MEMORANDUM TO: Office of the Secretary

FROM: Paul Friedman, FERC staff

SUBJECT: Mountain Valley Project
CP16-10

DATE: November 21, 2017

Please place this document in the public files for the project proposed by Mountain Valley Pipeline LLC in Docket No. CP16-10-000:

- Copy of Biological Opinion produced by the U.S. Fish & Wildlife Service on November 21, 2017, to comply with Section 7 of the Endangered Species Act.

The document was sent to staff. The document is NOT confidential.

Paul Friedman

From:	Troy Andersen <troy_andersen@fws.gov>
Sent:	Tuesday, November 21, 2017 1:37 PM
To:	James Martin
Cc:	Cindy Schulz; Walker, William T Jr CIV USARMY CENAO (US); erika_vaughan@ios.doi.gov; Paul Friedman; tabing@fs.fed.us; Adams, Jennifer - FS; Tignor, Keith (VDACS); Hypes, Rene (DCR); ERNIE.ASCHENBACH@dgif.virginia.gov; Brown, Clifford L; Dawley, Joseph; Stahl, Megan D.
Subject:	Mountain Valley Pipeline, LLC; Docket Number CP16-10-000 - Biological Opinion
Attachments:	20171121_letter_Service to FERC_MVP BO SIGNED.pdf

Mr. Martin:

The signed subject document is attached.

Wishing everyone a safe and happy holiday season.

V/R
Troy

Endangered Species/Conservation Planning Assistance Supervisor
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United States Department of the Interior

FISH AND WILDLIFE SERVICE

Virginia Field Office
6669 Short Lane
Gloucester, VA 23061

November 21, 2017

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

Attn: James Martin, Branch Chief

Re: Mountain Valley Pipeline, LLC; Docket Number CP16-10-000; Project #05E2VA00-2016-F-0880 and #05E2WV00-2015-F-0046

Dear Ms. Bose:

This document transmits the U.S. Fish and Wildlife Service's (Service) biological opinion (Opinion) based on our review of the referenced project and its effects on the federally listed species in Table 1 in accordance with Section 7 of the Endangered Species Act (16 U.S.C. 1531-1544, 87 Stat. 884), as amended (ESA).

Table 1. Species considered in this Opinion.

Species Common Name	Species Scientific Name	ESA Status	State
Small whorled pogonia (SWP)	*Isotria medeoloides*	threatened	West Virginia (WV)
Virginia spiraea (VASP)	*Spiraea virginiana*	threatened	WV
Roanoke logperch (RLP)	*Percina rex*	endangered	Virginia (VA)
Indiana bat (Ibat)	*Myotis sodalis*	endangered	VA, WV
Northern long-eared bat (NLEB)	*Myotis septentrionalis*	threatened	VA, WV

Your July 10, 2017 request for formal consultation was received on July 10, 2017.

This Opinion is based on information provided in the June 23, 2017 Final Environmental Impact Statement (FEIS) (Federal Energy Regulatory Commission [FERC] 2017a), July 10, 2017

Biological Assessment (BA) (FERC 2017b), telephone conversations, field investigations, and other sources of information. The consultation history is located after the Literature Cited. Because the project traverses 2 states under the geographic jurisdiction of the 2 Service Field Offices in Gloucester, VA (VAFO), and Elkins, WV (WVFO), each maintain their geographic portion of the administrative record in their respective Field Office.

FERC, under Section 7 of the Natural Gas Act, is required to consider, as part of its decision to authorize interstate gas facilities, all factors bearing on the public convenience and necessity. This includes any "nonjurisdictional" facilities that do not come under the jurisdiction of FERC but may be integral to the project objective. Nonjurisdictional facilities that lie outside the footprint of jurisdictional facilities were not included in the analysis of impacts to federally listed species provided to the Service by FERC. Therefore, any effects to and incidental take of listed species associated with nonjurisdictional facilities may not be covered in this Opinion. The nonjurisdictional facilities associated with this project are summarized in Appendix W of the FEIS and further discussed in Sections 2.2 and 4.13 (FERC 2017a).

BIOLOGICAL OPINION

DESCRIPTION OF PROPOSED ACTION

As defined in the ESA Section 7 regulations (50 CFR 402.02), "action" means "all activities or programs of any kind authorized, funded, or carried out, in whole or in part, by federal agencies in the United States or upon the high seas." The "action area" is defined as "all areas to be affected directly or indirectly by the federal action and not merely the immediate area involved in the action."

Mountain Valley Pipeline, LLC (Mountain Valley) has requested the FERC to authorize the construction and operation of a total of approximately 303.5 miles of natural gas transmission pipeline and associated facilities in WV and VA, known as the Mountain Valley Project (MVP) (Figure 1) (FERC 2017a, 2017b).

The following is a summary of the proposed action and a detailed description can be found in FERC's MVP and Equitrans Expansion Project FEIS (FERC 2017a) and BA (FERC 2017b) for MVP.

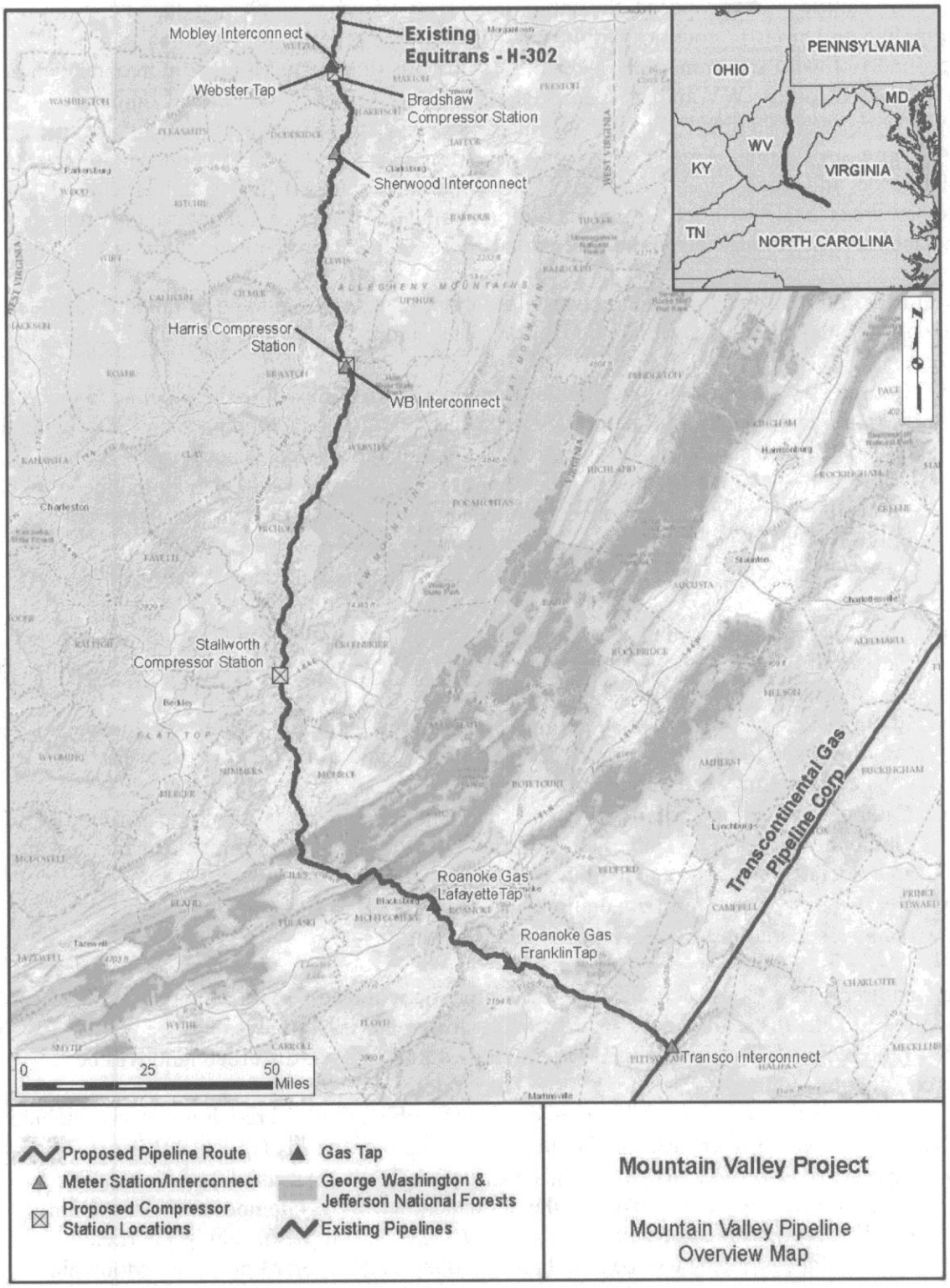


Figure 1. MVP overview.

Proposed Facilities – As proposed, the approximately 303.5 miles of 42-inch diameter natural gas pipeline will cross 17 counties within WV and VA. The pipeline route begins at an interconnection with Equitrans, L.P.'s existing H-302 pipeline at the Mobley Interconnect and Tap in Wetzel County, WV and proceeds to the Transcontinental Gas Pipeline Company's existing compressor station 165 in Pittsylvania County, VA. Additional components include 3 new compressor stations, 4 meter and regulation (M&R) stations (i.e., interconnects), 3 taps, 8 pig launchers and receivers at 5 locations, 36 new mainline valves (MLVs), and 31 cathodic protection beds. MVP will deliver up to 2 billion cubic feet (ft) per day of natural gas from the Appalachian Basin to markets in the Mid-Atlantic and Southeastern United States.

A brief description of the 7 types of above-ground facilities proposed to be installed is included below. Additional details describing the facilities are included in Section 2.1 of the FEIS (FERC 2017a) and Section 3.1 of the BA (FERC 2017b).

- Compressor stations – utilize engines to maintain pressure within the pipeline to deliver the contracted volumes of natural gas to specific points at specific pressures. Designed to attenuate noise and allow for operation and maintenance (O&M) activities.
- M&R stations – measure the volume of gas removed from or added to a pipeline system at receipt and delivery interconnects. Consist of a small graveled area with a small building(s) that enclose the measurement equipment.
- Taps – connect the MVP pipeline with other natural gas systems operated by other companies.
- MLVs – consist of a small system of aboveground and underground piping and valves that control the flow of gas within the pipeline and can also be used to vacate, or blowoff, the gas within a pipeline segment, if necessary.
- Pig launchers and receivers – facilities where internal pipeline cleaning and inspection tools, referred to as "pigs," can be inserted or retrieved from the pipeline. Generally consist of a segment of aboveground piping.
- Cathodic protection systems – systems that help prevent corrosion of underground pipeline facilities. Typically include a small, aboveground transformer-rectifier unit and an associated anode ground bed located underground.
- Very small aperture terminal equipment – provides telecommunication services at all compressor stations, M&R stations, and MLV sites.

Land Requirements – Construction of the MVP pipeline will disturb approximately 6,363 acres of land (FERC 2017b). Following construction, approximately 2,118 acres will be maintained for O&M of the pipeline. The remaining approximately 4,245 acres of disturbed land will be restored and allowed to revert to former use. A brief description of the 6 types of land requirements is included below. Additional details describing the land requirements are included in Section 2.3 of the FEIS (FERC 2017a) and Section 3.2.3 of the BA (FERC 2017b).

- Pipeline right-of-way (ROW) – The construction ROW consists of 2 portions, the temporary construction ROW and the permanent ROW. The temporary construction ROW will be restored or will revert to former use; a 50-ft permanent ROW (i.e., operational easement) will be maintained and utilized for O&M purposes. Mountain Valley will generally use a 125-ft construction ROW to install the pipeline in uplands and a 75-ft construction ROW through wetlands.
- Additional temporary workspace (ATWS) – additional space required in particular areas

necessary to complete construction of the pipeline. Examples include, but are not limited to, areas adjacent to crossings of roadways, railroads, waterbodies, wetlands, or other utilities; areas requiring extra trench depth; certain pipe bend locations; truck turnarounds or equipment passing lanes; staging and fabrication areas. ATWS will be used only during construction; after pipeline installation, all ATWS will be restored to their pre-construction condition and use.

- Aboveground facilities – used for construction of aboveground facilities, except cathodic protection areas. Temporary work areas used during construction of the aboveground facilities will be restored to their pre-construction condition and use after the facilities are built.
- Contractor and storage yards (yards) – used to temporarily store pipe, materials, and equipment; set up offices; and mobilize workers. After pipeline installation, all yards will be restored to their pre-construction conditions and use.
- Cathodic protection areas – used for installing cathodic protection rectifiers and groundbeds.
- Access roads (ARs) – necessary to gain access to the construction ROW and aboveground facilities. Many of the proposed ARs are existing roads and virtually all of the existing ARs will require improvements for pipeline construction traffic.

Construction Procedures – Mountain Valley will design, construct, operate, and maintain the MVP pipeline and facilities in accordance with U.S. Department of Transportation regulations under 49 CFR 192 and other applicable federal and state requirements. Mountain Valley will comply with siting and maintenance requirements under 18 CFR 380.15 and other applicable federal and state regulations and implement various forms of mitigations as defined in 40 CFR 1508.20. They will adopt FERC's general construction, restoration, and operational mitigation measures as outlined in FERC's Upland Erosion Control Revegetation and Maintenance Plan (FERC Plan) (FERC 2013a) and Wetland and Waterbody Construction and Mitigation Procedure (FERC Procedures) (FERC 2013b). Construction plans include some modifications to FERC Procedures and more details can be found in Section 2.4.1.1 of the FEIS (FERC 2017a). Specific mitigation plans for National Forest lands have been determined in consultation with the U.S. Forest Service (USFS).

A brief description of the 8 types of typical construction procedures associated with the project is included below. Additional details describing the typical construction procedures are included in Section 2.4.2 of the FEIS (FERC 2017a). These construction techniques will generally proceed in an assembly line fashion with construction crews moving down the construction ROW as work progresses. Once trees are cleared, construction and restoration at any point along the pipeline route will take about 3 weeks to complete; although progress could be delayed by topography, weather, or other factors (FERC 2017a, 2017b). Within 20 days of backfilling the trench (10 days in residential areas) all work areas will be graded. The proposed construction schedule can be found in Section 2.5 and Table 4.9.2-1 of the FEIS (FERC 2017a).

- Surveying and staking – marking of the limits of the construction ROW, centerline, ATWS, other approved work areas, and environmentally sensitive areas using temporary flagging or tape.
- Clearing and grading – removal of trees, shrubs, brush, roots, and large rocks from the construction work area and leveling of the construction ROW to allow for operation of

construction equipment.

- Trenching – digging of pipeline trench by removal of soil and rock by track-mounted excavator/backhoe or similar equipment. Tractor-mounted mechanical rippers or rock trenchers may be used to fracture rock prior to removal. Blasting may be used in specific areas where hard bedrock is close to the surface.
- Pipe stringing, bending, welding, and coating – transportation of pipe segments to the construction ROW or yards and bending of pipes to fit contours of the trench. Pipeline segments are aligned and welded together. Welds are inspected and covered with protective coating.
- Lowering-in and backfilling – lowering of pipe using side-boom tractors and backfill of trench with suitable excavated material using track-hoes, bulldozers, graders, or backfilling machines. In rocky areas, protective materials may be placed in trench to protect pipe. Trench breakers (sandbags or foam) will be installed in the trench on slopes prior to backfilling to prevent subsurface water movement along pipeline.
- Hydrostatic testing and pipe cleaning – hydrostatic testing to ensure the system is capable of withstanding the operating pressure for which is it designed. Additional details describing hydrostatic testing are included in Section 3.1.6 of the BA (FERC 2017b). Afterwards, the pipeline will be cleaned and dried with pressurized air.
- Commissioning – verifying that equipment has been properly installed and is working, verifying that controls and communication systems are functioning, and confirming that the pipeline is ready for service. As a final step, the pipeline will be purged of air and loaded with natural gas.
- Cleanup and restoration – grading and restoration of all work areas to pre-construction topographic contours as closely as possible.

Specialized construction methods are required when the pipeline is installed across waterbodies, wetlands, roads, railroads, foreign utilities, steep slopes, residences, agricultural lands, and other sensitive environmental resources. A brief description of the specialized construction methods is included below. Additional details describing the specialized construction methods are included in Sections 2.4.2.9 through 2.4.2.18 of the FEIS (FERC 2017a).

- Waterbody crossings (all dry open-cut crossings) –
    - Flume construction method – diversion of streamflow through flume pipes and placement of dam structures to exclude water flow from trench area.
    - Dam-and-pump construction method – diversion of stream flow using pumps and hoses and placement of dam structures to exclude water flow from trench area.
    - Cofferdam method – installation of a temporary diversion structure from 1 bank of the waterbody to the approximate midpoint of the waterbody crossing to isolate that section of the stream from the remainder of the waterbody, creating discrete dry sections around which water flows unimpeded.
- Wetland crossings – construction ROW through wetlands are typically 75 ft wide with ATWS located in upland areas a minimum of 50 ft from wetland edge, unless granted site-specific approval for a reduced setback. Mountain Valley has requested a ROW greater than 75 ft wide in wetlands at several specific locations as listed in Appendix G of the FEIS (FERC 2017a). Sediment barriers such as silt fence and staked straw bales will be utilized during clearing and construction. Wetlands will be crossed by wet or dry open trench lay, or open ditch push-pull methods.

- Road and railroad crossings – railroads and paved roads will generally be crossed by boring beneath the road or railroad. Most gravel, dirt, and grass roads will be crossed by open-cut method; traffic will be maintained during construction by the use of steel plates or detours.
- Residential construction – implement measures to minimize construction-related impacts on all residences and other structures located within 50 ft of the construction ROW following site-specific *Residential Construction Plans* included in Appendix H of the FEIS (FERC 2017a).
- Foreign utilities – buried pipelines and utilities will be identified and crossed without damage by implementing multiple measures, including using One-Call systems.
- Agricultural areas – identify and flag existing irrigation systems and drainage tiles; any damaged irrigation and drainage systems will be repaired or replaced. A minimum of 12 inches of topsoil will be segregated from the construction ROW in agricultural lands, in accordance with the FERC Plan (FERC 2013a).
- Rugged topography – temporary and permanent controls measures such as silt socks, reinforced "super" silt fence, slope breakers, trench breakers, trench drains, erosion control matting, and hydro-mulching will be put in place to minimize erosion and sedimentation. In areas where the pipeline route crosses laterally along a slope, "two-tone" construction techniques may be used. Equipment on steep slopes will be suspended from a series of winch tractors.
- Karst terrain – crossing of karst terrain will follow the project-specific construction, restoration, and mitigation methods, summarized in Section 4.1.2.5 in the FEIS (FERC 2017a) and described in the *Karst Mitigation Plan* (Draper Aden Associates 2016).
- Winter construction – specialized construction methods or procedures will be utilized to protect resources during the winter season as described in the *Winter Construction Plan* (Mountain Valley 2016).

Monitoring and Post-Approval Variances – Mountain Valley has developed procedures for construction monitoring and quality control, environmental inspection, compliance monitoring, and post-approval variances. A brief description of the procedures is included below. Additional details describing the procedures are included in Section 2.4.4 of the FEIS (FERC 2017a).

- Coordination – copies of all applicable environmental permits, construction drawings, and specifications will be provided to construction contractors.
- Environmental inspection and training – trained environmental inspectors (EIs) will be employed to ensure that construction complies with construction and mitigation plans and environmental conditions imposed by FERC and other regulatory agencies and conduct environmental training for company employees. EIs will have the authority to immediately "stop-work" for all activities and to take corrective actions to remedy instances of non-compliance.
- FERC compliance monitoring – in additions to EIs, a third-party compliance monitoring program will be funded to provide daily environmental monitoring services during construction and daily reports to the FERC Project Manager. Other federal, state/commonwealth, and local agencies may also monitor the project to the extent determined necessary by the agency.
- Post-approval variance process – variance requests for minor modifications within the previously surveyed corridor that will not impact sensitive resources, and have landowner

acceptance, will be submitted to the third-party compliance monitor for review and approval. Larger or more complex variance requests will be submitted to FERC staff for review and final determination.

- Post-construction monitoring – follow-up inspections and monitoring of all disturbed upland areas will be conducted for at least the first and second growing seasons to determine the success of restoration, including until revegetation thresholds are met, temporary erosion control devices are removed, and restoration is deemed complete.
- Monitoring the ROW grant for federal lands – the USFS and U.S. Corps of Engineers will monitor implementation of the MVP mitigation measures on federal lands to assure that the terms and conditions of the ROW Grant issued by Bureau of Land Management are carried out (40 CFR 1505.3) and that negative impacts from construction and operation of the pipeline on federal lands are minimized to the extent possible.

Operation and Maintenance – MVP pipeline and aboveground facilities will be operated and maintained in accordance with U.S. Department of Transportation regulations in 49 CFR 192, FERC's regulations at 18 CFR 380.15, and the maintenance provisions found in the FERC Plan (FERC 2013a) and Mountain Valley's modified FERC Procedures (FERC 2013b, 2017a). A brief description of the O&M details is included below. Additional details describing O&M are included in Section 2.6 of the FEIS (FERC 2017a) and Section 3.2 of the BA (FERC 2017b).

- Pipeline facility O&M – an O&M plan and an emergency plan will be established that include procedures to minimize the hazards in a natural gas pipeline emergency. Vegetation removal and maintenance within the 50-ft permanent ROW will be conducted in accordance with the FERC Plan (FERC 2013a). Regular patrols, inspection, and repair of the pipeline will be conducted.
- Aboveground facility O&M – all equipment at aboveground facilities will be routinely inspected and maintained by Mountain Valley. Routine maintenance checks will include equipment and instrumentation calibration and safety equipment testing. The aboveground facilities will be unmanned, with start/stop capabilities controlled from corporate headquarters. When the safety system or alarms are activated, personnel are notified and dispatched.

Future Plans and Abandonment – Mountain Valley may seek to expand or modify its facilities in the future if market conditions change. Any future expansion will require filing an amendment to its application or a new application to FERC.

Conservation Measures – Conservation measures proposed as part of the action (measures that will avoid, minimize, and mitigate effects of the proposed action on the species and/or benefit the species as a whole) are referred to as avoidance and minimization measures (AMMs) in this Opinion. AMMs are provided in the FEIS (FERC 2017a) and BA (FERC 2017b) and discussed, as applicable, in Appendix B.

Action Area

The action area is defined (50 CFR 402.02) as "all areas to be affected directly or indirectly by the federal action and not merely the immediate area involved in the action." The Service has determined that the action area for this project is all lands in VA and WV affected directly or

indirectly by the project's components described in Description of Proposed Action.

STATUS OF THE SPECIES

Per the ESA Section 7 regulations (50 CFR 402.14(g)(2)), it is the Service's responsibility to "evaluate the current status of the listed species or critical habitat."

To assess the current status of the species, it is helpful to understand the species' conservation needs which are generally described in terms of reproduction, numbers, and distribution (RND). The Service frequently characterizes RND for a given species via the conservation principles of resiliency (ability of species/populations to withstand stochastic events – numbers, growth rates), redundancy (ability of a species to withstand catastrophic events – number of populations and their distribution), and representation (variation/ability of a species to adapt to changing conditions) (collectively known as the three Rs).

Small whorled pogonia – As described in Service (2008), the SWP conservation needs include "resolving data gaps and assessing the conservation potential for populations on private lands." Currently, as a whole, the rangewide status of the species is stable (Service 2008). From 1985-2007, the populations in WV remained low but stable (Service 2008). The primary factors influencing the status include risks posed by land development; however these activities are diffuse across the species' range and do not constitute an acute threat to SWP survival and recovery (Service 2008). For a more detailed account of the species description, life history, population dynamics, threats, and conservation needs, refer to: https://ecos.fws.gov/ecp0/profile/speciesProfile.action?spcode=Q1XL.

Virginia spiraea – As described in Service (1992), VASP conservation needs include preserving existing populations by minimizing human disturbance and controlling invasive species. Currently, as a whole, the rangewide status of the species is stable (Service 2008). From 1992-2007, population numbers in WV remained stable (Service 2008). The primary factors influencing the status include risks posed by a limited range with increasing amounts of fragmentation, a lack of genetic variation, a lack of natural habitat succession, invasive species, application of herbicides, and disturbance by humans leading to "changes in hydrology by impoundment and by impact from recreational use, hydroelectric facilities, and run-off debris" (NatureServe 2017). For a more detailed account of the species description, life history, population dynamics, threats, and conservation needs, refer to: https://ecos.fws.gov/ecp0/profile/speciesProfile?spcode=Q2R1.

Roanoke logperch – As described in Service (2007), the RLP conservation needs include solving data gaps that limit an accurate assessment of population abundance, maintaining the health and vigor of present populations by addressing sediment loading at the watershed level and preserving ecological processes, increasing connectivity of populations by identifying and eliminating barriers, and preventing and reducing the risk of catastrophic extirpation from toxic spills. Currently, as a whole, the rangewide status of the species is improving, although the geographic range remains small. The populations in VA seem to be stable or increasing (Service 2007). The primary factors influencing the status include risks posed by large dams and reservoirs, small dams and barriers, watershed urbanization, agricultural and silvicultural

activities, channelization, roads, toxic spills, riparian/woody debris loss, and water withdrawals (Service 2007). For a more detailed account of the species description, life history, population dynamics, threats, and conservation needs, refer to: https://ecos.fws.gov/ecp0/profile/speciesProfile?spcode=E01G.

Indiana bat – As described in Service (2016), the Ibat conservation needs include assessing and offsetting adverse impacts to the species and promoting recovery. Currently, as a whole, the rangewide status of the species is declining (Service 2016) and the degree of threat to the continued existence of the species is high (Service 2009). The primary factors influencing the status of the species include risks posed by White-Nose Syndrome (WNS), habitat loss and degradation, forest fragmentation, winter disturbance, environmental contaminants, climate change, and collisions with manmade objects (Service 2009, 2016). For a more detailed account of the species description, life history, population dynamics, threats, and conservation needs, refer to: https://ecos.fws.gov/ecp0/profile/speciesProfile?spcode=A000.

Northern long-eared bat – The NLEB conservation needs include protecting and reducing disturbance of hibernacula, summer roosts, and the buffer zone known as "WNS zone" (81 FR 1900-1922). Currently, as a whole, the rangewide status of the species is declining (81 FR 1900-1922). The primary factors influencing the status include risks posed by WNS, tree removal, disturbance around roosts during the summer months, and disturbance at the entrance and interior of hibernacula. "This includes the physical or other alteration of the hibernaculum's entrance or environment when bats are not present if the result of the activity will impair essential behavioral patterns" (81 FR 1900-1922). For a more detailed account of the species description, life history, population dynamics, threats, and conservation needs, refer to: https://ecos.fws.gov/ecp0/profile/speciesProfile?spcode=A0JE.

STATUS OF CRITICAL HABITAT

No critical habitat has been designated for: SWP, VASP, RLP, or NLEB.

Critical habitat for Ibat has been designated at Hellhole Cave, Pendleton County, WV; however, this action does not affect that area.

