2015 for the purpose of biological inventory pursuant to environmental project review. The inventory was initiated in response to the close proximity of the proposed Mountain Valley gas pipeline to Canoe Cave (see Figure 2).

Biological inventory of Canoe Cave, a state designated significant cave located beneath the center line of the proposed Mountain Valley Pipeline, was performed on November 29 and 30, 2015. Taxa collected were two or more genera of millipedes (*Pseudotremia*, *Zygonopus*), two genera of amphipod (*Stygobromus*, *Gammarus* (from spring)), and one genus of aquatic isopod (*Caecidotea* sp.). Aquatic isopods had not previously been documented from the cave. Bait stations were left in three locations in the cave, but no additional cave adapted invertebrate taxa were present at the bait stations on November 30. Traps were left in place to be checked in mid-December. Two tri-colored bats were observed roosting in the cave. However, the fall of 2015 has been exceptionally mild, and hibernating bat species are probably not yet in torpor.

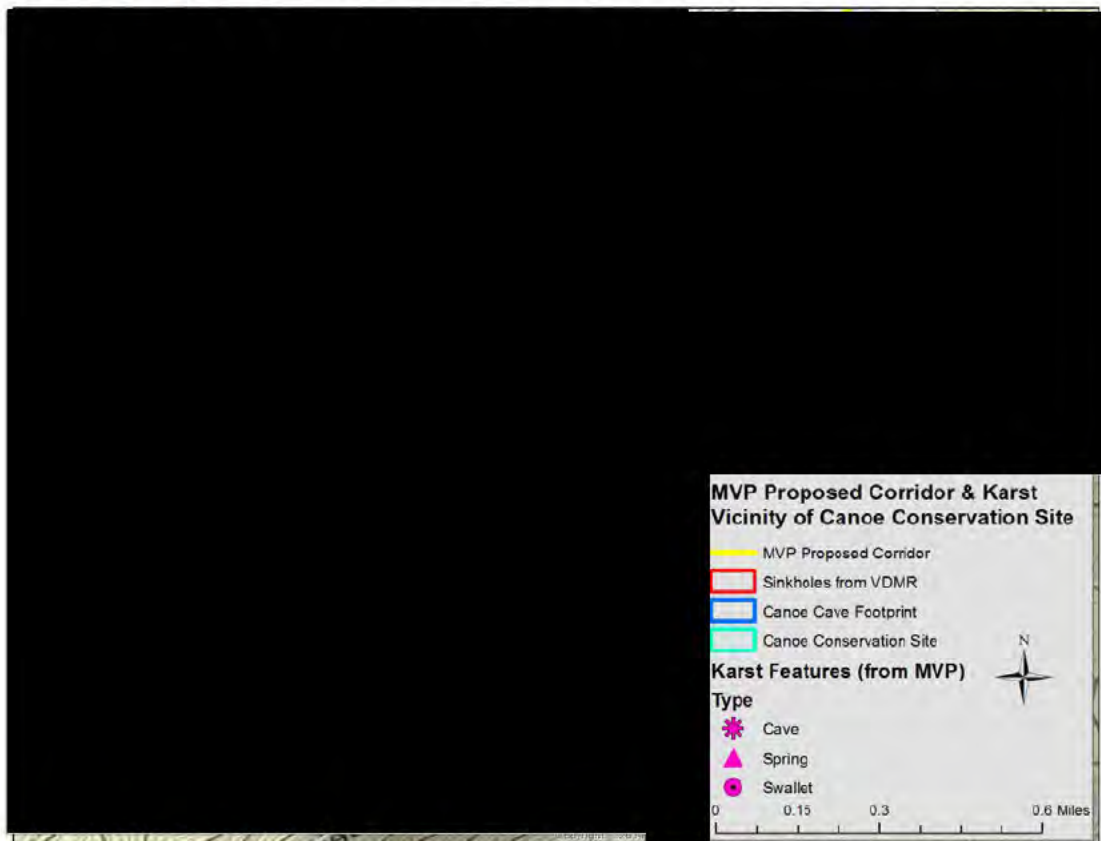
The extent of portions of the cave is not well depicted on the 1943 map. Roots and insects in the cave, as well as portions of the 1943 map, suggest that the cave comes very close to the surface directly beneath the pipeline route. The 1943 map indicates ~ 1000 feet of passage.

A modern resurvey of the cave is underway by members of the Virginia Speleological Survey. Expedition participants (personal communication) estimate ~ 3000’ of dry cave passage. Water from the cave, which includes three deep lakes at the northeast end of the cave, appears to resurge at a large spring at the bottom of the draw below the cave. There is additional underwater cave passage and potentially more dry cave passage beyond the lakes. However, scuba techniques will be necessary for additional exploration. Certified cave divers have expressed interest, and the property owner is considering this request. Water in the cave is most likely derived

from springs that emerge from talus slopes along the northwest slope of Sinking Creek Mountain, upslope from the upper boundary of the limestone outcrop belt. These springs are used as water supplies for several houses and a farm in the area. The landowner has expressed concern about potential impact to these springs from construction and operation of the Mountain Valley Pipeline.

Subsequent to the visit, (b) (6) (b) (6) which owns the cave, shared with DCR staff a copy of correspondence to former owner (b) (6) from Dr. Gary Nussbaum of Radford University. Nussbaum worked in conjunction with Radford University mammologist Dr. Jenny Tipton, who pioneered the study of Virginia's cave bats. This February 15, 1982 correspondence is attached and includes documentation of a single *Myotis keenii* (Keen's bat) roosting in the cave (Appendix A). The nature and author of the correspondence lend a high degree of credibility to this report. The Eastern North American populations of this species were subsequently reclassified as a separate species *Myotis septentrionalis* (Northern long-eared bat).

Figure 2 Proposed Corridor and Karst Vicinity of Canoe Conservation Site.



In 2015 Northern long-eared bat was federally listed threatened under the Endangered Species Act of 1973 (16 U.S.C. 1531-1544, 87 Stat. 884), as amended, largely in response to severe population declines resulting from White Nose Syndrome. While never found in huge numbers in caves in the mid-Atlantic states, Northern long-eared bats were one of the most commonly captured bats during summer mist net studies in the mountains of western Virginia prior to the devastation brought on by White Nose Syndrome. The 1982 record most likely reflects an individual associated with a larger population in the area near Canoe Cave. This record should be given equal priority to other *Myotis septentrionalis* records of similar vintage and nature, which comprise a significant number of the records for this species. Extensive survey work both at the cave (hibernacula, fall swarm) and during the summer (mist net studies) would be necessary to determine with any certainty the species presence or absence in the project area.

Due to the legal status of the Northern long eared-bat DCR recommends coordination with the US Fish and Wildlife Service and Virginia Department of Game and Inland Fisheries to address concerns related to the Northern long-eared bat (*Myotis septentrionalis*) record from the cave. DCR also recommends coordination with VDGIF due to the future state listing of the tri-colored bat (*Perimyotis subflavus*) and the little brown bat (*Myotis lucifugus*) **on April 1, 2016.**

Roanoke Logperch Survey

DCR has reviewed the “Habitat Assessments for the Roanoke Logperch (*Percina rex*) Along the proposed Mountain Valley Pipeline in Virginia” dated November 13, 2015. The descriptions of the Roanoke logperch (*Percina rex*, G1G2/S1S2/LE/LE) sites as presented in the report appear to be adequate for determining suitability of habitat. According to the report, the applicant is assuming presence at three waterbodies (i.e., North Fork Roanoke, Roanoke and Pigg Rivers) that are known to harbor Roanoke logperch. According to the habitat descriptions in the report, some of the sites accessed have detrimental factors such as impoundments, and poor habitat which may not support Roanoke logperch.

DCR recommends before construction begins, the identified sites with suitable habitat where presence is not assumed be accessed and surveyed. In addition to the Roanoke logperch, the Orange-fin madtom (*Noturus gilberti*, G2/S2/SOC/LT) was included in the habitat assessments due to its common association with the Roanoke logperch. Due to the legal status of the Roanoke logperch and Orange-fin madtom, DCR recommends continued coordination with VDGIF and USFWS to ensure compliance with protected species legislation. DCR requests a copy of any field survey results.

Freshwater Mussels Survey

DCR has reviewed the “Freshwater Mussel (Unionidae) Site Assessments and Surveys for the Proposed Mountain Valley Pipeline in Virginia” dated November 13, 2015. DCR recommends the applicant continue to conduct surveys prior to construction at sites identified as suitable habitat in the table of the report. For sites identified as suitable habitat for freshwater mussels with access restrictions, DCR recommends these sites should be reassessed for access and surveyed if possible prior to construction. Due to the legal status of the James spinymussel (*Pleurobema collina*, G1/S1/LE/LE), Atlantic pigtoe (*Fusconaia masoni*, G2/S2/SOC/LT) and Green floater (*Lasmigona subviridis*, G3/S2/NL/LT), DCR also recommends continued coordination with VDGIF and USFWS to ensure compliance with protected species legislation. DCR request copies of the field survey results.

Cave and Karst Information

The following information was prepared by Wil Orndorff, DCR Karst Protection Coordinator. The comments herein address the potential impact to karst resources from the proposed route (Rev 4.0) as well as alternatives, as described in Resource Report 10, part of the October filing by MVP-LLC with FERC.

Please note that the only consideration given karst in the comparison tables in Resource Report 10, which purports to support the proposed route from an environmental perspective, is the “Karst area crossed (miles)”(sic) which indicated the length of a proposed alternative overlying karst bedrock. Information regarding significant caves and their designated conservation sites, provide to MVP’s consultants during early stages of the environmental review process, are not addressed in Resource Report 10, and do not appear to have been considered in the preparation of MVP’s environmental assessment. More generally, natural heritage resources, defined as documented occurrences of rare plants, animals, or natural communities are not mentioned in the analysis, nor are the priority conservation areas (conservation sites and/or stream conservation units) associated with these occurrences. Caves designated as significant under the Virginia Cave Protection Act and caves that harbor rare, threatened, or endangered are designated as natural heritage resources in Virginia.

DCR analysis shows that the proposed route as submitted by MVP in October, 2015 has a very high potential to impact karst resources when compared with several of the other alternatives listed in Resource Report 10.

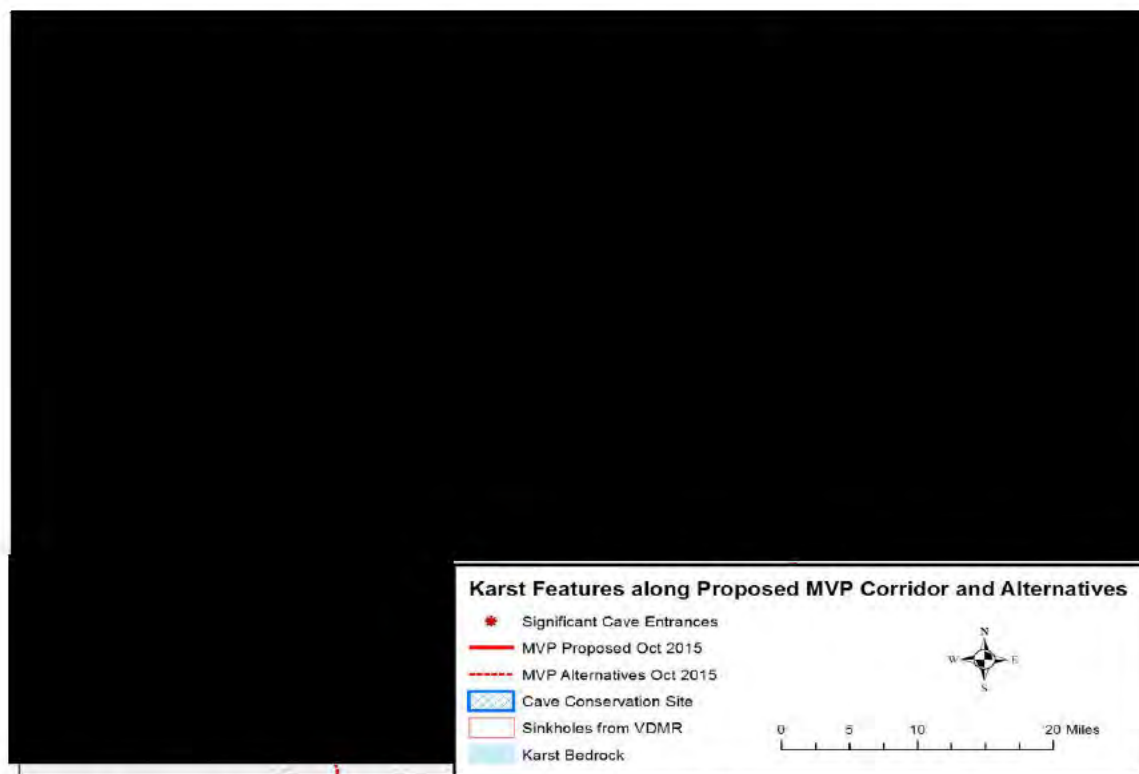


Figure 3. Proposed route and alternatives crossing the karst region of western Virginia.

Table 1 below presents a comparison of the impact of the proposed pipeline alternative routes in terms of proximity to sinkholes, cave entrances, and to Cave Element Occurrence Conservation sites. The conservation sites represent areas on the landscape where land disturbance could affect a state designated significant cave and/or one or more documented occurrences of cave obligate rare, threatened, or endangered species. Cave entrance locations are provided courtesy of the Virginia Speleological Survey (VSS). Sinkholes are as mapped by the Virginia Division of Mineral Resources. Cave conservation sites are those delineated by the Virginia DCR Natural Heritage Program.

Each cave conservation site has a biodiversity ranking (B rank) that is a function of the number, rarity, and quality of element occurrences (rare plants, animals, or natural communities, including significant caves) within each site. B ranks range from B1 to B5, with lower ranks representing a higher degree of biodiversity significance. B1 sites are considered of “Outstanding” significance, and are typically associated with high quality occurrences of multiple rare species or natural communities. More information on these rankings can be found at <http://www.dcr.virginia.gov/natural-heritage/help>.

Table 1. Comparative analysis of Proposed MVP Route and Alternatives on Karst

Route	Sinkholes (dist – mi.)	Cave entrances	Natural Heritage Resource Cave Conservation Sites*	Miles in	Karst consite
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(alternative)			(dist – mi.)					consite	impact index**
	<1	<.25	<1	<.25	1 mile	.25 mi.	intersect		
Proposed	394	108	73	12	10	7	3	4.93	1.82 FL
Alternative 110 and 110R	68	17	11	1	0	0	0	0	0
Alternative 110J	147	44	10	0	2	1	1	.84	.28
Proposed with AEP Newport Variation	396	87	71	18	10	7	5	3.96	1.86 FL
Route Alternative 1	541	123	52	9	5	5	5	3.92	1.62
ETNG***	1052	309	62	18	4	3	2	1.63	.34

* - includes any cave with documented element occurrences

** - sum of ratios of length in conservation sites to biodiversity ranking (B rank) of each site

***- only a partial route (values not useful for comparison unless combined with northern segment)

FL – federally listed species associated with a cave conservation site

To help compare degree of potential impacts to designated cave conservation sites, the length of each proposed or alternative pipeline route intersecting each conservation site was measured, and two simple metrics were calculated. First, the total length of a corridor within karst conservation sites was summarized. Secondly, a karst conservation site impact index was calculated by normalizing the length of a corridor segment crossing a specific conservation site to the biodiversity value of the site.

The sum of the individual indices (ratio of miles of corridor crossing a site to the site's B rank) for each alternative corridor was calculated and assigned to the corridor for comparison purposes. The karst conservation site impact index is probably the most useful metric in Table 1 for comparison of the potential impact of proposed alternative pipeline corridors on documented, karst-associated biodiversity.

Table 1 and Figure 3 clearly illustrate that the northern route(s) – 110, 110R, and 110J - have a much lower likelihood of impacting documented cave and karst resources. The northern route 110 is the proposed route least likely to impact cave and karst resources, with virtually no impact to documented cave and karst resources.

The proposed MVP corridor October 2015 (Rev 4.0) as submitted to FERC by MVP has the second highest potential impact to karst biodiversity of any of the alternatives submitted. The proposed corridor using the AEP-Newport variation has a slightly higher index. Both of these corridors intersect the Canoe Conservation site, which is associated with the federally listed (threatened) Northern long-eared bat (see Figure 4).

The geographic relationships between the cave entrance, the resurgence spring to which water from the cave flows, the conservation site (i.e. conservation buffer), and the proposed pipeline corridor are shown on Figure . The conservation buffer is based on geological patterns, topography, hydrological flow paths (inferred), and karst features. Detailed hydrological investigations would be necessary to determine the northeast and southwestern boundaries of the site.

To the maximum extent possible, avoidance of the Canoe Conservation site is recommended. Construction within the cave footprint is strongly discouraged. For any portions of the Mountain Valley Pipeline remaining

within the Canoe conservation site, appropriate best management practices must be adopted and strictly adhered to in order to minimize the potential for impact. Compensatory mitigation for karst areas permanently disturbed within the conservation site may be appropriate. Monitoring of the spring (resurgence) water for Canoe Cave should take place, and include at a minimum turbidity and volatile organic compounds. Monitoring should begin prior to construction for sufficient duration to establish a meaningful baseline for water quality against which data gathered during and post construction can be compared.

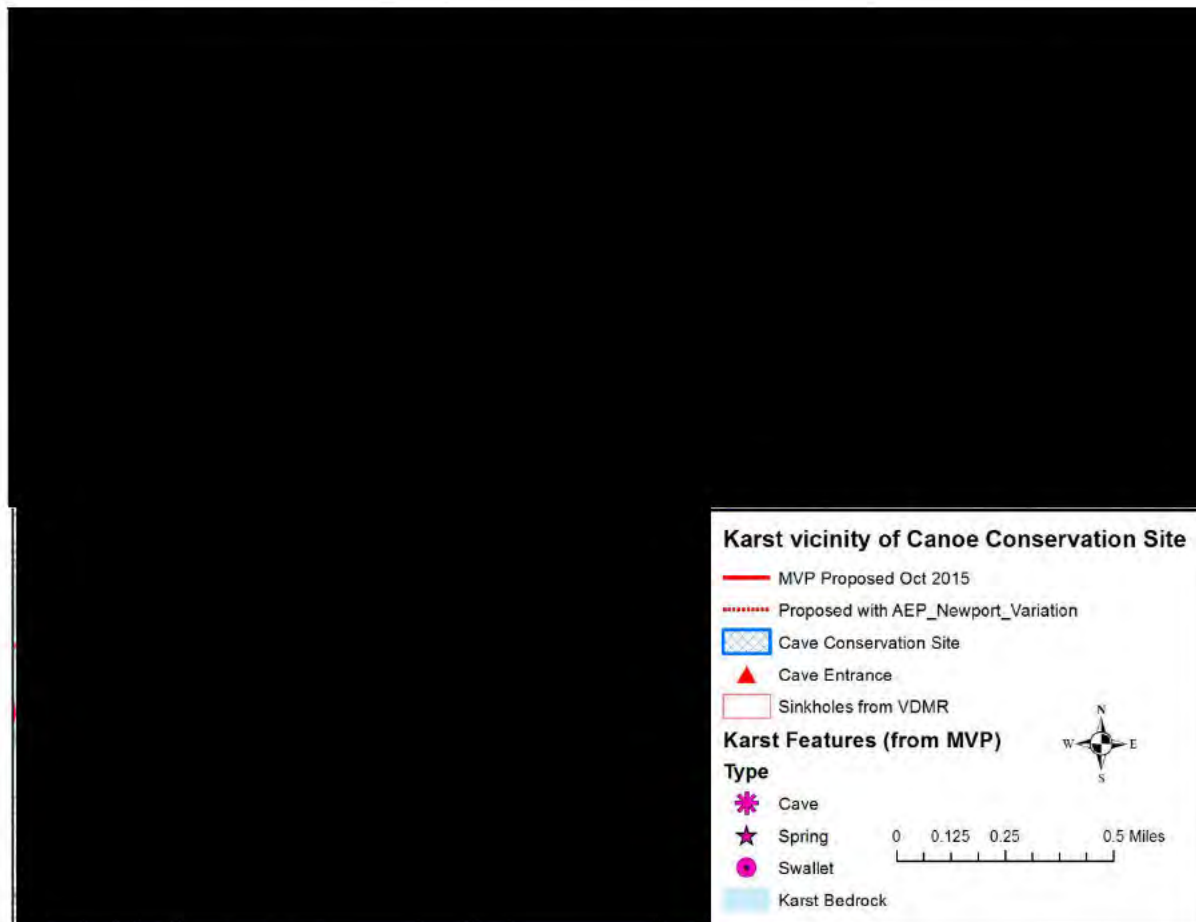


Figure 4. Karst Features vicinity of Canoe Cave.

The proposed MVP corridor October 2015 (Rev 4.0) as submitted to FERC by MVP also intersects the Slussers Chapel and Old Mill Conservation sites in Montgomery County, as does the AEP Newport alternative.