ENVIRONMENTAL BASELINE

Regulations implementing the ESA (50 CFR 402.02) define the environmental baseline as the past and present impacts of all federal, state, or private actions and other human activities in the action area. Also included in the environmental baseline are the anticipated and/or ongoing impacts of all proposed federal projects in the action area that have undergone Section 7 consultation, and the impacts of state and private actions which are contemporaneous with the consultation in progress.

Status of the Species within the Action Area

Small whorled pogonia – No SWP were found within the accessible parts of the action area during 2015 and 2016 plant surveys in WV (Environmental Solutions & Innovations, Inc. [ESI]

2015, 2016). Due to restricted land access, 0.22 mile of the construction ROW in Greenbrier County, WV, has not been surveyed (T. Pankiewicz, ESI, letter to T. Andersen, T. Lennon, J. Schmidt, Service; S. Hypes, VA Department of Conservation and Recreation [VDCR]; C. Stihler, B. Sargent, WV Division of Natural Resources [WVDNR], August 2, 2017). Based on GIS desktop analyses, suitable habitat for SWP was identified within this 0.22 mile area (FERC 2017b). FERC is assuming presence of SWP in this unsurveyed area (FERC 2017a, 2017b) based on this information and because SWP colonies occur in Greenbrier County. The 8.1 acres (0.22 mile x 300 ft survey corridor) of unsurveyed area includes 3.5 acres in the construction ROW and areas downslope (4.6 acres) on both sides of the construction ROW (M. Stahl, EQT, email to J. Stanhope and T. Lennon, Service, October 17, 2017).

A published, peer-reviewed methodology to determine the number of SWP stems (i.e., individuals) at a particular site with potential suitable habitat has not been developed. The number of stems observed in known SWP colonies in WV is variable (1 to 30 stems) and changes within a colony annually because stems may not emerge every year (M. McCormick, Smithsonian Environmental Research Center, email to J. Stanhope, Service, October 11, 2017). There is also not a consistent relationship between stem count and area of a colony or potential suitable habitat. To calculate the number of SWP stems in the action area, we used the best available data of the average number of stems observed in SWP colonies in WV. For 8 colonies monitored in 2016 and 2017, the average number of stems observed was 6 and 7 stems, respectively (M. McCormick, Smithsonian Environmental Research Center, email to J. Stanhope, Service, October 11, 2017). Based on this monitoring data, we estimate that approximately 7 SWP stems occur in the action area with 3 stems in the construction ROW and 4 stems downslope of the construction ROW.

Based on aerial imagery, the construction ROW is a forested area and is upslope from a cleared field and multiple homes on a gravel/stone road, more than 400 ft and 1,300 ft away, respectively (DigitalGlobe 2017, WV Department of Transportation 2017). The unsurveyed area is on private land and we are not aware of specific activities that have occurred that benefit or adversely affect the species.

Virginia spiraea – The proposed action crosses portions of the Gauley, Greenbrier, and Meadow Rivers, in Nicholas and Summers Counties, WV, which provide habitat for VASP (https://www.fws.gov/westvirginiafieldoffice/PDF/Aquatic%20Habitats%20Supporting%20Federally%20Listed%20Species%20-%20April2017.pdf). VASP surveys were completed near these rivers across a 300 ft wide environmental study corridor (a total of 3.64 acres along 0.14 mile) (ESI 2015) in 2015 and no VASP was found (ESI 2016).

Due to restricted access, 2.3 acres within the construction ROW, ARs, and ATWS in close proximity to the Greenbrier River in Summers County was not surveyed. Mountain Valley will complete surveys for VASP if access is granted during the time of year when surveys for VASP can be conducted (FERC 2017b). Potentially suitable habitat for VASP has been identified in the 2.3-acre area based on the VASP habitat model (WVDNR 2017). VASP is a clonal shrub found among large boulders, flatrock, and flood debris along scoured streamsides and rivers, as well as roadside wet areas and wet marshy meadows. VASP requires periodic flood scouring to eliminate taller woody competitors and to create river-wash deposits and early successional

habitats. Because VASP occurs along rivers, streams, and wetlands, we used National Wetlands Inventory maps to confirm that the 2.3 acres contain suitable habitat. Thus, for the purposes of this Opinion, presence of VASP suitable habitat is assumed within the 2.3 acre unsurveyed area.

To estimate the extent of VASP within the 2.3 acres, we used 1996-2010 VASP occurrence data from the Greenbrier River (Table 2). This data was collected from 3 VASP occurrences (WVDNR 2011), which together are considered 1 population (the Greenbrier River population). More recent data is available for these occurrences. The more recent data was collected using the stem count method, instead of the extent of VASP coverage method used in previous years. Because of the difficulty in using this new data to determine extent of coverage, we are utilizing the 1996-2010 data. The more recent surveys indicate the occurrences appear to be healthy and comparable in size to previous years (J.J. Hajenga, WVDNR, phone call to T. Lennon, Service, October 10, 2017; P.J. Harmon, WVDNR, email to T. Lennon, Service, October 11, 2017).

Based on the survey data collected from the Greenbrier River population, the extent of VASP coverage averaged 221.33 square meters (m) (0.05 acre) (Table 2). Therefore, we are assuming the extent of VASP coverage within the 2.3 acres is 0.05 acre, and that the VASP on this 0.05 acre is 1 occurrence, which is also part of the Greenbrier River population.

Table 2. Estimated extent of VASP coverage on the Greenbrier River (WVDNR 2011).

Year	Extent of Coverage (m^2)
1996	205.31
1997	183.00
2001	226.37
2003	226.37
2005	233.07
2007	237.61
2010	237.61
Average	221.33

Since VASP is a species that occurs along rivers, streams, and wetlands, we are assuming that the 0.05 acre of VASP is along a 288.6 linear ft reach of an unnamed tributary of the Greenbrier River (milepost [MP] 170.4-170.6) that overlaps with the construction ROW, ARs, and ATWS (Figure 2).

Figure 2. Unsurveyed area and VASP within the construction ROW, ARs, and ATWS.

We are not aware of specific activities that have occurred in the action area adversely affecting VASP. Potential threats within the action area include: invasive species, such as Japanese knotweed (*Fallopia japonica*) and purple loosestrife (*Lythrum salicaria*) that compete with VASP; changes in water flow regimes from weather related factors; and construction of boat docks or other streambank modifications (Service 2008). All of these threats may affect the amount of habitat available for the species along the streambanks in the action area.

Roanoke logperch – Presence/absence surveys for RLP were not conducted for the proposed action. RLP presence is assumed where suitable habitat was identified within potential habitat and in areas known to support RLP. Genetic analysis (Roberts et al. 2013) of RLP indicated a

dispersal extent of up to 80 river kilometers (rkm); however, median lifetime dispersal distance is 6-24 rkm (Roberts et al. 2016). The following waterbody crossings were categorized as suitable habitat identified by desk-top analysis or in-situ assessment: Bradshaw Creek 1 (MP 230.9), Bradshaw Creek AR (MP 231.6), North Fork Blackwater River (MP 249.8), Teels Creek 4 (MP 262.4), Little Creek 1.5 (MP 262.7), Little Creek 2 (MP 263.4), Maggodee Creek 1 (MP 269.4), Blackwater River 3 (MP 269.8), and Harpen Creek 1 (MP 290). The following waterbody crossings were categorized as known to support RLP-presence assumed: North Fork Roanoke River AR1 (MP 227.4), North Fork Roanoke River AR2 (MP 231.7), North Fork Roanoke River (MP 227.4), Roanoke River (MP 235.6), and Pigg River (MP 289.2).

To date survey efforts have not documented RLP in the Blackwater River drainage, which includes the North Fork Blackwater River, Teels Creek 4, Little Creek 1.5, Little Creek 2, Maggodee Creek 1, and Blackwater River 3 crossings. However, the Blackwater River mainstem is large enough to potentially support RLP (FERC 2017b). No instream work will occur at these crossing from March 15 - June 30, the RLP spawning season. Based on the lack of documented occurrences in the watershed and the time-of-year restriction (TOYR), no impacts to RLP are anticipated from these crossings and they will not be discussed further in this Opinion.

The North Fork Roanoke River AR2 crossing, Montgomery County, VA, is known to support RLP. RLP presence is assumed and habitat suitability was not assessed. Reese Mountain Road, an existing road that includes a paved bridge across the river, will be used as the AR to reach the construction site; therefore, no instream construction impacts or impacts to RLP will occur at this crossing and it will not be discussed further in this Opinion.

Bradshaw Creek AR crossing, Montgomery County, VA, is 5.8 rkm above the confluence of Bradshaw Creek with the Roanoke River and contains suitable RLP habitat based on the in-situ assessment (ESI 2016). North Fork Roanoke River AR1 crossing, Montgomery County, VA, is known to support RLP. Mountain Valley has committed that no temporary fill placement will occur at the temporary ARs. They will be crossed by a temporary single span bridge (M. Stahl, EQT, email to S. Hoskin, Service, November 9, 2017). These crossings will be used to reach the construction site, no instream construction impacts or impacts to RLP will occur at these crossings, and they will not be discussed further in this Opinion.

At each of the remaining crossings discussed below the proposed action will impact 1,000 m (200 m above and 800 m below each crossing) plus the construction ROW.

Bradshaw Creek 1 crossing, Montgomery County, VA, is 2.5 rkm above the confluence of Bradshaw Creek with the Roanoke River and contains suitable RLP habitat based on the in-situ assessment (ESI 2015). At this crossing Bradshaw Creek was classified as moderately low gradient with narrow and shallow riffles. The construction ROW is 22.86 m wide at this crossing, the wetted width is 6 m. The Anderson (2016) model identifies this crossing as potential RLP habitat. Based on the creek width and proximity to the Roanoke River, we expect RLP will use Bradshaw Creek when water levels are high; therefore we anticipate RLP numbers are low in this creek. Since we do not anticipate fish to disperse far up Bradshaw Creek from the Roanoke River we considered documented occurrences 6 rkm from the crossing, the lower end of the RLP lifetime dispersal distance. Seven RLP occurrences are documented within 6 rkm of

the crossing, all in the Roanoke River (VA Fish and Wildlife Information Service 2017). We added a correction factor since mark-recapture data indicates that only about 10% of RLP are actually detected during surveys (P. Angermeier, U.S. Geological Survey VA Cooperative Fish and Wildlife Research Unit, email to Service, February 2, 2012). To incorporate the detectability correction factor we multiplied the 7 RLP by 10 and estimate that approximately 70 RLP occur within 6 rkm of this crossing. We expect a small portion of those fish (10%) or 7 RLP will disperse up Bradshaw Creek and occur at this crossing.

Harpen Creek 1, Pittsylvania County, VA, is 2.3 rkm above the confluence with the Pigg River and contains limited suitable RLP habitat based on the in-situ assessment (ESI 2015). At this crossing Harpen Creek was classified as low gradient with shallow riffles that exhibit heavy embeddedness and siltation. The construction ROW is 22.86 m wide at this crossing, the wetted width is 5 m. Based on the creek width and proximity to the Pigg River, we expect RLP would use Harpen Creek when water levels are high; therefore we anticipate RLP numbers are low in this creek. Since we do not anticipate fish to disperse far up Harpen Creek from the Pigg River we considered documented occurrences 6 rkm from the crossing, the lower end of the RLP lifetime dispersal distance. Two RLP occurrences are documented within 6 rkm of the crossing, both in the Pigg River (VA Fish and Wildlife Information Service 2017). To incorporate the detectability correction factor we multiplied the 2 RLP by 10 and estimate that approximately 20 RLP occur within 6 rkm of this crossing. We expect a small portion of those fish (10%) or 2 RLP will disperse up Harpen Creek and occur at this crossing.

North Fork Roanoke River crossing, Montgomery County, VA, is known to support RLP. It is a VA Department of Game and Inland Fisheries (VDGIF) designated RLP threatened and endangered species waters, which "identifies streams and rivers that contain documented occurrences of federal/state- or state-listed threatened or endangered species and their associated habitat." RLP presence is assumed and habitat suitability was not assessed. The construction ROW is 22.86 m wide at this crossing, the wetted width was not measured since a habitat assessment was not conducted. We expect the wetted width at this crossing is comparable to the wetted width of the Blackwater River (22 m) because the rivers are of similar size at the crossings. The Anderson (2016) model identifies this crossing as potential RLP habitat. Ferguson et al. (1994) surveyed 27 sites in the North Fork Roanoke River. The estimated number of RLP per 100 m at sites above and below the crossing was 0.4-1.9; 1 RLP was the most common number captured; average was 10 RLP per rkm. The length of impacts to this waterbody is 1,022.86 m (the construction ROW at the crossing plus the 1,000 m stream length at each crossing); therefore there are an estimated 10.2 RLP at this crossing. To incorporate the detectability correction factor we multiplied the 10.2 RLP by 10 and estimate that 102 RLP occur at this crossing.

Roanoke River crossing, Roanoke County, VA is known to support RLP. It is a VDGIF designated RLP threatened and endangered species waters. RLP presence is assumed and habitat suitability was not assessed. The construction ROW is 22.86 m wide at this crossing, the wetted width was not measured since a habitat assessment was not conducted. We expect the wetted width at this crossing is comparable to the wetted width of the Blackwater River (22 m) because the rivers are of similar size at the crossings. The Anderson (2016) model identifies this crossing as potential RLP habitat. In 2010, 84 RLP were documented 1 rkm downstream of the crossing

(Roberts and Angermeier 2010), in a reach of similar length to the action area. To incorporate the detectability correction factor we multiplied the 84 RLP by 10 and estimate that 840 RLP occur at this crossing.

Pigg River crossing, Pittsylvania County, VA, is known to support RLP. It is a VDGIF designated RLP threatened and endangered species waters. RLP presence is assumed and habitat suitability was not assessed. The construction ROW is 22.86 m wide at this crossing, the wetted width was not measured since a habitat assessment was not conducted. We expect the wetted width at this crossing is comparable to the wetted width of the Blackwater River (22 m) because the rivers are of similar size at the crossings. The Anderson (2016) model identifies this crossing as potential RLP habitat. Since this area is known to support RLP we considered documented occurrences 24 rkm from the crossing, the upper end of the RLP lifetime dispersal distance. Two RLP occurrences are documented within 24 rkm of the crossing (VA Fish and Wildlife Information Service 2017). To incorporate the detectability correction factor we multiplied the 2 RLP by 10 and estimate that approximately 20 RLP occur within 24 rkm of this crossing. RLP are documented in the Pigg River at low numbers and we expect a portion of those fish (30%) or 6 RLP occur at this crossing.

In summary, 7 RLP are estimated to occur at the Bradshaw Creek 1 crossing; 2 at the Harpen Creek 1 crossing; 102 at the North Fork Roanoke River crossing; 840 at the Roanoke River crossing; and 6 at the Pigg River crossing. A total of 957 RLP are expected to occur in the action area.

In the Anderson (2016) model, RLP potential habitat covers approximately 2,552 rkm in VA, of which 1,581.83 rkm are in the Roanoke River basin. The proposed project crosses 5 waterbodies (Bradshaw Creek, Harpen Creek, North Fork Roanoke River, Roanoke River, Pigg River) known or with potential to support RLP. The action area represents approximately 0.32% of the total RLP potential habitat in the Roanoke River basin and 0.20% of the total RLP potential habitat in VA.

RLP decline in the action area is primarily the result of destruction and modification of habitat and fragmentation of the species range. Primary causes of RLP habitat degradation include chemical spills, non-point runoff, channelization, impoundments, impediments, and siltation; and the Roanoke River and tributaries were added to VA's impaired waters list in 2002.

Indiana bat – The action area (279,077.2 acres) is within the Ibat Appalachian Mountain Recovery Unit (RU) (Service 2007) and encompasses 52,064 acres in VA and 184,222.2 acres in WV. Approximately 42,791 acres of the action area in VA fall outside of the Appalachian Mountain RU. The Appalachian Mountain RU covers 8,762,586 acres in VA and 15,506,210 acres in WV. The action area is within 0.6% of the Appalachian Mountain RU in VA and 1.2% in WV. The construction ROW is approximately 303.5 miles in WV and VA. The action area contains 6 categories of Ibat habitat: suitable unoccupied summer habitat in VA and WV; known use summer habitat in WV; unknown use summer habitat in VA and WV; known or presumed occupied hibernacula in VA and WV; unknown use spring staging/fall swarming habitat in VA and WV; and known use spring staging/fall swarming habitat in VA and WV.

Suitable unoccupied summer habitat is defined as forested/wooded habitats in an Ibat RU in which survey results per the level of effort outlined in the Range-wide Indiana bat Summer Survey Guidelines (Service 2017b) suggest probable absence during the summer months. Approximately 484.4 acres in VA and 764.2 acres in WV (94.26 miles in total) proposed for clearing are classified as suitable unoccupied summer habitat. This includes an estimated 2 miles of construction ROW in suitable unoccupied summer habitat that will be cleared for the Atlantic Coast Pipeline and Supply Header Project, Doddridge and Harrison Counties, WV, for which a non-jeopardy biological opinion was issued by the Service on October 16, 2017. Mist-net surveys were conducted at 338 net sites (1,953 complete and 426 partial net nights) within the action area in VA and WV during the 2015 and 2016 mist-net survey season and no Ibats were captured (FERC 2017b). Therefore, adverse effects to Ibats are not expected from clearing suitable unoccupied summer habitat.

Known use summer habitat is defined as areas within a 5-mile radius (home range) of a pregnant female or juvenile capture or within 2.5 miles of a known roost tree. None occurs in the VA portion of the action area (Table 3). Approximately 10.3 miles of construction ROW and 10.3 miles of ARs (a total of 228.4 acres) will be cleared within known use summer habitat in WV (Table 3) (FERC 2017b). Potential roost tree surveys were conducted in known use summer habitat in WV and documented 413 potential roost trees, of which 74 were potential primary trees and 339 were potential secondary trees (M. Stahl, EQT, email to T. Lennon, Service, November 8, 2017).

Table 3. Ibat habitat categories in VA and WV with adverse effects to Ibats (M. Stahl, EQT, email to T. Lennon, Service, November 8, 2017).

Habitat Category	Acres of Tree Removal		
	VA	WV	Total
Known use summer habitat	0	228.4[a]	228.4
Unknown use summer habitat	78.6	1,807.9	1,886.5
Unknown use spring staging/fall swarming habitat	526.2	279.1	805.4
Known use spring staging/fall swarming habitat	138.8	171.3	310.1

[a]This value differs from the total in the BA (227.8 acres) (FERC 2017b). The difference is due to a review of updated aerial imagery that provided more accurate information (M. Stahl, EQT, email to T. Lennon, Service, November 8, 2017).

Unknown use summer habitat is defined as areas that contain suitable maternity habitat where presence/probable absence mist-net surveys were not conducted and FERC has elected to assume Ibat presence. Mist-net surveys were not conducted along approximately 128.9 miles (42.4%) of the construction ROW and 102.3 miles (50%) of ARs in WV and VA (ESI 2015a, 2015b). Approximately 97.5 miles of construction ROW (4.9 in VA and in 92.6 WV) and 56.4 miles of ARs (1.1 in VA and 55.3 miles in WV), a combined total of 1,886.5 acres (78.6 in VA and 1,807.9 in WV), will be cleared within unknown use summer habitat (Table 3). Potential roost tree surveys in unknown use summer habitat in WV documented 2,505 potential roost trees, of which 460 were potential primary trees and 2,045 were potential secondary trees. Potential roost

tree surveys in unknown use summer habitat in VA documented 47 potential roost trees, of which 10 were potential primary trees and 37 were potential secondary trees (M. Stahl, EQT, email to T. Lennon, Service, November 8, 2017). Approximately 2,686 acres in WV and 330 acres in VA were not surveyed for potential roost trees in unknown use summer habitat. As part of the potential roost tree surveys completed in known and unknown use summer habitat, a total of 321 primary (1 in VA and 320 in WV) and 1,319 secondary (50 in VA and 1,269 in WV) roosts were documented within close proximity, but outside of, the construction workspace.

Known or presumed occupied hibernacula are defined as suitable caves/mine portals which are occupied, or presumed to be occupied, by hibernating Ibats. Potential hibernacula surveys for Ibat were conducted within the action area in VA and WV between November 2014 and January 2017 (FERC 2017b). Initially, potential hibernacula surveys yielded a total of 134 suitable caves/mine portals within 5 miles of the action area. Of these, 86 were determined to be suitable based on field survey results or information provided by a team of karst specialists with demonstrated experience in karst and karst hydrogeology in southern WV and southwestern VA. Of those that are suitable, 16 are within the action area (M. Stahl, EQT, email to T. Lennon, Service, November 9, 2017). Mountain Valley has elected to assume that these 16 suitable caves/mine portals within the action area are occupied by Ibat. The action area is within 5 miles of 3 known Ibat hibernacula, 1 in VA and 2 in WV, and the most recent Ibat population estimates for each are summarized in Table 4. However, only 1 known hibernaculum (Tawney's Cave) is within the action area. In total, there is 1 known hibernaculum (Tawney's Cave) and 16 presumed occupied hibernacula within the action area in VA and WV. We do not anticipate adverse effects to bats in this habitat category based on the protections included in the Karst Mitigation Plan provided in the FEIS (FERC 2017a) and the information provided in the November 9, 2017, *Potentially Suitable Hibernacula within the Action Area* table (M. Stahl, EQT, email to T. Lennon, J. Stanhope, and S. Hoskin, Service, November 9, 2017).

Table 4. Known Ibat hibernacula within 5 miles of the action area (Powers et al. 2015; Service 2007; WVDNR 2013, 2015, 2016).

County, State	Hibernaculum Name	Approximate Distance (miles) to Project [a]	Hibernaculum Priority Number [b]	WNS Status (date)	Ibat Population Estimate (date)
Monroe, WV	Greenville Saltpeter Cave	2 (AR)	3	Confirmed[c] (2012)	16 (2012) 4 (2016)
Monroe, WV	Patton Cave	5 (AR)	4	Confirmed (2010)	2 (2013) 0 (2017)
Giles, VA	Tawney's Cave	0.04 (ROW)	4	Confirmed[d] (2009)	14 (2007) 0 (2013)

[a]ROW – construction ROW; AR – access road.
[b]Priority 1 is highest priority, and most essential to recovery of the species. Priority 4 is least important to recovery (Service 2007).
[c]B.D. Sargent, WVDNR, email to T. Lennon, Service, October 19, 2017.
[d]https://microbiology.usgs.gov/documents/Swezey_Garrity_2011.pdf.

Unknown use spring staging/fall swarming habitat is defined as areas within a 5-mile radius of a potentially suitable hibernaculum that have not been surveyed and FERC has elected to assume

Ibat presence. There are 86 caves/mine portals that FERC is assuming are occupied hibernacula within 5 miles of the action area. Approximately 805.4 acres proposed for clearing are classified as unknown use spring staging/fall swarming habitat, 526.2 acres in VA and 279.1 in WV (Table 3).

Known use spring staging/fall swarming habitat is defined as areas within a 5-mile radius of priority 3 and 4 hibernacula or a 10-mile radius of priority 1 and 2 hibernacula. There are 3 known Ibat hibernacula within 5 miles of the action area (Table 4). Approximately 310.1 acres proposed for clearing are classified as known use spring staging/fall swarming habitat, 138.8 acres in VA and 171.3 acres in WV (Table 3).

In certain areas known and unknown use summer habitat and spring staging/fall swarming habitat overlap and determining the quantity of that overlap is difficult. Thus, for the purposes of this Opinion, total habitat removed will be classified as either summer habitat or spring staging/fall swarming habitat not both (Table 3).

The Service (2017a) estimates the 2017 hibernating Ibat population is 425 in VA and 1,076 in WV; these numbers indicate an 8.4% decline in VA and a 54.7% decline in WV since the 2015 census. WNS was first detected in VA and WV during the 2008/2009 winter hibernacula surveys (Stihler 2012, Powers et al. 2015). VA and WV hibernacula surveys indicate Ibat populations have decreased at least 95% since the discovery of WNS (https://www.fws.gov/midwest/endangered/mammals/inba/pdf/2017IBatPopEstimate5July2017.pdf).

Northern long-eared bat – This Opinion is for effects to the NLEB not addressed by the January 5, 2016 programmatic biological opinion implementing the final 4(d) rule (https://www.fws.gov/midwest/endangered/mammals/nleb/pdf/BOnlebFinal4d.pdf).

There are 3 known hibernacula in the action area: Canoe and Tawney's Caves, Giles County, VA, and PS-WV3-Y-P1, Braxton County, WV. Hibernacula surveys documented 1 NLEB in Canoe Cave in 1982 and 1 NLEB in Tawney's Cave in 2011, 2009, 1990, and 1986 (R. Reynolds, VDGIF, email to S. Hoskin, Service, October 30, 2017). Harp net surveys captured 1 NLEB at PS-WV3-Y-P1 (FERC 2017b). Hibernacula surveys are not good indicators of total number of NLEBs hibernating because NLEB are found in small crevices or crack in the walls or ceiling, often only their noses and ears are visible, and they are easily overlooked (78 FR 61046-61080). While we acknowledge hibernacula surveys likely underestimate winter abundance, we do not have an estimate of how the counts might correlate to the number of bats hibernating in that particular hibernaculum.

Mountain Valley has committed to providing a site-specific plan to the Service for review and written approval prior to initiating any construction activities within 0.5 mile of portal PS-WV3-Y-1 (M. Stahl, EQT, email to P. Friedman, FERC, and J. Stanhope, Service, November 17, 2017). The site-specific plan will ensure no alteration, physical or otherwise, of the portal's entrance or environment that will adversely affect its use by federally listed bats, including those hibernating within the portal. In the event that the Service determines the site-specific plan cannot ensure that construction activities are not likely to adversely affect federally listed bats, Mountain Valley will consider a realignment of the pipeline within the range of possible

alternatives such that all activities are at least 0.5 mile away from portal PS-WV3-Y-1. In certain instances, conducting some activities within 0.5 mile of portal PS-WV3-Y-1 may not adversely affect federally listed bats; however, Mountain Valley will receive Service review and written approval of all activities within 0.5 mile of portal PS-WV3-Y-1 prior to initiating such activities. Based on this AMM, we do not anticipate adverse effects to NLEB from impacts to this hibernacula. Effects to the NLEB from tree removal within 0.25 mile of PS-WV3-Y-1 are analyzed below.

Mountain Valley conducted a hydrologic and geologic analysis of the risk of the pipeline to Canoe and Tawney's Caves. In summary, they determined that the catchment area for Canoe Cave is topographically higher than and upgradient of the pipeline and the pipeline is approximately 900 ft from the nearest entrance and 800 ft from the nearest mapped passage. Similarly, the pipeline will be on an opposite ridge west of Tawney's Cave, topographically higher, and below the known cave passages (FERC 2017b).

WNS was first detected in VA and WV during the 2008/2009 winter hibernacula surveys (Stihler 2012, Powers et al. 2015). Since that time, WNS has been confirmed in all areas of VA and WV where NLEB hibernacula are known to occur (Stihler 2012, Powers et al. 2015).