Of these Oct 2015 alternatives, the proposed MVP corridor October 2015 (Rev 4.0) poses the highest risk to the Slussers Chapel Conservation site, and the stream in Mill Creek Cave in particular, by virtue of the fact it has the largest footprint within the conservation site with a linear distance of 3.1 miles of ROW in the conservation site. All of these alternatives pass directly over the subterranean stream in Old Mill Cave. There are additional openings in the hillside above and east of the cave with significant airflow suggesting additional cave passage. The spatial relationships can be observed in Figure 5. Note that three newly discovered caves are indicated on the map, all with potential significance in terms of length, depth, hydrology, and biology. Two of these newly discovered caves likely lie within the Slussers Chapel Conservation Site, and one within the Old Mill

Conservation Site. It is almost certain that more undiscovered caves lie proximal to or beneath the proposed pipeline corridor within these conservation sites.



Figure 5. Karst near Slussers Chapel and Old Mill Conservation Sites.

DCR recommends avoidance of the Slussers Chapel Conservation Site and Old Mill Conservation Site.

The proposed MVP corridor (Rev 4.0) and AEP-Newport cross the Nature Conservancy's Mill Creek Springs (Blake) Natural Area Preserve crosses the southwestern corner of the Mill Creek Springs Natural Area Preserve (Figure 6). These two alignments pass directly through the base of a sinkhole on the preserve. As currently drawn, construction of this section of the line is likely to have impacts to karst resources, and possible impacts to undocumented occurrences of natural heritage resources associated with the local karst. DCR recommends avoidance of the Mill Creek Springs Natural Area Preserve.

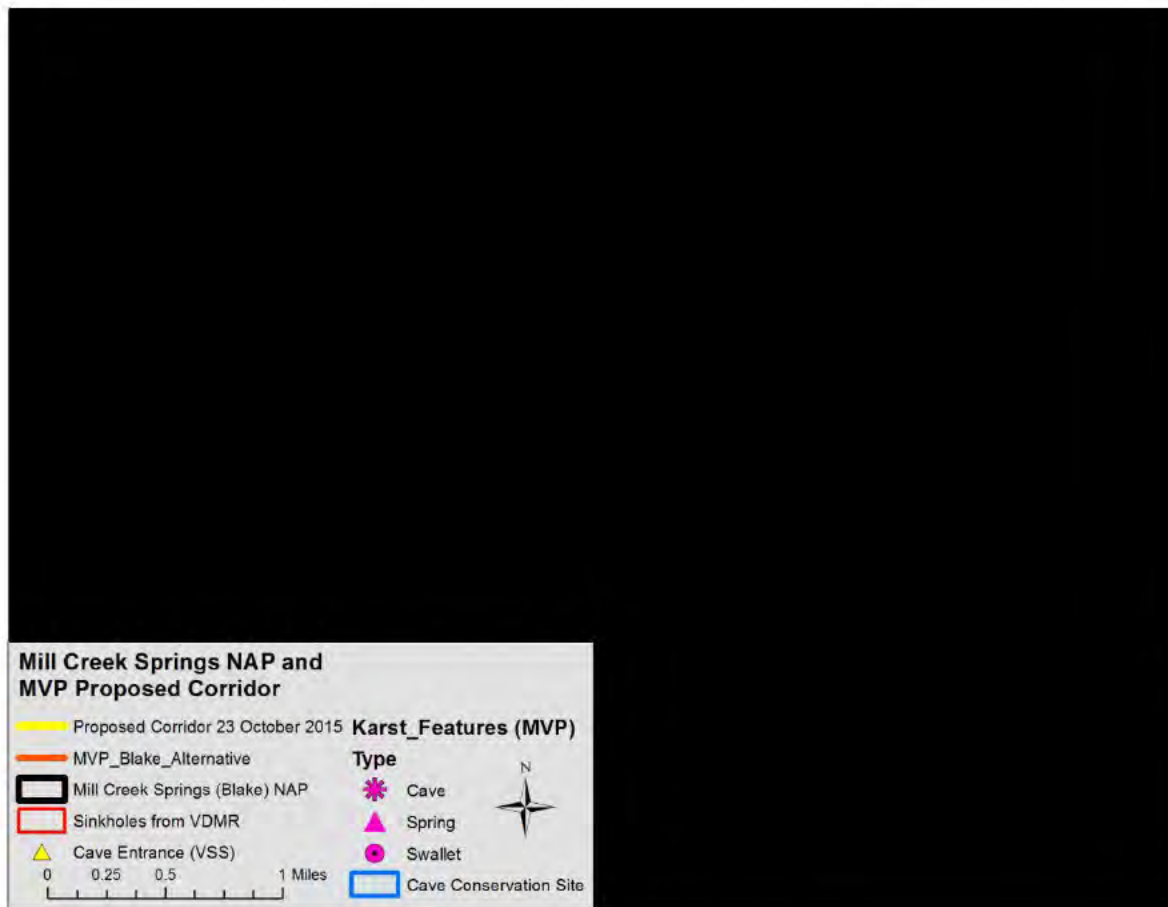


Figure 6. Mill Creek Springs NAP and MVP Proposed Corridor.

Route Alternative 1 has a slightly less, but similar impact to cave and karst biodiversity resources as the Proposed Corridor (with or without AEP-Newport variation.)

Comparison of the ETNG alternative is rendered difficult because is only a partial route that could be combined with numerous other alternatives, any of which other than alternatives 110, 110R, or 110J would dramatically increase its potential impact to karst.

Appendix B contains descriptions of the specific cave element occurrence conservation sites that intersect a proposed or alternative corridor.

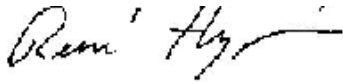
The type localities of several cave limited invertebrate animals lie within conservation sites intersected by proposed or alternative corridors. These are enumerated in Appendix C.

It must be emphasized that our knowledge of the karst is incomplete. The Virginia Speleological Survey (VSS) may know of additional caves that are not shared with DCR due to landowner restrictions. In addition, there are likely to be undocumented caves proximal to any corridor that is chosen. These caves should be investigated as they are discovered. Some cave entrances may even be opened during the actual excavation of the pipeline itself, as happened during the construction of the Jewell Ridge Pipeline. In such cases, DCR should be notified immediately and given opportunity to examine and inventory these features.

Appendix D includes general concerns of gas line installation and operation in karst.

Should you have any questions or concerns, feel free to contact me at 804-371-2708. DCR looks forward to the opportunity to provide comments on additional information as it becomes available.

Sincerely,

A handwritten signature in black ink, appearing to read "René Hypes", with a stylized flourish at the end.

S. René Hypes
Project Review Coordinator

CC: Troy Anderson, USFWS
Ernie Aschenbach, VDGIF
Wil Orndorff, DCR-Karst

Literature Cited

Weakley, A.S, J. C. Ludwig, and J.F. Townsend 2012. Flora of Virginia. Bland Crowder, ed. Foundation of the Flora of Virginia Project Inc., Richmond. Fort Worth: Botanical Research Institute of Texas Press. p. 974.

Appendix A



Radford University

Radford, Virginia 24142
(703) 731-5221/5172/5447/5369

Department of Recreation and Leisure Services

February 15, 1982

To: (b) (6)
From: Dr. Gary Mussbaum
Re: Canoe Cave Management Plan

I. Results of the 7 February 1982 biological and geological survey of Canoe Cave.

- A. Estimated total bat population: 300-350 bats.
- B. Bats actually counted:
 - 1. myotis lucifugus (little brown bats): 112
 - 2. pipistrellus subflavus (Eastern pipistrelle) 150
 - 3. myotis keenii (rare in this area) 1
 - total 263
- C. Troglolithic millipedes were found on some pieces of old, wet wood (before the "canoe"), probably trichopetalum packardii.
- D. Another millipede was spotted next to a bat (probably pseudotremia species).
- E. There were many fragile and beautiful formations, including the "Finger of God" (a stalagmite), the "The Prophets" (a cluster of stalagmites), and rare aragonite helictites (miniature tree-like formations).
- F. There were some old signatures dating back to the late 1800's.
- G. Although "elephant tracks" were evidenced, the cave was seen to have born relatively little traffic and and damage over the years and to be, at present, in a relatively untrammelled state. It was felt that few caves in Giles County (or in Virginia, for that matter) were in as good condition as Canoe.

II. Canoe Cave Management Plan. Given the above findings and after numerous discussions with both (b) (6) and Dr. Ginny Tipton of the Cave Commission of the Commonwealth of Virginia, the following cave management plan is recommended for the protection of the cave:

- A. The cave should be closed completely during the winter bat hibernation period (approx. November 1-March 31).
- B. During the nonhibernation period (approx. April 1-October 31), trips to the cave should be restricted as follows:
 - 1. no more than one (1) trip per month.
 - 2. no more than five (5) persons per trip, one of whom is both familiar with and sensitive to the delicate nature of the cave (for example, Dr. Tipton).
 - 3. biological, geological, historical, and aesthetic study must be the primary purpose of the trip.
 - 4. those desiring entry must submit a written request including the nature of the trip, the number of persons, the dates and times, and the names of group members.
 - 5. (b) (6) will forward the request to Dr.'s Mussbaum and Tipton who will review it, consult with her about the request, and make the appropriate arrangements.

Appendix B. Cave related conservation sites along the MVP Corridors

This Appendix contains descriptions of conservation sites for cave element occurrences that are intersected by proposed Mountain Valley Pipeline corridors and alternatives specified in Resource Report 10. Greater detail is given to conservation sites that intersect the proposed corridor.

Please note that biological inventory work in many of these sites is incomplete, the level of sampling across sites is inconsistent, and the assigned biodiversity ranking may under represent the biodiversity significance of any individual site.

Canoe Conservation Site (Proposed Corridor; AEP-Newport Variation)

Canoe is a conservation site of at least second order significance (B2). It encompasses one state designated significant cave and one globally rare, cave adapted invertebrate. No extant records of federal or state listed species are associated with this conservation site. However, it has been nearly 50 years since biological collections were made in the cave, and there is a high likelihood of additional, globally rare species using this cave.

*Based on its geometry and the history of saltpeter mining, Canoe Cave has a high potential for use as a bat hibernacula. There is potential for use of the cave by the Federally Endangered Indiana bat (*Myotis sodalis*) and federally threatened Northern long-eared bat (*Myotis septentrionalis*.) Hibernacula surveys should be performed during the first quarter of calendar year 2016.*

See additional comments above regarding Canoe Cave under New Record for Northern long-eared bat-Giles County

Slussers Chapel Conservation Site (Proposed Corridor; AEP-Newport Variation; Blake Alternative)

Slussers Chapel is a conservation site of third order significance (B3). No extant records of federal or state listed species are associated with this conservation site. There is potential for the state listed endangered Ellett Valley Millipede (*Pseudotremia cavernarum*) in the site. This conservation site protects cave and karst associated element occurrences, including 2 state designated significant caves, both under conservation ownership. The conservation site boundary includes the land overlying the caves and the watershed of the cave streams as determined by dye trace studies and topographic analysis. Six additional caves are documented within the conservation site.

The two significant caves are Slussers Chapel and Mill Creek Caves. Entrances to both caves are in conservation ownership, Slussers Chapel by the Cave Conservancy of the Virginias and Mill Creek Cave by the Nature Conservancy. Three cave limited terrestrial invertebrate species and two cave limited aquatic invertebrate species are known from the site. Of these, three species are globally very rare, cave limited invertebrates. Slussers Chapel cave is the type locality for one of these species. The range for two of these species is limited to the karst of the upper Roanoke River basin.

A recent biological inventory of Mill Creek Cave (2012) obtained specimens of the millipede genus *Pseudotremia*. They specimens were consistent with the state listed endangered Ellett Valley millipede. However, the specimens were juveniles and not identifiable to the species level. Subsequent collections of adult male *Pseudotremia* will help to determine whether or not the state endangered species is present in the conservation site. *Recent exploration by cave divers in Mill Creek Cave has increased the length of the cave by more than 1000', in the direction of the proposed route for the MVP pipeline. Exploration is ongoing, and there is a high likelihood that significant, additional subterranean habitat will be documented.*

The relationship of the Slussers Chapel Conservation site to potential MVP corridors is show in Figure .

Little brown, tricolored, and big brown bats are known from caves in the site, but not in high numbers

Old Mill Conservation Site (Proposed Corridor; AEP-Newport Variation)

Old Mill is a conservation site of third order significance (B3). No extant records of federal or state listed species are associated with this conservation site. There is potential for the state listed endangered Ellett Valley Millipede (*Pseudotremia cavernarum*) in the site.

This conservation site protects cave and karst associated element occurrences, including a state designated significant cave. The conservation site boundary includes the land overlying the cave and the watershed of the cave stream as determined by dye trace studies and topographic analysis. The current boundary should be modified to include the entire watershed of Dry Run, which sinks in its bed supplying the majority of the water in the Old Mill Cave stream. Two additional caves are documented within the conservation site.

Three cave limited terrestrial invertebrate species and two cave limited aquatic invertebrate species are known from the site. Of these, three species are globally very rare, cave limited invertebrates. In addition, a globally rare troglomorphic beetle is known from the cave. The range for two of these species is limited to the karst of the upper Roanoke River basin. No information is available regarding bat use of the site.

Clover Hollow Conservation Site (AEP-Newport Variation)

Clover Hollow is a conservation site of first order significance (B1). No extant records of federally listed species are associated with this conservation site. There is a historical record for the Indiana bat.

This conservation site protects cave and karst associated element occurrences, including 4 state designated significant caves. The conservation site boundary includes the land overlying the caves and the watershed of the cave streams as determined by dye trace studies and topographic analysis. Nineteen additional caves are documented within the conservation site.

A total of 7 cave limited terrestrial species and 3 cave limited aquatic species are known from the site. Of these six species are globally very rare, cave limited invertebrate. Tawneys cave is the type locality for three of these species, Smokehole cave for one, and Stay High Cave (state Natural Area Preserve) for another. The range for three of these species is limited to the Sinking Creek Valley in Giles and Craig counties, VA.

Two rare bat species, the Eastern small-footed bat and the Indiana bat are known from the conservation site. However, the Indiana bat record is very old and the species has not been observed in the conservation site for decades. Nonetheless, coordination with the US Fish and Wildlife Service is recommended should the AEP-Newport Variation be pursued.

The current center line of the AEP/Newport alternative passes directly over known cave passage in two designated significant caves – Tawneys and Smokehole. In addition to the invertebrate element occurrences, Tawneys Cave has hosted a modest hibernacula (~800-1000 total individuals) for little brown (*Myotis lucifugus*), tricolored (*Perimyotis subflavus*), and big brown bats (*Eptesicus fuscus*.)

Tawneys and Smokehole caves are highly significant in terms of recreational use. Tawney's Cave is used by numerous parks and recreation departments, scouting troops, church groups, and other civic organizations, as well as members of the caving community. Smokehole Cave is popular among cavers in the region, and receives some informal visitation as well. The loss of these caves as recreational resources due to safety concerns associated with underlying a gas pipeline would be likely to move the "traffic" to other sites, many of which are less suitable due to safety and environmental reasons.

Pig Hole Conservation Site (AEP-Newport Variation):

Pig Hole is a conservation site currently ranked at 4th order significance (B4). No extant records of federally listed species are associated with this conservation site. However, no biological inventories for cave-related fauna had been performed in the site prior to 2014. Inventories of the site are currently in progress.

This conservation site protects a state designated significant cave. The conservation site boundary includes the land overlying the cave and the watershed of the cave stream as determined by dye trace studies and topographic analysis. A second small cave occurs within the site.

B.1 – Cave adapted invertebrates in Pig Hole Cave

Cave limited species occur in the significant cave, but they are poorly documented. A recent collection trip obtained specimens of cave adapted millipedes, *Stygobromus sp.* cave-adapted amphipods, cave adapted spiders, a flea, troglomorphic beetles, cave adapted spiders, and monogynaspid mites.

Dr. John Holsinger of Old Dominion University has examined the *Stygobromus* specimens collected in the fall of 2014 and determined that they are new to science. Once this species is formally described, it will be added to the state list of rare species, which will bump the biodiversity ranking of Pig Hole Cave Conservation Site to B2. In the highly likely event that additional globally rare cave adapted invertebrates are found in the cave, the site could be raised to B1 status. For example, the spotted cave beetle (*Pseudanophthalmus punctatus*), known only from the Sinking Creek basin, was recently documented from a cave 0.3 km east of the current boundary of the Pig Hole conservation site. Dye trace studies suggest that water from this cave passes beneath the site and that the beetle is likely present in Pig Hole Cave.

For purposes of environmental planning, we recommend treating the site as a B2 rather than B4 conservation site.

B.2 – Bats in Pig Hole Cave

Although Pig Hole cave has long been known to cavers as a bat cave, there has been no formal inventory of the cave in terms of bat use. At the very least, it is clear the little brown bats, big brown bats, and tricolored bats currently use the cave. Cavers report that as recently as the mid- to late 1990s, there were probably over a thousand *Myotis* (little browns?) hibernating in the Hess' Hollow portion of the cave, and there were several clusters of bats near the lower elevation entrance of the cave. These clustering bats were probably little brown bats, but could have been Indiana bats or possibly Virginia big-eared bats. *Myotis* populations have declined precipitously in response to White Nose Syndrome in the New River Valley, so currently populations are anticipated to be much lower than those reported from the 1990s. Nonetheless, investigation of Pig Hole cave's current significance as a hibernacula was warranted, and performed in early March, 2015. The historic record of the Indiana bat from a cave 3km to the east suggested that use of Pig Hole by Indiana bats may have been probable.

A thorough inventory of the cave for hibernating bats was performed on March 3, 2015, by Virginia Natural Heritage Program staff scientists and volunteers from the VPI (Virginia Tech) Cave Club. A total of nine bats of three species were observed (1 little brown bat, 3 tricolored bats, and 5 big brown bats.) No listed species were observed. It is likely that White Nose Syndrome is responsible for the precipitous decline of the bat population over the last 6 years.

B.3 – Recreational use of Pig Hole Cave

The current centerline for the AEP/Newport alternative passes within 300' of an underlying mapped cave passage in Pig Hole Cave. It also passes down a steep slope below the cave's lower entrance, into which air flows aggressively during the winter months due to the chimney effect of the higher entrance. It is a concern that gas

leaking from the pipeline down slope of the cave could become entrained in airflow entering the cave and subsequently concentrated within domes in the cave. The cave receives significant recreational use on a regular basis, and an accumulation of gas would pose a risk to human health and safety.

Roan Smith Conservation Site (110J):

Roan Smith is a conservation site of third order significance (B3). No extant records of federal or state listed species are associated with this conservation site.

Colliers Conservation Site (Route Alternative 1)

Colliers Conservation site is assigned fourth order significance (B4.) No extant records of federal or state listed species are associated with this conservation site.

Fifty Fifty Conservation Site (Route Alternative 1, ETNG)

Fifty fifty is a conservation site of third order significance (B3) due to presence of rare cave adapted invertebrates. No extant records of federal or state listed species are associated with this conservation site.

Giant Conservation Site (Route Alternative 1)

Giant conservation site has at least second order (B2) biodiversity significance due to the presence of two cave adapted invertebrate species limited to Giles County, Virginia.

Harris Conservation Site (Route Alternative 1)

Harris conservation site fourth order biodiversity significance.

Wilburn Valley Conservation Site (Route Alternative 1)

Wilburn conservation site has at least second order (B2) biodiversity significance due to the presence of two cave adapted invertebrate species limited to Giles County, Virginia. In addition, there are several state designated significant caves within the conservation site.

Watsons Conservation Site (ETNG)

Watsons Conservation Site has 3rd order (B3) biodiversity significance due to presence of rare cave adapted invertebrate species.

Appendix C. Cave limited species whose type locality conservation sites are intersected by Mountain Valley Pipeline alignments under consideration (10/23/2015)

Clover Hollow Conservation Site:

- Smokehole Cave, *Caecidotea henroti* – 2 of 4 sites are in consite; *Va endemic*
- Tawney's Cave, *Stygobromus ephemerus* – endemic to Sinking Creek basin in Giles County, all but one known occurrence are in Clover Hollow Conservation site

- Tawney's Cave, *Pseudanophthalmus punctatus* – Giles County endemic; all but one occurrence are in Clover Hollow Conservation site
- Tawney's Cave, *Pseudanophthalmus gracilis* – Endemic to Sinking Creek basin; all but one occurrence are in Clover Hollow Conservation site
- Stay High Cave, *Pygmarrhopalites commorus* – widespread springtail

Slussers Chapel Conservation Site

- Slussers Chapel Cave – *Stygobromus fergusonii* (2 of 3 records are in consite)

Pig Hole Conservation site

- Pig Hole Cave – undescribed species of amphipod, genus *Stygobromus*

Appendix D. General concerns regarding gas line installation and operation in karst

In addition to concerns about impacts to documented resources, there are some important, general considerations regarding the potential impact of pipeline construction and operation on karst resources. It is critical both for resource conservation and for the integrity of the pipeline that karst issues be recognized and dealt with in an appropriate manner. For some features, this will mean avoidance, while for others, appropriate engineering solutions. Of particular relevance are:

- 1) The use of directional drilling for stream crossings in karst areas, where loss of drilling fluid into voids can damage habitat and contaminate ground and surface water. This happened during the Duke Energy Patriot Pipeline crossing of the New River near Fosters Falls in Wythe County. For these reasons, direction drilling in karst is not recommended.
- 2) The potential for subsidence along the pipeline, which could affect the structural integrity of the pipeline and induce leakage. Subsidence prone areas should be avoided if possible, and/or the structural integrity of the pipeline must be documented as sufficient to bridge any voids that may form.
- 3) The impact to undocumented karst features encountered during survey and construction. The project's proponents should document and investigate any features of potential significance discovered during the course of the project, and the results of any such investigation be shared with Virginia DCR.
- 4) The discharge of slug test water to sinkholes or the karst land surface. Discharge of slug test water to the land surface, including but not limited to sinkholes, has in the past (for example, during the Duke Energy Patriot pipeline) induced the formation of sinkholes adjacent to pipeline ROWs, causing safety hazards and introducing sediment as well as any chemicals in the slug test water into the local ground water. Slug test water should not be discharged to sinkholes or to the land surface in karst areas.
- 5) Spills of fuel and other chemicals during project construction and maintenance activities. If such spills drain to sinkholes, caves, or sinking streams, they have the potential to contaminate groundwater and adversely impact subterranean habitat as well as drinking water supplies. Project proponents should include karst specific provisions in the spill prevention plan that provide the same level of protection to karst features as that afforded to surface waters. A recent (2015) spill associated with construction of the Columbia Gas Pipeline feeding the Celanese plant in Pearisburg, VA entered a sinkhole and contaminated the drinking water supply of Peterstown, WV. This recent spill illustrates the fact that such events have and continue to occur, stressing the need for implementation of best practices, guaranteed by strict project oversight from regulatory agencies.



TELEPHONE / PERSONAL CONVERSATION REPORT

PROJECT NAME:	Mountain Valley Pipeline Project
MVP ATTENDEES:	Taina Pankiewicz – Environmental Solutions & Innovations, Inc. Valerie Clarkston – Environmental Solutions & Innovations, Inc. Daniel Judy – Environmental Solutions & Innovations, Inc. John Spaeth – Environmental Solutions & Innovations, Inc. Greg Anderson – Environmental Solutions & Innovations, Inc. Casey Swecker – Environmental Solutions & Innovations, Inc.
CONVERSATION WITH:	Kimberly Smith – US Fish & Wildlife Service (via phone)
AGENCY:	USFWS
EMAIL ADDRESS:	kimberly_smith@fws.gov
PHONE NUMBER:	804-824-2410
SUBJECT:	USFWS response letter dated 8 March 2016
DATE AND TIME:	3/16/16 11:00am

SUMMARY OF CONVERSATION:

John Spaeth: In regards to the mussel surveys being good for 2 years, since construction won't be happening until 2017, and surveys were done in 2015, the time elapsed will likely be slightly more than 2 years. Do we actually have to resurvey everything?

Kim: If the habitat assessment was negative, then no. But if it was positive, then yes. We are especially concerned about the many crossings of Craig Creek. We want to see one crossing and the route not running parallel to the stream.

Taina: The project route has been revised and there is now only one crossing.

Kim: Is that one of the crossings you already surveyed?

Spaeth: Yes.

Kim: Did you find habitat for James spinymussel there?

Spaeth: Not really. It was way up in the headwaters and the substrate was predominantly bedrock.

Kim: Time of year restrictions will still apply in Craig Creek because of the occurrence of downstream populations.



Taina: We can and will provide you the revised section of the route related to the Craig Creek crossing.

Kim: We also need a justification for WHY the project needs to cross in these streams with listed species?

Taina: There were a variety of factors that were considered during the routing analysis, ranging from potential environmental impacts like listed species to wetlands to cultural resources to engineering and constructability.

Kim: I understand that. But I still need an alternatives analysis related to species impacts.

Taina: I know that Alternatives Analysis related to NEPA is a bit different than for ESA... We also only have field survey data on this preferred alternative so I'm not quite sure how we can compare species occurrence data for other alternatives that were considered but abandoned? Are you asking us to collect field data on abandoned alternatives?

Kim: Not necessarily. But I would at least like to see a desktop review of the other alternatives. Do you need to cross right there? How are you going to cross? Did you provide adequate info to justify the crossing method? Now that we know where the eco-resources are, what is the Project going to do to avoid, minimize, or mitigate those resources. The sequential preference of any project is to 1) avoid, 2) minimize, and 3) mitigate.

Taina: We can probably do that... I am trying to understand, in terms of doing a desktop assessment, for aquatic species, along alternatives, what are you asking for? In the BA we addressed the impacts from sedimentation, and found that sometimes most significant impacts were actually downstream, not actually AT the proposed crossing.

Kim: I don't just look at the crossing. I look at the downstream impacts too.

Taina: OK. We do have a lot of alternatives information data that was compiled for the NEPA alternatives analysis; we will look through that and attempt to address T&E issues along the routes.

Kim: Do you already have information on why the proposed crossing method is better?

Taina: Yes. We can include that in our response as well.



Kim: Have you addressed impacts associated with all of the facilities that are adjacent to these streams and the impacts on logperch?

Taina: Not that I can recall... ???

Spaeth: I'm not sure if you are aware of this or not but at the request of Mike Pinder over at VDGIF we are planning to do fish removals at the time of construction.

Kim: OK

Spaeth: We currently have 6 streams with habitat. Do you want species occurrence surveys even if we are going to adhere to a time of year restriction?

Kim: Presence/absence surveys are useless because if you don't find it, it doesn't mean it's not there. We assume presence if habitat is present. I would welcome surveys because it would provide info but survey absence would NOT indicate a lack of species presence. Also, I did not agree with the assessment in the survey report regarding the absence of the species in the Blackwater River.

Spaeth: The literature seems to indicate that the species isn't there.

Kim: But habitat is present.

Taina: It is my understanding that there is a relatively extensive data set regarding survey collection efforts on the Blackwater River and the species has never been documented?

Kim: I'm not aware of all that data. All I have to go on is what is in the survey report. The habitat is there, correct?

Greg: Yes. It's actually a really beautiful system. The habitat is perfect. I have no clue why they aren't there. But there have been extensive surveys dating back decades and no collections at all.

Kim: You need to provide additional information if you want to try to support the assertion that the species is not present.

Greg: At what point do we not have to assume presence? Is the whole Roanoke River basin considered habitat? Anything that is a HUC 8? For example, we wouldn't assume presence in the Roanoke rapids area, correct? Likewise, I assume that the Blackwater River gets picked up automatically as habitat because it is in the Upper Roanoke?



Kim: That's correct? And I'm not sure. You just have to present the data / argument and we can review it and decide.

Greg: OK. There is survey data that we can cite, dating back to Bob Jenkins in the 70s.

Spaeth: Can you help me understand how USFWS interprets how geographic features that affect distribution and occurrence for aquatic species? For example, the Bottom Creek crossings are north of the Gorge. It is in the headwaters of the stream. Species are not known from north of the Gorge. Would we need to conduct habitat assessments up there or can they be omitted?

Kim: They can be omitted.

Spaeth: There are also some unnamed tributaries that go into Blackwater River. They are marginal second order streams; can we omit surveys on those as well?

Kim: Yes, tentatively. However, I don't have this information all off the top of my head. If I'm on the spot, I will say you have to survey everything just because I don't have specific knowledge of the streams.

Spaeth: Are there any other streams that we did not pick up as being included for survey that need survey?

Kim: I would have picked them up in my review and included them in this letter.

Kim: Oh one last thing, we are going to request a third party biological monitor be present on site, during construction, anywhere that logperch potential habitat exists.

Taina: Is that something that ESI can do or is that too much of a conflict of interest since we are already so closely involved in the project?

Kim: The most important thing is that the individual(s) is/are qualified to work with the species, so probably it is ok but I need to think on it.

Taina: You had comments related to Migratory Birds. Have you reviewed the Migratory Bird Conservation Plan that we prepared? ... It was submitted on 25 January.

Kim: I have not.

Taina: I will send that to you.

Kim: Have you done any eagle surveys?



Taina: We did in West Virginia, and then on JNF. However, we did not do them in other areas of Virginia, because it did not show up during our review of the Center for Conservation Biology's VA Bald Eagle Nest Locator.

Kim: I have concerns because the CCB nest locator doesn't have any aerial data surveys in the western part of the state

Taina: I will send you the MBCP we prepared and you can look at it and let us know if you need additional information or data.

Contact Signature: _____

Valerie Clarkston

Subject: FW: 3 MVP questions

From: Smith, Kimberly [mailto:kimberly_smith@fws.gov]

Sent: Thursday, March 24, 2016 2:28 PM

To: Taina Pankiewicz

Cc: Troy Andersen; Sarah Nystrom

Subject: Re: 3 MVP questions

We have reviewed the eagle sections of the Migratory Bird Habitat Conservation Plan as requested so that surveys may proceed in a timely manner. We are currently reviewing the Plan and will provide substantive comments on the entirety of the plan at a later date. The Nature Conservancy is currently working with us to address migratory birds and associated impacts from tree clearing and we would like to share the Plan with them. Please let us know if that is acceptable.

General Comments:

The plan does address the potential presence of golden eagles in the project area; however, there are no survey results, data collected or avoidance and minimization measures for golden eagles. These should be provided in order to accurately assess the risk to golden eagles. The current survey effort for bald eagles does not adequately address the likelihood of their presence. In order to avoid project delays due to the late discovery of a nest, we recommend additional survey effort prior to the beginning of the project.

General avoidance and minimization measures for bald and golden eagles should be included in the plan such as keeping the project site clean of garbage, ensuring that vehicles drive slowly to avoid hitting animals and creating carrion, and encouraging hunters in the area to bury or remove gut piles. These measures can decrease the likelihood that eagles will be drawn to the construction site. Winter tree clearing should be avoided in areas with high concentrations of wintering golden eagles. Measures to reduce noise should be implemented whenever possible. Blasting should be minimized and measures taken to reduce noise and vibration effects whenever possible. A qualified observer should be present whenever construction is occurring to identify the presence of bald or golden eagles and implement the appropriate avoidance and minimization measures. If a nest is discovered within 660 feet of the project, work should stop until the appropriate USFWS field office has been contacted and recommendations have been provided.

Title Page:

Habitat Conservation Plan is a term of art for the Service under Section 10 of the Endangered Species Act. To avoid confusion, we recommend that you rename the plan. Bird Conservation Strategy is a term often used with wind projects that could be applicable (usually Bird and Bat Conservation Strategy) or simply Migratory Bird Conservation Plan.

Page 1, Page 3 and throughout:

The Nov. 1, 2013 notice in the Federal Register states that 1,026 birds are listed on the MBTA.

Page 19, Section 7.5.1:

Golden eagles do not nest in the eastern United States. Surveys should be conducted to document presence or absence of wintering golden eagles in the project area from December through early March. Aerial surveys are unlikely to successfully document golden eagles because they tend to stay below tree line. Camera trap surveys have had success in identifying individual golden eagles on wintering territories. Todd Katzner and Trish Miller have data sets from golden eagles with GPS transmitters that they may be willing to provide.

Page 19, Section 7.5.1:-

Aerial surveys for bald eagle nests should be conducted during the breeding season, preferably before leaf out. The presence of the eagles at the nest often helps to find the nest as the bright white head of the bird will stand out, particularly in conifers. It can be difficult to identify a large nest structure conclusively as an eagle nest without the birds being on territory and at the nest. Many former bald eagle nests are used by other species. Future surveys should be conducted during the breeding season, with January through March or April as targeted months.

Page 20, Section 7.5.1:-

Surveys should be conducted along the entire length of the proposed pipeline in Virginia. Surveys should be conducted for at least 0.5 mi on either side of the proposed pipeline in areas of dense forest. Surveys should be conducted for at least 1.0 mi of either side of the proposed pipeline in areas with open line of sight.

Page 20:

Limited short-term disturbance related activities can occur within 660 feet of nests that have been inactive for longer than two years; however, permanent habitat changes, such as tree clearing, should not be conducted within 330 feet of the nests. The recommendations found in the National Bald Eagle Management Guidelines should be applied to alternate nests that have not been used in the previous two years as they are more restrictive than the VDGIF guidelines.

Page 21, Section 7.7:

If blasting is occurring in Jefferson National Forest, bald eagle surveys should have been conducted for 0.5 mi on either side of the proposed route.

From: Harding, Sergio (DGIF) <Sergio.Harding@dgif.virginia.gov>
Sent: Wednesday, October 12, 2016 10:57 AM
To: Doug Gilbert
Cc: ProjectReview (DGIF); Valerie Clarkston; Aschenbach, Ernie (DGIF)
Subject: RE: Update of peregrine falcon surveys near New River (Ripplemead, VA); ESSLog 35246 Mountain Valley Pipeline

Hi Doug,

Yes, CMI conducted peregrine surveys in 2016 at the site along the New River where the peregrine falcon was detected last year. No falcons were detected through this year's surveys. Let me know if you need additional details.

Sergio

Sergio Harding | Nongame Bird Conservation Biologist | Virginia Department of Game and Inland Fisheries | 7870 Villa Park Dr, Suite 400, Henrico, VA 23228 | 804-367-0143 | www.dgif.virginia.gov | www.vabci.org

From: Doug Gilbert [<mailto:dgilbert@envsi.com>]
Sent: Monday, October 10, 2016 9:56 AM
To: Harding, Sergio (DGIF)
Cc: Aschenbach, Ernie (DGIF); Valerie Clarkston
Subject: Update of peregrine falcon surveys near New River (Ripplemead, VA); ESSLog 35246 Mountain Valley Pipeline

Hello Sergio,

I am contacting you to determine whether or not VDGIF and its partners (Conservation Management Institute at Virginia Tech) were able to complete additional surveys in 2016 for peregrine falcons along the New River. Attached is a copy of correspondence between you and my colleague, Valerie Clarkston, indicating that surveys were planned for 2016. I am in the process of updating documents on behalf of the Mountain Valley Pipeline and the question was brought to my attention regarding whether or not any peregrine falcons were found during your 2016 survey efforts. I appreciate any insight you can provide regarding these surveys.

Thank you for your time. Feel free to contact me via email or by phone. I look forward to hearing from you.

Thanks,



Doug Gilbert

Scientist

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4525 Este Avenue | Cincinnati, OH 45232 | USA
office: 513.451.1777 **direct:** 513.591.4317
fax: 513.451.3321
dgilbert@envsi.com | www.envsi.com

Valerie Clarkston

Subject: RE: MVP MBCP Review
Attachments: MVPBirdConservationPlanComments_SHupdated.docx

-----Original Message-----

From: Harding, Sergio (DGIF) [mailto:Sergio.Harding@dgif.virginia.gov]
Sent: Tuesday, December 20, 2016 11:39 AM
To: Aschenbach, Ernie (DGIF) <Ernie.Aschenbach@dgif.virginia.gov>; Stahl, Megan D. <MStahl@eqt.com>; Fernald, Ray (DGIF) <Ray.Fernald@dgif.virginia.gov>; Cooper, Jeff (DGIF) <Jeff.Cooper@dgif.virginia.gov>
Cc: Troy Andersen <troy_andersen@fws.gov>; Kimberly Smith <kimberly_smith@fws.gov>; Sumalee Hoskin <sumalee_hoskin@fws.gov>; Jennifer Stanhope <jennifer_stanhope@fws.gov>; Tiernan Lennon <tiernan_lennon@fws.gov>; sarah_nystrom@fws.gov; Taina Pankiewicz <TPankiewicz@envsi.com>; Valerie Clarkston <VClarkston@envsi.com>; Daniel Judy <djudy@envsi.com>; Hypes, Rene (DCR) <Rene.Hypes@dcr.virginia.gov>; Barbara.D.Sargent@wv.gov; Dawley, Joseph <JDawley@eqt.com>
Subject: RE: MVP MBCP Review

Hi Megan,

Ray Fernald and I are available for the conference call tomorrow. I reviewed the migratory bird conservation plan back in November, but I am not sure whether my comments ever made their way to you. I have looked over my original comments today and have attached an updated copy. These would likely form the basis of our discussion of the plan in terms of what DGIF would like to cover. If you feel that you need additional time to review these comments ahead of a conference call, we are happy to reschedule. Please let us know - thanks.

Sergio

Sergio Harding | Nongame Bird Conservation Biologist | Virginia Department of Game and Inland Fisheries | 7870 Villa Park Dr, Suite 400, Henrico, VA 23228 | 804-367-0143 | www.dgif.virginia.gov | www.vabci.org

Review of Migratory Bird Conservation Plan for Mountain Valley Pipeline Project in Virginia and West Virginia 11/4/2016 (updated 12/20/2016)

Overarching comments:

Avian species list:

The Plan focuses its evaluation of potential Project impacts on migratory birds of conservation concern (BCC). These were drawn from Bird Conservation Region (BCR) lists for Appalachian Mountains and Piedmont and through consultation with state natural resource agencies.

- DGIF chose to focus on loggerhead shrike as a state-listed species in our communications with the consultant. Given that the Plan is drawing from BCR lists (at least one of which (Appalachians) is out-of-date and in the process of being revised), we recommend that the Plan instead emphasize the top 2 tiers of Species of Greatest Conservation Need (SGCN) from DGIF's 2015 Wildlife Action Plan
- BCCs are summarized in Table 4 on pp. 41-42. For the most part, they capture the Tier I and II avian SGCN with which we are concerned
 - American Woodcock is excluded from the list and should be included
 - Of the BCCs listed, we particularly want to emphasize our concern for the following species:
 - Golden-winged warbler – records in vicinity of project area
 - Cerulean warbler – records in vicinity of project area
 - Swainson's warbler - listed in Table 4 as occurring within project area only in WV; we recommend adding VA to this – we don't have very good data for this species, and it is possible that it may occur within the pipeline area west of the Blue Ridge
 - Loggerhead shrike – we continue to coordinate with the consultant on this species
 - Black-billed cuckoo – records in vicinity of project area
 - Northern saw-whet owl – records in vicinity of project area
 - Peregrine falcon - see below

Peregrine Falcon:

- Although this was not mentioned in previous correspondence between DGIF and the applicant/consultant, the pipeline is ~2 mi from a historic peregrine falcon nesting cliff (Barney's Wall in Giles County, near Mountain Lake). The site is not known to be occupied, but has not been surveyed in over a decade.
- There are cliffs that are suitable for peregrine falcon nesting at different points along the New River within 2 miles of the Project. As communicated to the consultant, the most recent surveys, conducted in 2016, did not detect peregrines. However, not all suitable cliffs were surveyed in 2016, and a single bird was documented at one of the cliff sites in 2015 (surveyed

again in 2016). Therefore, there is potential for peregrines to nest along the New River in coming years.

- It is not expected that the Project would result in nest abandonment by any breeding peregrines at these sites, but there is concern that loud blasting could have impacts (including flushing an incubating falcon from the nest, which could cause egg damage). We therefore recommend that there be coordination with DGIF on the proposed location and timing of blasting activities.

Loggerhead Shrike:

- Section 7.6.2 Loggerhead Shrike Avoidance and Minimization (pp. 26-27)
 - states that 'Although tree clearing within the LOD in the loggerhead shrike[LOSH] study area is expected to occur outside of the nesting period, construction activities may occur during this timeframe'
 - we recommend that any work, including construction activities, should take place outside of the TOYR for shrike within habitat that has been evaluated as suitable for shrike, unless shrike surveys have been conducted and shrikes have not been documented;
 - States that 'If clearing cannot be implemented prior to the nesting season, three occupancy surveys on separate days ... will be completed during the nesting season.'
 - if it is anticipated that a TOYR cannot be followed, then occupancy surveys should be coordinated with DGIF to be conducted during the breeding season preceding vegetation clearing and construction activities, and NOT immediately preceding vegetation clearing as is implied. These surveys should follow recommended DGIF protocols. As these protocols may be subject to change, coordination with DGIF is recommended ahead of survey implementation
 - States that any active nests that are located would receive a protective buffer and that the area within the nest buffer be cleared only after nestlings have fledged
 - We recommend that construction activities during the LOSH breeding season (April 1 – July 31) should be immediately suspended at a site if presence of LOSH is detected, whether in the form of a LOSH sighting or the discovery of cached prey on thorny shrubs or barbed wire. Coordination with DGIF should then take place as soon as possible. Construction activities, even if unrelated to vegetation clearing, can result in nest abandonment or otherwise adversely impact LOSH breeding.
 - Generally speaking, we strongly recommend that construction activities, including but not limited to vegetation clearing, not take place within suitable shrike habitat during the shrike TOYR, unless occupancy surveys have been conducted according to DGIF protocols and following coordination with DGIF.

Shrubland classification in the Plan:

- Classification of open habitats (grasslands and shrublands) in the Plan was based on NLCD classifications – NLCD is notorious for the inadequate job it does of correctly identifying shrubby

patches on the landscape. These are often found at woodland edges and within the context of open pasture/hay fields.