EFFECTS OF THE ACTION

Direct effects are the direct or immediate effects of the project on the species, its habitat, or designated/proposed critical habitat. Indirect effects are defined as those that are caused by the proposed action and are later in time, but still are reasonably certain to occur (50 CFR 402.02). An interrelated activity is an activity that is part of the proposed action and depends on the proposed action for its justification. An interdependent activity is an activity that has no independent utility apart from the action under consultation. Direct and indirect effects of the proposed action along with the effects of interrelated/interdependent activities are all considered together as the "effects of the action."

To standardize the effects analysis, the proposed action was divided into discrete actions described as subactivities. Defining subactivities allows for easier interpretation and consideration of complex activities. The project subactivities are defined in the species effects tables (Appendix B Tables 1-5).

Small whorled pogonia – The potential effects of the proposed action are described in Appendix B Table 1. The project subactivities unlikely to result in any impacts to SWP are described in Appendix B Table 1; no effect (NE) subactivities. For those subactivities of the proposed action that are determined to result in NE to SWP, there will be no further discussion in this Opinion.

The project subactivities that may affect, but are not likely to adversely affect (NLAA), the SWP are described in Appendix B Table 1; NLAA subactivities. For those subactivities of the proposed action that are determined NLAA SWP, there will be no further discussion in this Opinion.

There are other subactivities of the project that are likely to adversely affect (LAA) SWP

(Appendix B Table 1; LAA subactivities). For some components of the proposed action that may affect SWP, AMMs have been incorporated to ameliorate those effects and those are also noted in Appendix B Table 1. These subactivities are LAA SWP by physically impacting individual plants and/or altering and degrading SWP habitat.

In the construction ROW, the proposed vehicle operation, foot traffic, and vegetation clearing subactivities will crush and kill all SWP stems. SWP depend on mycorrhizal fungi for nutrition, growth, and survival. We do not anticipate SWP re-establishing in the permanent ROW post-construction due to removal of trees and mycorrhizal fungi that require host trees (e.g., oaks [*Quercus* spp.], hickories [*Carya* spp.], and beech [*Fagus grandifolia*]) (McCormick et al. 2015), both of which are essential components of SWP habitat .

SWP downslope of the construction ROW will be affected because multiple subactivities occur in the SWP's upslope drainage area (i.e., the SWP's watershed includes the construction ROW). Ground disturbing and vegetation clearing/management subactivities will result in soil compaction and vegetation removal in the construction ROW. The impacts to the upslope drainage area are anticipated to increase surface water flow and downslope erosion rates and alter surface and subsurface hydrology in the watershed, causing changes in evapotranspiration rates and soil moisture downslope of the construction ROW near the SWP. Some of these subactivities will also redistribute and loosen soils in the construction ROW, which will cause sedimentation downslope towards the SWP. These stressors will affect both the mycorrhizal fungi relied on by SWP and individual SWP, decreasing SWP fitness and reproductive success and possibly killing individual plants. Depending on the degree of surface water runoff and sedimentation, SWP habitat is anticipated to be degraded and individual stems will be buried. Blasting will also loosen large rocks, which is anticipated to fall and crush SWP.

The vegetation clearing, management, and trimming subactivities that remove and thin mid- and over-story canopy trees will alter SWP habitat in the areas downslope of the construction ROW by increasing direct and ambient light. Increased light availability may increase SWP flowering and population size (Dibble et al. 1997; Dibble 2000a, 2000b; Brumback et al. 2011; McCormick et al. 2015). However, increased light availability above an unknown threshold is anticipated to degrade SWP habitat by increasing soil temperature, drying soils, and changing evapotranspiration rates, which will cause decreased fitness and reproductive success and possibly death of individual stems. Increased light levels will also facilitate germination and development of other herbaceous and/or woody species, including invasive species, which could compete with SWP. Significant changes to the sunlight regime and potential competition due to increased vegetation are anticipated to cause decreased fitness and reproductive success and possibly death of SWP individuals.

AMMs (e.g., FERC Plan [FERC 2013a], Restoration and Rehabilitation Plan [Mountain Valley 2017]) are anticipated to reduce surface water runoff and sedimentation, on average 79% sediment containment, but not to insignificant levels (ESI 2017). Methods described in the Exotic and Invasive Species Control Plan (Mountain Valley 2016) will minimize effects due to invasive species in the construction ROW, but will not address herbaceous and invasive vegetation growing outside of the construction ROW and near the SWP stems due to increased light. In the Restoration and Rehabilitation Plan (Mountain Valley 2017), Mountain Valley

proposes to apply woody seed mixes to the temporary construction ROW. Approximately 25-35 years after seed application, canopy trees (e.g., eastern white pine [*Pinus strobus*]) are expected to provide some mid-story shade (Burns and Honkala 1990), which may contribute to partially restoring the SWP habitat in the areas downslope of the construction ROW. Mountain Valley has committed to baseline (e.g., before and during construction) and 10 years of post-construction monitoring, conducted annually, to assess SWP colony status and potential threats to continued success (M. Stahl, EQT, letter to J. Stanhope, Service, November 8, 2017). Monitoring assessments before, during, and post-construction will include measurements of light, soil moisture, and temperature. The applicant will develop the monitoring plan in coordination with the WVFO and WVDNR and submit it to them for review and approval. The AMMs will minimize some effects (Appendix B Table 1); however we expect that a few SWP stems downslope of the construction ROW will have decreased fitness and reproductive success and/or will be killed.

Virginia spiraea – The potential effects of the proposed action are described in Appendix B Table 2. The project subactivities unlikely to result in any impacts to VASP are described in Appendix B Table 2; NE subactivities. For those subactivities of the proposed action that are determined to result in NE to VASP, there will be no further discussion in this Opinion.

The project subactivities that may affect, but are NLAA, the VASP are described in Appendix B Table 2; NLAA subactivities. For those subactivities of the proposed action that are determined NLAA VASP, there will be no further discussion in this Opinion.

There are other subactivities of the project that are LAA VASP (Appendix B Table 2; LAA subactivities). For some components of the proposed action that may affect VASP, AMMs have been incorporated to ameliorate those effects and those are also noted in Appendix B Table 2. These subactivities are LAA VASP by physically impacting individual plants and/or altering or degrading its habitat.

Subactivities related to vehicle operation, vegetation and shrub/tree clearing, AR grading and graveling, and stream and wetland crossings (for the construction ROW, ARs, and ATWS) will kill VASP stems, bury seeds, and alter/degrade VASP habitat (Appendix B Table 2). Vehicle operation and vegetation and shrub/tree clearing will cause individual VASP to experience decreased fitness (e.g., from competition with introduced invasive species), decreased reproductive success (e.g., from physical damage, competition with introduced invasive species, habitat disturbance), and crushing or death (e.g., from cutting, digging up, burying, soil compaction). Stream and wetland crossings will cause soil compaction and sedimentation and hydrological changes that will degrade and alter habitat. As a result, plants and seeds will be buried and reestablishment of VASP in the construction ROW, ARs, or ATWS post-construction is not expected. Placement of fill and gravel for ARs will cause habitat loss in all permanently maintained areas, preventing reestablishment of VASP post-construction. The combined effects from these subactivities will result in the permanent removal of all VASP plants, seeds, and habitat in the 0.05 acre.

AMMs have been included in the proposed action that will minimize the extent and significance of adverse effects on VASP. These AMMs include: implementing sediment and erosion control

measures during and after construction; ensuring restoration of pre-existing topographic contours after any ground disturbance; restoring native vegetation (where possible); developing plans and procedures for invasive species management; expediting construction within any waterbody, effectively reducing disturbance to the streambed and adjacent soils and the quantity of suspended sediments; prohibiting construction equipment, vehicles, hazardous materials, chemicals, fuels, lubricating oils, and petroleum products from being parked, stored, or serviced within a 100 ft radius of any wetland or waterbody; and avoiding the use of herbicides and pesticides to maintain any portion of the construction ROW. While these AMMs may initially minimize the extent and significance of adverse effects on VASP, effects from the subactivities described above will result in the permanent removal of all plants and habitat in the 0.05 acre.

If VASP is found within the construction ROW, ARs, or ATWS, MVP has committed to relocate individuals outside of the affected area in coordination with the Service. However, the sequencing of construction and the time of year when VASP surveys can effectively be conducted make it unlikely that plants will be found and relocated prior to construction. Therefore, the analyses in this Opinion do not consider such relocations.

Roanoke logperch – The potential effects of the proposed action are described in Appendix B Table 3. The project subactivities unlikely to result in any impacts to RLP are described in Appendix B Table 3; NE subactivities. For those subactivities of the proposed action that are determined to result in NE to RLP, there will be no further discussion in this Opinion.

The project subactivities that may affect, but are NLAA, the RLP are described in Appendix B Table 3; NLAA subactivities. For those subactivities of the proposed action that are determined NLAA RLP, there will be no further discussion in this Opinion.

There are other subactivities of the project that are LAA RLP (Appendix B Table 3; LAA subactivities). For some components of the proposed action that are anticipated to affect RLP, AMMs have been incorporated to ameliorate those effects and those are also noted in Appendix B Table 3. These subactivities are anticipated to result in a loss of prey items and/or an ability to see the prey, temporarily remove habitat, entrain RLP, or result in habitat degradation and loss due to vegetation removal, pump around, placement of cofferdams, and/or altering water quality.

Immediately prior to instream work at each crossing RLP will be removed and released approximately 50 ft downstream of the construction area. Once cofferdams are in place, fish depletion surveys will be conducted within the area isolated by cofferdams. Relocating RLP will minimize effects from instream work (e.g., stream diversion, cofferdam placement) that occur immediately after fish relocation. The fish removal/relocation portion of the action will be conducted by individuals with state (VDGIF) permits that are issued as part of the Cooperative Agreement for Management of Endangered Species between the Service and VDGIF, thus no additional effects analysis is required. If RLP remain in the crossing area after removal/relocation efforts we anticipate they will be entrained. Because we anticipate that the majority of RLP will be removed from the area, we expect only a few individuals will be entrained.

Instream structure placement and removal will result in temporary loss of habitat and will create

a sediment plume that will increase sediment/turbidity downstream, to include the areas where relocated RLP are released. RLP are sight feeders and flip rocks to expose invertebrates (Rosenberger and Angermeier 2002). Sediment deposited on the waterbody bottom will interfere with the ability of RLP to feed (Robertson et al. 2006). Increased sedimentation is anticipated to result in a loss of prey items and/or an ability to see the prey. We expect all RLP to move to areas with cleaner substrate until the structures are removed and turbidity returns to baseline levels. Changing foraging areas will cause decreased fitness to the majority of RLP that moved from the crossing areas. After removal of structures and a return to baseline turbidity conditions, we anticipate that RLP will resume use of crossings.

Streambank vegetation clearing/trimming and trenching during O&M subactivities will alter RLP habitat. Decreased riparian vegetation is expected to increase light and water temperature at the crossings, and increase sedimentation and turbidity. Changes in light regime and water temperature may affect the RLP prey base and make the habitat less suitable for RLP. We expect all RLP will move from cleared areas to areas with vegetative cover. Removal of vegetative cover is permanent along a 10 ft corridor of the ROW centered over the pipeline and we do not expect RLP to return to these areas. As a result of this temporary and permanent habitat loss, we anticipate the majority of RLP will experience a decrease in individual fitness. We expect increased sedimentation and turbidity will make the waterbodies unusable to RLP for foraging in the immediate vicinity of the crossings. Increased sedimentation is anticipated to result in a loss of prey items and/or an ability to see the prey. However, prey items are anticipated to recolonize the areas within a few days to months (Brooks and Boulton 1991, Matthaei and Townsend 2000) after sedimentation and turbidity have returned to baseline levels. Increased sedimentation and turbidity are also expected to temporarily lower dissolved oxygen (DO) levels at the stream crossings and for the extent of the sediment plume. Darters and shiners in the Roanoke River exhibited sensitivity to abrupt changes in DO levels (Matthews and Styron 1978). We expect RLP to move to areas with cleaner substrate/less turbid water and higher DO to allow for foraging. After a return to baseline turbidity conditions, we anticipate that RLP will resume use of crossings. As a result of this habitat shift, we anticipate the majority of RLP will experience decrease in fitness.

The duration of effects depend on the AMMs (e.g., TOYRs, fish removal and relocation, FERC Plan [FERC 2013a], and Restoration and Rehabilitation Plan [Mountain Valley 2017]), which are anticipated to reduce surface water runoff and sedimentation, on average 79% sediment containment, but not to insignificant levels (ESI 2017). The Restoration and Rehabilitation Plan states that herbaceous and woody seed mixes native to the area will be applied to the temporary construction ROW. Herbaceous seeds are assumed to take approximately 4 weeks to establish, 6 months to develop, and 1 year to become a maturing crop. A minimum of 6 tree species (bare-root saplings) and 4 shrub species will be planted at each stream crossing. We expect the effects from sedimentation and turbidity will last from 0.5-1 year. The effects of removal of streambank vegetation on sedimentation rates are expected to continue for 3-5 years as streamside vegetation develops to provide streambank stabilization (FERC 2017b). We expect effects from increased light to be minimized in 3-5 years. While implementation of AMMs is expected to significantly reduce the likelihood of mortality or injury and reduce adverse effects from habitat alteration, all impacts to RLP will not be avoided or minimized.

Indiana bat – The potential effects of the proposed action are described in Appendix B Table 4. We did not reach a NE determination for Ibat for any of the subactivities.

The project subactivities that may affect, but are NLAA, the Ibat are described in Appendix B Table 4; NLAA subactivities. For those subactivities of the proposed action that are determined NLAA Ibat, there will be no further discussion in this Opinion.

There are other subactivities of the project that are LAA Ibat (Appendix B Table 4; LAA subactivities). For some components of the proposed action that are likely to affect Ibats, AMMs have been incorporated to ameliorate those effects and those are also noted in Appendix B Table 4. These subactivities, all of which involve tree removal, will temporarily or permanently remove a total of 3,230.4 acres of suitable habitat in the Ibat Appalachian Mountain RU within 4 habitat categories. We expect the TOYRs (Table 5) to limit the magnitude and duration of adverse effects to Ibats from these subactivities.

Table 5. Tree clearing by Ibat habitat category.

Habitat Category	TOYRs	Season/Months when Tree Clearing will Occur
Known use summer habitat	Trees will be removed between November 15 and March 31, when Ibats will not be present	winter
Unknown use summer habitat	Trees will not be removed between June 1 and July 31, when young cannot fly	winter, April, May, August, September
Unknown use spring staging/fall swarming habitat	Trees will be removed between November 15 and March 31, and potentially in April, May, August, and September	winter, April, May, August, September
Known use spring staging/fall swarming habitat	Trees will be removed between November 15 and March 31, when Ibats will not be present	winter

Known and unknown use summer habitat – We expect effects to Ibats from tree clearing will occur in known and unknown use summer habitat. Approximately 2,114.9 acres (107.1 miles of construction ROW and 76.5 miles of AR) of known use summer habitat (228.4 acres) and unknown use summer habitat (1,886.5 acres) in VA and WV will be cleared. We anticipate tree clearing will impact current Ibat home ranges; however, not all 2,114.9 acres are expected to be occupied. Ibat home ranges vary in size from 205.1-827.8 acres (Menzel et al. 2005, Sparks et al. 2005, Watrous et al. 2006, Kniowski and Gehrt 2014, Jachowski et al. 2014). The 2,114.9 acres of known and unknown use summer habitat to be cleared represents 3-12 home ranges that will be removed if tree clearing were to occur in large blocks. However, the proposed action is linear and is not anticipated to remove entire potential home ranges rather, sections of potential home ranges. Worst case scenario is potential home ranges will be centered along the 183.6 miles of the construction ROW/ARs every 5 miles, affecting 22 potential home ranges. This is not a reasonable scenario for several reasons. First, Ibat home ranges are not linear, so it is likely that the 125-ft wide construction ROW will only displace Ibats from a small portion of their home range, not their entire home range. Second, forest cover in the counties in action area is 55-86% (https://www.fia.fs.fed.us/tools-data/), which means that if bats are displaced from their habitat there will likely be alternative habitat available within the action area.

Tree removal in known use summer habitat (outside of the active season) – Tree removal in known use summer habitat during the winter is likely to alter roosting and travel habitat. This

will result in displaced Ibats expending additional energy seeking out alternate roosts and travel corridors when they return the following season.

Roost trees, although ephemeral in nature, may be occupied by a colony for a number of years until they are no longer available (i.e., the roost has naturally fallen to the ground) or suitable (i.e., the bark has completely fallen off of a snag). Although loss of a roost (e.g., blowdown, bark loss) is a natural phenomenon that Ibats have adapted to, the loss of multiple roosts likely stresses individual bats, affects reproductive success, and impacts the social structure of a colony (Service 2007). Removal of an Ibat primary roost tree (that is still suitable for roosting) in winter is expected to result in disruption of maternity colony cohesion and temporary or permanent colony fragmentation. Smaller colonies may be expected to provide less thermoregulatory benefits for adults and non-volant pups in cool spring temperatures. Also, removal of a primary roost is expected to result in increased energy expenditures for affected bats. Female bats have tight energy budgets, and in the spring need to have sufficient energy to keep warm, forage, and sustain pregnancies. Increased flight distances or smaller colonies are expected to result in some percentage of bats having reduced pregnancy success and/or reduced pup survival. Removal of multiple alternate roost trees in winter is expected to result in similar effects.

One area of known use summer habitat in WV will be crossed by the proposed action. Rangewide, the Service (2007) estimates that less than 10% of existing Ibat maternity colonies have been detected. Therefore, some risk exists that primary roosts or multiple alternate roosts will be removed. Tree removal in known use summer habitat is likely to limit roosting options or necessitate roost tree switching when Ibats return the following season. Because maternity roost trees are ephemeral, Ibats have evolved to relocate roosts at the beginning of the season if needed. Because trees will be removed outside of the active season when the roost trees are not in use, the stress on an Ibat is decreased. Ibats have primary and secondary roosts and will shift between sites during a season (Humphrey et al. 1977, Gardner et al. 1991, Callahan 1993, Kurta et al. 1993, Romme et al. 1995). There is substantial roosting habitat remaining in the action area, and although we expect a small number of individuals will experience death or injury from loss of roost trees, we expect the majority of Ibats will relocate roosting areas with minimal effects to individuals.

We anticipate some areas that will be cleared during the winter are currently used as a travel corridor between hibernacula and roost trees and that effects will be greatest to pregnant females that expend additional energy to seek alternate travel corridors as a result of tree clearing. If pregnant females dramatically alter their travel corridor they will divert their energetic demands to seek new corridors and will likely give birth to smaller pups, which could decrease pup survival. Ibats consistently follow tree-lined paths rather than cross open areas (Murray and Kurta 2004) and, depending on the amount of forested habitat in the surrounding area, tree removal may fragment the habitat such that Ibats traveling through the area will be more vulnerable to predation, resulting in injury or death.

In summary, we anticipate that effects of tree removal in known use summer habitat (outside of the active season) will result in predation, reduced pregnancy success, and/or reduced pup survival for a small percentage of Ibats. These effects will be greatest the first season after tree removal has occurred. We expect the same types and extent of effects will occur from tree

removal outside of the active season in unknown use summer habitat as those described above for known use summer habitat.

Tree removal in unknown use summer habitat (during the active season) – Tree removal in unknown use summer habitat during the active season (April, May, August, and September) is expected to affect Ibats using undocumented occupied roosts and Ibat foraging areas. AMMs (most tree removal will occur during winter; trees will not be removed between June 1 and July 31 when young cannot fly) will minimize effects from loss of undocumented occupied roosts. If an occupied roost tree is cut down, bats will stay in the tree and be injured or killed (non-volant pups) or will fly out (adults or volant pups) (e.g., Belwood 2002) and be more susceptible to predation (e.g., by raptors). The risk of injury or death is greater for adults during cooler weather when bats periodically enter torpor and will be unable to arouse quickly enough to respond if the tree they are roosting in is felled. The likelihood of potential roost trees containing large number of bats is greatest during pregnancy and lactation (April-July) (Barclay and Kurta 2007). Some tree removal will occur (April, May) when Ibat colonies are most concentrated (largest colony counts in fewer trees) and young bats occupy roosts. We anticipate a small percentage of Ibats (adults and volant young) present within unknown use summer habitat will be injured or killed from the felling of undocumented occupied roost trees.

The forested habitat within the action area provides suitable foraging habitat for Ibats. Removal of foraging habitat when bats are present is expected to disrupt bat foraging patterns. During tree clearing, some individual bats may avoid crossing the cleared area. Bats will expend additional time and energy searching for new foraging areas. Due to the availability of suitable foraging opportunities in the surrounding landscape, bats will have little difficulty locating new foraging areas. Bats crossing through cleared areas will have an increased risk of mortality from predation. We anticipate a small percentage of Ibats present within unknown use summer habitat will experience reduced pregnancy success and/or reduced pup survival associated with increased energy expenditure from the loss of foraging habitat, and injury or death as a result of predation.

Known and unknown use spring staging/fall swarming habitat –
Tree removal in known use spring staging/fall swarming habitat (outside of the active season) – Tree removal in known use spring staging/fall swarming habitat during the winter will remove foraging and roosting areas for a concentrated number of Ibats in an abbreviated season (i.e., spring emergence or fall swarming). Bats use the area around hibernacula to build fat reserves prior to hibernation and to socialize and mate in the fall. In the spring, bats spend a few hours or days around hibernacula or migrate immediately to summer habitat. Clearing trees around hibernacula will permanently decrease foraging and roosting habitat, requiring bats to spend more time searching for food, which could result in bats entering hibernation with less fat reserves resulting in decreased overwinter survival or poorer spring body condition or result in less time on social interactions, which could result in decreased breeding success. The spring emergence period (April through May) is also a sensitive time period for bats because WNS affected bats that do not die during hibernation may be weakened by the effects of the disease and may have reduced fat reserves and damage to wing membranes. WNS affected bats may have difficulty flying and may be less likely to survive long-distance migrations to summer areas. They may also emerge from hibernation sites earlier and may be more likely to stay closer

to the hibernation site for a longer time period following spring emergence. We anticipate that effects will be greatest to WNS affected bats emerging in the spring the first season after tree removal has occurred.

We do not anticipate Ibats will be present during tree removal activities in known use spring staging/fall swarming habitat and no impacts are anticipated to Ibat hibernacula or hibernating bats. However, tree clearing will result in temporary or permanent habitat loss, which we expect will cause decreased breeding success and survival (of WNS affected bats) of a small percentage of Ibats.

We expect the same types and extent of effects will occur from tree removal outside of the active season in unknown use spring staging/fall swarming habitat as those described above for known use spring staging/fall swarming habitat.

Tree removal in unknown use spring staging/fall swarming habitat (during the active season) – Tree removal in unknown use spring staging/fall swarming habitat may occur during the active season, which will disrupt bats engaging in fall swarming, spring staging, and roosting behavior. Bats could be killed, injured, or forced to flee if an occupied roost tree is cut. During spring staging/fall swarming, bats often roost individually rather than in groups, typically have numerous suitable day-roosts available, and frequently roost-switch. Therefore, there is less potential to affect a tree being used by multiple bats or a large bat colony, and effects are likely restricted to smaller groups of bats or individual bats. We expect the same types and extent of effects will occur from tree removal during the active season in unknown use spring staging/fall swarming habitat as those described for unknown use summer habitat above.

To ameliorate effects to Ibats within unknown use spring staging/fall swarming habitat, a 121-acre property was acquired in Braxton County, WV. The parcel contains mature, upland deciduous forest dominated by mostly oak, hickory, and red maple (*Acer rubrum*). There are numerous travel/foraging corridors and snags for bats throughout the property. Approximately 860 ft of the construction ROW crosses the eastern portion of the property. After project completion, approximately 106 acres will remain as interior forest and will be maintained as such in perpetuity. Protection of this property may provide habitat, immediately adjacent to the project area, for bats displaced during construction activities. Due to the property's proximity to the construction ROW, displaced bats will only need to travel a short distance to locate alternative spring staging/fall swarming habitat. It is anticipated that the availability and protection of this property may reduce adverse effects on returning bats; however, bats have not been detected on this property as of the date of this Opinion.

Northern long-eared bat – The potential effects of the proposed action are described in Appendix B Table 5. We did not reach a NE determination for NLEB for any of the subactivities.

The project subactivities that may affect, but are NLAA, the NLEB are described in Appendix B Table 5; NLAA subactivities. For those subactivities of the proposed action that are determined NLAA NLEB, there will be no further discussion in this Opinion.

There are several project subactivities that may affect (MA) the NLEB. Some of these have

effects that have been previously addressed in the Service's January 5, 2016 programmatic biological opinion implementing the final 4(d) rule (https://www.fws.gov/midwest/endangered/mammals/nleb/pdf/BOnlebFinal4d.pdf) and are described in Appendix B Table 5; MA subactivities. For those subactivities, no detailed effects analysis discussion is required.

There are other subactivities of the project that have not been addressed in the Service's January 5, 2016 programmatic biological opinion implementing the final 4(d) rule (Appendix B Table 5; LAA subactivities). Each of these subactivities involves tree clearing within 0.25 mile of hibernacula: Canoe Cave, Tawney's Cave, and PS-WV3-Y-P1. For some components of the proposed action that are LAA NLEB, AMMs have been incorporated to ameliorate those effects and those are also noted in Appendix B Table 5.

For context, 542.5 acres of tree removal is proposed within 5 miles (anticipated spring staging/fall swarming range) of Canoe Cave, Tawney's Cave, and PS-WV3-Y-P1 (Table 6).

Table 6. Tree removal within 5 miles of NLEB hibernacula[a].

Feature	Acres of Tree Removal	
	Within 5 miles	Within 0.25 mile
Canoe Cave	72.1[b]	0.5
Overlap area within both Canoe and Tawney's Caves	97.4	N/A
Tawney's Cave	135.9[b]	2.4
PS-WV3-Y-P1	237.1	13.9
Total	542.5	16.8

[a]M. Stahl, EQT, email to S. Hoskin, Service, October 30, 2017.
[b]Minus 97.4 acres of overlap within 5 miles of both Canoe and Tawney's Caves.

Tree clearing will impact foraging and roosting areas for a concentrated number of bats in an abbreviated season (spring emergence or fall swarming). Bats use the area around hibernacula to build fat reserves prior to hibernation and to socialize and mate in the fall. In the spring, bats may spend a few hours or days around hibernacula or migrate immediately to summer habitat. A TOYR (trees will be removed between November 15 and March 31, when NLEBs will not be present) will be implemented within 0.25 mile of the hibernacula.

Clearing trees around hibernacula will permanently decrease foraging and roosting habitat, requiring bats to spend more time searching for food, which could result in bats entering hibernation with less fat reserves resulting in decreased overwinter survival or poorer spring body condition or result in less time on social interactions, which could result in decreased survival or breeding success of a small percentage of NLEBs. The spring emergence period (April through May) is also a sensitive time period for bats because WNS affected bats that do not die during hibernation may be weakened by the effects of the disease and may have reduced fat reserves and damage to wing membranes. WNS affected bats may have difficulty flying and

may be less likely to survive if their summer areas require a long-distance migration. They may also emerge from hibernation sites earlier and may be more likely to stay closer to the hibernation site for a longer time period following spring emergence which could result in decreased survival or breeding success of a small percentage of NLEBs. We anticipate that effects will be greatest to bats emerging in the spring the first season after tree removal has occurred, especially those affected by WNS. NLEBs not affected by WNS are expected to acclimate to this change and shift to alternative habitat.

In addition, NLEBs may have summer maternity colonies around Canoe Cave, Tawney's Cave, or PS-WV3-Y-P1. Individual NLEB home ranges have been minimally estimated at 148.8-173.7 acres (Owen et al. 2003, Lacki et al. 2009). The proposed clearing of 542.5 acres represents a loss of up to 3 individual home ranges. However, the proposed action is linear and therefore tree clearing is not anticipated to remove an entire potential home range, rather sections of potential home ranges. Depending on the resulting level of habitat fragmentation, tree clearing will make the remaining forest less suitable for future roosting or foraging. We expect NLEB will avoid the permanently cleared areas and start exploring undisturbed areas for future roost sites. This will cause a small percentage of NLEBs to expend more energy searching for alternative roosting or foraging sites, which will delay their ability to gain post-hibernation weight resulting in decreased survivorship.

To ameliorate effects to NLEB within known use spring staging/fall swarming habitat, a 121-acre property was acquired in Braxton County, WV. Five NLEBs were captured 4 miles north of the property and 1 NLEB was captured about 3 miles south of the property. The parcel contains mature, upland deciduous forest dominated by mostly oak, hickory, and red maple. There are numerous travel/foraging corridors and snags for bats throughout the property. Approximately 860 ft of the construction ROW crosses the eastern portion of the property. After project completion, approximately 106 acres will remain as interior forest and will be maintained as such in perpetuity. Protection of this property may provide habitat, immediately adjacent to the project area, for bats displaced during construction activities. Due to the property's proximity to the construction ROW, displaced bats will only need to travel a short distance to locate alternative spring staging/fall swarming habitat. It is anticipated that the availability and protection of this property may reduce adverse effects on returning bats; however, bats have not been detected on this property as of the date of this Opinion.

The majority of effects described above have been previously addressed in the Service's January 5, 2016 programmatic biological opinion implementing the final 4(d) rule and any incidental take that may occur further than 0.25 mile from a hibernacula is not prohibited under the final 4(d) rule (50 CFR §17.40(o)). However, any anticipated take of NLEB that may occur within 0.25 mile of a hibernaculum requires separate incidental take authorization (see Incidental Take Statement).

CUMULATIVE EFFECTS

Cumulative effects are those "effects of future State or private activities, not involving federal activities, that are reasonably certain to occur within the action area" considered in this Opinion (50 CFR 402.02).

Small whorled pogonia – The Service is not aware of any future state, tribal, local, or private actions that are reasonably certain to occur within the action area at this time; therefore, no cumulative effects are anticipated.

Virginia spiraea – The Service is not aware of any future state, tribal, local, or private actions that are reasonably certain to occur within the action area at this time; therefore, no cumulative effects are anticipated.

Roanoke logperch – While the Service is not aware of any specific proposed projects scheduled to occur immediately within the action area, RLP is likely currently being affected by a variety of actions and activities such as habitat alteration, as described in the Environmental Baseline section above. RLP habitat destruction, modification, and fragmentation from chemical spills, non-point runoff, channelization, impoundments, impediments, and siltation is expected to continue to occur, resulting in declines in RLP abundance.

Indiana bat – The Service is not aware of any future state, tribal, local, or private actions that are reasonably certain to occur within the action area at this time; therefore, no cumulative effects are anticipated.

Northern long-eared bat – The Service is not aware of any future state, tribal, local, or private actions that are reasonably certain to occur within the action area at this time; therefore, no cumulative effects are anticipated.

JEOPARDY ANALYSIS

Section 7(a)(2) of the ESA requires that federal agencies ensure that any action they authorize, fund, or carry out is not likely to jeopardize the continued existence of any endangered or threatened species or result in the destruction or adverse modification of designated critical habitat.

Jeopardy Analysis Framework

"Jeopardize the continued existence of" means to engage in an action that reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species (50 CFR 402.02). The following analysis relies on 4 components: (1) Status of the Species, (2) Environmental Baseline, (3) Effects of the Action, and (4) Cumulative Effects. The jeopardy analysis in this Opinion emphasizes the rangewide survival and recovery needs of the listed species and the role of the action area in providing for those needs. It is within this context that we evaluate the significance of the proposed federal action, taken together with cumulative effects, for purposes of making the jeopardy determination.

Analysis for Jeopardy

Small whorled pogonia

Impacts to Individuals – The proposed action includes vehicle operation, foot traffic, herbaceous vegetation and ground cover clearing, tree and shrub clearing, tree side trimming, grading, trenching, blasting, regrading/stabilization, vegetation management, and permanent ROW repair/regrading. As discussed in the Effects of the Action, potential effects of the action include effects to SWP present within the action area year-round. All individual SWP in the construction ROW are anticipated to be crushed and killed by vehicles, foot traffic, and vegetation clearing subactivities. For SWP downslope of the construction ROW, effects include decreased fitness and reproductive success and death of individual SWP due to degradation and loss of habitat caused by altered hydrology, changes in soil moisture, downslope erosion, sedimentation, changes to sunlight regime, competition, and crushing by rocks from blasting. The AMMs (e.g., FERC Plan [FERC 2013a], Restoration and Rehabilitation Plan [Mountain Valley 2017], Exotic and Invasive Species Control Plan [Mountain Valley 2016]) are anticipated to reduce effects from surface water runoff and minimize competition from invasive plants. In summary, there will be impacts to individual SWP in their reproductive success and survival rates.

Impacts to Populations – As we have concluded that individual SWP are likely to be killed or experience some reductions in their annual or lifetime reproductive success, we need to assess the aggregated consequences of the anticipated losses of the exposed individuals on the population to which these individuals belong.

One colony of SWP is assumed to be present in the action area and represents 1 population. We expect that multiple project subactivities (Appendix B Table 1) will permanently affect this SWP population because of permanent habitat loss and degradation and long-term changes in sunlight regime. We anticipate that the long-term viability of the SWP population will be reduced significantly due to decreased fitness, reproductive success, and death of individual SWP and the population will have a lower number of SWP individuals permanently, but will likely not be extirpated. The affected population represents 11% of SWP populations in WV.

Impacts to Species – As we have concluded that the population of SWP is likely to experience reductions in its fitness, we need to assess the aggregated consequences of the anticipated losses and reductions in fitness of the exposed population on the species as a whole.

To understand the consequences of population-level effects at the species level, we need to understand the RND needs of the species. As discussed in the Status of the Species, the SWP conservation needs include "resolving data gaps and assessing the conservation potential for populations on private lands" (Service 2008). Prior to this project, the rangewide status of the species was considered stable. To meet the recovery objectives of SWP, the following must be met: 1) a minimum of 61 sites (or populations) (75% of number of sites known in 1992) must be permanently protected and distributed proportionately among the 3 geographic centers and the outliers; 2) these sites must represent at least 75% of the known self-sustaining, viable populations as determined at the time of reclassification, including a total of 20 sites having 80 stems or more (self-sustaining, viable population defined as showing a geometric mean of 20 emergent stems, over a 10-year period); 3) establishment of appropriate habitat management programs for occupied SWP habitat or protection of sufficient amount of unoccupied habitat adjacent to existing populations (Service 1992). As of 2007, 150 extant SWP populations were documented rangewide; however few SWP populations are monitored annually and some

populations may only be visited once every 5 to 10 years, therefore it is difficult to fully assess population viability. Since 2007, 6 additional populations have been found in WV. With the addition of this population assumed to be present in the action area, the total rangewide is approximately 157 SWP populations.

The proposed action is anticipated to cause a permanent reduction in fitness of 1 population, affecting 0.6% of SWP populations rangewide. Due to the presence of 157 populations throughout its range, the reduced fitness of 1 population is not anticipated to change the status of the species.

Virginia spiraea

Impacts to Individuals – The proposed action includes vehicle operation, vegetation and shrub/tree clearing, AR grading and graveling, and stream and wetland crossings subactivities. As discussed in the Effects of the Action, potential effects of the action include effects to VASP present within the action area year-round. Effects generally include decreased fitness, decreased reproductive success, or death of individual VASP due to physical damage, competition with introduced invasive species, habitat disturbance, crushing, cutting, digging up, burying, or soil compaction. Additionally, these activities are expected to permanently alter and degrade habitat such that conditions are no longer favorable for VASP re-establishment post-construction. The AMMs will initially minimize some of these adverse effects, but we expect that all VASP individuals in the 0.05 acre will be killed. In summary, there will be impacts to individual VASP in their annual survival.

Impacts to Populations – As we have concluded that individual VASP are likely to be killed, we need to assess the aggregated consequences of the anticipated losses of the exposed individuals on the population to which these individuals belong.

We expect that the population level impacts from decreased fitness, decreased reproductive success, death of individual VASP, and habitat degradation and loss will be relatively minor because the proposed action only affects 1 occurrence of VASP. This occurrence is 1 of 4 that comprise the Greenbrier River population. The other 3 occurrences will not be affected by the proposed action and based on 2017 survey information these 3 occurrences appear healthy. Therefore, the loss of this 1 occurrence will not affect the stability and recovery of the Greenbrier River population as a whole.

Impacts to Species – As we have concluded that the population of VASP is unlikely to experience reductions in fitness, there will be no harmful effects (i.e., there will be no reduction in RND) on the species as a whole.

Roanoke logperch

Impacts to Individuals – The proposed action includes instream structure placement and removal, streambank vegetation clearing/trimming, and trenching during O&M subactivities. As discussed in the Effects of the Action, potential effects of the action include effects to RLP present within the action area year-round. Effects to individual RLP are expected to include injury or death from pump around. Temporary reductions in RLP foraging are expected as a result of cofferdams preventing access to foraging areas and moving to new habitat to avoid sedimentation. As

previously mentioned, sediment deposited on the waterbody bottom will interfere with the ability of RLP to feed (Robertson et al. 2006). Sediment plumes and increased turbidity will also temporarily lower DO levels. In response to sediment plumes, most RLP are anticipated to cease feeding and move to clearer water until sediment levels return to background levels. Individuals will expend more energy to seek out different foraging areas. A TOYR (March 15 - June 30) to protect RLP during their spawning season will be implemented, which will minimize the potential for effects from sedimentation. Permanent removal of riparian vegetation in a 10 ft corridor centered over the pipeline is expected to decrease fitness of a small portion of RLP individuals. In summary, there will be impacts to individual RLP in their annual survival rates.

Impacts to Populations – As we have concluded that individual RLP are likely to be killed or experience some reduction in their annual survival rate, we need to assess the aggregated consequences of the anticipated losses of the exposed individuals on the population to which these individuals belong.

We expect that the population level impacts from injury, death, and foraging disruption to the RLP will be relatively small because the proposed action affects a small number of individuals in 0.32% of the RLP potential habitat within the Roanoke River basin, which is a small portion (0.20%) of the entire RLP potential habitat in VA. Following completion of each action that results in adverse effects to RLP, we expect that the RLP population, given no other major stressors, will recover within 3-5 years assuming that most RLP in the action area experience temporary impacts. Similarly, habitat impacts are minor compared to the overall amount of RLP habitat available. The effects of the proposed action are expected to be primarily temporary; in general, RLP habitat will recover to a suitable condition following temporary impacts; and RLP are expected to continue to occupy waterways within the action area. Therefore, we conclude that the effects from the proposed action do not pose a significant risk to the RLP and will not result in permanent population declines.

Impacts to Species – As we have concluded that populations of RLP are unlikely to experience reductions in their fitness, there will be no harmful effects (i.e., there will be no reduction in RND) on the species as a whole.

Additionally, as part of the proposed action, funds will be provided to continue and expand restoration efforts along the North Fork Roanoke River and expand on an existing successful, landscape approach that tangibly benefits the RLP within its known, occupied range (FERC 2017b). While providing funds to implement restoration will likely provide conservation benefits for the RLP, its potential beneficial impact was not considered in the above analysis or the below conclusion because the nature and extent of that benefit is not determinable at this time. Further, support will be provided for proper stream restoration activities within the distributional range of RLP and other sensitive riparian areas within the pipeline corridor (FERC 2017b). Proper stream restoration activities can provide a multitude of environmental and economic benefits including, but not limited to, the following: improved water quality; augmentation of habitat diversity; re-establishment of critical watershed functions; increased property and aesthetic values; and reduction of flood damages and riparian property loss. Targeted restoration activities in or near waterbodies will take place at 55 stream crossing locations along the action area. While supporting stream restoration activities will likely provide conservation benefits for the RLP, its

potential beneficial impact was not considered in the above analysis or the below conclusion because the nature and extent of that benefit is not determinable at this time.

Indiana bat

Impacts to Individuals – The proposed action includes removal of a total of 3,230.4 acres of Ibat habitat (Table 3). As discussed in the Effects of the Action, potential effects of the action include effects to Ibat present within the action area year-round. Tree removal in known use and unknown use summer habitat during winter will alter roosting and travel habitat. Displaced Ibats will expend additional energy seeking out alternate roosts and travel corridors when they return the following season. Tree removal during winter in known use and unknown use summer habitat will result in predation, reduced pregnancy success, and/or reduced pup survival for a small percentage of individual Ibats. These effects will be greatest the first season after tree removal has occurred.

Tree removal in April, May, August, and September in unknown use summer habitat is expected to affect Ibats using undocumented occupied roosts and foraging areas. Most tree removal in unknown use summer habitat will occur during winter and trees will not be removed between June 1 and July 31 when young cannot fly. We anticipate a small percentage of individual Ibats present within unknown use summer habitat will be injured or killed (adults and volant young) from the felling of undocumented occupied roost trees, will experience reduced pregnancy success and/or reduced pup survival associated with increased energy expenditure from the loss of foraging habitat, and injury or death as a result of predation.

Tree removal in known use and unknown use spring staging/fall swarming habitat during winter will remove foraging and roosting areas for a concentrated number of Ibats in an abbreviated season (i.e., spring emergence or fall swarming). We do not anticipate Ibats will be present during tree removal activities in known use spring staging/fall swarming habitat and no impacts are anticipated to Ibat hibernacula or hibernating bats. However, tree clearing will result in temporary or permanent habitat loss, which we expect will cause decreased breeding success and survival (of WNS affected bats) of a small percentage of individual Ibats.

Tree removal in unknown use spring staging/fall swarming habitat during the active season will disrupt bats engaging in fall swarming, spring staging, and roosting behavior. A small percentage of individual Ibats present within unknown use spring staging/fall swarming habitat will be injured or killed (adults and volant young) from the felling of undocumented occupied roost trees; will experience reduced pregnancy success and/or reduced pup survival associated with increased energy expenditure from the loss of foraging habitat; and will be injured or killed as a result of predation. To minimize impacts to individual Ibats, 121 acres of suitable forested habitat within Braxton County, WV, will be permanently protected. While this property will likely provide habitat for Ibats, it does not avoid all impacts to individual bats.

In summary, there will be impacts to individual Ibats in their survival or reproductive rates.

Impacts to Populations – As we have concluded that individual Ibats are likely to experience some reduction in their lifetime survival or reproductive success, we need to assess the aggregated consequences of the anticipated reductions in fitness of the exposed individuals on

the population to which these individuals belong.

There are known maternity colonies scattered throughout VA and WV and we expect there are undocumented maternity colonies in the action area. The AMMs (Appendix B Table 4) will minimize adverse impacts to known and unknown maternity colonies such that we do not expect direct impacts to known colonies when bats are present (November 15 - March 31) and to unknown colonies when lactating females and non-volant pups are present (June - July). This will avoid significant reductions in population numbers and reproductive rates in affected maternity colonies. For known and unknown colonies, given the linear nature of the proposed action and small acreage of known and unknown use summer habitat affected (2,114.9 acres) within the Appalachian Mountain RU in VA and WV (24,268,796 acres), we do not anticipate significant areas of habitat (roosting, foraging areas, travel corridors) (0.009%) will be removed or affected. Therefore, we conclude that adequate habitat will remain to maintain numbers, reproduction, and viability for any given maternity colony.

There are 3 known hibernacula and 86 presumed occupied hibernacula within 5 miles of the action area. Of these, 1 known hibernaculum (Tawney's Cave) and 16 presumed occupied hibernacula occur within the action area. We anticipate impacts to Ibat colonies present within known and unknown use spring staging/fall swarming habitat from tree clearing activities. These impacts are primarily expected in unknown use spring staging/fall swarming habitat during the active season, with more limited impacts at known use spring staging/fall swarming habitat outside of the active season. Due to TOYRs we expect that most tree removal activities will occur when Ibat colonies are not present. Most effects will occur during the first fall swarm after tree clearing. Ibat colonies are expected to acclimate to this change and shift to alternative habitat within the known and unknown use spring staging/fall swarming habitat. We do not expect a long-term reduction in any hibernating populations because a significant portion of the known and unknown use spring staging/fall swarming habitat will remain. Given the linear nature of the proposed action and small acreage of known and unknown use spring staging/fall swarming habitat affected (1,115.5 acres) within the Appalachian Mountain RU in VA and WV (24,268,796 acres), we do not anticipate significant areas of habitat (0.005%) will be removed or otherwise lost (staging, swarming, roosting, foraging areas, travel corridors). We expect that adequate roosts will remain to maintain numbers, reproduction, and viability of the staging/swarming populations. Thus, we conclude that overall long-term health and viability of spring staging/fall swarming populations will not be negatively impacted.

Impacts to Species – As we have concluded that populations of Ibats are unlikely to experience reductions in their fitness, there will be no harmful effects (i.e., there will be no reduction in RND) on the species as a whole.

Furthermore, in collaboration with the VA and WV state environmental agencies, a mitigation model has been developed for federally listed bats. The mitigation model utilizes interior forest as the benchmark to which habitat impacts are compared. The goal of the model is to identify the quantity of acres required to fully offset forest impacts from the project. Although negotiations with the state agencies are ongoing, Mountain Valley has agreed to place funds in an interest bearing account for the purchase of optimal bat habitat that is essential to the recovery of the species, throughout VA and WV. The amount of acreage will be determined in coordination with

the Service and applicable state agencies. A Memorandum of Understanding with the agencies is being developed to establish criteria for ensuring the funds from the conservation escrow account are disbursed in accordance with the final mitigation proposal. While implementation of this mitigation model will likely provide additional conservation for the Ibat, its potential beneficial impact was not considered in the above analysis or the below conclusion because the nature and extent of that benefit is not determinable at this time.

Northern long-eared bat

Impacts to Individuals – The majority of impacts to NLEB have been previously addressed in the Service's January 5, 2016 programmatic biological opinion implementing the final 4(d) rule. Some effects to NLEB associated with impacts to habitat surrounding Canoe Cave, Tawney's Cave, and PS-WV3-Y-P1 have not. The proposed action includes the permanent removal of 542.5 acres of forest around 3 NLEB known hibernacula, of which 16.8 acres are not addressed by the programmatic opinion. This area may be used as roosting/foraging habitat in the fall or spring or by maternity colonies. No direct effects are anticipated but individual NLEB will be temporarily affected by loss of fall swarming, spring staging, and summer habitat resulting in reduced overwinter survival or reproductive success. To minimize impacts to individual NLEBs, 121 acres of suitable forested habitat within Braxton County, WV, will be permanently protected. While this property will likely provide habitat for NLEBs, it does not avoid all impacts to individual bats.

Impacts to Populations – As we have concluded that individual NLEB are likely to experience some reduction in their lifetime survival or reproductive success, we need to assess the aggregated consequences of the anticipated reductions in fitness of the exposed individuals on the population to which these individuals belong.

Bats are expected to acclimate to this permanent habitat removal by shifting to alternative habitat. All impacts are expected to be limited and short-term in nature. We do not expect a long-term reduction in the Canoe Cave, Tawney's Cave, or PS-WV3-Y-P1 populations or potential maternity colonies because the NLEB is adapted to ephemeral environments and a significant portion of the spring staging/fall swarming winter habitat or potential maternity colony habitat will remain. Therefore, we conclude that the effects from the proposed action will not result in permanent population declines.

Impacts to Species – As we have concluded that populations of NLEB are unlikely to experience reductions in their fitness, there will be no harmful effects (i.e., there will be no reduction in RND) on the species as a whole.

Furthermore, in collaboration with the VA and WV state environmental agencies, a mitigation model has been developed for federally listed bats. The mitigation model utilizes interior forest as the benchmark to which habitat impacts are compared. The goal of the model is to identify the quantity of acres required to fully offset forest impacts from the project. Although negotiations with the state agencies are ongoing, Mountain Valley has agreed to place funds in an interest bearing account for the purchase of optimal bat habitat that is essential to the recovery of the species, throughout VA and WV. The amount of acreage will be determined in coordination with the Service and applicable state agencies. A Memorandum of Understanding with the agencies is

being developed to establish criteria for ensuring the funds from the conservation escrow account are disbursed in accordance with the final mitigation proposal. While implementation of this mitigation model will likely provide additional conservation for the NLEB, its potential beneficial impact was not considered in the above analysis or the below conclusion because the nature and extent of that benefit is not determinable at this time.

CONCLUSION

Small whorled pogonia – We considered the current overall stable status of the SWP and the similar condition of the species within the action area (environmental baseline). We then assessed the effects of the proposed action and the potential for cumulative effects in the action area on individuals, populations, and the species as a whole. These types of effects of the proposed action are currently considered primary factors influencing the status of the species. While they may compound those factors, as stated above, we do not anticipate any reductions in the overall RND of the SWP. It is the Service's Opinion that authorization to construct and operate the pipeline, as proposed, is not likely to jeopardize the continued existence of the SWP.

Virginia spiraea – We considered the current overall stable status of VASP and the similar condition of the species within the action area (environmental baseline). We then assessed the effects of the proposed action and the potential for cumulative effects in the action area on individuals, populations, and the species as a whole. These types of effects of the proposed action are currently considered primary factors influencing the status of the species. While they may compound those factors, as stated above, we do not anticipate any reductions in the overall RND of the VASP. It is the Service's Opinion that authorization to construct and operate the pipeline, as proposed, is not likely to jeopardize the continued existence of the VASP.

Roanoke logperch – We considered the current overall improving status of the RLP and the stable condition of the species within the action area (environmental baseline). We then assessed the effects of the proposed action and the potential for cumulative effects in the action area on individuals, populations, and the species as a whole. These types of effects of the proposed action are not currently considered primary factors influencing the status of the species. While they may compound those factors, as stated above, we do not anticipate any reductions in the overall RND of the RLP. It is the Service's Opinion that authorization to construct and operate the pipeline, as proposed, is not likely to jeopardize the continued existence of the RLP.

Indiana bat – We considered the current overall declining status of the Ibat and the similar condition of the species within the action area (environmental baseline). We then assessed the effects of the proposed action and the potential for cumulative effects in the action area on individuals, populations, and the species as a whole. These types of effects of the proposed action are currently considered primary factors influencing the status of the species. While they may compound those factors, as stated above, we do not anticipate any reductions in the overall RND of the Ibat. It is the Service's Opinion that authorization to construct and operate the pipeline, as proposed, is not likely to jeopardize the continued existence of the Ibat.

Northern long-eared bat – We considered the current overall declining status of the NLEB and the similar condition of the species within the action area (environmental baseline). We then

assessed the effects of the proposed action and the potential for cumulative effects in the action area on individuals, populations, and the species as a whole. These types of effects of the proposed action are currently considered primary factors influencing the status of the species. While they may compound those factors, as stated above, we do not anticipate any reductions in the overall RND of the NLEB. It is the Service's Opinion that authorization to construct and operate the pipeline, as proposed, is not likely to jeopardize the continued existence of the NLEB.

INCIDENTAL TAKE STATEMENT

Section 9 of the ESA and federal regulation pursuant to Section 4(d) of the ESA prohibit the take of endangered and threatened species, respectively, without a special exemption. Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. Harm is further defined by the Service to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns including breeding, feeding, or sheltering (50 CFR § 17.3). Harass is defined by the Service as intentional or negligent actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavior patterns, which include, but are not limited to, breeding, feeding, or sheltering (50 CFR § 17.3). Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of Section 7(b)(4) and Section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the ESA provided that such taking is in compliance with the terms and conditions of this incidental take statement.

The measures described below are nondiscretionary, and must be undertaken by FERC so that they become binding conditions of any grant or permit issued to the applicant, as appropriate, for the exemption in Section 7(o)(2) to apply. FERC has a continuing duty to regulate the activity covered by this incidental take statement. If FERC: (1) fails to assume and implement the terms and conditions or (2) fails to require the applicant to adhere to the terms and conditions of the incidental take statement through enforceable terms that are added to the permit or grant document, the protective coverage of Section 7(o)(2) may lapse. To monitor the impact of incidental take, FERC must report the progress of the action and its impact on the species to the Service as specified in the incidental take statement [50 CFR 402.14(i)(3)].

On January 14, 2016, the Service published a final species-specific rule pursuant to Section 4(d) of the ESA for the NLEB (50 CFR §17.40(o)), which became effective February 16, 2016. The Section 4(d) rule defines prohibited take of the NLEB, which is limited to certain circumstances and activities within the full suite of prohibitions otherwise applicable to threatened species under 50 CFR §17.31. The majority of incidental take of the NLEB that may occur from the proposed action is not considered prohibited take under the NLEB 4(d) rule. Therefore, that incidental take does not require exemption from the Service. However, any incidental take associated with 16.8 acres of habitat removal within 0.25 mile of the hibernacula is addressed below.

Section 7(b)(4) and 7(o)(2) of the ESA generally do not apply to listed plants species. However,

limited protection of listed plants from take is provided to the extent that the ESA prohibits the removal and reduction to possession of federally listed endangered plants or the malicious damage of such plants on areas under federal jurisdiction, or the destruction of endangered plants on non-federal areas in violation of State law or regulation or in the course of any violation of a State criminal trespass law.

AMOUNT OR EXTENT OF TAKE ANTICIPATED

The Service analyzed the effects to the species above.