- Section 5.1 – references upland habitats dominated by herbaceous vegetation (pasture/hay, grassland/herbaceous) as comprising >18% of Project area, and shrub/scrub as comprising 1% of project area based on NLCD classification.
 - The percentage of shrub/scrub within the Project area is likely significantly higher due to the shortcomings of NLCD classification of shrubby habitat
- Section 6.2 (page 21) – References Project impacts on pasture/hay NLCD class. States ‘Grassland habitat clearing is unlikely to have any long-term impacts due to proposed replanting of cleared areas and the relatively fast growth and recovery of herbaceous vegetation’
 - this does not account for shrubs that are undoubtedly embedded within many sites classified as pasture/hay, and which would require a longer period of time to regrow
- Section 6.3 (page 21) – states that ‘A total of ~29 acres of shrub/scrub habitat will be cleared during construction. Of this, 21.5 ac will be permanently removed ... The remaining area will be replanted with native shrubs’
 - Again, this is likely a gross underestimate of the amount of shrub/scrub on the landscape in pasture/hay settings.
 - Replanting with native shrubs should also occur in pasture/hay settings whenever such shrubs are removed. Within pasture/hay settings, care should be taken to replace shrubs with the same species that were removed (ex. Eastern red cedar should be replaced with Eastern red cedar) or its functional counterpart if the shrub removed is non-native (ex. non-native osage-orange, which is a thorny plant, should be replaced with hawthorn)

Forest fragmentation effects:

- The Plan quantifies potential Project fragmentation impacts, but does not discuss mitigation for forest fragmentation effects
- Section 6.1.1. (page 20) – states that ‘While calculations are used to estimate interior forest loss and the extent of forest fragmentation, it is difficult to estimate the severity of local impacts to forest interior birds with limited data that are available ... Avian monitoring surveys, including occupancy surveys and nest monitoring surveys, may provide information concerning the gradient of effects on forest interior birds associated with the clearing of forest for the Project; however, such surveys have not been proposed and this information is unavailable.’
 - This seems to be making the case that such surveys be proposed and implemented in order to evaluate the impacts that the project has on bird populations; this in turn suggests a path toward quantifying mitigation.

Timing of clearing (Section 7.8):

- P. 28 – states that ‘While construction noise can be a nuisance to nesting forest bird species, these activities should not result in mortality for individuals nor eggs.’

- actually, they can result in egg/chick mortality if sustained noise and/or visual disturbance or proximity of construction to active nests results in nest abandonment
- p. 28 – states that the majority of Project-related tree clearing is planned between Sept 1, 2017 and March 31, 2018. Also states that ‘...”clearing” in grassland and scrub-shrub habitat tends to happen immediately preceding (i.e. concurrent with) construction activities ...’
 - does this imply that no construction activities will be taking place in open areas between April and August? Needs clarification.
 - In fact, on p. 29, there is a statement that ‘construction has potential to occur throughout the nesting season of migratory birds’ –if construction and vegetation clearing are concurrent in open areas, this implies that vegetation clearing has the potential to occur throughout the nesting season in open areas –it is important that this be clarified

Specific comments:

- p. 4 – states ‘... the MBTA lists 1026 species of ... birds, 25 of which occur within or near the project area’
 - what is meant is that 25 Birds of Conservation Concern occur within or near the Project area; a far greater number of avian species than 25 occur within the Project area
- p. 10 – states ‘The VDGIF recommended that MVP commit to suspending tree removal or land clearing activity from May 1 to July 31 ...’
 - the actual dates were April 1 to July 31
- p. 13 – states ‘Because MVP does plan on completing construction activities between April 1 and July 31 within potential shrike habitat, habitat studies ... have been completed. Off-season tree and shrub clearing is proposed for areas with suitable habitat.’
 - even if habitat is evaluated as not being suitable for shrike, it may still be used for nesting by other breeding bird species of open areas. We therefore have concerns about potential impacts of vegetation clearing to shrubland-nesting birds and recommend that, to the extent possible, vegetation clearing in these areas should still be implemented in the off-season (Sept 1, 2017 – March 31, 2018), similar to what is being proposed for vegetation clearing in forested habitat.
- p. 13 - Section 4.2.1 Bald and Golden Eagles – references having received a map from Dr. Todd Katzner in May 2016 of spring, fall and winter telemetry locations of migrating golden eagles
 - Map is not referenced again in Plan –is Project expected to impact golden eagles based on the information from Todd Katzner?
- p. 14 – states ‘Surveyors were asked to document any incidental observations of the eleven locally rare avian species during other field surveys ...’
 - the context is that the USFS identified four species requiring further investigation. The eleven species above should be changed to four species, unless it is referencing a different set of species, in which case clarification is needed.
- p. 17 – in reference to ‘large patches of contiguous grass-dominated landscapes’, states ‘Loggerhead shrikes and peregrine falcons both use these habitats for hunting’
 - shrikes also use them for nesting

- p. 18 – states ‘The peregrine falcon commonly nests on buildings and skyscrapers in highly developed areas ...’
 - change to ‘may nest’
- p. 23 - Section 7.4 – Post-construction restoration, operation, and maintenance – ‘... requiring permanent mowing in the ROW must not occur more frequently than every three years and not during the period of April 15 to August 1’
 - Should be changed to April 1 – July 31 to account for potential breeding by loggerhead shrike
- p. 26 - Section 7.5.2 Bald Eagle Avoidance and Minimization –states that ‘MVP will notify USFWS regarding any [Bald Eagle] nests located during the remaining surveys ...’
 - DGIF should also be notified for any eagle nests found in Virginia
- p. 28 – states ‘The majority ... of Project-related tree clearing is planned between September 1, 2017 and March 31, 2018. The remaining portion of the Project will be cleared in April 2018 between mileposts 103.4 and 104.4. All but four of the Project-specific MBSC (bald eagle, peregrine falcon, pied-billed grebe, and yellow-bellied sapsucker) nest outside of this window.
 - Add loggerhead shrike to this list, begin nesting in April



TELEPHONE / PERSONAL CONVERSATION REPORT

PROJECT NAME:	Mountain Valley Pipeline Project
MVP TEAM CALLER:	Megan Stahl, Joe Daley, Taina Pankiewicz, Doug Gilbert, Valerie Clarkston, Mike Bruening
CONVERSATION WITH:	Cliff Brown – WVDNR Jo Weber – VA Ray Fernald – VDGIF Sergio Harding – VDGIF Sarah Nystrom - USFWS Jennifer Stanhope – USFWS Jason Bullock
AGENCY:	USFWS, VDGIF, WVDNR
EMAIL ADDRESS:	
PHONE NUMBER:	
SUBJECT:	Migratory Bird Conservation Plan
DATE AND TIME:	12/21/2016 – 2 p.m.

SUMMARY OF CONVERSATION:

Sergio – Requested clarification on staging and timing of construction and surveys. Stated that overall assessment was fairly thorough although he identified 5 areas that we didn't evaluate that he thinks should be evaluated. He will send ArcGIS bookmarks.

Doug – Stated that LOSH report proposed 3 sequential days of occupancy surveys vs agency requested protocol of 2 weeks in between each of 3 surveys

Sergio - Requested that MVP follow stated agency survey protocol for Loggerhead Shrike (LOSH). Referenced page 13 of the report regarding TOYR and clearing of shrike habitat. Stated that it seemed as though additional habitat would be cleared? Why would an avian biologist be needed on site if this was not the case?

Taina – Explained pipeline construction with tree clearing versus grubbing and that although the project might have the area slated for "Tree clearing" during the off season, shrubby areas could be inadvertently ignored since these areas are often cleared during "grubbing" not "tree clearing". Therefore, an avian biologist would be on site to ensure that construction crews clear these areas during the appropriate time frame outside of nesting season.

Sergio – Stated that it appears MVP is proposing to use native grass seed mixtures for replanting the entire ROW. Requested that shrike areas be replanted with shrubs (i.e., red cedars) instead of grasses to mitigate impacts. Said this would hasten the habitat regeneration and suitability.



Doug – Asked if Sergio was asking for this just in the designated shrike areas or in all scrub / shrub areas across the project?

Sergio – Said it would be ideal if this could be done on all scrub/shrub within the project footprint. Said that approx. 29 acres will be impacted and should be returned to scrub/shrub instead of “grassland”.

Someone??? Brought up forest fragmentation impacts and associated mitigation.

Megan? – replied that Jason Bullock had comments regarding 100m used for indirect impacts.

Doug – stated that 100 meters was used because that is what is listed in the Virginia Landscape Natural Resources and University of Connecticut’s Land Use data sets.

Taina – asked what types of mitigation may be used to offset impacts from forest fragmentation, including fighting invasive species. Can replanting of shrubs mitigate impacts to shrike? Can “feathering” of plantings at edge of ROW smooth transition to forest and reduce interior impacts? Can grass seed planting mixes be changed at the micro-level to be most in line with the habitat along that portion of the project and minimize impacts?

Ray – Stated that there are 2 issues at hand: 1.) Use of native seed mixes should be identified in conjunction with local biologists (not sure who exactly they are but they are Region 3 staff in Marion office) and 2.) Reducing impacts of forest fragmentation. The agency likes the idea of the use of transition zones between herbaceous species and forest areas. These ideas can/should be discussed more fully with the District Biologist and the Regional Manager. The Virginia Conservation Partnership that includes VCR and DOF can provide more info. Kevin Heffernin is the Endangered Species Biologist with DCR who should be contacted. DGIF, DCR, DOF & DEQ all working together to develop model to capture forest impacts.

Cliff – Reviewed MOU between USFWS and FERC. That document says that Mitigation may include replacement of land or service. Said the MVP MBTA CP does not address requirement for mitigation to core forest impacts in WV. Also said document was not clear that impacts contained addressed 100 m to EACH side of the ROW (both edges) which it should. Says there are 3 types of impacts that need to be addressed – Permanent, Temporary and Buffer zones.

Contact Signature: _____

Doug Gilbert

From: Harding, Sergio (DGIF) <Sergio.Harding@dgif.virginia.gov>
Sent: Thursday, December 22, 2016 10:03 AM
To: Doug Gilbert; MStahl@eqt.com
Cc: Valerie Clarkston; Taina Pankiewicz; Daniel Judy; Fernald, Ray (DGIF); Aschenbach, Ernie (DGIF); sarah_nystrom@fws.gov
Subject: RE: ESSLOG 35246 Mountain Valley Pipeline - Follow-up regarding potential loggerhead shrike habitat
Attachments: AdditionalPotentialLOSHHabitatMVP.DAT; GWWApointsMVP.ZIP

Hi All,

As a follow-up to yesterday's conference call, I am providing you with some of the information that we discussed.

Additional potentially suitable loggerhead shrike habitat – I have attached an ArcMap bookmark file which can be imported into your GIS project. In addition, I offer some comments below referencing the specific locations that I bookmarked. Map #s refer to maps contained in 'Field Surveys for Loggerhead Shrike along the Mountain Valley Pipeline in Giles, Craig, Montgomery, and Roanoke Counties, Virginia' (incidentally, it's up to you whether you want to change it, but this report title is a bit misleading, as this was really a loggerhead shrike field habitat assessment rather than surveys for shrike):

- Potential LOSH Habitat 1 = area of pipeline and access roads before map 6 in report; part of a very narrow open valley in Montgomery County
- Potential LOSH Habitat 2 = access road between maps 6 and 7 in report
- Potential LOSH Habitat 3 = area of access road and pipeline between maps 8 and 9 in report – access road passes under shrubby powerline – area surrounding access road may not have been marked because there is an existing road that may not require vegetation clearing – need clarification
- Map 13 – did not bookmark in ArcMap, but add portions of field with access road to the areas already marked
- Map 14 – did not bookmark in ArcMap, but the portion of the field associated with one of the access roads is not designated on the map – this access road abuts a vegetated fencerow – area surrounding this access road may not have been marked because there may be an existing dirt road that may not require vegetation clearing – need clarification

Records of priority DGIF Species of Greatest Conservation Need in the vicinity of the MVP:

Golden-winged Warbler (GWWA)

- I have attached a shapefile with GWWA records within 2 miles of MVP – they are slated to be entered into WERMS, but have not yet been
- Looked at eBird, filtered for May-July past 10 years – it is difficult to match up eBird map with MVP map, but there is a cluster of GWWA points along rte 700 (Mountain Lake Road) – this would put the points in the same general area as some of the points in the shapefile

Cerulean Warbler (CERW)

- Looked at eBird, filtered for May-July past 10 years
 - A few breeding season records from 2014-2015 on the Blue Ridge Pkwy between Bent Mtn and Copper Creek (which is the general area where MVP crosses the Blue Ridge)
 - June 2015 – CERW seen by several in a party in the Mountain Lake area

Northern Saw-whet Owl

- One 3/29/1997 Nelson Lafon (DGIF personnel) observation at Mountain Lake, coordinates [REDACTED] – this observation is in WERMS
- In eBird, filtered for past 10 years, year-round
 - 2 adults calling at Mountain Lake 5/22/2013 by Andrew Hoffman
 - 1 heard somewhere along 5 mi stretch of rte 708 (Poverty Creek Rd) south of MVP near Newport, by John Wilson 1-8-2012
- Generally speaking, we don't have very good data for this species in VA, and they are thought to be more widespread than the sparse records indicate

Black-billed Cuckoo

- eBird – filtered for past 10 years, year-round:
 - May 2009 Pandapas Pond record
 - 2010 and 2011 Mountain Lake breeding season records
 - May 2012 and May 2013 records on Poor Mountain Rd in Roanoke County, roughly 3.5 mi NE of pipeline, NE of Spring Hollow Reservoir
 - May 2016 Bishop Road Pond record in Montgomery Co by Xavier Gitre, roughly 2 mi S of pipeline
 - So can be said to be found in that general area in Giles County, although I am not familiar with any of the observers

Swainson's Warbler

- eBird – filtered for past 10 years, year-round – no records anywhere in vicinity of pipeline
- generally speaking, we do not have good data for this species in VA - it is possible that the species may occur within the pipeline area west of the Blue Ridge – we recommend adding VA to table 4 for this species as a 'possible'

American Woodcock

- eBird – filtered for past 10 years, year-round
 - May 2013 record from Mountain Lake area
 - A few breeding season records from 2014-2015 on the Blue Ridge Pkwy between Bent Mtn and Copper Creek (which is general area where MVP crosses the Blue Ridge)
 - 3-8-2014 record by Tim Quinn at Edgewood Farm Lane in Franklin Co, roughly 2 mi N of MVP
 - 6-16-2015 record by Tom Davis at Blue Ridge Pkwy Cahos Knob Overlook, between Copper Hill and Bent Mtn, which is where MVP crosses the Blue Ridge
 - March 2016 record from Caldwell Fields along Craig Creek Rd (Phil Leman), ~ 5 mi from where pipeline crosses the mountain; also a few records south of rte 460/N of Blacksburg in that general area (where MVP crosses mountain)

I hope that the above is helpful. Please let me know if you have any questions or need additional information.

Sergio

Sergio Harding | Nongame Bird Conservation Biologist | Virginia Department of Game and Inland Fisheries | 7870 Villa Park Dr, Suite 400, Henrico, VA 23228 | 804-367-0143 | www.dgif.virginia.gov | www.vabci.org

From: Doug Gilbert [mailto:dgilbert@envsi.com]

Sent: Thursday, December 22, 2016 9:36 AM

To: Harding, Sergio (DGIF)

Cc: Valerie Clarkston; Taina Pankiewicz; Daniel Judy

Subject: RE: ESSLOG 35246 Mountain Valley Pipeline - Follow-up regarding potential loggerhead shrike habitat

Perfect. Thanks so much, Sergio.

Doug

From: Harding, Sergio (DGIF) [<mailto:Sergio.Harding@dgif.virginia.gov>]

Sent: Thursday, December 22, 2016 9:28 AM

To: Doug Gilbert

Cc: Valerie Clarkston; Taina Pankiewicz; Daniel Judy

Subject: RE: ESSLOG 35246 Mountain Valley Pipeline - Follow-up regarding potential loggerhead shrike habitat

Hi Doug,

Thanks, I already have the bookmark file exported, am just finishing up the e-mail and will send later this morning.

Sergio

From: Doug Gilbert [<mailto:dgilbert@envsi.com>]

Sent: Thursday, December 22, 2016 9:26 AM

To: Harding, Sergio (DGIF)

Cc: Valerie Clarkston; Taina Pankiewicz; Daniel Judy

Subject: ESSLOG 35246 Mountain Valley Pipeline - Follow-up regarding potential loggerhead shrike habitat

Hello Sergio,

I am contacting you to follow-up about the five areas with potential loggerhead shrike habitat you mentioned on our call yesterday. Below is an email from ESI's GIS Manager (Mike Bruening) about how to pass along bookmarks associated with ArcGIS. If sending it as a shapefile is easier that works as well. Whatever works best for you.

Please let me know if you have any additional questions or comments related to the loggerhead shrike habitat assessment report.

Thank you,
Doug



Doug Gilbert

Scientist

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fax: 513.451.3321

dgilbert@envsi.com | www.envsi.com

From: Michael Bruening

Sent: Wednesday, December 21, 2016 3:23 PM

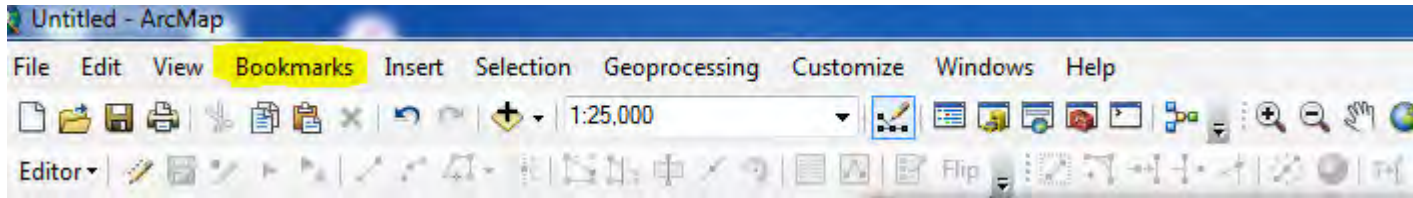
To: Doug Gilbert

Subject: Saved Bookmarks

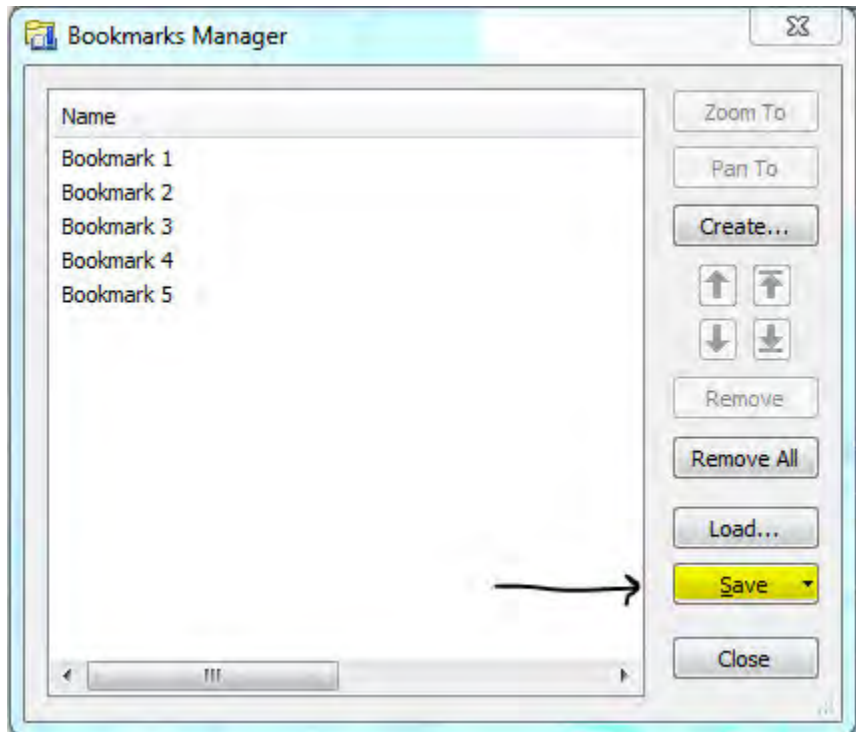
Doug,

If you want to pass along this email on how to transfer the ESRI ArcGIS Desktop “Bookmarks” to the appropriate person, then we can take a look at the 5 areas of concern for the LOSH report.

First there will be a need to open up the ArcMAP document that contains the bookmarks. If there are no bookmarks, then they can be created by going into the “Bookmarks” drop-down dialog list and choose “Create Bookmark”, then the user will be prompted to enter a bookmark name. they will need to repeat this as many times as needed.



Once the Bookmarks have been created, then the user will need to go back into the Bookmarks drop-down dialog and choose Manage Bookmarks (dialog screenshot below). The user will need to click on the Save button and choose “Save All”. The user will then be prompted for a location to save the Bookmarks file on the server or the PC hard drive. This will be the file that the user can send to us in order to see the 5 areas of concern for the LOSH report.



Thanks!
Mike

APPENDIX D
MVP'S RESTORATION AND REHABILITATION PLAN



Mountain Valley Pipeline Project

Docket No. CP16-10-000

Restoration and Rehabilitation Plan

May 2017

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Appendix A – USFS Recommended Species for Seed Mixes

Appendix B – List of Potential Exotic and Invasive Plant Species

1.0 Introduction

1.1 Project Description

Mountain Valley Pipeline, LLC (MVP), a joint venture of EQT Midstream Partners, LP, a subsidiary of NextEra Energy, Inc., Con Edison Gas Midstream, LLC, WGL Holdings, Inc., and RGC Midstream, LLC, plans to construct the Mountain Valley Pipeline (Project), an approximately 303-mile, 42-inch diameter natural gas pipeline, to provide timely, cost-effective access to the growing demand for natural gas for use by local distribution companies, industrial users and power generation in the Mid-Atlantic and southeastern markets, as well as potential markets in the Appalachian region. MVP is seeking a Certificate of Public Convenience and Necessity from the Federal Energy Regulatory Commission (FERC) pursuant to Section 7(c) of the Natural Gas Act (NGA) authorizing it to construct and operate the proposed Project located in 17 counties in West Virginia and Virginia.

The proposed pipeline will extend from the existing Equitrans, L.P. transmission system and other natural gas facilities in Wetzel County, West Virginia to the existing Transcontinental Gas Pipe Line Company, LLC's (Transco) Zone 5 compressor station 165 in Pittsylvania County, Virginia. In addition to the pipeline, the Project will require approximately 171,600 horsepower (hp) of compression at three compressor stations currently planned along the route as well as measurement, regulation, and other ancillary facilities required for the safe operation of the pipeline. The pipeline is designed to transport up to 2.0 million dekatherms per day (MMDth/d) of natural gas.

The Project area consists of the temporary and permanent right-of-way (ROW) established for construction, operation, and maintenance of the pipeline, access roads, and aboveground facilities. The pipeline will require a 125-foot construction ROW and a 50-foot permanent, operational ROW. MVP will neck down to a 75-foot construction ROW in streams and wetlands wherever possible.

1.2 Project Timeline

Tree clearing is expected to occur as early as November 2017, continuing through May 31, 2018 and resuming August 1, 2018 through November 15, 2018. Pipeline construction will be completed by December 2018 with a target full in-service date for the Project of December 2018. Restoration will begin immediately following pipeline installation throughout the construction process and continue through June 2019, or until vegetation is successfully established.

1.3 Purpose of Plan

This *Restoration and Rehabilitation Plan* was prepared to address post-construction restoration, rehabilitation, and habitat mitigation activities. This plan will be implemented in conjunction with the FERC's 2013 *Upland Erosion Control, Revegetation, and Maintenance Plan* (Plan) and 2013 *Wetland and Waterbody Construction and Mitigation Procedures* (Procedures) as well as MVP's other construction, restoration, and mitigation plans (e.g., project-specific erosion and sedimentation control plans, *Spill Prevention, Control, and Countermeasure Plans*, *Karst Mitigation Plan*, and *Exotic and Invasive Species Control Plan*). The following sections provide details regarding MVP's proposed seed mixes, restoration procedures, maintenance and monitoring, and habitat enhancement within select areas of the Project.

2.0 Seed Mixes

MVP is partnering with the Wildlife Habitat Council (WHC), a nonprofit organization dedicated to assisting corporations, conservation organizations, and individuals with restoration and enhancement of wildlife habitat. The WHC is working with MVP on their commitment toward restoration of the Project ROW and establishment of perennial vegetation using native seed mixes created in collaboration with local seed supplier, Ernst Conservation Seeds, Inc. These seed mixes or an approved equivalent from another supplier will be applied along the Project's ROW except where landowners request a specific seed mix or on state or federally managed land where agencies request alternative seed mixes.

Proposed seed mixes will be distributed to representatives within state and federal agencies for approval and comment. These agencies include the United States Forest Service (USFS), West Virginia Department of Environmental Protection (WVDEP), West Virginia Division of Natural Resources (WVDNR), Virginia Department of Environmental Quality (VDEQ), and the Virginia Department of Conservation and Recreation – Division of Natural Heritage (VDCR-DNH).

2.1 Herbaceous Seed Mixes

A temporary cover crop containing oats (*Avena sativa*), grain rye (*Elymus* spp.), or Japanese millet (*Echinochloa esculenta*) will be applied at 30 pounds per acre to prevent encroachment of non-favorable vegetation and provide erosion control until permanent vegetation can establish.

An upland herbaceous seed mix (Table 1) containing of forbs and grasses capable of establishing quickly to provide soil stabilization and revegetation will be applied at 20 pounds per acre in areas of the ROW not considered riparian, wetland, or within pollinator enhancement areas. In areas highly susceptible to erosion and characterized as steep slope, the upland mix will be applied at 45 pounds per acre. In West Virginia, slopes are considered steep when above a 3:1 grade (33%). In Virginia, the definition of a steep slope varies by county:

- Craig County – slopes greater than 20%
- Giles County – slopes greater than 25%
- Montgomery County – slopes greater than 33%
- Roanoke County – slopes greater than 25%
- Franklin County – slopes greater than 25%
- Pittsylvania County – slopes greater than 20%

Table 1. Upland, steep slope herbaceous seed mix and recommended application rates.

Species	Common Name	WV Seeding Rate (lbs/acre)	VA Seeding Rate (lbs/acre)	pH	Bloom Period (if applicable)
<i>Agrostis perennans</i>	Autumn Bentgrass	3.15	3.15	5.5 - 7.5	Midsummer
<i>Elymus virginicus</i>	Virginia Wildrye	9.45	9.05	5.0 - 7.4	June to October
<i>Panicum clandestinum</i>	Deertongue	4.50	4.50	4.0 - 7.5	May to September
<i>Schizachyrium scoparium</i>	Little Bluestem	11.70	11.25	5.0 - 7.4	July to October
<i>Sorghastrum nutans</i>	Indiangrass	13.59	14.40	5.0 - 7.8	August to October
<i>Asclepias syriaca</i>	Common Milkweed	0.23	0.09		June to August
<i>Aster novae-angliae</i>	New England Aster	0.09	n/a	5.1 - 6.8	August to October
<i>Aster pilosus</i>	Heath Aster	0.05	0.05	5.4 - 7.0	After fall frost
<i>Aster prenanthoides</i>	Zigzag Aster	0.09	n/a	5.5 - 7.2	August to October
<i>Chamaecrista fasciculata</i>	Partridge Pea	n/a	0.45	5.5 - 7.5	July to September
<i>Coreopsis lanceolata</i>	Lanceleaf Coreopsis	0.45	0.45	6.0 - 7.0	April to July
<i>Desmodium paniculatum</i>	Panicledleaf Ticktrefoil	0.14	n/a	6.0 - 7.0	July to August
<i>Eupatorium coelestinum</i>	Mistflower	0.05	0.05	5.5 - 7.5	July to August
<i>Helianthus annuus</i>	Oxeye Sunflower	0.36	0.45	5.5 - 7.0	July to August
<i>Liatris graminifolia</i>	Grassleaf Blazing Star	n/a	0.09	5.8 - 6.8	August to October
<i>Monarda fistulosa</i>	Wild Bergamot	0.18	0.23	6.0 - 8.0	June to September
<i>Pycnanthemum incanum</i>	Hoary Mountainmint	0.05	0.05	< 6.8	Summer
<i>Rudbeckia hirta</i>	Blackeyed Susan	0.45	0.45	6.0 - 7.0	May to July
<i>Senna hebecarpa</i>	Wild Senna	0.18	0.23		July to August
<i>Solidago juncea</i>	Early Goldenrod	0.09	n/a		June to July
<i>Solidago nemoralis</i>	Gray Goldenrod	0.14	0.05	6.5 - 7.5	August to September
<i>Tradescantia ohiensis</i>	Ohio Spiderwort	0.09	0.05		late April to mid-July
		45.00	45.00		

An herbaceous seed mix containing facultative wetland species will be applied to forested, emergent, and shrub/scrub wetlands where appropriate (Table 2). In forested wetlands, the herbaceous seed mix will be augmented with the planting of bare-root saplings and shrubs at specified distances from the pipeline centerline. See Section 5.3.1 for more details.

An herbaceous seed mixture containing warm season grass and wildflower species well suited to vegetate the banks of water features will be used within a 100-foot riparian buffer at perennial waterbody crossings (Table 3). At forested perennial stream crossings, a woody seed mixture specific to forest type will be applied with the herbaceous seed mix to temporary workspaces (see Section 2.2), and at 55 select perennial crossings planting of bare root seedlings will occur at specified distances from the pipeline centerline (see Section 5.3.1).

Table 2. Wetland herbaceous seed mix and recommended application rates.

Species	Common Name	WV Seeding Rate (lbs/acre)	VA Seeding Rate (lbs/acre)	pH	Bloom Period (if applicable)
<i>Alisma subcordatum</i>	Mud Plantain	0.04	0.04	5.0 - 7.0	Midsummer
<i>Asclepias incarnata</i>	Swamp Milkweed	n/a	0.40		July to August
<i>Aster novae-angliae</i>	New England Aster	0.16	n/a		August to October
<i>Aster prenanthoides</i>	Zigzag Aster	0.14	n/a	5.5 - 7.2	August to October
<i>Aster umbellatus</i>	Flat Topped White Aster	0.10	n/a		August to Late Summer
<i>Carex gynandra</i>	Fringed Sedge	0.10	0.10		May to June
<i>Carex lupulina</i>	Hop Sedge	1.00	1.00	6.2 - 7.0	June to October
<i>Carex lurida</i>	Shallow Sedge	3.00	3.00	4.9 - 6.8	June to July
<i>Carex scoparia</i>	Blunt Broom Sedge	1.00	1.00	4.6 - 6.9	July to August
<i>Carex vulpinoidea</i>	Fox Sedge	7.00	6.90	6.8 - 8.9	June to August
<i>Cinna arundinacea</i>	Wood Reedgrass	0.40	0.40	4.0 - 8.5	August to September
<i>Elymus virginicus</i>	Virginia Wildrye	4.00	4.00	5.0 - 7.4	June to October
<i>Eupatorium coelestinum</i>	Mistflower	0.10	0.10	5.5 - 7.5	July to October
<i>Eupatorium fistulosum</i>	Joe Pye Weed	0.14	0.14	4.5 - 7.0	July to September
<i>Eupatorium perfoliatum</i>	Boneset	0.20	0.20		July to October
<i>Helenium autumnale</i>	Common Sneezeweed	n/a	0.10		July to October
<i>Heliopsis helianthoides</i>	Oxeye Sunflower	0.40	0.40		July to August
<i>Juncus effusus</i>	Soft Rush	0.60	0.60	5.5 - 7.0	May to June
<i>Ludwigia alternifolia</i>	Seedbox	0.10	0.10		August to September
<i>Mimulus ringens</i>	Square Stemmed Monkeyflower	0.10	0.10		June to September
<i>Onoclea sensibilis</i>	Sensitive Fern	0.20	0.20		June to October
<i>Scirpus cyperinus</i>	Woolgrass	0.20	0.20	4.8 - 7.2	July to September
<i>Scirpus polyphyllus</i>	Many-leaved Bulrush	0.20	0.20		July to August
<i>Verbena hastata</i>	Blue Vervain	0.72	0.72		June to October
<i>Vernonia noveboracensis</i>	New York Ironweed	0.10	0.10	4.5 - 8.0	July to September
		20.00	20.00		

Table 3. Riparian herbaceous seed mix and recommended application rates.

Species	Common Name	WV Seeding Rate (lbs/acre)	VA Seeding Rate (lbs/acre)	pH	Bloom Period (if applicable)
<i>Agrostis perennans</i>	Autumn Bentgrass	0.54	0.50	5.5 - 7.5	Midsummer
<i>Andropogon gerardii</i>	Big Bluestem	3.00	3.00	6.0 - 7.5	July to October
<i>Elymus virginicus</i>	Virginia Wildrye	4.00	4.00	5.0 - 7.4	June to October
<i>Juncus effusus</i>	Soft Rush	0.20	0.20	5.5 - 7.0	May to June
<i>Juncus tenuis</i>	Path Rush	0.20	0.20	4.5 - 7.0	May to June
<i>Panicum clandestinum</i>	Deertongue	5.60	5.40	4.0 - 7.5	May to September
<i>Sorghastrum nutans</i>	Indiangrass	3.60	3.60	5.0 - 7.8	August to October
<i>Asclepias incarnata</i>	New England Aster	0.20	n/a	5.0 - 8.0	June to July
<i>Aster novae-angliae</i>	Swamp Milkweed	0.20	0.20		Late Summer
<i>Chamaecrista fasciculata</i>	Partridge Pea	n/a	0.40	5.5 - 7.5	July to September
<i>Eupatorium coelestinum</i>	Mistflower	0.20	0.20	5.5 - 7.5	July to October
<i>Eupatorium fistulosum</i>	Joe Pye Weed	0.14	0.14	4.5 - 7.0	July to September
<i>Eupatorium perfoliatum</i>	Boneset	0.10	0.10		July to October
<i>Geum canadense</i>	White Avens	0.20	0.20	4.5 - 7.5	May to June
<i>Helenium autumnale</i>	Common Sneezeweed	n/a	0.10	4.0 - 7.5	August to September
<i>Heliopsis helianthoides</i>	Oxeye Sunflower	0.40	0.40		July to August
<i>Monarda fistulosa</i>	Wild Bergamot	0.10	0.10	6.0 - 8.0	June to September
<i>Pycnanthemum tenuifolium</i>	Slender Mountainmint	0.06	0.06		July to September
<i>Rudbeckia hirta</i>	Blackeyed Susan	0.60	0.60	6.0 - 7.0	May to October
<i>Senna hebecarpa</i>	Wild Senna	0.08	0.10		July to August
<i>Senna marilandica</i>	Maryland Senna	0.08	n/a	4.0 - 7.0	Summer
<i>Verbena hastata</i>	Blue Vervain	0.40	0.40		June to October
<i>Vernonia noveboracensis</i>	New York Ironweed	0.10	0.10	4.5 - 8.0	July to September
		20.00	20.00		

Portions of the ROW within Braxton, Lewis, Fayette, and Nicholas counties, West Virginia and Giles and Montgomery counties, Virginia not considered as steep slope, riparian, or wetland will receive an herbaceous seed mix designed for native pollinators (Table 4). These select counties crossed by the Project contain either historical or extant records for presence of the federally endangered rusty patch bumblebee (*Bombus affinis*). MVP will voluntarily apply the aforementioned pollinator seed mix in an attempt to provide or enhance available foraging habitat necessary for the rusty patched bumblebee's recovery efforts in West Virginia and Virginia.

Table 4. Upland meadow, pollinator herbaceous seed mix and recommended application rates.

Species	Common Name	WV Seeding Rate (lbs/acre)	VA Seeding Rate (lbs/acre)	pH	Bloom Period (if applicable)
<i>Elymus virginicus</i>	Virginia Wildrye	4.00	4.00	5.0 - 7.4	June to October
<i>Schizachyrium scoparium</i>	Little Bluestem	11.66	11.68	5.0 - 7.4	July to October
<i>Sorghastrum nutans</i>	Indiangrass	1.00	1.00	5.0 - 7.8	August to October
<i>Asclepias syriaca</i>	Common Milkweed	n/a	0.10	June to August	<i>Asclepias syriaca</i>
<i>Asclepias tuberosa</i>	Butterfly Milkweed	0.20	0.10	4.8 - 6.8	June to August
<i>Aster novae-angliae</i>	New England Aster	0.14	n/a	5.1 - 6.8	August to October
<i>Chamaecrista fasciculata</i>	Partridge Pea	n/a	0.60	5.5 - 7.5	July to September
<i>Chamaecrista nictitans</i>	Sensitive Partridge Pea	n/a	0.06		June to October
<i>Coreopsis lanceolata</i>	Lanceleaf Coreopsis	0.40	0.44	6.0 - 7.0	June to August
<i>Echinacea purpurea</i>	Purple Coneflower	0.60	n/a	6.5 - 7.2	Late Summer
<i>Eupatorium coelestinum</i>	Mistflower	0.10	0.04	5.5 - 7.5	July to October
<i>Heliopsis helianthoides</i>	Oxeye Sunflower	0.40	0.40	5.5 - 7.0	July to August
<i>Lespedeza virginica</i>	Slender Bushclover	n/a	0.10		July to September
<i>Liatris graminifolia</i>	Grassleaf Blazing Star	n/a	0.10	5.8 - 6.8	August to October
<i>Liatris spicata</i>	Marsh Blazing Star	0.16	n/a	5.6 - 7.5	July to September
<i>Monarda fistulosa</i>	Wild Bergamot	0.12	0.10	6.0 - 8.0	June to September
<i>Parthenium integrifolium</i>	Wild Quinine	0.10	n/a	unknown	Late May to Late August
<i>Penstemon laevis</i>	Appalachian Beardtongue	0.20	0.10	unknown	May to June
<i>Pycnanthemum incanum</i>	Hoary Mountainmint	0.04	0.20	< 6.8	Summer
<i>Rudbeckia fulgida</i> var. <i>fulgida</i>	Orange Coneflower	0.04	0.02		July to October
<i>Rudbeckia hirta</i>	Blackeyed Susan	0.60	0.04	6.0 - 7.0	May to July
<i>Senna hebecarpa</i>	Wild Senna	0.10	0.60		July to August
<i>Solidago juncea</i>	Early Goldenrod	0.04	0.10		June to July
<i>Solidago nemoralis</i>	Gray Goldenrod	0.04	0.04	6.5 - 7.5	August to September
<i>Tradescantia ohimensis</i>	Ohio Spiderwort	0.06	0.04		Late April to Mid-July
<i>Tradescantia virginiana</i>	Virginia Spiderwort	n/a	0.10		late April to mid-July
		20.00	20.00		

2.2 Woody Seed Mix

Herbaceous seed mixes will be augmented with an oak-hickory forest woody seed mix to revegetate temporary workspaces and access roads within impacted forested areas. All species proposed within the woody seed mix are native to the Project area and are summarized in Table 5. At minimum, three of the five overstory, four of the seven understory, and two of the four shrub species will comprise the woody seed mix.

Table 5. Oak-hickory forest woody seed mix and recommended application rate.

Layer	Species	Common Name	Seeding Rate (lbs/acre)
Overstory	<i>Fagus grandifolia</i>	American Beech	0.3
	<i>Liriodendron tulipifera</i>	Tulip Poplar	0.3
	<i>Pinus strobus</i>	White Pine	0.3
	<i>Pinus virginiana</i>	Virginia Pine	0.3
	<i>Prunus serotina</i>	Black Cherry	0.3
Understory	<i>Amelanchier canadensis</i>	Canadian Serviceberry	0.3
	<i>Cercis canadensis</i>	Eastern Redbud	0.3
	<i>Cornus florida</i>	Flowering Dogwood	0.3
	<i>Diospyros virginiana</i>	Persimmon	0.3
	<i>Ilex opaca</i>	American Holly	0.3
	<i>Nyssa sylvatica</i>	Black Gum	0.3
	<i>Sassafras albidum</i>	Sassafras	0.3
Shrub	<i>Hamamelis virginiana</i>	Witch Hazel	0.3
	<i>Lindera benzoin</i>	Spicebush	0.3
	<i>Vaccinium angustifolium</i>	Lowbush Blueberry	0.3
	<i>Viburnum acerifolium</i>	Mapleleaf Viburnum	0.3
	<i>Vitis aestivalis</i>	Grape	0.3

2.3 Jefferson National Forest

MVP will follow the USFS's recommendations for restoration and rehabilitation of the permanent ROW, as defined in the Plan of Development, to reduce impacts to visual resources, in a manner that preserves MVP's ability to access, monitor, patrol, and inspect the ROW in accordance with PHMSA requirements (49 CFR Part 192). MVP consulted with the USFS regarding appropriate seed mixtures for use within the Jefferson National Forest (JNF). The USFS indicated that the initial goal of seeding on the JNF is to establish vegetative cover to minimize surface erosion and sedimentation, while the secondary goal is to establish an assortment of native species congruent with local ecological communities and benefits for wildlife and pollinators. Species recommended by the USFS (Appendix A) for use in upland, riparian, and steep slope areas are comparable to those species contained in the seed mixes prepared by Ernst Conservation Seeds, Inc. As such, MVP will apply the herbaceous seed mixes described in Section 2.1 in appropriate areas within the JNF. In addition, MVP will add the woody seed mix described in Section 2.2 to herbaceous seed mixes applied within temporary workspaces of the ROW.

As requested by the USFS, all leguminous seeds shall be either pre-inoculated, or mixed with inoculant specified for use on that particular seed according to manufacturer's directions. Inoculants shall be manually applied at double the manufacturer's rate and inoculant shall be mixed with legume seed prior to mixing with other seeds. For hydroseeding, a minimum of five times the dry seeding rate of inoculant will be used.

3.0 Restoration Procedures

As mentioned above, MVP will follow the directions and requirements in FERC's Plan and Procedures during restoration efforts. However, MVP will also follow any requirements set forth by federal and state agencies where the Project crosses land under their jurisdiction. These additional requirements and measures that have been identified to-date have been incorporated into this plan.

3.1 Topsoil and Spoil Treatment

MVP will identify and segregate the topsoil layer from the subsoil layer as described in FERC's Plan and Procedures. Within residential, agricultural areas, and the JNF, MVP will prevent the mixing of topsoil and subsoil during construction by stripping topsoil from the permanent and temporary ROW during construction. The stockpiled topsoil and subsoil will be stored separately within the 125-foot construction ROW, and will be replaced in the proper order during backfilling and final grading in order to prevent mixing of the soil horizons. All stockpiled spoils will be stored at least 10 feet from waterbodies, and within approved construction areas (as required by FERC's Plan and Procedures). Erosion controls will be installed around stockpiled spoils to ensure that they do not erode and impact adjacent areas.

3.2 Installation of Erosion Controls

Temporary erosion Best Management Practices (BMPs) will be installed prior to construction activities that can disturb soils, and these BMPs will be inspected and maintained throughout the construction process. The inspections will be conducted on a daily basis in areas that are under active construction or equipment operation, on a weekly basis in areas where no active construction is currently occurring, and within 24 hours in areas that have just received a rainfall event of at least 0.5 inch. Any necessary repairs that are identified during these inspections will be conducted within 24 hours or as soon as conditions allow if compliance with this time frame would result in greater environmental impacts.