Roanoke logperch – To estimate incidental take, we calculated the area of RLP habitat at each crossing (i.e., wetted width of the waterbody by the total of the construction ROW width and the 1,000 m stream length at each crossing) as follows: Bradshaw Creek 1 (6 m)(22.86 m + 1,000 m) = 6,137.16 m^2; Harpen Creek 1 (5 m)(22.86 m + 1,000 m) = 5,114.3 m^2; North Fork Roanoke River (22 m)(22.86 m + 1,000 m) = 22,502.92 m^2; Roanoke River (22 m)(22.86 m + 1,000 m) = 22,502.92 m^2; and Pigg River (22 m)(22.86 m + 1,000 m) = 22,502.92 m^2. Total = 124,788.92 m^2. Then we calculated the subset of the action area (i.e., wetted width of the waterbody by the construction ROW width) for cofferdam placement and removal: Bradshaw Creek 1 (6 m x 22.86 m) = 137.16 m^2; Harpen Creek 1 (5 m x 22.86 m) = 114.3 m^2; North Fork Roanoke River (22 m x 22.86) = 502.92 m^2; Roanoke River (22 m x 22.86 m) = 502.92 m^2; and Pigg River (22 m x 22.86 m) = 502.92 m^2. Total = 1,760.22 m^2. The area affected by stream diversion and cofferdam dewatering comprises approximately 1.4% [(1,760.22 m^2/124,788.92 m^2)(100)] of the action area. This 1.4% of the action area is the same area from which we anticipate the majority of RLP will be removed and relocated downstream. The anticipated take is described in Table 7 below.

Table 7. RLP amount and type of anticipated incidental take.

Species	Amount of Take Anticipated	Life Stage when Take is Anticipated	Type of Take	Take is Anticipated as a Result of
RLP	2	Adults or juveniles	Injury or Kill	Entrainment due to stream diversion and cofferdam dewatering.
RLP	955	Adults or juveniles	Harm or Harass	Habitat alteration from instream structure placement and removal, streambank vegetation clearing/trimming, and trenching during O&M subactivities.

Indiana bat – The Service anticipates incidental take of the Ibat will be difficult to detect for the following reasons: species has small body size, finding a dead or impaired specimen is unlikely, and species occurs in habitat (forest and caves) that makes detection difficult. However, the following level of take of this species can be anticipated by loss of 3,230.4 acres because this area contains suitable Ibat habitat. To account for differences in Ibat use of the habitat categories (unknown use habitat vs. known use habitat), a multiplier of 0.5 was used to estimate Ibat use for unknown use summer habitat and unknown use spring staging/fall swarming habitat. The anticipated take is described in Table 8 below.

Table 8. Ibat amount and type of anticipated incidental take.

Species	Amount of Take Anticipated	Life Stage when Take is Anticipated	Type of Take	Take is Anticipated as a Result of
Ibat	Small percent of individuals present within 228.4 acres of known use summer habitat	Adults or pups	Harm, Harass, Injure, or Kill	Relocating roosting areas and travel corridors will result in predation, reduced pregnancy success, and/or reduced pup survival.
Ibat	Small percent of individuals present within 943.25 acres of unknown use summer habitat	Adults or pups	Harm, Harass, Injure, or Kill	Felling undocumented occupied roost trees will result in the injury or death of adults and volant young. Relocating roosting/foraging areas and travel corridors will result in predation, reduced pregnancy success, and/or reduced pup survival.
Ibat	Small percent of individuals present within 402.7 acres of unknown use spring staging/fall swarming habitat	Adults or pups	Harm, Harass, Injure, or Kill	Felling undocumented occupied roost trees will result in the injury or death of adults and volant young. Relocating foraging areas will result in predation, reduced pregnancy success, and/or reduced pup survival. Temporary or permanent habitat loss will cause decreased breeding success and survival of WNS affected bats.
Ibat	Small percent of individuals present within 310.1 acres known use spring staging/fall swarming habitat	Adults	Harm, Harass, or Kill	Temporary or permanent habitat loss will cause decreased breeding success and survival of WNS affected bats.

Northern long-eared bat – The majority of effects have been previously addressed in the Service's January 5, 2016 programmatic biological opinion implementing the final 4(d) rule and any incidental take further than 0.25 mile from Canoe Cave, Tawney's Cave, and PS-WV3-Y-P1 is not prohibited under the final 4(d) rule (50 CFR §17.40(o)). The Service anticipates incidental take of NLEB will be difficult to detect for the following reasons: species has small body size, finding a dead or impaired specimen is unlikely, and species occurs in habitat (forest and caves) that makes detection difficult. However, the following level of take of this species can be anticipated by the loss of 16.8 acres of habitat because this area is within 0.25 mile of Canoe Cave, Tawney's Cave, and PS-WV3-Y-P1. The anticipated take is described in Table 9 below.

Table 9. NLEB amount and type of anticipated incidental take.

Species	Amount of Take Anticipated	Life Stage when Take is Anticipated	Type of Take	Take is Anticipated as a Result of
NLEB	Small percent of individuals present within 16.8 acres	Adults	Harm or Harass	Habitat loss will decrease survival and breeding success, particularly to WNS affected bats.

REASONABLE AND PRUDENT MEASURES

The Service believes the following reasonable and prudent measures are necessary and appropriate to minimize take.

Roanoke logperch –

- Provide information to individuals involved in project construction on how to avoid and minimize potential effects to the RLP.
- Conduct construction in a manner that minimizes disturbance to RLP.

Indiana bat –

- Provide information to individuals involved in project construction on how to avoid and minimize potential effects to the Ibat.
- Finalize the Braxton County conservation property preservation and the Memorandum of Understanding regarding federally listed bat mitigation.

Northern long-eared bat –

- Finalize the Braxton County conservation property preservation and the Memorandum of Understanding regarding federally listed bat mitigation.

TERMS AND CONDITIONS

In order to be exempt from the prohibitions of Section 9 of the ESA, the FERC must comply with the following terms and conditions, which implement the reasonable and prudent measures described above and outline required reporting/monitoring requirements. These terms and conditions are nondiscretionary.

Roanoke logperch –

1. Prior to initiation of on-site work, notify all prospective employees, operators, and contractors about the presence and biology of the RLP, special provisions necessary to protect the RLP, activities that may affect the RLP, and ways to avoid and minimize these effects. This information can be obtained by reading RLP-related information in this Opinion or a fact sheet containing this information can be created and provided by FERC or the applicant.
2. Use the most non-lethal technique first when removing fish from the instream workspaces.

3. Construct cofferdams (North Fork Roanoke River, Bradshaw Creek, Roanoke River, Pigg River, and Harpen Creek) using non-erodible materials. Remove cofferdams in their entirety upon project completion.
4. Fill any sandbags used in cofferdams with clean sand and no other materials. All sandbags must be new with no prior use and must be removed at the time of cofferdam removal.
5. Build cofferdams to a height, strength, and configuration to resist no less than normal peak daily flows. All construction must take place outside of the RLP TOYR.
6. Minimize instream (North Fork Roanoke River, Bradshaw Creek, Roanoke River, Pigg River, and Harpen Creek) foot traffic during construction.
7. Vehicles or construction equipment may not enter North Fork Roanoke River, Bradshaw Creek, Roanoke River, Pigg River, and Harpen Creek, except within cofferdams.
8. Inspect all vehicles for leaks immediately prior to instream or cofferdam work (North Fork Roanoke River, Bradshaw Creek, Roanoke River, Pigg River, and Harpen Creek). Repair any leaks and clean construction vehicles thoroughly to remove any residual dirt, mud, debris, grease, motor oil, hydraulic fluid, coolant, or other hazardous substances from construction vehicles. Inspections, repairs, cleaning, and/or servicing will be conducted either before the vehicle, equipment, or machinery is transported into the field or at the work site within the staging area. All wash-water runoff and/or harmful materials will be appropriately controlled to prevent entry into the waterbody, including the riparian zone.

Indiana bat –

1. Prior to initiation of on-site work, notify all prospective employees, operators, and contractors about the presence and biology of the Ibat, special provisions necessary to protect the Ibat, activities that may affect the Ibat, and ways to avoid and minimize these effects. This information can be obtained by reading Ibat-related information in this Opinion or a fact sheet containing this information can be created and provided by FERC or the applicant.
2. A mechanism for preservation of the Braxton County conservation property must be in place prior to completion of project construction or on a date mutually agreed upon by the Service. Contact the WVFO (tiernan_lennon@fws.gov) regarding Service approval.
3. Finalize the Memorandum of Understanding regarding federally listed bat mitigation prior to the completion of project construction. Contact the WVFO (tiernan_lennon@fws.gov) and VAFO (sumalee_hoskin@fws.gov) regarding Service review and approval.

Northern long-eared bat –

1. A mechanism for preservation of the Braxton County conservation property must be in place prior to completion of project construction or on a date mutually agreed upon by the Service. Contact the WVFO (tiernan_lennon@fws.gov) regarding Service review and approval.
2. Finalize the Memorandum of Understanding regarding federally listed bat mitigation prior to the completion of project construction. Contact the WVFO (tiernan_lennon@fws.gov) and VAFO (sumalee_hoskin@fws.gov) regarding Service review and approval.

MONITORING AND REPORTING REQUIREMENTS

Care must be taken in handling any dead specimens of proposed or listed species to preserve biological material in the best possible state. In conjunction with the preservation of any dead specimens, the finder has the responsibility to ensure that evidence intrinsic to determining the cause of death of the specimen is not unnecessarily disturbed. The finding of dead specimens does not imply enforcement proceedings pursuant to the ESA. The reporting of dead specimens is required to enable the Service to determine if take is reached or exceeded and to ensure that the terms and conditions are appropriate and effective. Upon locating a dead specimen, notify the Service's VA Law Enforcement Office at 804-771-2883 and VAFO at the phone number provided below or at 804-693-6694.

Roanoke logperch –

1. Any high water event that disturbs the construction site, including failure or overtopping of cofferdams, must be reported to the Service at the contact phone number/email address below within 24 hours.
2. Any spills of motor oil, hydraulic fluid, coolant, or similar fluids, not contained before entry into the action area, must be reported to the Service at the contact number/email provided below and National Response Center (800-424-8802) immediately.
3. Conduct a RLP survey and habitat assessment at North Fork Roanoke River, Bradshaw Creek, Roanoke River, Pigg River, and Harpen Creek crossings 6 months the to assess the status of the RLP. Survey/habitat assessment will be conducted 200 m upstream and 800 m downstream of each crossing site by a qualified surveyor(s) with a valid VDGIF Permit for these activities. Provide a report containing raw data and summarized information from the surveys and habitat assessments at each site to the VAFO (sumalee_hoskin@fws.gov) within 30 days of completion of the survey/habitat assessment.

Indiana bat –

1. Monitor Ibat activity around Greenville Saltpeter Cave and Tawney's Cave to determine effects to Ibats in the fall swarming/spring staging areas. Two weeks prior to the start of tree clearing place acoustic monitors outside the entrance of each cave. Monitors will remain in place until completion of 2 hibernating seasons post-construction. Provide a report including the raw acoustic data every year on January 30 to the WVFO (tiernan_lennon@fws.gov) and VAFO (sumalee_hoskin@fws.gov).

Northern long-eared bat –

1. Monitor NLEB activity around Canoe Cave, Tawney's Cave, and PS-WV3-Y-1 to determine effects to NLEBs in the fall swarming/spring staging areas. Two weeks prior to the start of tree clearing place acoustic monitors outside the entrance of each cave. Monitors will remain in place until completion of 2 hibernating seasons post-construction. Provide a report including the raw acoustic data every year on January 30 to the WVFO (tiernan_lennon@fws.gov) and VAFO (sumalee_hoskin@fws.gov).

CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the ESA directs federal agencies to utilize their authorities to further the purposes of the ESA by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information.

Small whorled pogonia –

- Utilize an alternative pipeline route to avoid effects to the SWP colony and protect its upland drainage area.
- If an alternative pipeline route is not feasible, work with the WVFO (tiernan_lennon@fws.gov) to develop an experimental design to transplant the SWP stems in the construction ROW to protected suitable habitat or to utilize these plants for research purposes.
- Conduct SWP surveys within suitable habitat in the area surrounding the SWP colony to determine if additional colonies are present.

Virginia spiraea –

- Remove VASP plants by hand prior to construction and maintain them at a Service-approved facility during construction. After MVP is complete, plant VASP plants and any propagules within the action area where they are most likely to thrive. Contact the WVFO (tiernan_lennon@fws.gov) for specific recommendations.
- Monitor any documented occurrences of VASP within and adjacent to the action area and conduct surveys in WV to locate additional populations.
- Permanently protect habitat for the Greenbrier River VASP population.
- Assist with breeding ecology (seed viability/pollinators/compatibility) and genetic diversity research efforts.
- Develop a site-specific exotic/invasive species management plan to be implemented at sites occupied by VASP.

Roanoke logperch –

- Fund or conduct projects to identify and remove manmade barriers to fish passage that will benefit RLP.
- Continue to work with the VAFO (sumalee_hoskin@fws.gov) to identify appropriate restoration efforts.

Indiana bat –

- Fund research on understanding/controlling and mitigating the effects of WNS.
- Fund research to improve knowledge of Ibat use of suitable habitat in VA and WV.
- Plant native trees with exfoliating bark in the temporary construction ROW to replace those that were cleared. Contact the VAFO (sumalee_hoskin@fws.gov) and WVFO (tiernan_lennon@fws.gov) for area-specific recommendations.
- Conduct mist-net surveys and telemetry studies within 5 miles of the location of the pregnant female Ibat captured in Wetzel County, WV to identify occupied roost trees.
- Implement habitat enhancement measures (e.g., erect artificial roost structures, create vernal pools, girdle trees, etc.) on the Braxton County conservation property. Develop a

site specific plan for the conservation property that includes: a description of the quality of the habitat; extent and location of on-site enhancements; and a long-term management plan. Conduct bat monitoring on the property to document use by bats. Contact the WVFO (tiernan_lennon@fws.gov) for specific recommendations.

Northern long-eared bat –

- Fund research on understanding/controlling and mitigating the effects of WNS.

For the Service to be kept informed of actions minimizing or avoiding adverse effects or benefitting listed species or their habitats, the Service requests notification of the implementation of any conservation recommendations.

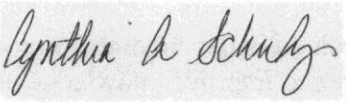
REINITIATION NOTICE

This concludes formal consultation on the action outlined in the request. As provided in 50 CFR 402.16, reinitiation of formal consultation is required where discretionary federal agency involvement or control over the action has been retained (or is authorized by law) and if: (1) the amount or extent of incidental take is exceeded; (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this Opinion; (3) the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat not considered in this Opinion; or (4) a new species is listed or critical habitat designated that may be affected by the action. In instances where the amount or extent of incidental take is exceeded, any operations causing such take must cease pending reinitiation.

Except as specifically noted, any modifications to the proposed action made since the issuance of the FEIS (FERC 2017a) and BA (FERC 2017b) were not considered as part of this Opinion. The Service strongly recommends that any changes or modifications to the various construction, restoration, and mitigation plans listed in table 2.4-2 of the FEIS be summarized and provided to the Service to ensure reinitiation is not necessary prior to commencing work.

If you have any questions regarding this Opinion or our shared responsibilities under the ESA, please contact Troy Andersen of this office at (804) 824-2428 or via email at Troy_Andersen@fws.gov.

Sincerely,



Cindy Schulz
Field Supervisor
Virginia Ecological Services

Enclosures

cc: Corps, Norfolk, VA (Attn: William Walker)
DOI, Washington, DC (Attn: Erika Vaughan)
FERC, Washington, DC (Attn: Paul Friedman)
USFS, Atlanta, GA (Attn: Timothy Abing)
USFS, Roanoke, VA (Attn: Jennifer Adams)
VDACS, Richmond, VA (Attn: Keith Tignor)
VDCR-DNH, Richmond, VA (Attn: Rene Hypes)
VDGIF, Richmond, VA (Attn: Ernie Aschenbach)
WVDNR, Elkins, WV (Attn: Cliff Brown)
MVP, Pittsburgh, PA (Attn: Joseph Dawley)
MVP, Pittsburgh, PA (Attn: Megan Stahl)

LITERATURE CITED

Introduction

Federal Energy Regulatory Commission. 2017a. Mountain Valley Project and Equitrans Expansion Project Final Environmental Impact Statement. Docket Nos. CP16-10-000 and CP16-13-000. Office of Energy Projects, Washington, DC.

Federal Energy Regulatory Commission. 2017b. Biological Assessment for Mountain Valley Pipeline, LLC, Mountain Valley Pipeline Project. Docket No. CP16-10-000. Office of Energy Projects, Washington, DC.

Description of Proposed Action

Draper Aden Associates. 2016. Karst Mitigation Plan. Prepared for Mountain Valley Pipeline, Pittsburgh, PA.

Federal Energy Regulatory Commission. 2013a. Upland erosion control, revegetation, and maintenance plan. Washington, DC. Available from: https://www.ferc.gov/industries/gas/enviro/plan.pdf

Federal Energy Regulatory Commission. 2013b. Wetland and waterbody construction and mitigation procedures. Washington, DC. Available from: https://www.ferc.gov/industries/gas/enviro/procedures.pdf

Federal Energy Regulatory Commission. 2017a. Mountain Valley Project and Equitrans Expansion Project Final Environmental Impact Statement. Docket Nos. CP16-10-000 and CP16-13-000. Office of Energy Projects, Washington, DC.

Federal Energy Regulatory Commission. 2017b. Biological Assessment for Mountain Valley Pipeline, LLC, Mountain Valley Pipeline Project. Docket No. CP16-10-000. Office of Energy Projects, Washington, DC.

Mountain Valley Pipeline, LLC. 2016. Winter Construction Plan. Docket No. CP16-10-000. Report to Federal Energy Regulatory Commission, Office of Energy Projects, Washington, DC.

Status of the Species

SWP

U.S. Fish and Wildlife Service. 2008. Small whorled pogonia (*Isotria medeoloides*) 5-year review: summary and evaluation. New England Field Office, Concord, NH.

VASP

NatureServe. 2017. NatureServe Explorer: An online encyclopedia of life [web application]. Version 7.1. NatureServe, Arlington, VA. Available from: http://explorer.natureserve.org.

U.S. Fish and Wildlife Service. 1992. Virginia spiraea (*Spiraea virginiana* Britton) recovery plan. Newton Corner, MA.

U.S. Fish and Wildlife Service. 2008. Virginia spiraea (*Spiraea virginiana*) draft 5-year review: summary and evaluation. Virginia Field Office, Gloucester, VA.

RLP

U.S. Fish and Wildlife Service. 2007. Roanoke logperch (*Percina rex*) 5-year review: summary and evaluation. Virginia Field Office, Gloucester, VA.

Ibat

U.S. Fish and Wildlife Service. 2009. Indiana bat (*Myotis sodalis*) 5-year review: summary and evaluation. Indiana Field Office, Bloomington, IN.

U.S. Fish and Wildlife Service. 2016. Revised programmatic biological opinion for transportation projects in the range of the Indiana bat and Northern long-eared bat. Midwest Regional Office, Bloomington, MN.

NLEB

N/A

Environmental Baseline

SWP

DigitalGlobe. 2017. Satellite imagery of area in Greenbrier County, West Virginia [computer file]. Generated by Jennifer Stanhope; using Google Earth Pro [cited October 5, 2017]. Version 7.1.2.2041. Available from: https://www.google.com/earth/download/ge/agree.html?gl=US&hl=en.

Environmental Solutions & Innovations, Inc. 2015. Study Plan: Habitat assessments and surveys for rare plants along the Mountain Valley Pipeline Project in Virginia and West Virginia. Report to U.S. Fish and Wildlife Service, West Virginia Field Office, Elkins, WV; U.S. Fish and Wildlife Service, Virginia Field Office, Gloucester, VA; VA Department of Game and Inland Fisheries, Henrico, VA; Department of Conservation and Recreation, Richmond, VA; and West Virginia Division of Natural Resources, Elkins, WV.

Environmental Solutions & Innovations, Inc. 2016. Surveys for rare plants along the Mountain Valley Pipeline Project in West Virginia. Report to U.S. Fish and Wildlife Service, West Virginia Field Office, Elkins, WV.

Federal Energy Regulatory Commission. 2017a. Mountain Valley Project and Equitrans Expansion Project Final Environmental Impact Statement. Docket Nos. CP16-10-000 and CP16-13-000. Office of Energy Projects, Washington, DC.

Federal Energy Regulatory Commission. 2017b. Biological Assessment for Mountain Valley Pipeline, LLC, Mountain Valley Pipeline Project. Docket No. CP16-10-000. Office of

Energy Projects, Washington, DC.

West Virginia Department of Transportation. 2017. 2017 West Virginia county maps; 2017 general highway map, Greenbrier County, West Virginia. [pdf map]. Charleston, WV [cited October 5, 2017]. Available from: http://www.transportation.wv.gov/highways/programplanning/gti/GIS/MAPS/Pages/WVMapGISSelect.aspx.

VASP

Environmental Solutions & Innovations, Inc. 2015. Study Plan: Habitat assessments and surveys for rare plants along the Mountain Valley Pipeline Project in Virginia and West Virginia. Report to U.S. Fish and Wildlife Service, West Virginia Field Office, Elkins, WV; U.S. Fish and Wildlife Service, Virginia Field Office, Gloucester, VA; VA Department of Game and Inland Fisheries, Henrico, VA; Department of Conservation and Recreation, Richmond, VA; and West Virginia Division of Natural Resources, Elkins, WV.

Environmental Solutions & Innovations, Inc. 2016. Surveys for rare plants along the Mountain Valley Pipeline Project in West Virginia. Report to U.S. Fish and Wildlife Service, West Virginia Field Office, Elkins, WV.

Federal Energy Regulatory Commission. 2017b. Biological Assessment for Mountain Valley Pipeline, LLC, Mountain Valley Pipeline Project. Docket No. CP16-10-000. Office of Energy Projects, Washington, DC.

U.S. Fish and Wildlife Service. 2008. Virginia spiraea (*Spiraea virginiana*) draft 5-year review: summary and evaluation. Virginia Field Office, Gloucester, VA.

West Virginia Division of Natural Resources. 2011. Federal Assistance Performance Report: Endangered species (plants). Project E-2, Segment 24 (1 March 2010 – 28 February 2011) Elkins, WV.

West Virginia Division of Natural Resources. 2017. Shapefile of modeled suitable habitat for Virginia spiraea in West Virginia. Unpublished Shapefile to U.S. Fish and Wildlife Service, Elkins, WV.

RLP

Anderson, G.B. 2016. Development and application of a multiscale model of habitat suitability for Roanoke logperch. Final Report to U.S. Fish and Wildlife Service, Virginia Field Office, Gloucester, VA.

Environmental Solutions & Innovations, Inc. 2015. Habitat assessments for Roanoke logperch (*Percina rex*) along the proposed Mountain Valley Pipeline in Virginia. Report to U.S. Fish and Wildlife Service, Virginia Field Office, Gloucester, VA.

Environmental Solutions & Innovations, Inc. 2016. Habitat assessments conducted in 2016 for Roanoke logperch (*Percina rex*) along the proposed Mountain Valley Pipeline in

Virginia. Report to U.S. Fish and Wildlife Service, Virginia Field Office, Gloucester, VA.

Federal Energy Regulatory Commission. 2017b. Biological Assessment for Mountain Valley Pipeline, LLC, Mountain Valley Pipeline Project. Docket No. CP16-10-000. Office of Energy Projects, Washington, DC.

Ferguson, M.T., S.A. Bruenderman, and P.S. Lookabaugh. 1994. A survey of the Roanoke logperch (*Percina rex*) in the North Fork Roanoke River. Final report prepared by Virginia Department of Game and Inland Fisheries, Blacksburg, VA.

Roberts, J.H. and P.L. Angermeier. 2010. Survey of fishes and habitat at the Montgomery County Route 773 bridge over Roanoke River, Virginia. Report prepared by Virginia Cooperative Fish and Wildlife Research Unit, Department of Fisheries and Wildlife Sciences, Virginia Tech for Virginia Department of Game and Inland Fisheries, Blacksburg, Virginia for Virginia Department of Transportation, Richmond, VA.

Roberts, J.H., P.L. Angermeier, and E.M. Hallerman. 2013. Distance, dams and drift: what structures populations of an endangered, benthic stream fish? Freshwater Biology 58:1-15.

Roberts, J.H., P.L. Angermeier, and E.M. Hallerman. 2016. Extensive dispersal of Roanoke logperch (*Percina rex*) inferred from genetic marker data. Ecology of Freshwater Fish 25:1-16.

Virginia Fish and Wildlife Information Service. 2017. Species Information [Internet]. Richmond, VA [cited October 5, 2017]. Available from: http://vafwis.org/fwis.

Ibat

Environmental Solutions & Innovations, Inc. 2015a. Listed bat studies along MVP's proposed Mountain Valley Pipeline Project in Craig, Franklin, Giles, Montgomery, Pittsylvania, and Roanoke Counties, Virginia. Report to U.S. Fish and Wildlife Service, Virginia Field Office, Gloucester, VA; and Virginia Department of Game and Inland Fisheries, Richmond, VA.

Environmental Solutions & Innovations, Inc. 2015b. Listed bat studies along MVP's proposed Mountain Valley Pipeline Project in Braxton, Doddridge, Fayette, Greenbrier, Harrison, Lewis, Monroe, Nicholas, Summers, Webster, and Wetzel Counties, West Virginia. Report to U.S. Fish and Wildlife Service, West Virginia Field Office, Elkins, WV; and West Virginia Division of Natural Resources, Elkins, WV.

Federal Energy Regulatory Commission. 2017a. Mountain Valley Project and Equitrans Expansion Project Final Environmental Impact Statement. Docket Nos. CP16-10-000 and CP16-13-000. Office of Energy Projects, Washington, DC.

Federal Energy Regulatory Commission. 2017b. Biological Assessment for Mountain Valley Pipeline, LLC, Mountain Valley Pipeline Project. Docket No. CP16-10-000. Office of Energy Projects, Washington, DC.

Powers, K.E., R.J. Reynolds, W. Orndorff, W.M. Ford, and C.S. Hobson. 2015. Post-white-nose syndrome trends in Virginia's cave bats, 2008-2013. Journal of Ecology and the Natural Environment 7(4):113-123.

Stihler, C.W. 2012. White-nose syndrome a deadly enigma. West Virginia Wildlife Magazine. Fall/Winter edition. Available from: https://www.wvdnr.gov/wildlife/magazine/Archive/12Winter/White-nose_Syndrome.pdf.

U.S. Fish and Wildlife Service. 2007. Indiana bat (*Myotis sodalis*) draft recovery plan: first revision. Midwest Regional Office, Fort Snelling, MN. 258 pp.

U.S. Fish and Wildlife Service. 2017a. Ibat hibernacula data 3-6-2017. Unpublished data. Indiana Field Office, Bloomington, IN.

U.S. Fish and Wildlife Service. 2017b. Range-wide Indiana bat summer survey guidelines. Available from: http://www.fws.gov/midwest/endangered/mammals/inba/inbasummersurveyguidance.html.

West Virginia Division of Natural Resources. 2013. Federal Assistance Performance Report: Endangered species (animals). Project E-1, Segment 30 (1 October 2012 – 30 September 2013) Elkins, WV.

West Virginia Division of Natural Resources. 2015. Federal Assistance Performance Report: Endangered species (animals). Project E-1, Segment 32 (1 October 2014 – 30 September 2015) Elkins, WV.