Inspection and repair of temporary erosion BMPs will continue until they are replaced by permanent erosion controls or until the area is restored. Temporary erosion BMPs include temporary slope breakers, sediment barriers, trench plugs, and mulch. As requested by the USFS for implementation on the JNF, erosion and sediment control BMPs will be promptly removed after soils are stable and vegetative cover is established.

Temporary slope breakers are intended to reduce runoff velocities and divert water to vegetated areas off the construction ROW. Temporary sediment barriers are installed to stop the movement of sediments and to prevent the deposition of sediments beyond

approved workspaces or into sensitive areas. As indicated in FERC's Plan, these structures can be constructed of materials such as soil (e.g., diversion ditches), sand bags, silt-fences, or other approved materials. As requested by the USFS, within the JNF silt fences reinforced with metal or plastic mesh will be avoided if possible. In the case of the temporary slope breaker, water will be directed to a stable well-vegetated area or to an energy-dissipating device. The required spacing for these controls will be outlined in erosion and sedimentation control sheets.

Temporary trench plugs are intended to segment a continuous open trench prior to backfilling in order to prevent pooling and movement of water along the open trench. These plugs will consist of unexcavated portions of the trench (i.e., undisturbed soils), compacted subsoils, sandbags, or some functional equivalent.

If permanent seeding cannot occur immediately following final grading, mulch will be applied to all disturbed slopes that have the potential to erode in order to stabilize the soil and to reduce wind and water erosion. Mulch will be spread uniformly over an affected area to at least 75 percent coverage at a rate of 2-4 tons/acre. In wetland areas FERC's Plan requires that mulch applications will be increased to 3 tons/acre. This rate can be increased or decreased on the JNF based on slope classes. The following describes the USFS requirements regarding mulch applications, which would be followed on the JNF:

- Materials will be certified weed free or be accompanied by vendor's test results for noxious weed content. Hay will not be used on the JNF.
- Seeded areas can be mulched with weed free straw at a rate of 2-4 tons/acre (hand spread or blown), fiber mulch hydro-seeded at 1-2 tons/acre or other appropriate material.
- Natural biodegradable products will be used and materials will be demonstrated to be free of invasive species, including but not limited to plants, pests, and pathogens.
- If the use of stabilization netting is required/permitted, wildlife friendly geotextiles will be used. These products must either be free of netting or netting must be made of 100% biodegradable non-plastic materials such as jute, sisal, or coir fiber. Plastic netting (such as polypropylene, nylon, polyethylene, and polyester), even if advertised as biodegradable, is not an acceptable alternative. Any netting used must also have a loose-weave design with movable joints between horizontal and vertical twines to reduce the chance for wildlife entanglement, injury, or death.
- Water used for any products that require mixing with water will come from a USFS-approved water source. The source of water must not be contaminated with non-native invasive organisms that could spread into streams.

Permanent erosion controls will be installed following completion of construction. Permanent erosion controls consist of vegetation, permanent trench breakers and slope breakers. The placement, number, and composition of these permanent erosion controls will be illustrated on the erosion and sediment control plans and supplemented as determined by the EI, the applicable land management agency, and the FERC Plan and Procedures.

3.3 Re-contouring

All disturbed areas will be regraded and re-contoured to blend into the surrounding landscape, reestablish natural drainage patterns, and be compatible with surrounding drainage patterns, except at locations where permanent changes in drainage will be required to prevent erosion, scour, and possible exposure of the pipeline. The emphasis during re-contouring will be returning the entire ROW to its approximate original contours, stabilize slopes, control surface drainage, and aesthetically blend the area with the contours of adjacent lands. The re-contouring and replacement of topsoil in areas of disturbed wetlands to their original grade is especially critical to maintain wetland hydrology. If existing culverts are damaged or removed during construction, they will be replaced to their original condition in order to maintain the original hydrology.

3.4 Cleanup

Cleanup of an area (including final grading and installation of permanent erosion control structures) will be completed within 20 days after backfilling the trench (10 days in residential areas). All construction debris (e.g., mats, garbage, etc.) will be cleared from the construction area and disposed of in accordance with state and local regulations. Excess rock and spoil materials will be distributed along the construction ROW or disposed of in existing quarries or in permanent disposal sites. Hazardous materials will be handled and disposed of as described in the Project's *Hazardous Materials Management Plan*.

All non-merchantable brush and slash will be windrowed to the edge of the ROW, utilized in downslope areas of the ROW and access roads, burned and chipped, or removed from the area in accordance with local, state, or federal requirements. Windrowing of non-merchantable brush and slash along the ROW will result in habitat for many types of wildlife including: rabbits and other small mammals, ruffed grouse, song birds and reptiles. Over time the windrows will provide food for wildlife as insects will establish residence in the materials. The windrows can serve as escape cover from predators, locations for nesting and shelter from inclement weather. The windrows will generally range from 10 to 20 feet in width and 6 to 8 feet in height. Breaks will be left in the windrows at approximately 100 feet in order to provide for fire breaks and wildlife crossings.

Non-merchantable brush and slash can be utilized in downslope areas of the ROW and access roads to aid in soil stabilization and erosion control. Layering the brush and slash at the toe of a low-side slope along an access road provides for physical protection in the form of soil stabilization, and erosion and sediment control. Layering of brush and slash can promote physical protection to the downslope areas of the ROW. Additionally, the layering can provide long-term support for revegetation in downslope areas of the ROW.

3.5 Seeding

The goals of permanent seeding are to establish a dense, self-propagating, low maintenance ground cover in order to minimize erosion and sedimentation while also providing wildlife habitat.

Seeding will occur promptly after construction is complete; however, if ground conditions delay restoration until the following spring, the ground will be mulched and seeding will take place during the next growing season. A *Winter Construction Plan* has been prepared to address how restoration and revegetation would proceed if seeding could not be completed before the onset of winter. Additionally, if seeding must occur outside the normal seeding season a temporary erosion control seed mix will be applied, and either a permanent erosion control seed mix or native seed mix will be applied during the next normal seeding season. Seed will be uniformly applied using a broadcast seeder, drill, or hydroseeder. These methods are described in more detail below. When dryseeding, the seeding depth should be $\frac{1}{4}$ to $\frac{1}{2}$ inch. Following application of seed mix, mulch will be applied as described in Section 3.5.5.

3.5.1 Seedbed Preparation

Areas targeted for restoration will be prepared for reseeding before applying the seed in order to establish an environment that is conducive to seed placement and moisture retention (as described in FERC's Plan and Procedures). Permanent erosion control devices will be installed to minimize the risk of erosion and mulch will be used to prevent soils from eroding or desiccating.

Soil compaction can reduce the likelihood of disturbed areas being successfully revegetated. In order to minimize soil compaction, construction activities will be timed to dry periods when possible, and construction mats will be used in wetland habitats. On the JNF, no heavy equipment will be used on plastic soils when the water table is within 12 inches of the surface, or when soil moisture exceeds the plastic limit. Also, on the JNF, heavy equipment will not be used during site preparation on sustained slopes over 35 percent, or on sustained slopes over 20 percent when soils have a high erosion hazard or are failure-prone. If compacted soils are identified by the EI or the USFS within areas targeted for restoration, the compacted soils will be ripped to a depth of at least 6 to 8 inches.

As stated in Section 3.1, MVP will identify and segregate the topsoil layer from the subsoil layer as described in FERC's Plan and Procedures. Stockpiled topsoil and subsoil will be stored separately, and will be replaced in the proper order during backfilling and final grading, and prior to seeding. Following topsoil placement, dry fertilizer and lime will be applied. Unless site-specific recommendations are received from local, state or federal agencies, MVP will incorporate up to 4,000 lbs/acre of agricultural lime and 500 lbs/acre of 10-20-10 (Nitrogen [N], Phosphorous [P], Potassium [K]) fertilizer into the soil.

The following are guidelines for fertilizer and lime application rates recommended by the USFS to be used on JNF:

Fertilizer:

- 600 – 800 lbs/acre of 10-20-10 (N-P-K) fertilizer;
- 400 lbs/acre of 15-30-15 (N-P-K) fertilizer; or
- 800-1,000 lbs/acre of 10-10-10 (N-P-K)

Lime:

- 1,500-4,000 lbs/acre (pelletized or dust); or
- 4,000 lbs/ac of Hydro Lime (2.5 gal container is equivalent to 1000 lbs limestone; 5-10 containers /acre.

3.5.2 Drill Seeding

Drill seeding is a mechanical seeding method which places seed directly into the soil. Due to the equipment required; however, drill seeding is generally limited to areas with slopes less than 3:1 (USDA 2005). Because native seed mixes need to be drilled or otherwise covered to enhance germination success, drill seeding is the preferred option to be used in areas where a native seed mix will be applied.

3.5.3 Broadcast Seeding

Broadcast seeding will be the preferred seeding method used on steep slopes (i.e., slopes greater than 3:1) or other areas that cannot be accessed with other seeding equipment; areas that will be covered with erosion control fabric; or other areas determined to be appropriate for broadcast seeding by the EI and/or USFS. Seeds will be broadcast with a mechanical seeder immediately after the seedbed has been prepared and the soil is loose. This will allow the seeds to be lightly covered as the soil settles. The seeded area may also be disrupted by lightly dragging the area with chains or other appropriate harrows to lightly cover the seed. Broadcast seeding will occur immediately prior to installation of erosion control fabric or the application of mulch.

3.5.4 Hydroseeding

Hydroseeding may be used in upland areas that can be safely accessed with hydroseeding equipment, on slopes where drill seeding is not feasible (i.e., slopes greater than 3:1), and in areas determined to be appropriate for this method by the EI and/or USFS. Hydroseeding equipment shall be equipped with sufficient tanks, pumps, nozzles, and other devices required for mixing and hydraulically applying the seed, lime, fertilizer, wood fiber mulch, and tackifier mix in slurry form onto the prepared ground. The hydroseeding equipment shall have built-in agitators, which will keep the seed, mulch, tackifier, and water mixed homogeneously until pumped from the tank. Hydroseeding and hydromulching will be done from two directions (e.g., left and right or up and down), where feasible, to ensure maximum coverage of the soil. The amount of tackifier will be adjusted based on the slope of area being hydroseeded. For example, typical application rates for guar (a plant based tackifier) range from 40 lbs/acre for flat areas to 50 lbs/acre for 33 percent (3:1) slopes (CASQA 2003). During hydroseeding, it is recommended to add 50% more seed to the tank if a machinery breakdown occurs. Five times the recommended rate of inoculant will be used during hydroseeding.

In addition, the following USFS recommendations will be implemented in areas that are hydroseeded within the JNF:

- Hydroseeding will occur during a periods of dry weather, whenever possible, as wood-fiber hydraulic mulches are generally short-lived and require a 24-hour period to dry before rainfall occurs.
- Materials or additives used as binders or emulsifiers will not be toxic to soil organisms or otherwise prevent or inhibit seed germination.
- Only products suitable for wildlife will be used.
- Tackifiers will be non-toxic and organic based (e.g., guar, psyllium, or pitch and rosin emulsions).
- Tackifiers to be used, as well as, application rates, and methods of application will be submitted to the USFS for approval prior to use.

3.5.5 Mulching

After dry seeding, mulch will be applied to help the seed remain in place, protect seed from scavengers, and retain soil moisture. Mulch can consist of straw, erosion control fabric, or some functional equivalent, and will be certified as free of noxious weeds. Recommended loose mulch and application rates are provided in Table 6.

Table 6. Recommended mulch and application rates.

Mulch Application	Rate (lbs/acre)	Notes
Straw	4,000	Free from weeds and coarse matter. Must be anchored. Spread with mulch blower or by hand.
Fiber Mulch	1,500	Do not use as mulch for winter cover or during hot, dry periods. Apply as slurry.
Corn Stalks	8,000-12,000	Cut or shredded in 4 – 6 inch lengths. Air-dried. Do not use in fine turf areas. Apply with mulch blower or by hand.
Wood Chips	8,000-12,000	Free of coarse matter. Air-dried. Do not use in fine turf areas. Apply with mulch blower, chip handler, or by hand. Apply additional 12 lbs slow-release nitrogen/ton of wood chips.

3.5.6 Agricultural Lands

MVP will work with individual landowners to address restoration of active agricultural areas. Following construction, impacted agricultural land will be restored to pre-construction conditions in accordance with the FERC Plan, and any specific requirements identified by landowners, or state or federal agencies with regulatory jurisdiction over or interest in agricultural land. Agricultural land affected by the construction ROW and additional temporary workspace will be allowed to revert to prior use, with the exception of tree crops within the permanent ROW.

4.0 Bare-Root Sapling and Shrub Planting

Planting of bare-root saplings and shrubs will occur within select areas of the Project (Table 7 and Table 8). The purpose of these plantings is to establish target native tree species comparable to the region, site characteristics (e.g., topography; soil characteristics; adjacent vegetation), and adjacent forest composition in order to encourage the timely reestablishment of habitat removed during Project construction. For small mammals and birds, adequate spacing of planted shrubs can form a large clump or thicket and provide excellent cover, refuge, or brood-rearing habitat often absent in open landscapes. Furthermore, planting a diverse array of native shrubs and saplings with varying blooming periods will provide reliable sources of pollen and nectar for pollinator species during spring, summer, and autumn.

All species planted will be native to the area, and the seed source or ecotype of the saplings and shrubs will be as local as possible with preference given to within-state, then mountainous regions of an adjacent state, followed by within the Appalachian Mountain range.

Handling and storage of saplings is important to ensure viability and to limit loss prior to planting. To the extent practicable, time between delivery of saplings to the restoration site and planting will be limited. In an effort to prevent desiccation and preserve moisture, saplings will be kept in original shipping container (e.g., sack; box) and stored in cool, moist, and shady locations not within direct sunlight and wind. Refrigerated storage will be used when possible. Only one bag or bundle of saplings will be opened at a time, and partially used bundles will be rolled or tied closed to prevent exposure of roots to air. Saplings will be protected from harsh materials such as gasoline, diesel fuels, oils, or other chemicals. Immediately prior to planting, saplings will be inspected for damage that may result in mortality. Saplings will be discarded if the following are present: broken stems or main roots, mold or mildew, stems with missing bark, desiccated roots, or a root system less than 5 inches long.

Saplings deemed suitable will be planted using a spade, auger, or dibble bar between October 1 and April 30 following seed mix application (Section 3.5). Only one sapling at a time will be removed from the planting bag after a suitable hole is dug. Holes will be dug to a depth where groundline is at approximate root collar level, typically between 8 and 10 inches. Before being placed in a vertical position within the debris-free hole, roots will be moistened and treated with root dip absorbent polymers and mycorrhizal root dip inoculates in accordance with manufacturer's recommendations. One sapling will be placed in each hole with the roots inserted to the bottom and then lifted upward slightly so that the root collar is at or slightly below the finished grade. Each sapling will be fertilized with a 5 gram tablet of controlled release fertilizer. The









spade, planting bar, or shovel is inserted behind the planting hole and tilted back to close the bottom of the planting hole. The tool is then tilted forward to close the top of the hole. Soil will be firmly packed around each planting to fill any remaining voids. Tree tubes (minimum of 5 feet tall) will be used to protect saplings from browse damage caused by local wildlife or livestock. In areas experiencing higher than average browse damage or when planting species highly preferred by wildlife (e.g., apple, plum, hazelnut, or persimmon trees), 5- to 6-foot tall, 12- to 14-gauge welded wire fence with 2-inch by 4-inch openings is recommended to protect saplings.

4.1 Riparian Stabilization and Restoration

The stabilization of streambanks and areas adjacent to waterbodies is critical to minimize the risk of erosion, slope failure, and impacts to sensitive aquatic species. In general, all affected riparian areas will be revegetated using native species and appropriate seeding prescriptions based upon the preexisting vegetative community within the disturbed area. MVP will restore waterbody banks to preconstruction contours to the extent practical following pipe installation and initial bank stabilization. Permanent bank stabilization and erosion control devices will be installed as necessary to minimize sediment deposition into waterbodies. Areas with steep slopes may require additional grading to reestablish contours capable of supporting preconstruction drainage patterns.

If grubbing has not been extensive, then native shrub and tree species are expected to sprout and regenerate naturally within temporary workspaces. To further avoid and minimize impacts to sensitive wildlife, temporary workspaces at select streams with known or potentially suitable habitat for sensitive aquatic species (i.e., freshwater mussels and fish) MVP is committed to be hand planting with bare-root live shrubs and tree saplings in addition to installing a prescribed herbaceous seed mix (Table 7).

Table 7. Stream crossings proposed for bare-root seedling plantings.

Waterbody Name	MP	County	State	Valuable Resource
Leading Creek		Lewis	WV	Headwaters of Group 2 Mussel Stream, warmwater
Sand Fork		Lewis	WV	Non-listed freshwater mussel stream, warmwater
Little Kanawha River		Braxton	WV	Group 2 Mussel Stream, warmwater
Elk River		Webster	WV	Headwaters of Group 2 Mussel Stream, coldwater stream, B2 trout stream, Elk River Crayfish
Gauley River		Nicholas	WV	candy darter, warmwater stream, whitewater recreational uses
Hominy Creek		Nicholas	WV	candy darter, coldwater stream, B2 trout stream
Meadow River		Greenbrier	WV	candy darter, B2 trout stream, Swainson's Warbler
Greenbrier River		Summers	WV	Non-listed mussels, candy darter, warmwater stream

Waterbody Name	MP	County	State	Valuable Resource
Indian Creek	█	Monroe	WV	possible hellbenders and mussels (historic); bald eagle
Kimballton Branch	█	Giles	VA	headwaters of wild trout stream, coldwater stream
Stony Creek	█	Giles	VA	candy darter, green floater, coldwater stream, wild trout stream
Little Stony Creek	█	Giles	VA	coldwater stream, wild trout stream
Sinking Creek	█	Giles	VA	candy darter, green floater, coldwater stream, wild trout stream, non-listed mussels
UNT Craig Creek	█	Montgomery	VA	Headwaters of James spiny mussel occurrences, USFS lands area
UNT Craig Creek	█	Montgomery	VA	Headwaters of James spiny mussel occurrences, USFS lands area
Craig Creek	█	Montgomery	VA	Headwaters of James spiny mussel occurrences, USFS lands area
Craig Creek	█	Montgomery	VA	Headwaters of James spiny mussel occurrences, USFS lands area
UNT Craig Creek	█	Montgomery	VA	Headwaters of James spiny mussel occurrences, USFS lands area
UNT Craig Creek	█	Montgomery	VA	Headwaters of James spiny mussel occurrences, USFS lands area
Mill Creek	█	Montgomery	VA	upstream of Roanoke logperch suitable habitat, orange fin madtom, coldwater stream, wild trout
North Fork Roanoke River	█	Montgomery	VA	Roanoke logperch present, non-listed mussels present, orange fin madtom, coldwater stream, wild trout
North Fork Roanoke River	█	Montgomery	VA	Roanoke logperch present, non-listed mussels present, orange fin madtom, coldwater stream, wild trout
Bradshaw Creek	█	Montgomery	VA	Roanoke logperch suitable habitat, orange fin madtom, coldwater stream, wild trout
Bradshaw Creek	█	Montgomery	VA	Roanoke logperch suitable habitat, orange fin madtom, coldwater stream, wild trout
Roanoke River	█	Montgomery	VA	Roanoke logperch present, orange fin madtom, non-listed mussels present
Bottom Creek	█	Roanoke	VA	upstream of Bottom Creek Gorge, orange fin madtom, coldwater stream, wild trout
Bottom Creek	█	Roanoke	VA	upstream of Bottom Creek Gorge, orange fin madtom, coldwater stream, wild trout
Mill Creek	█	Roanoke	VA	upstream of Bottom Creek Gorge, orange fin madtom, coldwater stream, wild trout
Green Creek	█	Franklin	VA	upstream of Bottom Creek Gorge, orange fin madtom, coldwater stream, wild trout
Green Creek	█	Franklin	VA	upstream of Bottom Creek Gorge, orange fin madtom, coldwater stream, wild trout

Waterbody Name	MP	County	State	Valuable Resource
North Fork Blackwater River	█	Franklin	VA	Roanoke logperch suitable habitat, coldwater stream wild trout stream
Teels Creek	█	Franklin	VA	upstream of Roanoke logperch suitable habitat, one of numerous project crossings of Teels Creek
Teels Creek	█	Franklin	VA	upstream of Roanoke logperch suitable habitat, one of numerous project crossings of Teels Creek
Teels Creek	█	Franklin	VA	upstream of Roanoke logperch suitable habitat, one of numerous project crossings of Teels Creek
Teels Creek	█	Franklin	VA	upstream of Roanoke logperch suitable habitat, one of numerous project crossings of Teels Creek
Teels Creek	█	Franklin	VA	Roanoke logperch suitable habitat, one of numerous project crossings of Teels Creek contributing sediment impacts
Little Creek	█	Franklin	VA	Roanoke logperch suitable habitat, numerous crossings upstream contributing sediment impacts
Little Creek	█	Franklin	VA	Roanoke logperch suitable habitat, non-listed mussels present, numerous crossings upstream contributing sediment impacts
Maggodee Creek	█	Franklin	VA	Roanoke logperch suitable habitat
Blackwater River	█	Franklin	VA	Roanoke logperch present, non-listed mussels present
UNT to Jacks Creek	█	Franklin	VA	orangefin madtom
Turkey Creek	█	Franklin	VA	orangefin madtom
Strawfield Creek	█	Franklin	VA	orangefin madtom
Parrot Branch	█	Franklin	VA	orangefin madtom
Jonnikin Creek	█	Pittsylvania	VA	orangefin madtom
UNT to Rocky Creek	█	Pittsylvania	VA	orangefin madtom
Pigg River	█	Pittsylvania	VA	Roanoke logperch present, orangefin madtom, mussels present including yellow lampmussel (VA threatened)
Harpen Creek	█	Pittsylvania	VA	Roanoke logperch suitable habitat, orangefin madtom
Harpen Creek	█	Pittsylvania	VA	orangefin madtom

Table 8 lists suitable bare-root native tree and shrub species for use in restoring riparian areas and palustrine forested wetlands. The final species mix will depend on nursery stocks, availability, soil condition, and nearby species composition; however, six different tree species and four different shrub species, at minimum, will be planted at each riparian target area. In general, live, bare-root saplings and shrubs will be at least 18 inches in height, a minimum two years old, and planted no closer than 8 – 10 feet at a rate of approximately 300 to 500 stems per acre. A 10-foot strip centered on the pipeline will be maintained in an herbaceous state and no trees will be planted within 15 feet on either side of the pipeline to avoid the possibility of roots reaching the

pipeline and compromising the integrity of the pipeline coating. A mix of shrubs and trees will be planted within the remaining sections of the ROW parallel to the waterbody and extending up to 100 feet, where possible, from the top of either side of the stream bank. Stream banks will be treated with lime and fertilizer, then the bare-root saplings and a riparian herbaceous cover seed will be applied and lightly covered with soil before mulch is added to the area. A sediment barrier will be maintained at the edge of the water until revegetation is successful. Plantings will be completed between October 1 and April 30 of the same year as construction, and no plantings will occur when soils are frozen.

Table 8. Native tree and shrub species for bare root plantings within riparian areas and forested wetlands.

Species	Common Name	Indicator Status	Riparian Planting	Forested Wetland Planting
Native Trees				
<i>Acer rubrum</i>	Red Maple	FAC	X	X
<i>Acer saccharinum</i>	Silver Maple	FACW	X	X
<i>Betula nigra</i>	River Birch	FACW	X	X
<i>Carpinus caroliniana</i>	American Hornbeam	FAC	X	X
<i>Carya glabra</i>	Pignut Hickory	FACU	X	
<i>Carya ovata</i>	Shagbark Hickory	FACU	X	
<i>Chionanthus virginicus</i>	White Fringe Tree	FAC+	X	
<i>Diospyros virginiana</i>	Common Persimmon	FAC-	X	
<i>Fraxinus pennsylvanica</i>	Green Ash	FACW	X	X
<i>Juniperus virginiana</i>	Eastern Red Cedar	FACU	X	X
<i>Liquidambar styraciflua</i>	Sweet Gum	FAC	X	X
<i>Liriodendron tulipifera</i>	Tuliptree	FACU	X	X
<i>Nyssa sylvatica</i>	Black Gum	FAC	X	
<i>Platanus occidentalis</i>	American Sycamore	FACW-	X	X
<i>Populus deltoids</i>	Eastern Cottonwood	FAC	X	
<i>Quercus bicolor</i>	Swamp White Oak	FACW+	X	X
<i>Quercus falcata</i>	Cherrybark Red Oak	FACW	X	X
<i>Quercus phellos</i>	Willow Oak	FAC+	X	X
<i>Quercus nigra</i>	Water Oak	FAC	X	
<i>Quercus palustris</i>	Pin Oak	FACW	X	X
<i>Salix nigra</i>	Black Willow	FACW	X	X
<i>Ulmus americana</i>	American Elm	FACW-	X	X
Native Shrubs				
<i>Alnus serrulata</i>	Brook-side Alder	OBL		X
<i>Amelanchier canadensis</i>	Canada Serviceberry	FAC	X	
<i>Aronia arbutifolia</i>	Red Chokecherry	FACW	X	X
<i>Baccharis halimifolia</i>	Groundsel Bush	FACW-	X	X
<i>Cephalanthus occidentalis</i>	Buttonbush	OBL		X
<i>Cornus amomum</i>	Silky Dogwood	FACW	X	X
<i>Cornus stolonifera</i>	Red-osier Dogwood	FAC	X	X

Species	Common Name	Indicator Status	Riparian Planting	Forested Wetland Planting
<i>Hamamelis virginiana</i>	American Witchhazel	FAC-	X	
<i>Ilex verticillata</i>	Common Winterberry	FACW+	X	X
<i>Itea virginica</i>	Virginia Willow	OBL		X
<i>Iva frutescens</i>	Marsh Elder	FACW+	X	X
<i>Leucothoe racemosa</i>	Fetter-bush	FACW	X	X
<i>Lindera benzoin</i>	Spicebush	FACW-	X	X
<i>Lyonia ligustrina</i>	Maleberry	FACW	X	X
<i>Magnolia virginiana</i>	Sweetbay Magnolia	FACW+	X	X
<i>Physocarpus opulifolius</i>	Eastern Ninebark	FACW-	X	X
<i>Sambucus canadensis</i>	American Elder	FACW-	X	X
<i>Vaccinium corymbosum</i>	Highbush Blueberry	FACW-	X	X
<i>Viburnum dentatum</i>	Arrow-wood	FAC	X	
<i>Viburnum prunifolium</i>	Black-haw	FACU	X	

4.2 Forested Wetlands

Bare-root saplings and shrubs (Table 8) will be planted in combination with an herbaceous wetland seed mix (Table 2) to ultimately restore of the impacted palustrine forested wetlands within the temporary ROW and the non-maintained portion of the permanent ROW to their pre-construction condition. Similarly, native shrubs (Table 8) will be planted in combination with an herbaceous wetland seed mix (Table 2) to revegetate the 50-foot-wide portion of the permanent ROW. The final species mix will depend on nursery stocks, availability, soil condition, and nearby species composition; however, six different tree species and four different shrub species, at minimum, will be planted at each forested wetland.

4.3 Loggerhead Shrike Foraging and Nesting Habitat

The Project is expected to impact a total of 57.04 hectares (140.95 ac) of habitat suitable for nesting and foraging, and 1.45 hectares (3.59 ac) of foraging habitat. Of this, 16.01 hectares (39.56 ac) of nesting and foraging habitat and 0.41 hectare (1.01 ac) of foraging habitat will be permanently impacted. Within the permanently impacted areas and temporarily impacted foraging habitat, a native herbaceous vegetation seed mix or landowner-approved seed mix matching pre-construction conditions will be used for revegetation. For temporarily, disturbed areas that are considered suitable for nesting and foraging, either of the aforementioned seed mixes will be used for revegetation along with planting of native shrubs/trees. As recommended by the VDGIF, native shrubs/trees removed from suitable habitat will be replaced with the same native species (e.g., eastern red cedar [*Juniperus virginiana*] will be replaced with eastern red cedar). Nonnative shrubs/trees that provide suitable nesting substrate and are removed as a result of Project-related activities will be replaced with its native, functional counterpart (e.g., Osage orange [*Maclura pomifera*], which is a nonnative,

thorny tree, should be replaced with hawthorn [*Crataegus* spp.]). In some cases, it may be beneficial to promote a diversity of shrub/tree species in disturbed areas. For example, if an area is heavily dominated by eastern red cedar, MVP may choose to plant a combination of another native species (e.g., hawthorn) along with red cedar to avoid the potential loss of all red cedar in the event of a pest-infestation or spread of pathogen that may result in death of entire stands of the species. This may also be advantageous in areas where impaling stations (e.g., thorny vegetation; barbed wire) are limited.

Based on field habitat assessments and review of aerial imagery, approximately 1,225 preferred broadleaf shrubs/trees and 1,100 preferred coniferous shrubs/trees will be planted within temporarily disturbed nesting and foraging habitat (41.04 ha [101.41 ac]) and adjacent area (4.52 ha [11.16 ac]) to compensate for the removal of 1,221 broadleaf and 1,085 coniferous shrubs/trees. Shrubs/trees will be planted following completion of construction activities in suitable habitat. While quantity and general assemblage of shrubs and trees planted will be similar to pre-construction conditions, spatial arrangement of plantings will vary from where trees were removed. Spatial arrangement of plantings will be dependent on site conditions (e.g., topography; existing vegetation), proximity to the permanent ROW and roadways, planting technique, and what will best promote habitat enhancement for loggerhead shrike. Shrub/tree-planting efforts may focus more on areas with higher landowner-interest and engagement, as well as areas recommended by the VDGIF.

Of the shrubs/trees proposed for removal in suitable habitat, approximately 63.49 percent are of the preferred shrubs/trees noted by the VDGIF (i.e., eastern red cedar; hawthorn; black locust; Osage orange). MVP is committed to improving habitat quality where feasible and, therefore, have agreed to replace all removed shrubs/trees in suitable habitat in order to enhance conditions for loggerhead shrike. Increasing the number of preferred shrubs/trees within areas containing suitable loggerhead shrike habitat will potentially enhance the overall quality of nesting habitat promoting the conservation of this state-threatened species.

5.0 Maintenance and Monitoring

5.1 Permanent Right-of-Way

A 50-foot-wide permanent ROW will be maintained in a grassland/low-shrub state above the pipeline by periodic mechanical mowing, cutting, and trimming. Mechanical removal of vegetation will not occur more frequently than every three years (per standard FERC procedures) and not during the period of April 15 to August 1 in order to avoid impacts to ground-nesting migratory birds. This permanent ROW will maintain MVP's access to the pipeline's routes for terrestrial patrols, visibility of the pipeline's route for aerial patrols, and maintaining access in the event of emergency repairs. In upland areas, trees or deep-rooted shrubs will not be allowed to grow within the 15 feet of either side of the centerline in order to maintain the integrity of the pipe. Within wetlands or adjacent to waterbodies, MVP will maintain vegetation in a 10-foot corridor centered over the pipeline by mechanical means. Vegetation maintenance is not expected to be required in agricultural areas.

MVP will monitor disturbed areas where seed mixes were applied after the first and second growing seasons to determine the success of revegetation. The permanently maintained ROW will be considered successfully restored when the soils have been stabilized, and a native vegetation community is established (i.e., native grasses and shallow-rooted shrubs). In agricultural areas of the permanent ROW, revegetation will be considered successful when the area has been revegetated and is similar to adjacent undisturbed areas within the same field. As needed, additional seed and fertilizer will be applied to areas where revegetation is not deemed successful.

Management and control of invasive species is critical if disturbed areas are to be successfully revegetated and restored, as invasive species can outcompete and exclude native species. MVP will utilize techniques approved by the FERC and USFS to control invasive species along the construction areas, which will include mechanical methods (e.g., pulling, mowing, disking, etc.) as well as chemical treatments (e.g., herbicides). MVP will comply with all local, state, and federal requirements related to the use of herbicides, including any requirements specified by the USFS on the JNF. See Section 5.4 below for more details.

5.1.1 Jefferson National Forest

MVP will follow the USFS's recommendations for restoration and rehabilitation of the permanent ROW, as defined in the Plan of Development, to reduce impacts to visual resources, in a manner that preserves MVP's ability to access, monitor, patrol, and inspect the ROW in accordance with PHMSA requirements (49 CFR Part 192).

5.2 Temporary Right-of-Way

Along the portion of the Project allowed to return to pre-construction conditions (e.g., areas beyond the permanent ROW), successful restoration will be determined by monitoring reclaimed areas for up to two growing seasons and comparing them to adjacent, undisturbed areas. Restoration in these areas will be determined successful if the seeded areas germinate and demonstrate, over time, an ability to achieve species distribution and diversity comparable to the pre-established targeted conditions.

5.3 Bare-Root Sapling and Shrub Plantings

5.3.1 Riparian and Forested Wetland Restoration

Assuming a 70% survival rate (Davis et al. 2010), approximately 380 stems per acre per Planting Area (stems/ac/PA) are expected to be present following the Year 1 planting. During Year 2 (first growing season), habitat assessments will be performed to determine whether the expected average survived. If not, the ratio of surviving stems to total stems planted will be calculated to determine the stem survival rate. The actual survival rate will be used to determine the number of trees necessary to plant in Year 2 in order to achieve the desired average in Year 3. Annual habitat assessments will occur as necessary beyond Year 2 until an average of 300 stems/ac/PA have survived.

5.3.2 Loggerhead Shrike Shrub Plantings

MVP will monitor habitat restoration and enhancement activities by evaluating survival of planted shrubs/trees.

Planted shrubs/trees will be monitored for a minimum of two growing seasons following the initial planting. Planting efforts will be deemed successful with 70 percent survival of shrubs/trees initially planted. This threshold will ensure that there is a net gain in preferred shrubs/trees throughout the study area (i.e., Giles, Craig, Montgomery, and Roanoke counties, Virginia) to promote conservation of loggerhead shrike and other shrub-nesting birds. If survivability drops below this threshold between initial planting and the end of the second growing season, shrubs/trees will be replaced to meet the 70 percent threshold.

The purpose of shrub/tree planting is to promote shrub-nesting bird species, such as loggerhead shrike. Along with monitoring the survival of shrubs/trees, MVP will provide VDGIF with locations as well as pre-construction and post-planting photos of the restored areas so that VDGIF can conduct future surveys of the restored habitat areas.

5.4 Exotic and Invasive Plant Species Control

The introduction and spread of exotic, noxious, and/or invasive plant species can cause significant ecological and/or economic impacts (Pimentel et al. 2005). Excavation for pipeline placement and other construction activities expose the topsoil surface to potential entrance of exotic, noxious, and/or invasive plant species. This can

occur either by physical transport onto the exposed soil site by way of equipment, machinery or vehicles, through windborne or wildlife dissemination of seeds, or by introduction of seeds or plant parts contained in mulch or straw bales. Physical disturbance of topsoil can also promote germination of seeds of nonnative, invasive vegetation that already occur in the local seed bed.

MVP will implement the following measures to prevent and control the introduction and spread of nonnative, invasive plant species during construction and operation of the Project:

- Identifying areas supporting significant populations of invasive plants;
- Pre-treating areas with invasive plants prior to construction;
- Avoiding the introduction and spread of invasive plants from construction activities;
- Selecting native seed mixes appropriate for local site conditions (e.g., soils) for restoration efforts;
- Post-construction monitoring of vegetation in areas disturbed by construction in order to identify potential invasive plant infestations;
- Addressing invasive plant infestations that manifest following construction and during restoration.

5.4.1 Pre-Construction Measures

Surveyors noted several non-native plant species during on-site field assessments along the Project's proposed route (Appendix B).

Problem areas will be flagged, staked, or otherwise marked for clear identification. Identifying these problem areas prior to construction will help reduce the potential risk of further spread of invasive plant infestations.

Mechanical (e.g., mowing) and/or chemical measures (i.e., herbicide-application) will be implemented in order to eradicate invasive plants from the identified problem areas. Specific measures will be determined based on site conditions, seasonality, proximity to sensitive resources (e.g., known occurrences of rusty patched bumble bee), and through consultation with appropriate agencies.

Herbicides can be a safe and effective means of controlling both perennial and annual invasive vegetation. MVP will coordinate with appropriate land management agencies when applying herbicides for invasive plant control. The preferred method will be spot application; however, large infestations may require a broader application. Use of herbicides will be dependent on a variety of factors related to specific species (e.g., annual or perennial; woody or herbaceous), site-characteristics (e.g., soils; proximity

to wetlands/open water), time of year, and weather conditions. Herbicide-use will be restricted when invasive plant species occur in close proximity to documented occurrences of sensitive resources that may potentially be affected (e.g., rare, threatened, or endangered plants). Other control measures may be used to address invasive plants in areas where herbicide-use is restricted.

A variety of equipment may be used to apply herbicides and will all be inspected on a daily basis, maintained as needed, and in accordance with applicable regulations, including maintaining Safety Data Sheets for all herbicides/materials. For rough terrain and/or areas with low densities of invasive plant species, backpack sprayers or other hand application methods will be used. For open areas that require intensive work and allow access for vehicles, mounted sprayers may be used. Care will be given to avoid excessive quantities of an herbicide on any given site, to the extent practical. The amount of herbicide located at any given site will be dependent on the quantity and density of invasive plants present. All concentrate will be in approved containers and transported using measures to avoid tipping and spilling. Mixing of concentrate will be completed in upland areas away from waterbodies and wetlands (>100 ft), private wells (>200 ft; identified through assistance with landowner), karst features (>300 ft), and public wells (>400 ft).

MVP developed a Project-specific *Spill Prevention, Control, and Countermeasure Plan and Unanticipated Discover of Contamination Plan for Construction Activities* in West Virginia and Virginia. One goal of these documents is to avoid or minimize the risk and potential impact of hazardous material spills during construction and operation. All herbicide applicators/contractors will be responsible for keeping and maintaining spill kits in their vehicles and at herbicide storage areas to ensure quick response to any spills. Spills are handled based on the herbicide/material type, scale, and location of the spill. Priorities of addressing the spill are as follows, 1) ensure safety of personnel and public; 2) contain spill to minimize risk to the environment; 3) complete initial clean-up; and 4) conduct remediation activities. Any spills will be reported to appropriate agencies in accordance with applicable laws and agreements.

5.4.2 Construction Measures

All equipment used for construction will be cleaned and inspected before arriving on site, and the EI will verify that equipment is free of soil and debris that may harbor invasive plant propagules. Cleaning stations will be established along the Project in areas without sensitive resources (e.g., wetlands). All soil/debris is removed from equipment by hand or compressed air. Equipment is also cleaned prior to moving from one construction spread to the next. The EI will maintain a log documenting cleaning and inspection of equipment. Visual markers (e.g., stickers) will be used to identify that equipment has been cleaned and inspected.

Topsoil and vegetation cleared from areas with invasive plants will be marked and stockpiled adjacent to the areas from which they were removed to ensure propagules are not spread to other areas. Barriers will be placed around topsoil and vegetation to eliminate the risk of material being moved. Signs identifying that piles contain invasive plant materials will be placed on barriers. Materials will be returned to areas from which they were removed during the reclamation process. Only certified weed-free mulch, straw and hay bales will be used to construct sediment control devices during construction.

5.4.3 Post-Construction Measures

MVP will adhere to the FERC's Plan and Procedures. Monitoring measures included in these documents and those proposed in the following section will help ensure invasive plant species are identified and addressed through appropriate control measures. Mechanical and chemical control measures—dependent on species, time of year, and site characteristics—will be implemented to reduce the risk of invasive plants becoming heavily established in and adjacent to the Project footprint. MVP is committed to working with adjacent landowners to ensure Project activities have a limited potential to result in the establishment of novel invasive plant species.

Revegetation measures will be performed immediately following construction or the following spring/summer depending on soil conditions (i.e., frozen versus not frozen). MVP will reseed and replant areas of the permanent and temporary ROW using only native species (see Section 2.0).). Immediate revegetation, as soon as practical, will reduce the time that bare soil is exposed and, therefore, minimize the opportunity for invasive plant species to become established.

MVP will monitor the ROW annually after the first and second growing seasons following construction to allow for early detection of exotic or invasive species infestations. If invasive plant species are found in numbers that are substantially greater than adjacent locations, MVP will conduct selective eradications of those species. Mechanical and chemical control measures will be completed, to the degree feasible, prior to maturation of seeds of invasive plants to avoid seed dispersal. As previously mentioned with pre-treatment and preventative measures to control invasive plants, herbicide types will be determined based on species requiring control, time of year, and site characteristics. Spot application of herbicide is the preferred method; however, dense infestations may be more appropriately addressed with a broader application. All herbicides will be applied by applicators appropriately licensed or certified by the state in which the work is conducted. Following herbicide application and based on the specific persistence of the herbicide in the soil, areas treated will be seeded with a native seed mix.

When implementing chemical control measures, as previously mentioned, care is taken to avoid sensitive resources that may be affected by herbicides (e.g., rare,

threatened, and/or endangered plants; existing or created habitat for rusty patched bumble bee). In these areas, mechanical control measures, such as mowing or cutting/pulling by hand, will be the preferred method. If these methods result in a disturbance to topsoil, native seed will be applied to the affected area to reduce the risk of subsequent invasive species establishment.

5.4.4 Jefferson National Forest

An Exotic and Invasive Species Control Plan was developed and included in MVP's Plan of Development for the JNF. The document provides four strategies that will be implemented to avoid and minimize the exotic and invasive species introduction and infestation: 1) identifying and subsequent treatment of exotic and invasive species occurring in the Project area prior to any Project-related disturbance; 2) avoiding transportation of exotic and invasive species propagules through cleaning equipment between construction sites, using certified weed-free mulch and straw bales, and using locally sourced topsoil; 3) monitoring and treating any exotic and invasive species encountered during construction and post-construction; and 4) using seed mixes that do not contain any invasive plant species and which have been approved by the USFS for use on the JNF.