West Virginia Division of Natural Resources. 2016. Federal Assistance Performance Report: Endangered species (animals). Project E-1, Segment 33 (1 October 2015 – 30 September 2016) Elkins, WV.

NLEB

Federal Energy Regulatory Commission. 2017b. Biological Assessment for Mountain Valley Pipeline, LLC, Mountain Valley Pipeline Project. Docket No. CP16-10-000. Office of Energy Projects, Washington, DC.

Powers, K.E., R.J. Reynolds, W. Orndorff, W.M. Ford, and C.S. Hobson. 2015. Post-white-nose syndrome trends in Virginia's cave bats, 2008-2013. Journal of Ecology and the Natural Environment 7(4):113-123.

Stihler, C.W. 2012. White-nose syndrome a deadly enigma. West Virginia Wildlife Magazine. Fall/Winter edition. Available from: http://www.wvdnr.gov/wildlife/magazine/Archive/12Winter/White-nose_Syndrome.pdf.

Effects of the Action

SWP

Brumback, W.E., S. Cairns, M.B. Sperduto, and C.W. Fyler. 2011. Response of an *Isotria medeoloides* population to canopy thinning. Northeastern Naturalist 18(2):185-196.

Burns, R.M. and B.H. Honkala. 1990. Silvics of North America: 1. Conifers; 2. Hardwoods. Agriculture Handbook 654, Vol. 2. U.S. Department of Agriculture, U.S. Forest Service, Washington, D.C.

Dibble, A.C. 2000a. Demographic monitoring and habitat manipulation experiment for small whorled pogonia (*Isotria medeoloides*). Report to U.S. Fish and Wildlife Service, Northeast Regional Office, Hadley, MA.

Dibble, A.C. 2000b. Demographic monitoring and habitat manipulation of the small whorled pogonia, Isotria medeoloides, (Orchidaceae), in New England, U.S.A. Draft manuscript to Maine Department of Conservation, Maine Natural Areas Program, Augusta, ME.

Dibble, A.C., W.A. Wright, and C.S. Campbell. 1997. Small whorled pogonia (*Isotria medeoloides*): demographic monitoring and habitat manipulation experiment. Report to Maine Department of Conservation, Maine Natural Areas Program, Augusta, ME and U.S. Fish and Wildlife Service, Northeast Regional Office, Newton Corner, MA.

Environmental Solutions & Innovations, Inc. 2017. Hydrologic analysis of sedimentation, Mountain Valley Pipeline, Jefferson National Forest, Eastern Divide Ranger District. Report to the U.S. Department of Agriculture, Forest Service, Jefferson National Forest, Blacksburg, VA.

Federal Energy Regulatory Commission. 2013a. Upland erosion control, revegetation, and maintenance plan. Washington, DC. Available from: https://www.ferc.gov/industries/gas/enviro/plan.pdf

McCormick, M.K., D.F. Whigham, and J.P. O'Neill. 2015. Restore the federally threatened small whorled pogonia (*Isotria medeoloides*) in three National Park Service regions. Report to the U.S. National Park Service, Washington, DC.

Mountain Valley Pipeline, LLC. 2016. Exotic and invasive species control plan. Docket No. CP16-10-000. Report to Federal Energy Regulatory Commission, Office of Energy Projects, Washington, DC.

Mountain Valley Pipeline, LLC. 2017. Restoration and rehabilitation plan. Docket No. CP16-10-000. Report to Federal Energy Regulatory Commission, Office of Energy Projects,

Washington, DC.

VASP
N/A

RLP
Brooks, S.S. and A.J. Boulton. 1991. Recolonization dynamics of benthic macroinvertebrates after artificial and natural disturbances in an Australian temporary stream. Australian Journal of Marine and Freshwater Research 42:295-308.

Environmental Solutions & Innovations, Inc. 2017. Hydrologic analysis of sedimentation, Mountain Valley Pipeline, Jefferson National Forest, Eastern Divide Ranger District. Report to the U.S. Department of Agriculture, Forest Service, Jefferson National Forest, Blacksburg, VA.

Federal Energy Regulatory Commission. 2013a. Upland erosion control, revegetation, and maintenance plan. Washington, DC. Available from: https://www.ferc.gov/industries/gas/enviro/plan.pdf

Federal Energy Regulatory Commission. 2017b. Biological Assessment for Mountain Valley Pipeline, LLC, Mountain Valley Pipeline Project. Docket No. CP16-10-000. Office of Energy Projects, Washington, DC.

Matthaei, C.D. and C.R. Townsend. 2000. Long-term effects of local disturbance history on mobile stream invertebrates. Oecologia 125:119-126.

Matthews, W.J. and J.T. Styron, Jr. 1978. Comparative tolerance of head water and mainstream fishes for abrupt changes in pH, dissolved oxygen, and temperature. Virginia Journal of Science 29:65.

Mountain Valley Pipeline, LLC. 2017. Restoration and rehabilitation plan. Docket No. CP16-10-000. Report to Federal Energy Regulatory Commission, Office of Energy Projects, Washington, DC.

Ibat
Barclay, R.M.R. and A. Kurta. 2007. Ecology and behavior of bats roosting in tree cavities and under bark. Pages 17-59 in Bats in forests: conservation and management. (M.J. Lacki, J.P. Hayes, and A. Kurta, eds.). Johns Hopkins University Press, Baltimore, MD.

Belwood J.J. 2002. Endangered bats in suburbia: observations and concerns for the future. pp.193-198. In The Indiana bat: biology and management of an endangered species (A. Kurta and J. Kennedy, eds.). Bat Conservation International, Austin, TX.

Callahan, E.V. 1993. Indiana bat summer habitat requirements. M.S. Thesis, University of Missouri, Columbia, MO.

Gardner, J.E., J.D. Garner, and J.E. Hofmann. 1991. Summary of *Myotis sodalis* summer habitat studies in Illinois: with recommendations for impact assessment. Report to Indiana/Gray bat Recovery Team Meeting, Columbia, MO.

Humphrey, S.R., A.R. Richter, and J.B. Cope. 1977. Summer habitat and ecology of the endangered Indiana bat, *Myotis sodalis*. Journal of Mammalogy 58:334-346.

Jachowski, D.S., J.B. Johnson, C.A. Dobony, J.W. Edwards, W.M. Ford. 2014. Space use and resource selection by foraging Indiana bats at the northern edge of their distribution. Endangered Species Research 24(2):149.

Kniowski, A.B. and S.D. Gehrt. 2014. Home range and habitat selection of the Indiana bat in an agricultural landscape. Journal of Wildlife Management 78(3):503-512.

Kurta, A., J. Kath, E.L. Smith, R. Foster, M.W. Orick, and R. Ross. 1993. A maternity roost of the endangered Indiana bat (*Myotis sodalis*) in an unshaded, hollow, sycamore tree (*Platanus occidentalis*). American Midland Naturalist 130:405-407.

Menzel, J.M., W.M. Ford, M.A. Menzel, T.C. Carter, J.E. Gardner, J.D. Garner, and J.E. Hofmann. 2005. Summer habitat use and home-range analysis of the endangered Indiana bat. Journal of Wildlife Management 69(1):430-436.

Murray, S.W. and A. Kurta. 2004. Nocturnal activity of the endangered Indiana bat (*Myotis sodalis*). Journal of Zoology 262:197-206.

Romme, R.C., K. Tyrell, and V. Brack, Jr. 1995. Literature summary and habitat suitability index model: components of summer habitat for the Indiana bat, *Myotis sodalis*. Report to Indiana Department of Natural Resources, Division of Wildlife, Bloomington, Indiana by 3D/Environmental, Cincinnati, OH.

Sparks, D.W., C.M. Ritzi, J.E. Duchamp, and J.O. Whitaker, Jr. 2005. Foraging habitat of the Indiana bat, (*Myotis sodalis*) at an urban-rural interface. Journal of Mammalogy 86:713-718.

U.S. Fish and Wildlife Service. 2007. Indiana bat (*Myotis sodalis*) draft recovery plan: first revision. Midwest Regional Office, Fort Snelling, MN. 258 pp.

Watrous, K.S., T.M. Donovan, R.M. Mickey, S.R. Darling, A.C. Hicks, and S.L. VonOettingen. 2006. Predicting minimum habitat characteristics for the Indiana bat in the Champlain Valley. Journal of Wildlife Management 70(5):1228-1237.

NLEB

Lacki, M.J., D.R. Cox, L.E. Dodd, and M.B. Dickinson. 2009. Response of northern bats (*Myotis septentrionalis*) to prescribed fires in eastern Kentucky forests. Journal of Mammalogy 90(5):1165-1175.

Owen, S.F., M.A. Menzel, W.M. Ford, B.R. Chapman, K.V. Miller, J.W. Edwards, and P.B. Wood. 2003. Home-range size and habitat used by the Northern Myotis (*Myotis septentrionalis*). American Midland Naturalist 150(2):352-359.

Analysis for Jeopardy

SWP

Federal Energy Regulatory Commission. 2013a. Upland erosion control, revegetation, and maintenance plan. Washington, DC. Available from: https://www.ferc.gov/industries/gas/enviro/plan.pdf

Mountain Valley Pipeline, LLC. 2016. Exotic and invasive species control plan. Docket No. CP16-10-000. Report to Federal Energy Regulatory Commission, Office of Energy Projects, Washington, DC.

Mountain Valley Pipeline, LLC. 2017. Restoration and rehabilitation plan. Docket No. CP16-10-000. Report to Federal Energy Regulatory Commission, Office of Energy Projects, Washington, DC.

U.S. Fish and Wildlife Service. 1992. Small whorled pogonia (*Isotria medeoloides*) recovery plan, first revision. Northeast Regional Office, Newton Corner, MA.

U.S. Fish and Wildlife Service. 2008. Small whorled pogonia (*Isotria medeoloides*) 5-year review: summary and evaluation. New England Field Office, Concord, NH.

VASP

N/A

RLP

Federal Energy Regulatory Commission. 2017b. Biological Assessment for Mountain Valley Pipeline, LLC, Mountain Valley Pipeline Project. Docket No. CP16-10-000. Office of Energy Projects, Washington, DC.

Robertson, M.J., D.A. Scruton, R.S. Gregory, and K.D. Clarke. 2006. Effect of suspended sediment on freshwater fish and fish habitat. Canadian Technical Report of Fisheries and Aquatic Sciences 2644.

Ibat

N/A

NLEB

N/A

Appendix A.

CONSULTATION HISTORY

10-13-14	The Service received an introductory letter from Mountain Valley regarding MVP.
11-10-14	Mountain Valley met with the Service in Elkins, WV, to formally introduce MVP.
04-03-15	VAFO provided formal comments on MVP.
04-17-15	The Service received FERC's Notice of Intent to prepare an EIS for MVP.
06-28-15	The Service received FERC's Notice of Schedule for Environmental Review of MVP.
09-09-15	VAFO met with Mountain Valley, ESI, and VDGIF regarding the overall project scope and consultation to date.
09-10-15	WVFO met with Mountain Valley regarding the overall project scope and consultation to date.
10-23-15	The Service received notification from FERC that Mountain Valley filed its certificate application and received the EIS schedule.
11-13-15	Mountain Valley submitted official notification of intent to initiate formal consultation to the Service.
11-23-15	WVFO met with Mountain Valley to discuss the BA.
02-18-16	Mountain Valley submitted the draft BA to the Service.
03-08-16	VAFO submitted a letter to ESI providing recommendations for MVP and surveys in VA.
04-07-16	The Service met with Mountain Valley and ESI to discuss the draft BA.
04-07-16	WVFO provided comments to Mountain Valley on the draft BA.
04-20-16	ESI submitted a letter to VAFO responding to the Service's March 8, 2016 letter.
06-24-16	Mountain Valley submitted the updated BA to the Service.
09-16-16	The Service received FERC's Notice of Availability of the Draft EIS for the proposed MVP.
09-28-16	The Service received FERC's Draft EIS.

10-25-16	Mountain Valley submitted the updated BA to the Service.
12-08-16	The Service met with Mountain Valley and ESI to discuss the BA.
01-18-17	The Service provided comments on the draft BA.
03-14-17	Mountain Valley submitted the draft BA to FERC and the Service.
03-23-17	Mountain Valley, ESI, the Service, and The Nature Conservancy met to discuss Mountain Valley's mitigation model, summary of revisions in the BA, and updates to the Migratory Bird Conservation Plan.
03-31-17	The Service received FERC's Notice of Revised Schedule for Environmental Review of MVP.
04-10-17	The Service received FERC's Administrative Draft FEIS.
05-16-17	The Service received Mountain Valley's final Migratory Bird Conservation Plan.
05-18-17	Mountain Valley filed responses to comments received on the BA.
06-23-17	The Service received FERC's Notice of Availability of the FEIS for MVP.
06-28-17	VAFO, Mountain Valley, and ESI met to discuss Mountain Valley's voluntary conservation measures and MVP schedule.
07-05-17	The Service received FERC's FEIS for MVP.
07-10-17	FERC submitted the BA to the Service and requested initiation of formal consultation.
07-20-17	The Service, WVDNR, Mountain Valley, and ESI met to discuss Mountain Valley's voluntary conservation measures, remaining plant surveys, and MVP schedule.
07-27-17	The Service received Supplemental Information to the BA from Mountain Valley.
08-04-17	The Service submitted a letter to FERC initiating formal consultation.
09-05-17	The Service received Mountain Valley's Upland Forest Impact Assessment and Voluntary Mitigation Plan.
09-08-17	The Service sent a letter to FERC regarding Mountain Valley's final Migratory Bird Conservation Plan.

11-08-17 The Service received a letter from Mountain Valley providing avoidance and minimization measures for small whorled pogonia and Virginia spiraea.

Appendix B. Species-Specific Effects Tables.

Tables 1-5 are color coded as follows:

- NE rows are light green
- NLAA rows are light yellow
- LAA are light red

Table 1. Analysis of effects on small whorled pogonia.

Project Activity	Subactivity	Environmental Impact or Threat	Stressor	Stressor Pathway (optional)	Exposure (Resource Affected)	Range of Response	Conservation Need Affected	Demographic Consequences	NE, NLAA, or LAA	Comments
New Disturbance - Construction	Vehicle Operation and Foot Traffic	physical impacts to individuals, habitat degradation	crushing, competition, collection, chemical contaminants	introduction of invasive species, poaching, exposure to chemicals from surface water runoff	habitat, population, individuals	injury, death	reproduction, nutrition, habitat	numbers, reproduction	LAA	This subactivity will crush and possibly kill SWP stems in the construction ROW. For SWP downslope of the construction ROW, AMMs (e.g., Upland Erosion Control, Revegetation, and Maintenance Plan [FERC 2013a], Exotic and Invasive Species Control Plan [Mountain Valley 2016], Restoration and Rehabilitation Plan [Mountain Valley 2017]) are anticipated to reduce exposure to chemicals and competition from invasive plants due to vehicle operation. Cleared ROW may increase chances of poaching and attract ORV traffic due to increased ease of public access, causing collection, crushing, and death. However, AMM of installing barriers such as signs, fences, gates, vegetation, or boulders along the construction ROW to discourage use of ORVs on ROW to avoid illegal access will minimize ORV effects such that it is NLAA. We anticipate that a portion of SWP stems will be crushed in the construction ROW.
New Disturbance - Construction	Clearing - herbaceous vegetation and ground cover	physical impacts to individuals, habitat degradation	crushing, soil compaction, altered hydrology, changes to evapotranspiration rates and soil moisture, downslope erosion, sedimentation, burial, competition	removal of vegetation, erosion, spread of herbaceous and invasive plant species	habitat, population, individuals	injury, death	reproduction, nutrition, habitat	numbers, reproduction	LAA	This subactivity will crush, remove, and kill SWP stems in the construction ROW. SWP downslope of the construction ROW will be affected by this subactivity. Soil compaction and removal of vegetation in the upslope drainage area will increase surface water flow and downslope erosion rates and alter surface and subsurface hydrology in the watershed, causing changes in evapotranspiration rates and soil moisture in SWP habitat downslope of the construction ROW. These stressors are will affect both the mycorrhizal fungi relied on by SWP and individual SWP, decreasing fitness and reproductive success and possibly killing individual plants. This subactivity will also redistribute and loosen soils, which will cause sedimentation downslope towards the SWP. Depending on the degree of surface water runoff and sedimentation, SWP habitat are anticipated to be degraded and individual stems will be buried. AMMs (e.g., Upland Erosion Control, Revegetation, and Maintenance Plan [FERC 2013a], Restoration and Rehabilitation Plan [Mountain Valley 2017]) are anticipated to reduce surface water runoff and sedimentation, on average 79% sediment containment, but not to insignificant levels (ESI 2017). Methods described in the Exotic and Invasive Species Control Plan (Mountain Valley 2016) will minimize impacts due to invasive species. We anticipate that a portion of SWP stems will be killed in the construction ROW and a few SWP stems downslope of the construction ROW will have decreased fitness and reproductive success.
New Disturbance - Construction	Clearing - trees and shrubs	physical impacts to individuals, habitat degradation	crushing, changes to sunlight regime, soil compaction, altered hydrology, increased soil temperature, changes to evapotranspiration rates and soil moisture, downslope erosion, sedimentation, burial, competition	removal of over- and mid-story vegetation, erosion, spread of herbaceous and invasive plant species	habitat, population, individuals	injury, death	reproduction, nutrition, habitat	numbers, reproduction	LAA	This subactivity will crush and kill SWP stems in the construction ROW. SWP downslope of the construction ROW will be affected by this subactivity. Soil compaction and removal of vegetation in the upslope drainage area will increase surface water flow and downslope erosion rates and alter surface and subsurface hydrology in the watershed, causing changes in evapotranspiration rates and soil moisture in SWP habitat downslope of the construction ROW. These stressors will affect both the mycorrhizal fungi relied on by SWP and individual SWP, decreasing fitness and reproductive success and possibly killing individual plants. This subactivity will also redistribute and loosen soils, which will cause sedimentation downslope towards the SWP. Depending on the degree of surface water runoff and sedimentation, SWP habitat are anticipated to be degraded and individual stems will be buried. AMMs (e.g., Upland Erosion Control, Revegetation, and Maintenance Plan [FERC 2013a], Restoration and Rehabilitation Plan [Mountain Valley 2017]) are anticipated to reduce surface water runoff and sedimentation, on average 79% sediment containment, but not to insignificant levels (ESI 2017). Removal of mid- and over-story trees will also increase direct and ambient light in the areas adjacent to the construction ROW, which may increase SWP flowering and population size, but beyond an unknown threshold, is anticipated to degrade the SWP habitat by increasing soil temperature, drying soils, and changing evapotranspiration rates, thereby affecting SWP as described above. Methods described in the Exotic and Invasive Species Control Plan (Mountain Valley 2016) will minimize impacts due to invasive species in the construction ROW, but not address herbaceous and invasive vegetation growing outside of construction ROW and near SWP stems due to increased light. Invasive species will compete with SWP for light, space, and nutrients, causing decreased fitness and reproductive success and possibly death of individual SWP. In the Restoration and Rehabilitation Plan (Mountain Valley 2017), Mountain Valley proposes to apply woody seed mixes to the temporary construction ROW. Approximately 25-35 years after seed application, canopy trees (e.g., eastern white pine [*Pinus strobus*]) are expected to provide some mid-story shade (Burns et al. 1990), which would contribute to partially restoring the SWP habitat. Mountain Valley has committed to baseline (e.g., before and during construction) and 10 years of post-construction monitoring, conducted annually, to assess SWP colony status and potential threats to continued success (M. Stahl, EQT, letter to J. Stanhope, Service, November 8, 2017). Monitoring assessments before, during, and post-construction will include measurements of light, soil moisture, and temperature. We anticipate that a portion of SWP stems will be killed in the construction ROW and a few SWP stems downslope of the construction ROW will have decreased fitness and reproductive success.
New Disturbance - Construction	Vegetation Disposal (upland) - dragging, chipping, hauling, piling, stacking	physical impacts to individuals, habitat degradation	competition, crushing	spread of herbaceous and invasive plant species	NA	NA	NA	NA	NLAA	This subactivity will occur in the construction ROW, which has already been disturbed by previous activities and no longer provides suitable habitat for SWP. For SWP downslope of the construction ROW, chipped brush will not be blown off of the construction ROW into environmentally sensitive areas (FERC 2017a). Methods described in the Exotic and Invasive Species Control Plan (Mountain Valley 2016) will minimize impacts due to invasive species.
New Disturbance - Construction	Vegetation Disposal (upland) - brush pile burning	neutral	none	NA	NA	NA	NA	NA	NE	This subactivity will occur in the construction ROW, which has already been disturbed by previous activities and no longer provides suitable habitat for SWP.
New Disturbance - Construction	Vegetation Clearing - tree side trimming by bucket truck or helicopter	physical impacts to individuals, habitat degradation	changes to sunlight regime, increased soil temperature, changes to evapotranspiration rates and soil moisture, competition	trimming of over- and mid-story vegetation, spread of herbaceous and invasive plant species	habitat, population, individuals	injury, death	reproduction, nutrition, habitat	numbers, reproduction	LAA	This subactivity will occur in the construction ROW, which has already been disturbed by previous activities and no longer provides suitable habitat for SWP. Trimming of mid- and over-story trees will increase direct and ambient light in the areas adjacent to the construction ROW, which may increase SWP flowering and population size of the SWP downslope of the construction ROW. Beyond an unknown threshold, an increase in direct and ambient light is anticipated to degrade SWP habitat by increasing soil temperature, drying soils, and changing evapotranspiration rates, causing decreased fitness and reproductive success and possibly death of individual SWP. Methods described in the Exotic and Invasive Species Control Plan (Mountain Valley 2016) will minimize impacts due to invasive species in the construction ROW, but not address herbaceous and invasive vegetation growing outside of construction ROW and near SWP stems due to increased light. Invasive species will compete with SWP for light, space, and nutrients, causing decreased fitness and reproductive success and possibly death of individual SWP. We anticipate that a few SWP stems downslope of the construction ROW will have decreased fitness and reproductive success.
New Disturbance - Construction	Grading, erosion control devices	physical impacts to individuals, habitat degradation	crushing, soil compaction, altered hydrology, changes to soil moisture, downslope erosion, sedimentation, burial	erosion	habitat, population, individuals	injury, death	reproduction, nutrition, habitat	numbers, reproduction	LAA	This subactivity will occur in the construction ROW, which has already been disturbed by previous activities and no longer provides suitable habitat for SWP. SWP downslope of the construction ROW will be affected by this subactivity. Soil compaction and ground disturbance in the upslope drainage area will increase surface water flow and downslope erosion rates and alter surface and subsurface hydrology in the watershed, causing changes in evapotranspiration rates and soil moisture in SWP habitat downslope of the construction ROW. These stressors will affect both the mycorrhizal fungi relied on by SWP and individual SWP, decreasing fitness and reproductive success and possibly killing individual plants. This subactivity will also redistribute and loosen soils, which will cause sedimentation downslope towards the SWP. Depending on the degree of surface water runoff and sedimentation, SWP habitat are anticipated to be degraded and individual stems will be buried. AMMs (e.g., Upland Erosion Control, Revegetation, and Maintenance Plan [FERC 2013a], Restoration and Rehabilitation Plan [Mountain Valley 2017]) are anticipated to reduce surface water runoff and sedimentation, on average 79% sediment containment, but not to insignificant levels (ESI 2017). We anticipate that a few SWP stems downslope of the construction ROW will have decreased fitness and reproductive success.
New Disturbance - Construction	Trenching (digging, blasting, dewatering, open trench, sedimentation)	physical impacts to individuals, habitat degradation	crushing, altered hydrology, changes to soil moisture, downslope erosion, sedimentation, burial	erosion, movement of soil and larger material (e.g. boulders) when blasting	habitat, population, individuals	injury, death	reproduction, nutrition, habitat	numbers, reproduction	LAA	This subactivity will occur in the construction ROW, which has already been disturbed by previous activities and no longer provides suitable habitat for SWP. SWP downslope of the construction ROW will be affected by this subactivity. Ground disturbance in the upslope drainage area will increase surface water flow and downslope erosion rates and alter surface and subsurface hydrology in the watershed, causing changes in evapotranspiration rates and soil moisture in SWP habitat downslope of the construction ROW. These stressors will affect both the mycorrhizal fungi relied on by SWP and individual SWP, decreasing fitness and reproductive success and possibly killing individual plants. This subactivity will also redistribute and loosen soils, which will cause sedimentation downslope towards the SWP. Depending on the degree of surface water runoff and sedimentation, SWP habitat is anticipated to be degraded and individual stems will be buried. AMMs (e.g., Upland Erosion Control, Revegetation, and Maintenance Plan [FERC 2013a], Restoration and Rehabilitation Plan [Mountain Valley 2017]) are anticipated to reduce surface water runoff and sedimentation, on average 79% sediment containment, but not to insignificant levels (ESI 2017). Blasting will also loosen large rocks, which are anticipated to fall and crush SWP. We anticipate that a few SWP stems downslope of the construction ROW will have decreased fitness and reproductive success and/or will be killed.
New Disturbance - Construction	Pipe Stringing - bending, welding, coating, padding and backfilling	neutral	none	NA	NA	NA	NA	NA	NE	This subactivity will occur in the construction ROW, which has already been disturbed by previous activities and no longer provides suitable habitat for SWP.
New Disturbance - Construction	Hydrostatic Testing (water withdrawal and discharge)	neutral	none	NA	NA	NA	NA	NA	NE	Subactivity not proposed near the SWP colony.

Table 1. Analysis of effects on small whorled pogonia.

Project Activity	Subactivity	Environmental Impact or Threat	Stressor	Stressor Pathway (optional)	Exposure (Resource Affected)	Range of Response	Conservation Need Affected	Demographic Consequences	NE, NLAA, or LAA	Comments
New Disturbance - Construction	Regrading and Stabilization - restoration of corridor	physical impacts to individuals, habitat degradation	soil compaction, altered hydrology, changes to soil moisture, downslope erosion, sedimentation, burial, competition, increased nutrients, chemical contaminants	regrading, erosion, spread of herbaceous and invasive plant species, exposure to nutrients from surface water runoff (fertilizers, decomposed vegetation), exposure to chemicals from surface water runoff and wind	habitat, population, individuals	injury, death	reproduction, nutrition, habitat	numbers, reproduction	LAA	This subactivity will occur in the construction ROW, which has already been disturbed by previous activities and no longer provides suitable habitat for SWP. SWP downslope of the construction ROW will be affected by this subactivity. Ground disturbance in the upslope drainage area will increase surface water flow and downslope erosion rates and alter surface and subsurface hydrology in the watershed, causing changes in evapotranspiration rates and soil moisture in SWP habitat downslope of the construction ROW. These stressors will affect both the mycorrhizal fungi relied on by SWP and individual SWP, decreasing fitness and reproductive success and possibly killing individual plants. This subactivity will also redistribute and loosen soils, which will cause sedimentation downslope towards the SWP. Depending on the degree of surface water runoff and sedimentation, SWP habitat is anticipated to be degraded and individual stems will be buried. AMMs (e.g., Upland Erosion Control, Revegetation, and Maintenance Plan [FERC 2013a], Restoration and Rehabilitation Plan [Mountain Valley 2017]) are anticipated to minimize soil compaction and reduce surface water runoff and sedimentation, on average 79% sediment containment, but not to insignificant levels (ESI 2017). Methods described in the Exotic and Invasive Species Control Plan (Mountain Valley 2016) will minimize impacts due to invasive species; herbicides will not be used, except on a local scale based on requests from landowners or land management agencies. In addition, herbicide use will be restricted within 100 ft of SWP. We anticipate that a few SWP stems downslope of the construction ROW will have decreased fitness and reproductive success.
New Disturbance - Construction	Facilities - noise, lights	neutral	none	NA	NA	NA	NA	NA	NE	Facilities not proposed near the SWP colony.
New Disturbance - Construction	Access Roads - upgrading existing roads, new roads temp and permanent - grading, graveling	neutral	none	NA	NA	NA	NA	NA	NE	No temporary or permanent access roads proposed near SWP colony.
New Disturbance - Construction	Access Roads - upgrading existing roads, new roads temp and permanent - culvert installation	neutral	none	NA	NA	NA	NA	NA	NE	No temporary or permanent access roads proposed near SWP colony.
New Disturbance - Construction	Access Roads - upgrading existing roads, new roads temp and permanent - tree trimming and tree removal	neutral	none	NA	NA	NA	NA	NA	NE	No temporary or permanent access roads proposed near SWP colony.
New Disturbance - Construction	Stream Crossings, flume	neutral	none	NA	NA	NA	NA	NA	NE	SWP is not an aquatic species and not found in streams and wetland areas.
New Disturbance - Construction	Stream Crossings, dam & pump	neutral	none	NA	NA	NA	NA	NA	NE	SWP is not an aquatic species and not found in streams and wetland areas.
New Disturbance - Construction	Stream Crossings, cofferdam	neutral	none	NA	NA	NA	NA	NA	NE	SWP is not an aquatic species and not found in streams and wetland areas.
New Disturbance - Construction	Stream Equipment Crossing Structures	neutral	none	NA	NA	NA	NA	NA	NE	SWP is not an aquatic species and not found in streams and wetland areas.
New Disturbance - Construction	Crossings, wetlands and other water bodies (non- riparian) - clearing	neutral	none	NA	NA	NA	NA	NA	NE	Subactivity not proposed near the SWP colony.
New Disturbance - Construction	Crossings, wetlands and other water bodies (non- riparian) - tree side trimming	neutral	none	NA	NA	NA	NA	NA	NE	Subactivity not proposed near the SWP colony.
New Disturbance - Construction	Crossings, wetlands and other water bodies (non- riparian) - grading, trenching, regrading	neutral	none	NA	NA	NA	NA	NA	NE	Subactivity not proposed near the SWP colony.
New Disturbance - Construction	Crossings, wetlands and other water bodies (non- riparian) - pipe stringing	neutral	none	NA	NA	NA	NA	NA	NE	Subactivity not proposed near the SWP colony.
Operation & Maintenance	Facilities - vehicles, foot traffic, noise	neutral	none	NA	NA	NA	NA	NA	NE	Facilities not proposed near the SWP colony.
Operation & Maintenance	Vegetation Management - mowing	physical impacts to individuals, habitat degradation	soil compaction, altered hydrology, changes to evapotranspiration rates and soil moisture, downslope erosion, burial, competition	removal of vegetation, spread of herbaceous and invasive plant species	habitat, population, individuals	injury, death	reproduction, nutrition, habitat	numbers, reproduction	LAA	This subactivity will occur in the permanent ROW, which has already been disturbed by previous activities and no longer provides suitable habitat for SWP. We do not anticipate SWP re-establishing and growing in the permanent ROW post-construction due to removal of both trees and mycorrhizal fungi that require host trees (e.g., oaks [*Quercus* spp.], hickories [*Carya* spp.] and beech [*Fagus grandifolia*]) (McCormick et al. 2015). SWP depend on mycorrhizal fungi for nutrition, growth, and survival. SWP downslope of the permanent ROW will be affected by this subactivity. Soil compaction and removal of vegetation in the upslope drainage area will increase surface water flow and downslope erosion rates and alter surface and subsurface hydrology in the watershed, causing changes in evapotranspiration rates and soil moisture in SWP habitat downslope of the permanent ROW. These stressors will affect both the mycorrhizal fungi relied on by SWP and individual SWP, decreasing fitness and reproductive success and possibly killing individual plants. Methods described in the Exotic and Invasive Species Control Plan will minimize impacts due to invasive species; Mountain Valley will monitor the construction ROW annually after the first and second growing seasons following construction to allow for early detection of exotic or invasive species infestations or outbreaks (Mountain Valley 2016). We anticipate that a few SWP stems downslope of the permanent ROW will have decreased fitness and reproductive success.
Operation & Maintenance	Vegetation Management - chainsaw, tree clearing, tree side trimming	physical impacts to individuals, habitat degradation	changes to sunlight regime, soil compaction, altered hydrology, increased soil temperature, changes to evapotranspiration rates and soil moisture, downslope erosion, burial, competition	removal of over- and mid-story vegetation, spread of herbaceous and invasive plant species	habitat, population, individuals	injury, death	reproduction, nutrition, habitat	numbers, reproduction	LAA	This subactivity will occur in the permanent ROW, which has already been disturbed by previous activities and no longer provides suitable habitat for SWP. We do not anticipate SWP re-establishing and growing in the permanent ROW post-construction due to removal of both trees and mycorrhizal fungi. SWP downslope of the permanent ROW will be affected by this subactivity. Soil compaction and removal of vegetation in the upslope drainage area will increase surface water flow and downslope erosion rates and alter surface and subsurface hydrology in the watershed, causing changes in evapotranspiration rates and soil moisture in SWP habitat downslope of the permanent ROW. These stressors will affect both the mycorrhizal fungi relied on by SWP and individual SWP, decreasing fitness and reproductive success and possibly killing individual plants. This subactivity will also redistribute and loosen soils, which will cause sedimentation downslope towards the SWP. Depending on the degree of surface water runoff and sedimentation, SWP habitat is anticipated to be degraded and individual stems will be buried. AMMs (e.g., Upland Erosion Control, Revegetation, and Maintenance Plan [FERC 2013a], Restoration and Rehabilitation Plan [Mountain Valley 2017]) are anticipated to reduce surface water runoff and sedimentation, on average 79% sediment containment, but not to insignificant levels (ESI 2017). Removal of mid- and over-story trees will also increase direct and ambient light, which may increase SWP flowering and population size, but beyond an unknown threshold, is anticipated to degrade the SWP habitat by increasing soil temperature, drying soils, and changing evapotranspiration rates, causing decreased fitness and reproductive success and possibly death of individual SWP. Methods described in the Exotic and Invasive Species Control Plan (Mountain Valley 2016) will minimize impacts due to invasive species in the construction ROW, but not address herbaceous and invasive vegetation growing outside of the construction ROW and near the SWP stems due to the increased light. Invasive species will compete with SWP for light, space, and nutrients, causing decreased fitness and reproductive success and possibly death of individual SWP. Mountain Valley has committed to baseline (e.g., before and during construction) and 10 years of post-construction monitoring, conducted annually, to assess SWP colony status and potential threats to continued success (M. Stahl, EQT, letter to J. Stanhope, Service, November 8, 2017). Monitoring assessments before, during, and post-construction will include measurements of light, soil moisture, and temperature. We anticipate that a few SWP stems downslope of the permanent ROW will have decreased fitness and reproductive success.
Operation & Maintenance	Vegetation Management - herbicides - hand, vehicle mounted, aerial applications	physical impacts to individuals, habitat alteration	chemical contaminants	exposure to chemicals from surface water runoff and wind	NA	NA	NA	NA	NLAA	This subactivity will occur in the permanent ROW, which has already been disturbed by previous activities and no longer provides suitable habitat for SWP. We do not anticipate SWP re-establishing and growing in the permanent ROW post-construction due to removal of both trees and mycorrhizal fungi. For SWP downslope of the permanent ROW, herbicides will not be used, except on a local scale based on requests from landowners or land management agencies (Mountain Valley 2016, FERC 2017a). Selective treatments such as removal by manual or mechanical treatment will be used to remove invasive or noxious species. If herbicides are applied, its use will be restricted within 100 ft of SWP.
Operation & Maintenance	Vegetation Disposal (upland) - dragging, chipping, hauling, piling, stacking	habitat degradation	competition	spread of herbaceous and invasive plant species	NA	NA	NA	NA	NLAA	This subactivity will occur in the permanent ROW, which has already been disturbed by previous activities and no longer provides suitable habitat for SWP. We do not anticipate SWP re-establishing and growing in the permanent ROW post-construction due to removal of both trees and mycorrhizal fungi. For SWP downslope of the permanent ROW, methods described in the Exotic and Invasive Species Control Plan (Mountain Valley 2016) will minimize impacts due to invasive species.
Operation & Maintenance	Vegetation Disposal (upland) - brush pile burning	neutral	none	NA	NA	NA	NA	NA	NE	This subactivity will occur in the permanent ROW, which has already been disturbed by previous activities and no longer provides suitable habitat for SWP.

Table 1. Analysis of effects on small whorled pogonia.

Project Activity	Subactivity	Environmental Impact or Threat	Stressor	Stressor Pathway (optional)	Exposure (Resource Affected)	Range of Response	Conservation Need Affected	Demographic Consequences	NE, NLAA, or LAA	Comments
Operation & Maintenance	ROW repair, regrading, revegetation (upland) - hand, mechanical	physical impacts to individuals, habitat degradation	soil compaction, altered hydrology, changes to soil moisture, downslope erosion, burial, sedimentation	regrading, erosion	habitat, population, individuals	injury, death	reproduction, nutrition, habitat	numbers, reproduction	LAA	This subactivity will occur in the permanent ROW, which has already been disturbed by previous activities and no longer provides suitable habitat for SWP. We do not anticipate SWP re-establishing and growing in the permanent ROW post-construction due to removal of both trees and mycorrhizal fungi. SWP downslope of the permanent ROW will be affected by this subactivity. Soil compaction, ground disturbance, and vegetation removal in the upslope drainage area will increase surface water flow and downslope erosion rates and alter surface and subsurface hydrology in the watershed, causing changes in evapotranspiration rates and soil moisture in SWP habitat downslope of the permanent ROW. These stressors will affect both the mycorrhizal fungi relied on by SWP and individual SWP, decreasing fitness and reproductive success and possibly killing individual plants. This subactivity will also redistribute and loosen soils, which will cause sedimentation downslope towards the SWP. Depending on the degree of surface water runoff and sedimentation, SWP habitat is anticipated to be degraded and individual stems will be buried. AMMs (e.g., Upland Erosion Control, Revegetation, and Maintenance Plan [FERC 2013a], Restoration and Rehabilitation Plan [Mountain Valley 2017]) are anticipated to reduce surface water runoff and sedimentation, on average 79% sediment containment, but not to insignificant levels (ESI 2017). We anticipate that a few SWP stems downslope of the permanent ROW will have decreased fitness and reproductive success.
Operation & Maintenance	ROW repair, regrading, revegetation (wetland) - hand, mechanical	neutral	none	NA	NA	NA	NA	NA	NE	SWP is not an aquatic species and not found in streams and wetland areas.
Operation & Maintenance	ROW repair, regrading, revegetation - instream stabilization and/or fill	neutral	none	NA	NA	NA	NA	NA	NE	SWP is not an aquatic species and not found in streams and wetland areas.
Operation & Maintenance	Access Road Maintenance - grading, graveling	neutral	none	NA	NA	NA	NA	NA	NE	No temporary or permanent access roads proposed near SWP colony.
Operation & Maintenance	Access Road Maintenance - culvert replacement	neutral	none	NA	NA	NA	NA	NA	NE	No temporary or permanent access roads proposed near SWP colony.
Operation & Maintenance	General Appurtenance and Cathodic Protection Construction - Off ROW Clearing	neutral	none	NA	NA	NA	NA	NA	NE	Subactivity not proposed near the SWP colony.
Operation & Maintenance	General Appurtenance and Cathodic Protection Construction - trenching, anode, bell hole	neutral	none	NA	NA	NA	NA	NA	NE	Subactivity not proposed near the SWP colony.
Operation & Maintenance	Inspection Activities - ground and aerial	neutral	none	NA	NA	NA	NA	NA	NE	This subactivity will occur in the permanent ROW, which has already been disturbed by previous activities and no longer provides suitable habitat for SWP.

Table 2. Analysis of effects on Virginia spiraea.

Project Activity	Subactivity	Environmental Impact or Threat	Stressor	Stressor Pathway (optional)	Exposure (Resource Affected)	Range of Response	Conservation Need Affected	Demographic Consequences	NE, NLAA, or LAA	Comments
New Disturbance - Construction	Vehicle Operation and Foot Traffic	physical impacts to individuals, habitat alteration and/or degradation	crushing, soil compaction	vehicles	habitat, population, individuals	injury, death	reproduction, nutrition, habitat	numbers, reproduction	LAA	This subactivity will crush and possibly kill VASP plants and bury seeds in the construction ROW and ATWS. These activities will alter/degrade suitable habitat (changing hydrology, compacting soil, sedimentation), preventing reestablishment of VASP in the construction ROW and ATWS. AMMs (e.g., Upland Erosion Control, Revegetation, and Maintenance Plan [FERC 2013a], Exotic and Invasive Species Control Plan [Mountain Valley 2016], Restoration and Rehabilitation Plan [Mountain Valley 2017]) are anticipated to reduce exposure from sedimentation and invasive plants due to vehicle operation. We anticipate that a portion of VASP stems will be crushed and VASP seeds will be buried in the construction ROW and ATWS.
New Disturbance - Construction	Clearing - herbaceous vegetation and ground cover	physical impacts to individuals, habitat alteration and/or degradation	burying, soil compaction, introduction of invasive species, cutting, digging up, and crushing	NA	habitat, population, individuals	injury, death	reproduction, nutrition, habitat	numbers, reproduction	LAA	This subactivity will cut, dig up, bury, and/or crush VASP plants and seeds in the construction ROW and ATWS. These activities will alter/degrade suitable habitat (compacting soil, introducing invasive species, changing hydrology, sedimentation) preventing reestablishment of VASP in the construction ROW and ATWS post-construction. AMMs (e.g., Upland Erosion Control, Revegetation, and Maintenance Plan [FERC 2013a], Restoration and Rehabilitation Plan [Mountain Valley 2017]) are anticipated to reduce surface water runoff and sedimentation, on average 79% sediment containment (ESI 2017). Methods described in the Exotic and Invasive Species Control Plan (Mountain Valley 2016) will minimize impacts due to invasive species. We anticipate that a portion of VASP stems will be killed and VASP seeds will be buried in the construction ROW and ATWS.
New Disturbance - Construction	Clearing - trees and shrubs	physical impacts to individuals, habitat alteration and/or degradation	crushing, burying, digging up, cutting	NA	habitat, population, individuals	injury, death	reproduction, nutrition, habitat	numbers, reproduction	LAA	This subactivity will cut, dig up, bury, and/or crush VASP plants and seeds within the construction ROW and ATWS. These activities will alter/degrade suitable habitat (compacting soil, introducing invasive species, changing hydrology, sedimentation) preventing reestablishment of VASP in the construction ROW and ATWS post-construction. AMMs (e.g., Upland Erosion Control, Revegetation, and Maintenance Plan [FERC 2013a], Restoration and Rehabilitation Plan [Mountain Valley 2017]) are anticipated to reduce surface water runoff and sedimentation, on average 79% sediment containment (ESI 2017). We anticipate that a portion of VASP stems will be killed and VASP seeds will be buried in the construction ROW and ATWS.
New Disturbance - Construction	Vegetation Disposal (upland) - dragging, chipping, hauling, piling, stacking	neutral	none	NA	NA	NA	NA	NA	NE	VASP is a riparian/wetland species and is not found in upland areas. No impacts to riparian/wetland habitats are anticipated from this subactivity
New Disturbance - Construction	Vegetation Disposal (upland) - brush pile burning	neutral	none	NA	NA	NA	NA	NA	NE	VASP is a riparian/wetland species and is not found in upland areas. No impacts to riparian/wetland habitats are anticipated from this subactivity
New Disturbance - Construction	Vegetation Clearing - tree side trimming by bucket truck or helicopter	habitat alteration and/or degradation	altered sunlight	NA	NA	discountable - beneficial	NA	NA	NLAA	This subactivity will occur in the construction ROW and ATWS. Methods described in the Exotic and Invasive Species Control Plan (Mountain Valley 2016) will minimize impacts due to invasive species. VASP is not a shade tolerant species; overtopping from arboreal species will eventually eliminate VASP. Effects from side trimming along the ROW will range from discountable to beneficial over an extended period of time.

Table 2. Analysis of effects on Virginia spiraea.

Project Activity	Subactivity	Environmental Impact or Threat	Stressor	Stressor Pathway (optional)	Exposure (Resource Affected)	Range of Response	Conservation Need Affected	Demographic Consequences	NE, NLAA, or LAA	Comments
New Disturbance - Construction	Grading, erosion control devices	physical impacts to individuals, habitat alteration and/or degradation, temporary loss of habitat	crushing, burying, cutting roots	NA	NA	NA	NA	NA	NLAA	This subactivity will occur in the construction ROW and ATWS. Soil compaction and ground disturbance will increase surface water flow and erosion rates and alter surface and subsurface hydrology in the watershed, further degrading VASP habitat. AMMs (e.g., Upland Erosion Control, Revegetation, and Maintenance Plan [FERC 2013a], Restoration and Rehabilitation Plan [Mountain Valley 2017]) are anticipated to reduce surface water runoff and sedimentation, on average 79% sediment containment (ESI 2017). We anticipate no adverse effects.
New Disturbance - Construction	Trenching (digging, blasting, dewatering, open trench, sedimentation)	physical impacts to individuals, habitat alteration and/or degradation, temporary loss of habitat	crushing, burying, cutting roots	NA	NA	NA	NA	NA	NLAA	This subactivity will occur in the construction ROW. Digging, blasting, dewatering, open trench, and sedimentation will increase surface water flow and erosion rates and alter surface and subsurface hydrology in the watershed, further degrading VASP habitat. AMMs (e.g., Upland Erosion Control, Revegetation, and Maintenance Plan [FERC 2013a], Restoration and Rehabilitation Plan [Mountain Valley 2017]) are anticipated to reduce surface water runoff and sedimentation, on average 79% sediment containment (ESI 2017). We anticipate no adverse effects.
New Disturbance - Construction	Pipe Stringing - bending, welding, coating, padding and backfilling	neutral	none	NA	NA	NA	NA	NA	NE	This subactivity will occur in the construction ROW, which has already been disturbed by previous activities and no longer provides suitable habitat for VASP.
New Disturbance - Construction	Hydrostatic Testing (water withdrawal and discharge)	neutral	none	NA	NA	NA	NA	NA	NE	The water used during hydrostatic testing will be stored, if necessary, at the discharge location. The discharge location is on the other side of the river, in an upland area not suitable for VASP.
New Disturbance - Construction	Regrading and Stabilization - restoration of corridor	neutral	none	NA	NA	NA	NA	NA	NE	This subactivity will occur in the construction ROW, which has already been disturbed by previous activities and no longer provides suitable habitat for VASP.
New Disturbance - Construction	Facilities - noise, lights	neutral	none	NA	NA	NA	NA	NA	NE	Subactivity not proposed within VASP habitat.
New Disturbance - Construction	Access Roads - upgrading existing roads, new roads temp and permanent - grading, graveling	physical impacts to individuals, habitat alteration and/or degradation, temporary or permanent loss of habitat	crushing, changes in hydrology, contaminants, burying, digging up	NA	habitat, population, individuals	injury, death	reproduction, nutrition, habitat	numbers, reproduction	LAA	This subactivity will cut, dig up, bury, and/or crush VASP plants and seeds in the access road footprint. These activities will alter/degrade suitable habitat (compacting soil, introducing invasive species, changing hydrology, sedimentation) preventing reestablishment of VASP in the access road footprint post-construction. AMMs (e.g., Upland Erosion Control, Revegetation, and Maintenance Plan [FERC 2013a], Restoration and Rehabilitation Plan [Mountain Valley 2017]) are anticipated to reduce surface water runoff and sedimentation, on average 79% sediment containment (ESI 2017). Methods described in the Exotic and Invasive Species Control Plan (Mountain Valley 2016) will minimize impacts due to invasive species. We anticipate that a portion of VASP stems will be killed and VASP seeds will be buried in the access road footprint.
New Disturbance - Construction	Access Roads - upgrading existing roads, new roads temp and permanent - culvert installation	neutral	none	NA	NA	NA	NA	NA	NE	Subactivity not proposed within VASP habitat.

Table 2. Analysis of effects on Virginia spiraea.

Project Activity	Subactivity	Environmental Impact or Threat	Stressor	Stressor Pathway (optional)	Exposure (Resource Affected)	Range of Response	Conservation Need Affected	Demographic Consequences	NE, NLAA, or LAA	Comments
New Disturbance - Construction	Access Roads - upgrading existing roads, new roads temp and permanent- tree trimming and tree removal	habitat alteration and/or degradation	altered sunlight	NA	NA	discountable - beneficial	NA	NA	NLAA	This subactivity will occur along access roads. VASP is not a shade tolerant species; overtopping from arboreal species will eventually eliminate VASP. Effects from side trimming along access roads will range from discountable to beneficial over an extended period of time.
New Disturbance - Construction	Stream Crossings, flume	neutral	none	NA	NA	NA	NA	NA	NE	Subactivity not proposed within VASP habitat.
New Disturbance - Construction	Stream Crossings, dam & pump	neutral	none	NA	NA	NA	NA	NA	NE	Subactivity not proposed within VASP habitat.
New Disturbance - Construction	Stream Crossings, cofferdam	neutral	none	NA	NA	NA	NA	NA	NE	Subactivity not proposed within VASP habitat.
New Disturbance - Construction	Stream Equipment Crossing Structures	habitat alteration and/or degradation	sedimentation, soil compaction	NA	limited to some habitat, population, few to some individuals	injury, death	reproduction, nutrition, habitat	numbers, reproduction	LAA	This subactivity will alter/degrade suitable habitat (compacting soil, introducing invasive species, changing hydrology, sedimentation) preventing reestablishment of VASP in the access road footprint and ATWS post-construction. AMMs (e.g., Upland Erosion Control, Revegetation, and Maintenance Plan [FERC 2013a], Restoration and Rehabilitation Plan [Mountain Valley 2017]) are anticipated to reduce surface water runoff and sedimentation, on average 79% sediment containment (ESI 2017). Methods described in the Exotic and Invasive Species Control Plan (Mountain Valley 2016) will minimize impacts due to invasive species. We anticipate that a portion of VASP stems will be killed and VASP seeds will be buried in the access road footprint and ATWS.
New Disturbance - Construction	Crossings, wetlands and other water bodies (non- riparian) - clearing	physical impacts to individuals, habitat alteration and/or degradation	burying, soil compaction, introduction of invasive species, cutting and crushing	NA	habitat, population, individuals	injury, death	reproduction, nutrition, habitat	numbers, reproduction	LAA	This subactivity will alter/degrade suitable habitat (compacting soil, introducing invasive species, changing hydrology, sedimentation) preventing reestablishment of VASP in the construction ROW, access road footprint, and ATWS post-construction. AMMs (e.g., Upland Erosion Control, Revegetation, and Maintenance Plan [FERC 2013a], Restoration and Rehabilitation Plan [Mountain Valley 2017]) are anticipated to reduce surface water runoff and sedimentation, on average 79% sediment containment (ESI 2017). Methods described in the Exotic and Invasive Species Control Plan (Mountain Valley 2016) will minimize impacts due to invasive species. We anticipate that any remaining VASP stems will be killed and VASP seeds will be buried in the construction ROW, access road footprint, and ATWS.
New Disturbance - Construction	Crossings, wetlands and other water bodies (non- riparian) - tree side trimming	habitat alteration and/or degradation	none	NA	NA	NA	NA	NA	NE	This subactivity will occur in the construction ROW, access road footprint, and ATWS, which have already been disturbed by previous activities and no longer provide suitable habitat for VASP.
New Disturbance - Construction	Crossings, wetlands and other water bodies (non- riparian) - grading, trenching, regrading	physical impacts to individuals, habitat alteration and/or degradation	none	NA	NA	NA	NA	NA	NE	This subactivity will occur in the construction ROW, access road footprint, and ATWS which have already been disturbed by previous activities and no longer provide suitable habitat for VASP.
New Disturbance - Construction	Crossings, wetlands and other water bodies (non- riparian) - pipe stringing	neutral	none	NA	NA	NA	NA	NA	NE	This subactivity will occur in the construction ROW, which has already been disturbed by previous activities and no longer provides suitable habitat for VASP.
Operation & Maintenance	Facilities - vehicles, foot traffic, noise	neutral	none	NA	NA	NA	NA	NA	NE	Subactivity not proposed within VASP habitat.

Table 2. Analysis of effects on Virginia spiraea.