MVP will avoid the introduction of novel invasive species and utilize pre- and post-construction techniques approved by the FERC and USFS to control invasive species along construction areas, which will include mechanical methods (e.g., pulling, mowing, disking, etc.) as well as chemical treatments (e.g., herbicides) on the JNF, as requested by the USFS. MVP will comply with all local, state, and federal requirements related to the use of herbicides, including any specified by the USFS on the JNF. Herbicides to be used on the JNF will be approved by the USFS prior to use. For additional details regarding exotic and invasive vegetation control and herbicide use, refer to the Plan of Development for the JNF.

6.0 Literature Cited

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APPENDIX A
USFS RECOMMENDED SPECIES FOR SEED MIXES

Table 1. USFS recommended species for upland areas within the Jefferson National Forest.

Scientific Name	Common Name	Growth Habit	pH Preference
Non-native Species for Erosion Control			
<i>Lolium perenne</i> subsp. <i>multiflorum</i>	Italian ryegrass; Annual ryegrass	Graminoid	5.0 – 7.9
<i>Urochloa ramosa</i> (<i>Panicum ramosum</i>)	Browntop millet	Graminoid	5.5 – 6.9
<i>Secale cereale</i>	Cereal rye	Graminoid	5.2 – 8.0
<i>Setaria italica</i>	Foxtail millet	Graminoid	5.3 – 6.9
Native Species			
<i>Chasmanthium laxum</i> ^a	Slender woodoats	Graminoid	4.5 – 7.0
<i>Eragrostis spectabilis</i> ^a	Purple lovegrass	Graminoid	4.0 – 7.5
<i>Panicum virgatum</i>	Switchgrass	Graminoid	4.5 – 8.0
<i>Sorghastrum nutans</i>	Indiangrass	Graminoid	5.0 – 7.8
<i>Tridens flavus</i> ^a	Purpletop	Graminoid	4.5 – 6.5
<i>Apocynum cannabinum</i> ^a	Indian hemp	Forb	4.5 – 7.0
<i>Chamaecrista fasciculata</i>	Partridge pea	Forb	5.5 – 7.5
<i>Desmodium canadense</i>	Showy ticktrefoil	Forb	wide tolerance
<i>Desmodium paniculatum</i>	Panicledleaf ticktrefoil	Forb	6.0 – 7.0
<i>Elymus virginicus</i> ^b	Virginia wildrye	Graminoid	5.0 – 7.4
<i>Geum canadense</i> ^a	White avens	Forb	4.5 – 7.5
<i>Heliopsis helianthoides</i>	Oxeye sunflower; Smooth oxeye	Forb	unknown
<i>Monarda fistulosa</i> ^a	Wild bergamot	Forb	6.0 – 8.0
<i>Pycnanthemum</i> spp. ^b	Mountain mint	Forb	unknown
<i>Rubus allegheniensis</i> ^a	Common blackberry; Allegheny blackberry	Forb/ Subshrub	4.6 – 7.5
<i>Rudbeckia hirta</i>	Blackeyed Susan	Forb	6.0 – 7.0
<i>Solidago canadensis</i> ^a	Canada goldenrod	Forb	4.8 – 7.5
<i>Tradescantia virginiana</i> ^a	Virginia spiderwort	Forb	4.0 – 8.0

a/ This species is more tolerant of low pH soils

b/ Species is a good choice for higher elevation (i.e., areas higher than 3,000 feet or lower sites where the presence of red spruce indicates cold conditions) areas.

Table 2. USFS recommended species for riparian areas within the Jefferson National Forest.

Scientific Name	Common Name	Habit	pH Preference
Non-native Species for Erosion Control			
<i>Lolium perenne</i> subsp. <i>multiflorum</i>	Italian ryegrass; Annual ryegrass	Graminoid	5.0 – 7.9
<i>Urochloa ramosa</i> (<i>Panicum ramosum</i>)	Browntop millet	Graminoid	5.5 – 6.9
<i>Secale cereale</i>	Cereal rye	Graminoid	5.2 – 8.0
<i>Setaria italic</i>	Foxtail millet	Graminoid	5.3 – 6.9
Native Species			
<i>Agrostis perennans</i>	Autumn bentgrass; upland bentgrass	Graminoid	5.5 – 7.5
<i>Elymus virginicus</i>	Virginia Wildrye	Graminoid	5.0 - 7.4
<i>Sorghastrum nutans</i>	Indiangrass	Graminoid	5.0 – 7.8
<i>Asclepias incarnata</i>	Swamp milkweed	Forb	5.0 – 8.0
<i>Chamaecrista fasciculata</i>	Partridge pea	Forb	5.5 – 7.5
<i>Eutrochium fistulosum</i> (<i>Eupatorium fistulosum</i>)	Joe pye weed	Forb	4.5 – 7.0
<i>Eupatorium maculatum</i>	Spotted joe pye weed	Forb	5.5 – 7.0
<i>Eupatorium perfoliatum</i>	Boneset	Forb	unknown
<i>Helenium autumnale</i>	Common sneezeweed	Forb	4.0 – 7.5
<i>Senna hebecarpa</i>	Wild senna; American senna	Forb	unknown
<i>Senna marilandica</i>	Maryland senna	Forb / Subshrub	4.0 – 7.0
<i>Vernonia noveboracensis</i>	New York ironweed	Forb	4.5 -8.0

Table 3. USFS recommended species for steep slope areas within the Jefferson National Forest.

Scientific Name	Common Name	Growth Habit	pH Preference
Non-native Species for Temporary Erosion Control			
<i>Lolium perenne</i> subsp. <i>multiflorum</i>	Italian ryegrass; Annual ryegrass	Graminoid	5.0 – 7.9
<i>Urochloa ramosa</i> (<i>Panicum ramosum</i>)	Browntop millet	Graminoid	5.5 – 6.9
<i>Secale cereale</i>	Cereal rye	Graminoid	5.2 – 8.0
<i>Setaria italic</i>	Foxtail millet	Graminoid	5.3 – 6.9
Native – Highly Preferred			
<i>Sorghastrum nutans</i>	Indiangrass	Graminoid	5.0 – 7.8
<i>Tridens flavus</i>	Purpletop	Graminoid	4.5 – 6.5
Native – Preferred			
<i>Agrostis perennans</i>	Autumn bentgrass; Upland bentgrass	Graminoid	5.5 – 7.5
<i>Dichanthelium clandestinum</i>	Deertongue	Graminoid	4.0 – 7.5
<i>Elymus canadensis</i>	Canada wildrye	Graminoid	5.0 – 7.9
<i>Desmodium canadense</i>	Showy ticktrefoil	Forb	wide tolerance
<i>Heliopsis helianthoides</i>	Oxeye sunflower; Smooth oxeye	Forb	unknown
<i>Lespedeza virginica</i>	Slender bushclover; Slender lespedeza	Forb	acid tolerant
<i>Liatris spicata</i>	Dense blazing star; Spiked gayfeather	Forb	5.6 - 7.5
<i>Senna hebecarpa</i>	Wild senna; American senna	Forb	unknown
Native – Moderately Preferred			
<i>Panicum virgatum</i>	Switchgrass	Graminoid	4.5 – 8.0
<i>Chamaecrista fasciculata</i>	Partridge pea	Forb	5.5 – 7.5
<i>Rudbeckia hirta</i>	Blackeyed Susan	Forb	6.0 – 7.0

APPENDIX B
LIST OF POTENTIAL EXOTIC AND INVASIVE PLANT SPECIES

Common Name	Scientific Name	Growth Form	Typical Habitat(s)
Amur Honeysuckle	<i>Lonicera maackii</i>	Shrub	Pastures, fields, forest, forest edges, roadsides
Autumn Olive	<i>Elaeagnus umbellata</i>	Shrub	Pastures, fields, roadsides
Asian Bittersweet	<i>Celastrus orbiculata</i>	Vine	Fields, forest edges, roadsides, grasslands
Beefsteak Plant	<i>Perilla frutescens</i>	Herb	Roadsides
Bell's Honeysuckle	<i>Lonicera bella</i>	Shrub	Fields, pastures, forest edge, roadsides
Bishop's Goutweed	<i>Aegopodium podagraria</i>	Herb	Forests
Border Privet	<i>Ligustrum obtusifolium</i>	Shrub	Old fields, forest gaps
Bradford Pear	<i>Pyrus calleryana</i>	Tree	Full sun, orchards, parks, roadsides, yards, forest edge
Brittle Naiad	<i>Najas minor</i>	Herb	Ponds, streams, lakes, wetlands
Bull Thistle	<i>Cirsium vulgare</i>	Herb	Pastures, fields
Bush Honeysuckles	<i>Lonicera</i> spp.	Shrub	Pastures, fields, forest edges, roadsides
Butter-and-Eggs	<i>Linaria vulgaris</i>	Herb	Fields, pastures, roadsides, disturbed areas
Canada Bluegrass	<i>Poa compressa</i>	Grass	Fields, pastures, forest edge, wet sites, forest openings, waste areas
Canada Thistle	<i>Cirsium arvense</i>	Herb	Pastures, fields
Celandine	<i>Chelidonium majus</i> var. <i>majus</i>	Herb	Fields, roadsides, waste areas, dry to moist woodlands
Cheatgrass	<i>Bromus tectorum</i>	Grass	Pastures, fields
Chinese Bushclover	<i>Lespedeza cuneata</i>	Herb	Roadsides, rights-of-way, old fields, pasture, woodlands
Chinese Privet	<i>Ligustrum sinense</i>	Shrub	Pastures, fields, forest, forest edges, roadsides
Chinese Wisteria	<i>Wisteria sinensis</i>	Woody Vine	Forest, forest edges, roadsides, disturbed areas
Chinese Yam	<i>Dioscorea oppositifolia</i>	Vine	Streambanks, floodplain forests
Cinnamon Vine	<i>Dioscorea polystachya</i>	Vine	Forests, woodlands, thickets
Colonial Bent-grass	<i>Agrostis capillaris</i>	Grass	Pastures, fields
Common Buckthorn	<i>Rhamnus catharticus</i>	Shrub	Wetlands, old fields
Common Chickweed	<i>Stellaria media</i>	Herb	Fields, floodplain forests, disturbed areas, waste areas
Common Privet	<i>Ligustrum vulgare</i>	Shrub	Forests, fields, rights-of-way
Common Reed	<i>Phragmites australis</i>	Grass	Wetlands
Common Sheep Sorrel	<i>Rumex acetosella</i>	Herb	Fields, roadsides, disturbed areas, waste areas
Common Velvetgrass	<i>Holcus lanatus</i>	Grass	Meadows, wetlands, riparian areas
Cork Tree	<i>Phellodendron japonicum</i>	Tree	Residential, parks, open woodlands, roadsides
Crown Vetch	<i>Coronilla varia</i>	Herb	Pastures, fields
Curled Thistle	<i>Carduus crispus</i>	Herb	Pastures, fields
Curlyleaf Pondweed	<i>Potamogeton crispus</i>	Herb	Wetlands, ponds, lakes
Cut-leaf Teasel	<i>Dipsacus laciniatus</i>	Herb	Fields, pastures, roadsides, waste areas
Dame's Rocket	<i>Hesperis matronalis</i>	Herb	Fields, forest edges

Common Name	Scientific Name	Growth Form	Typical Habitat(s)
Drooping Star of Bethlehem	<i>Ornithogalum nutans</i>	Herb	Fields, floodplains, waste areas
English Ivy	<i>Hedera helix</i>	Vine	Forests, disturbed areas
Eurasian Water-milfoil	<i>Myriophyllum spicatum</i>	Herb	Aquatic ponds, ditches, wetlands
European Barberry	<i>Berberis vulgaris</i>	Shrub	Forests, wetlands, pastures
European Privet	<i>Ligustrum vulgare</i>	Shrub	Pastures, fields, forests, forest edges, roadsides, streams
European Stinging Nettle	<i>Urtica dioica</i>	Herb	Stream edges, marsh, meadows, moist woodlands
Field Hawkweed	<i>Hieracium caespitosum</i>	Herb	Fields, pastures, prairies, waste areas, disturbed areas
Fiveleaf Akebia	<i>Akebia quinata</i>	Vine	Forests
Fuller's Teasel	<i>Dipsacus fullonum</i>	Herb	Riparian areas, meadows, fields, forest openings, disturbed areas
Garden Yellow-rocket	<i>Barbarea vulgaris</i>	Herb	Pastures, fields, roadsides, moist meadows
Garlic Mustard	<i>Alliaria petiolata</i>	Herb	Forests
Giant Hogweed	<i>Heracleum mantegazzianum</i>	Herb	Right-of-ways, riverbanks, ditches
Glossy Buckthorn	<i>Frangula alnus</i>	Shrub	Wetlands, old fields
Goatsrue	<i>Galaga officinalis</i>	Herb	Pastures, streambanks
Goldern Bamboo	<i>Phyllostachys aurea</i>	Grass	Roadsides, disturbed areas, forest openings, forest edge
Goutweed	<i>Aegopodium podagraria</i>	Herb	Forests, fields, pastures
Great Mullein	<i>Verbascum thapsus</i>	Herb	Fields, meadows, forests, roadsides, disturbed areas
Ground Ivy	<i>Glechoma hederacea</i>	Herb	Open forests, disturbed areas, waste areas, lawn
Guelder Rose	<i>Viburnum opulus</i>	Shrub	Forests, wetlands, fields
Gypsy-flower	<i>Cynoglossum officinale</i>	Herb	Fields, pastures, forest edge, roadsides, disturbed areas
Hairy Cat's Ear	<i>Hypochaeris radicata</i>	Herb	Fields, pastures, grasslands, roadsides, disturbed areas
Hydrilla	<i>Hydrilla verticillata</i>	Herb	Wetlands, ponds
Indian-strawberry	<i>Duchesnea indica</i>	Herb	Fields, prairies, open woodlands, disturbed areas
Ivy-leaved Speedwell	<i>Veronica hederifolia</i>	Herb	Fields, forest edge, roadsides, disturbed areas
Japanese Barberry	<i>Berberis thunbergii</i>	Shrub	Forests, wetlands, pastures
Japanese Bromegrass	<i>Bromus japonicus</i>	Grass	Pastures, fields
Japanese Honeysuckle	<i>Lonicera japonica</i>	Vine	Forests, wetlands, fields
Japanese Hops	<i>Humulus japonicus</i>	Vine	Roadsides, streambanks, drainage ditch, meadows, disturbed areas, waste areas
Japanese Knotweed	<i>Polygonum cuspidatum</i>	Shrubby herb	Wetlands, streambanks, roadsides
Japanese Spiraea	<i>Spiraea japonica</i>	Shrub	Fields, forest openings
Japanese Stilt Grass	<i>Microstegium vimineum</i>	Grass	Pastures, fields, forests, wetlands
Jetbed	<i>Rhodotypos scandens</i>	Shrub	Forests, forest edge, roadsides
Jimsonweed	<i>Datura stramonium</i>	Herb	Pastures, fields
Johnson Grass	<i>Sorghum halepense</i>	Grass	Fields, wetlands, open forests

Common Name	Scientific Name	Growth Form	Typical Habitat(s)
Kentucky Bluegrass	<i>Poa pratensis ssp. pratensis</i>	Grass	Fields, grasslands, forest edge
Kudzu	<i>Pueraria lobata</i>	Vine	Forests
Lesser Burdock	<i>Arctium minus</i>	Herb	Fields, meadows, disturbed areas
Lesser Celandine	<i>Ranunculus ficaria var. bulbifera</i>	Herb	Forests
Lesser Periwinkle	<i>Vinca minor</i>	Vine	Fields, forest edge, forest openings
Linden Arrowwood	<i>Viburnum dilatatum</i>	Shrub	Forests, wetlands, disturbed areas
Long-bristled Smartweed	<i>Persicaria longiseta</i>	Herb	Lawns, roadsides, wet meadows, waste areas
Maiden Grass	<i>Miscanthus sinensis</i>	Grass	Pastures, fields
Marsh Dewflower	<i>Murdannia keisak</i>	Herb	Wetlands
Meadow Brome	<i>Bromus commutatus</i>	Grass	Pastures, fields
Meadow Fescue	<i>Schedonorus pratensis</i>	Grass	Pastures, fields
Mile-a-minute Vine	<i>Polygonum perfoliatum</i>	Vine	Fields, forest edges, roadsides, ditches
Mimosa	<i>Albizia julibrissin</i>	Tree	Forest edges, residential areas, roadsides
Moneywort	<i>Lysimachia nummularia</i>	Herb	Moist forests, streambanks, wet meadows, wetlands, roadsides, fields
Multiflora Rose	<i>Rosa multiflora</i>	Shrub	Pastures, fields, forest edges
Musk Thistle	<i>Carduus nutans</i>	Herb	Pastures, fields
Nodding Plumeless-thistle	<i>Carduus nutans ssp. marcolepis</i>	Herb	Disturbed sites, waste areas, roadsides
Norway Maple	<i>Acer platanoides</i>	Tree	Forests
Oriental Bittersweet	<i>Celastrus orbiculatus</i>	Vine	Forest edges, old fields
Oriental Lady's Thumb	<i>Polygonum caespitosum var. longisetum</i>	Herb	Wetlands, floodplain forests, upland forests
Oxeye Daisy	<i>Leucanthemum vulgare</i>	Herb	Fields, pastures, grasslands, roadsides, disturbed areas
Parrot Feather	<i>Myriophyllum aquaticum</i>	Herb	Wetlands, ponds
Perennial Ryegrass	<i>Lolium perenne ssp. multiflorum</i>	Grass	Pastures, fields
Plumeless Thistle	<i>Carduus acanthoides</i>	Herb	Pastures, fields, roadsides
Poison-hemlock	<i>Conium maculatum</i>	Herb	Fields, pastures, roadsides, forest edge, degraded wetlands and prairies
Porcelain Berry	<i>Ampelopsis brevipedunculata</i>	Vine	Forests, stream banks, old fields
Poverty Brome	<i>Bromus sterilis</i>	Grass	Pastures, fields
Princess Tree	<i>Paulownia tomentosa</i>	Tree	Forests
Purple Crown-vetch	<i>Coronilla varia</i>	Herb	Pastures, fields, roadsides, utility right-of-ways
Purple Loosestrife	<i>Lythrum salicaria</i>	Herb	Aquatic ponds, ditches, wetlands
Reed Canary Grass	<i>Phalaris arundinacea</i>	Grass	Wetlands
Rough Bluegrass	<i>Poa trivialis</i>	Grass	Pastures, fields, roadsides,
Russian Olive	<i>Elaeagnus angustifolia</i>	Shrub	Pastures, fields, roadsides

Common Name	Scientific Name	Growth Form	Typical Habitat(s)
Rye Brome	<i>Bromus secalinus</i>	Grass	Pastures, fields
Shattercane	<i>Sorghum bicolor</i>	Grass	Pastures, fields
Shrubby Bushclover	<i>Lespedeza bicolor</i>	Shrub	Forest edges, field edges, forest openings
Siberian Elm	<i>Ulmus pumila</i>	Tree	Forests
Small Carpgrass	<i>Arthraxon hispidus</i>	Grass	Wetlands, ponds, streams, river floodplains
Smooth Brome	<i>Bromus inermis</i> ssp. <i>inermis</i> var. <i>inermis</i>	Grass	Fields, Pastures
Spotted Knapweed	<i>Centaurea stoebe</i> ssp. <i>micranthos</i>	Herb	Pastures, fields, roadsides
Star of Bethlehem	<i>Ornithogallum umbellatum</i>	Herb	Forests, fields
Standish's Honeysuckle	<i>Lonicera standishii</i>	Shrub	Fields, pastures, forest edge, roadsides, disturbed areas
St. John's-Wort	<i>Hypericum perforatum</i>	Herb	Fields, pastures, disturbed areas
Stonecrop	<i>Sedum sarmentosum</i>	Herb	Forest, forest edge
Sweetclover	<i>Melilotus officinalis</i>	Herb	Fields, pastures, roadsides, waste areas
Sycamore Maple	<i>Acer Pseudoplatanus</i>	Tree	Forests
Tall Fescue	<i>Schedonorus phoenix</i>	Grass	Pastures, fields
Tartarian Honeysuckle	<i>Lonicera tatarica</i>	Shrub	Pastures, fields, roadsides, utility right-of-ways, forest edge
Tree of Heaven	<i>Ailanthus altissima</i>	Tree	Forests
Viper's Bugloss	<i>Echium vulgare</i>	Herb	Pastures, fields, roadsides, waste areas
Water Chestnut	<i>Trapa natans</i>	Herb	Wetlands
Watercress	<i>Rorippa nasturtium-aquaticum</i>	Herb	Wetlands, streams, springs
Water Shield	<i>Brasenia schreberi</i>	Herb	Ponds, lakes
Wild Carrot	<i>Daucus carota</i>	Herb	Fields, pastures, roadsides, degraded prairie, forest edge
Wild Parsnip	<i>Pastinaca sativa</i>	Herb	Roadsides
Wine Berry	<i>Rubus phoenicolasius</i>	Shrub	Forests, fields
Winged Euonymus	<i>Euonymus alatus</i>	Shrub	Forests
Winter Creeper	<i>Euonymus fortunei</i>	Vine	Forests, fields
Wocheiner knapweed	<i>Centaurea nigrescens</i>	Herb	Fields, pastures, grasslands, field edge, open forests
Yellow Flag	<i>Iris pseudocorus</i>	Herb	Wetlands

Source: USDA (2015), VDCR-DNH (2015), WVDNR (2009), WVDNR (2010)

**APPENDIX E
AVIAN SURVEY REPORTS**