Project Activity	Subactivity	Environmental Impact or Threat	Stressor	Stressor Pathway (optional)	Exposure (Resource Affected)	Range of Response	Conservation Need Affected	Demographic Consequences	NE, NLAA, or LAA	Comments
Operation & Maintenance	Vegetation Management - mowing	physical impact to individuals	none	NA	NA	NA	NA	NA	NE	This subactivity will occur in the permanent ROW, which has already been disturbed by previous activities and no longer provides suitable habitat for VASP. We do not anticipate VASP re-establishing and growing in the permanent ROW post-construction due to removal of plants, seed, and alteration/removal of habitat.
Operation & Maintenance	Vegetation Management - chainsaw, tree clearing, tree side trimming	neutral	none	NA	NA	NA	NA	NA	NE	Subactivity not proposed within VASP habitat.
Operation & Maintenance	Vegetation Management - herbicides - hand, vehicle mounted, aerial applications	neutral	none	NA	NA	NA	NA	NA	NE	Subactivity not proposed within VASP habitat.
Operation & Maintenance	Vegetation Disposal (upland) - dragging, chipping, hauling, piling, stacking	neutral	none	NA	NA	NA	NA	NA	NE	VASP is a riparian/wetland species and is not found in upland areas. No impacts to riparian/wetland habitats are anticipated from this subactivity.
Operation & Maintenance	Vegetation Disposal (upland) - brush pile burning	neutral	none	NA	NA	NA	NA	NA	NE	VASP is a riparian/wetland species and is not found in upland areas. No impacts to riparian/wetland habitats are anticipated from this subactivity.
Operation & Maintenance	ROW repair, regrading, revegetation (upland) - hand, mechanical	physical impacts to individuals, habitat alteration and/or degradation	none	NA	NA	NA	NA	NA	NE	VASP is a riparian/wetland species and is not found in upland areas. No impacts to riparian/wetland habitats are anticipated from this subactivity.
Operation & Maintenance	ROW repair, regrading, revegetation (wetland) - hand, mechanical	physical impacts to individuals, habitat alteration and/or degradation, temporary or permanent loss of habitat	none	NA	NA	NA	NA	NA	NE	This subactivity will occur in the permanent ROW, which has already been disturbed by previous activities and no longer provides suitable habitat for VASP. We do not anticipate VASP re-establishing and growing in the permanent ROW post-construction due to removal of plants, seed, and alteration/removal of habitat.
Operation & Maintenance	ROW repair, regrading, revegetation - instream stabilization and/or fill	physical impacts to individuals, habitat alteration and/or degradation, temporary or permanent loss of habitat	none	NA	NA	NA	NA	NA	NE	This subactivity will occur in the permanent ROW, which has already been disturbed by previous activities and no longer provides suitable habitat for VASP. We do not anticipate VASP re-establishing and growing in the permanent ROW post-construction due to removal of plants, seed, and alteration/removal of habitat.
Operation & Maintenance	Access Road Maintenance - grading, graveling	neutral	none	NA	NA	NA	NA	NA	NE	This subactivity will occur along access roads, which has already been disturbed by previous activities and no longer provides suitable habitat for VASP.
Operation & Maintenance	Access Road Maintenance - culvert replacement	neutral	none	NA	NA	NA	NA	NA	NE	This subactivity will occur along access roads, which has already been disturbed by previous activities and no longer provides suitable habitat for VASP.
Operation & Maintenance	General Appurtenance and Cathodic Protection Construction - Off ROW Clearing	neutral	none	NA	NA	NA	NA	NA	NE	VASP is a riparian/wetland species and is not found in upland areas. No impacts to riparian/wetland habitats are anticipated from this subactivity
Operation & Maintenance	General Appurtenance and Cathodic Protection Construction - trenching, anode, bell hole	neutral	none	NA	NA	NA	NA	NA	NE	VASP is a riparian/wetland species and is not found in upland areas. No impacts to riparian/wetland habitats are anticipated from this subactivity
Operation & Maintenance	Inspection Activities - ground and aerial	neutral	none	NA	NA	NA	NA	NA	NE	Subactivity not proposed within VASP habitat.

Table 3. Analysis of effects on Roanoke logperch.

Pipeline Activity	Subactivity	Environmental Impact or Threat	Stressor	Stressor Pathway (optional)	Exposure (Resource Affected)	Range of Response	Conservation Need Affected	Demographic Consequences	NE, NLAA, or LAA	Comments
New Disturbance - Construction	Vehicle Operation and Foot Traffic	Neutral	None	NA	NA	NA	NA	NA	NE	No impacts to stream habitats are anticipated from this action. Will not introduce sediment or contaminants into the streams or rivers.
New Disturbance - Construction	Clearing - herbaceous vegetation and ground cover	Habitat degradation and water quality degradation, Stress on individuals, Reduction in prey population	Sedimentation, Increase in Water Temperatures, Decrease of dissolved oxygen	denuding bank, grubbing with heavy equipment, disturbing soil, water quality degradation since vegetation no longer provides stormwater filter or shade to stream	Habitat, Population, Individuals	Harass, Harm, Kill	Breeding, Feeding, Sheltering	Numbers, reproduction, distribution	LAA	Mountain Valley will implement AMMs to minimize sedimentation (e.g. The Upland Erosion Control, Revegetation, and Maintenance Plan [FERC 2013a] and Restoration and Rehabilitation Plan [Mountain Valley.2017] outline the use of erosion control measures and restoration of graded areas) but not to insignificant levels. Increased sedimentation and high turbidity areas will be unusable to RLP for foraging in the immediate vicinity of the crossing. Increased sedimentation is anticipated to result in a loss of prey items and/or an ability to see the prey. We expect RLP to move to areas with cleaner substrate/less turbid water to allow for foraging. Loss of streambank vegetation is expected to result in increased water temperatures and changes in light regime in small areas. Changes in water temperature and light regime may affect the RLP prey base and make the habitat less suitable for RLP. We expect all RLP will move from cleared areas to areas with vegetative cover. Removal of vegetative cover is permanent along a 10 ft corridor and we do not expect RLP to return to these areas. No instream work will occur at RLP crossing from March 15 – June 30.
New Disturbance - Construction	Clearing - trees and shrubs	Habitat degradation and water quality degradation, Stress on individuals, Reduction in prey population	Sedimentation, Increase in Water Temperatures, Decrease of dissolved oxygen	denuding bank, grubbing with heavy equipment, disturbing soil, water quality degradation since vegetation no longer provides shade to stream	Habitat, Population, Individuals	Harass, Harm, Kill	Breeding, Feeding, Sheltering	Numbers, reproduction, distribution	LAA	Increased sedimentation and high turbidity areas will be unusable to RLP for foraging in the immediate vicinity of the crossing. Increased sedimentation is anticipated to result in a loss of prey items and/or an ability to see the prey. We expect RLP to move to areas with cleaner substrate/less turbid water to allow for foraging. Loss of streambank vegetation is expected to result in increased water temperatures and changes in light regime in small areas. Changes in water temperature and light regime may affect the RLP prey base and make the habitat less suitable for RLP. We expect all RLP will move from cleared areas to areas with vegetative cover. Removal of vegetative cover is permanent along a 10 ft corridor and we do not expect RLP to return to these areas. No instream work will occur at RLP crossing from March 15 – June 30.
New Disturbance - Construction	Vegetation Disposal (upland) - dragging, chipping, hauling, piling, stacking	Neutral	None	NA	NA	NA	NA	NA	NE	No impacts to stream habitats are anticipated from this action. Will not introduce sediment or contaminants into the streams or rivers.
New Disturbance - Construction	Vegetation Disposal (upland) - brush pile burning	Neutral	None	NA	NA	NA	NA	NA	NE	No impacts to stream habitats are anticipated from this action. Will not introduce sediment or contaminants into the streams or rivers.
New Disturbance - Construction	Vegetation Clearing - tree side trimming by bucket truck or helicopter	Habitat degradation and water quality degradation, Stress on eggs	Increase in Water Temperatures, Decrease of dissolved oxygen	habitat and water quality degradation since vegetation no longer provides shade to stream	NA	NA	NA	NA	NLAA	Temperature increases from vegetation removal will be slight. The construction ROW at waterbody crossings is narrowed to 75 ft to minimize clearing of trees and riparian vegetation. Post construction, a 10 ft wide ROW will be maintained, which will further lessen impacts from vegetation removal. Therefore, effects from this habitat change are expected to be insignificant.
New Disturbance - Construction	Grading, erosion control devices	Temporary loss of habitat, Habitat degradation, Physical impacts to individuals, Reduction of prey population	Sedimentation	Stormwater erosion	NA	NA	NA	NA	NLAA	We do not anticipate this subactivity will generate a large amount of sediment and AMMs will minimize sedimentation (e.g., The Upland Erosion Control, Revegetation, and Maintenance Plan [FERC 2013a] and Restoration and Rehabilitation Plan [Mountain Valley 2017] outline the use of erosion control measures and restoration of graded areas). Therefore, effects from this habitat change are expected to be insignificant.
New Disturbance - Construction	Trenching (digging, blasting, dewatering, open trench, sedimentation)	Temporary loss of habitat, Water quality degradation, Physical impacts, Reduction of prey population	Sedimentation, Short-term altered flow, Contaminants	near, in-stream, and tributary earth disturbance may result in increased sedimentation, altered flow result in increased sedimentation and short-term impoundment, contaminant spills from equipment located in- stream and tributary, noise from in water work	NA	NA	NA	NA	NLAA	This subactivity occurs behind cofferdams and impacts to RLP from the placement and removal of cofferdams are discussed below. Effects from any noise generated from activity behind the cofferdam are expected to be insignificant. If blasting is necessary it will be conducted once the area has been isolated and RLP have been relocated; therefore we expect effects from blasting to be discountable.

Table 3. Analysis of effects on Roanoke logperch.

Pipeline Activity	Subactivity	Environmental Impact or Threat	Stressor	Stressor Pathway (optional)	Exposure (Resource Affected)	Range of Response	Conservation Need Affected	Demographic Consequences	NE, NLAA, or LAA	Comments
New Disturbance - Construction	Pipe Stringing - bending, welding, coating, padding and backfilling	Temporary loss of habitat, Water quality degradation, Physical impacts, Reduction of prey population	Sedimentation, Short-term altered flow, Contaminants	near, in-stream, and tributary earth disturbance may result in increased sedimentation, altered flow result in increased sedimentation and short-term impoundment, contaminant spills from equipment located in- stream and tributary, noise from in water work	NA	NA	NA	NA	NLAA	This subactivity occurs after the stream crossing has been isolated behind cofferdams and impacts to RLP from the placement and removal of cofferdams are discussed below. Effects from any sediment that may leak through the cofferdam or noise generated from behind the cofferdam are expected to be insignificant.
New Disturbance - Construction	Hydrostatic Testing (water withdrawal and discharge)	Temporary loss of habitat, Habitat degradation	Minor sedimentation, Altered flow	Withdrawal and discharge of water	NA	NA	NA	NA	NLAA	Municipal water sources will be used for this subactivity. Discharge water will be discharged through sediment filters in vegetated uplands away from waterbodies and wetlands. Therefore, we expect any effects to be discountable.
New Disturbance - Construction	Regrading and Stabilization - restoration of corridor	Permanent or temporary loss of habitat, Habitat degradation, Water quality degradation, Physical impacts to individuals, Reduction of prey	Minor sedimentation, Loss of prey, Contaminants	tributary and/or near stream earth disturbance can cause minor increase in sedimentation , Stormwater runoff, fertilizers used in revegetation can cause algae blooms which will lower dissolved oxygen,	NA	NA	NA	NA	NLAA	This subactivity occurs behind cofferdams and impacts to RLP from the placement and removal of cofferdams are discussed below. Effects from any noise generated from behind the cofferdam are expected to be insignificant.
New Disturbance - Construction	Facilities - noise, lights	Neutral	None	NA	NA	NA	NA	NA	NE	No impacts to stream habitats are anticipated from this action. Will not introduce sediment or contaminants into the streams or rivers.
New Disturbance - Construction	Access Roads - upgrading existing roads, new roads temp and permanent - grading, graveling	Temporary loss of habitat, Water quality degradation, Physical impacts, Reduction of prey population	Sedimentation, Short-term altered flow, Contaminants, Loss of prey, Disruption of spawning, Crushing or removal of eggs	near, in-stream, and tributary earth disturbance may result in increased sedimentation, altered flow result in increased sedimentation and short-term impoundment, contaminant spills from equipment located in- stream and tributary, noise from in water work	NA	NA	NA	NA	NLAA	AR crossings will be spanned or existing crossing will be used. Effects from any instream impacts are expected to be discountable. Mountain Valley will implement a TOYR March 15 - June 30.
New Disturbance - Construction	Access Roads - upgrading existing roads, new roads temp and permanent - culvert installation	Permanent or temporary loss of habitat, Habitat degradation, Physical impacts to individuals, Reduction of prey population	Sedimentation, Contaminants, Altered flow.	tributary and instream earth disturbance can cause increase in sedimentation and turbidity, Equipment located in stream or tributary can increase chance of spills, altered flow velocities and temporary impoundment from in-water work, minor noise from construction activities in water. water work, minor	NA	NA	NA	NA	NE	This is not proposed at RLP crossings.

Table 3. Analysis of effects on Roanoke logperch.

Pipeline Activity	Subactivity	Environmental Impact or Threat	Stressor	Stressor Pathway (optional)	Exposure (Resource Affected)	Range of Response	Conservation Need Affected	Demographic Consequences	NE, NLAA, or LAA	Comments
New Disturbance - Construction	Access Roads - upgrading existing roads, new roads temp and permanent - tree trimming and tree removal	Habitat degradation and water quality degradation, Stress on individuals, Reduction in prey population	Sedimentation, Increase in Water Temperatures, Decrease of dissolved oxygen	denuding bank, grubbing with heavy equipment, disturbing soil, water quality degradation since vegetation no longer provides shade to stream	Habitat, Population, Individuals	Harass, Harm, Kill	Breeding, Feeding, Sheltering	Numbers, reproduction, distribution	LAA	Loss of streambank vegetation is expected to result in increased water temperatures and changes in light regime in small areas. Changes in water temperature and light regime may affect the RLP prey base and make the habitat less suitable for the RLP. We expect all RLP will move from areas where tree trimming and tree removal occurs to areas with vegetative cover. Removal of vegetative cover is permanent along a 10 ft corridor and we do not expect RLP to return to these areas. No instream work will occur at RLP crossing from March 15 – June 30.
New Disturbance - Construction	Stream Crossings, flume	Permanent or temporary loss of habitat, Habitat degradation, Physical impacts to individuals, Reduction of prey population	Sedimentation, Contaminants, Altered flow	tributary and instream earth disturbance can cause increase in sedimentation and turbidity, Equipment located in stream or tributary can increase chance of spills, altered flow velocities and temporary impoundment from in-water work, minor noise from construction activities in water. water work, minor	NA	NA	NA	NA	NLAA	This subactivity occurs behind cofferdams and impacts to RLP from the placement and removal of cofferdams are discussed below. Effects from any noise generated from behind the cofferdam are expected to be insignificant. Any RLP upstream not relocated in the removal/relocation efforts might be entrained when water is channeled through the flume; however this is extremely unlikely to occur. No instream work will occur at RLP crossing from March 15 – June 30.
New Disturbance - Construction	Stream Crossings, dam & pump	Temporary loss of occupied habitat, Physical impacts to individuals, Habitat degradation and water quality degradation, reduction of prey population	Sedimentation, Altered flow, Contaminants, Impoundment	tributary and near stream earth disturbance may result in increased sedimentation altered flow may result in increased sedimentation, contaminant spills from equipment located in tributary stream, dam could restrict up/down stream movement of species, noise from in water work	Habitat, Population, Individuals	Harass, Harm, Kill	Breeding, Feeding, Sheltering	Numbers, reproduction, distribution	LAA	Prior to instream disturbance (e.g., cofferdam installation, dewatering areas, instream construction activities, dam structures) fish from the instream disturbance area will be removed and released a minimum of 50 ft (15.24 m) downstream. Fish depletion surveys will be conducted within the isolated area once dam structures are in place. Relocating RLP will minimize direct impacts. This portion of the action will be conducted by individuals with state permits and thus no additional effects analysis is required. If RLP upstream are not relocated in the removal/relocation efforts we anticipate they will be entrained when the stream is diverted by pumping around the crossing. Dam structure placement and removal will result in the temporary loss of instream habitat and will create a sediment plume that will increase sediment/turbidity downstream. Increased sedimentation is anticipated to result in a loss of prey items and/or an ability to see the prey. We expect RLP to move to areas with cleaner substrate until the dam structures are removed and turbidity returns to baseline levels. Effects from any sediment that may leak through the dam structures are expected to be insignificant. No instream work will occur at RLP crossing from March 15 – June 30.
New Disturbance - Construction	Stream Crossings, cofferdam	Temporary loss of occupied habitat, Physical impacts to individuals, Habitat degradation and water quality degradation, Reduction of prey population	Sedimentation, altered flow, contaminants, impoundment, noise	tributary and near stream earth disturbance may result in increased sedimentation altered flow may result in increased sedimentation, contaminant spills from equipment located in tributary stream, dam could restrict up/down stream movement of species, noise from in water work	Habitat, Population, Individuals	Harass, Harm, Kill	Breeding, Feeding, Sheltering	Numbers, reproduction, distribution	LAA	Prior to instream disturbance (e.g., cofferdam installation, dewatering areas, instream construction activities including blasting) fish from the instream disturbance area will be removed and released a minimum of 50 ft (15.24 m) downstream. Fish depletion surveys will be conducted within the isolated area once cofferdams are in place. Relocating RLP will minimize direct impacts. This portion of the action will be conducted by individuals with state permits and thus no additional effects analysis is required. If RLP upstream are not relocated in the removal/relocation efforts we anticipate they will be entrained when cofferdams are dewatered. Cofferdam placement and removal will result in the temporary loss of instream habitat and will create a sediment plume that will increase sediment/turbidity downstream. Increased sedimentation is anticipated to result in a loss of prey items and/or an ability to see the prey. We expect RLP to move to areas with cleaner substrate until the instream structures are removed and turbidity returns to baseline levels. Effects from any sediment that may leak through the cofferdam structures are expected to be insignificant. No instream work will occur at RLP crossing from March 15 – June 30
New Disturbance - Construction	Stream Equipment Crossing Structures	Permanent or temporary loss of habitat, Habitat degradation, Physical impacts to individuals, Reduction of prey population	Sedimentation, Contaminants, Altered flow, Noise	tributary and in stream earth disturbance can cause increase in sedimentation and turbidity , Equipment located in stream or tributary can increase chance of spills, altered flow velocities and temporary impoundment from in- water work, minor noise from construction activities in water.	NA	NA	NA	NA	NE	This is not proposed at RLP crossings.
New Disturbance - Construction	Crossings, wetlands and other water bodies (non-riparian) - clearing	Neutral	None	NA	NA	NA	NA	NA	NE	Subactivity is not located in streams or rivers. In addition, if non-riparian then activity will not be adjacent to occupied habitat.
New Disturbance - Construction	Crossings, wetlands and other water bodies (non-riparian) - tree side trimming	Neutral	None	NA	NA	NA	NA	NA	NE	Subactivity is not located in streams or rivers. In addition, if non-riparian then activity will not be adjacent to occupied habitat.

Table 3. Analysis of effects on Roanoke logperch.

Pipeline Activity	Subactivity	Environmental Impact or Threat	Stressor	Stressor Pathway (optional)	Exposure (Resource Affected)	Range of Response	Conservation Need Affected	Demographic Consequences	NE, NLAA, or LAA	Comments
New Disturbance - Construction	Crossings, wetlands and other water bodies (non-riparian) - grading, trenching, regrading	Neutral	None	NA	NA	NA	NA	NA	NE	Subactivity is not located in streams or rivers. In addition, if non-riparian then activity will not be adjacent to occupied habitat.
New Disturbance - Construction	Crossings, wetlands and other water bodies (non-riparian) - pipe stringing	Neutral	None	NA	NA	NA	NA	NA	NE	Subactivity is not located in streams or rivers. In addition, if non-riparian then activity will not be adjacent to occupied habitat.
Operation & Maintenance	Facilities - vehicles, foot traffic, noise	Habitat degradation, Water quality degradation	Sedimentation, Contaminants	Stormwater runoff from pollution generating pavement, Stormwater erosion	NA	NA	NA	NA	NLAA	Subactivity is not located in streams or rivers.
Operation & Maintenance	Vegetation Management - mowing	Neutral	None	NA	NA	NA	NA	NA	NE	No impacts to stream habitats are anticipated from this action. Will not introduce sediment or contaminants into the streams or rivers.
Operation & Maintenance	Vegetation Management - chainsaw, tree clearing, tree side trimming	Habitat degradation and water quality degradation, Stress on individuals, Reduction in prey population	Sedimentation, Increase in Water Temperatures, Decrease of dissolved oxygen	denuding bank, grubbing with heavy equipment, disturbing soil, water quality degradation since vegetation no longer provides shade to stream	NA	NA	NA	NA	NLAA	Post construction, a 10 ft wide ROW will be maintained, which will further lessen impacts from vegetation removal. Effects from this habitat change are expected to be insignificant.
Operation & Maintenance	Vegetation Management - herbicides - hand, vehicle mounted, aerial applications	Habitat degradation and water quality degradation, Stress on individuals, Reduction in prey population	Chemical Contaminants	direct exposure to chemicals from spills and stormwater runoff	NA	NA	NA	NA	NLAA	Herbicides use will be on a local scale after a request from the landowner or land management agencies. Effects from this subactivity are expected to be insignificant.
Operation & Maintenance	Vegetation Disposal (upland) - dragging, chipping, hauling, piling, stacking	Neutral	None	NA	NA	NA	NA	NA	NE	No impacts to stream habitats are anticipated from this action.
Operation & Maintenance	Vegetation Disposal (upland) - brush pile burning	Neutral	None	NA	NA	NA	NA	NA	NE	No impacts to stream habitats are anticipated from this action.
Operation & Maintenance	ROW repair, regrading, revegetation (upland) - hand, mechanical	Habitat degradation, Water quality degradation	Minor sedimentation, Lowered dissolved oxygen, Contaminants	tributary and/or near stream earth disturbance can cause minor increase in sedimentation , Stormwater runoff, fertilizers used in revegetation can cause algae blooms which will lower dissolved oxygen	NA	NA	NA	NA	NLAA	We do not anticipate this subactivity will generate a large amount of sediment and AMMs will minimize sedimentation (e.g., The Upland Erosion Control, Revegetation, and Maintenance Plan [FERC 2013a] and Restoration and Rehabilitation Plan [Mountain Valley 2017] outline the use of erosion control measures and restoration of graded areas). Therefore, effects from this habitat change are expected to be insignificant.
Operation & Maintenance	ROW repair, regrading, revegetation (wetland) - hand, mechanical	Permanent or temporary loss of habitat, Habitat degradation, Water quality degradation, Physical impacts to individuals, Reduction of prey	Minor sedimentation, Lowered dissolved oxygen, Contaminants	tributary and/or near stream earth disturbance can cause minor increase in sedimentation , Stormwater runoff, fertilizers used in revegetation can cause algae blooms which will lower dissolved oxygen, Equipment located in connected wetland can increase chance of spills	NA	NA	NA	NA	NLAA	AMMs will minimize contaminant spill (e.g., Spill Prevention, Control, and Countermeasure Plan) and sedimentation (e.g., The Upland Erosion Control, Revegetation, and Maintenance Plan [FERC 2013a] and Restoration and Rehabilitation Plan [Mountain Valley 2017] outline the use of erosion control measures and restoration of graded areas) impacts, we do not anticipate this subactivity will generate a large amount of sediment. Therefore, effects from this habitat change are expected to be insignificant.
Operation & Maintenance	ROW repair, regrading, revegetation - instream stabilization and/or fill	Permanent or temporary loss of habitat, Habitat degradation, Water quality degradation, Physical impacts to individuals, Reduction of prey	Sedimentation, Contaminants, Altered flow	tributary and in stream earth disturbance can cause increase in sedimentation and turbidity , Equipment located in stream or tributary can increase chance of spills, altered flow velocities and temporary impoundment from in- water work	NA	NA	NA	NA	NLAA	Seeding and planting native bare-root seedlings (shrubs and tree saplings) at RLP crossing will facilitate riparian stabilization and restoration. Seeding will occur promptly after construction is complete; if ground conditions delay restoration, a Winter Construction Plan will be implemented. Therefore, effects from this habitat change are expected to be insignificant.
Operation & Maintenance	Access Road Maintenance - grading, graveling	Temporary loss of habitat, Habitat degradation, Physical impacts to individuals, Reduction of prey population	Sedimentation	tributary and in stream earth disturbance can cause increase in sedimentation	NA	NA	NA	NA	NLAA	Vegetation maintenance will be limited in the 50 ft adjacent to waterbodies, minimizing ground and vegetation disturbance. AMMs (e.g., the Upland Erosion Control, Revegetation, and Maintenance Plan [FERC 2013a], Restoration and Rehabilitation Plan [Mountain Valley 2017]) outline the use of erosion control measures and restoration of graded areas, we do not anticipate this subactivity will generate a large amount of sediment. Therefore, effects from this habitat change are expected to be insignificant.

Table 3. Analysis of effects on Roanoke logperch.

Pipeline Activity	Subactivity	Environmental Impact or Threat	Stressor	Stressor Pathway (optional)	Exposure (Resource Affected)	Range of Response	Conservation Need Affected	Demographic Consequences	NE, NLAA, or LAA	Comments
Operation & Maintenance	Access Road Maintenance - culvert replacement	Permanent or temporary loss of habitat, Habitat degradation, Physical impacts to individuals, Reduction of prey population	Sedimentation, Contaminants, Altered flow	tributary and in stream earth disturbance can cause increase in sedimentation and turbidity , Equipment located in stream or tributary can increase chance of spills, altered flow velocities and temporary impoundment from in- water work, minor noise from construction activities in water.	NA	NA	NA	NA	NE	Culvert placement will not occur at RLP crossings.
Operation & Maintenance	General Appurtenance and Cathodic Protection Construction - Off ROW Clearing	Habitat degradation and water quality degradation, Stress on individuals, Reduction in prey population	Sedimentation, Increase in Water Temperatures, Decrease of dissolved oxygen	denuding bank, grubbing with heavy equipment, disturbing soil, water quality degradation since vegetation no longer provides shade to stream	NA	NA	NA	NA	NE	No impacts to RLP stream habitats are anticipated from this action. Will not introduce sediment or contaminants into the streams or rivers.
Operation & Maintenance	General Appurtenance and Cathodic Protection Construction - trenching, anode, bell hole	Temporary loss of habitat, Water quality degradation, Physical impacts, Reduction of prey population	Sedimentation, Short-term altered flow, Contaminants	near, in-stream, and tributary earth disturbance may result in increased sedimentation, altered flow result in increased sedimentation and short-term impoundment, contaminant spills from equipment located in- stream and tributary, noise from in water work	Habitat, Population, Individuals	Harass, Harm, Kill	Breeding, Feeding, Sheltering	Numbers, reproduction, distribution	LAA	Trenching will increase sedimentation. Increased sedimentation is anticipated to result in a loss of prey items and/or an ability to see the prey. We expect RLP to move to areas with cleaner substrate until the turbidity returns to baseline levels.
Operation & Maintenance	Inspection Activities - ground and aerial	Neutral	None	NA	NA	NA	NA	NA	NE	No impacts to stream habitats are anticipated from this action. Will not introduce sediment or contaminants into the streams or rivers.

Table 4. Analysis of effects on Indiana bat.

Pipeline Activity	Subactivity	Environmental Impact or Threat	Stressor	Stressor Pathway (optional)	Exposure (Resource Affected)	Range of Response	Conservation Need Affected	Demographic Consequences	NE, NLAA, or LAA	Comments
New Disturbance - Construction	Vehicle Operation and Foot Traffic	Human activity and disturbance	daytime arousal	human presence	all life stages, spring-fall	NA	NA	NA	NLAA	Effects of noise from this activity are anticipated to be insignificant and not flush bats from adjacent roost trees.
New Disturbance - Construction	Clearing - herbaceous vegetation and ground cover	Vegetation removal, human activity, and disturbance	alteration of summer roosting/foraging habitat & staging/swarming habitat, daytime arousal	vegetation removal, human presence	all life stages, spring-fall	NA	NA	NA	NLAA	Effects of noise from this activity are anticipated to be insignificant and not flush bats from adjacent roost trees or disturb hibernating bats. Mowing herbaceous vegetation while bats are present in habitat is expected to effect the quality, quantity, and timing of prey resources; however, the effect on bats foraging is anticipated to be insignificant due to the small area of impact within a bat's ~2.5 mile home range.
New Disturbance - Construction	Clearing - trees and shrubs	Tree removal, loss or alteration of forested habitat, human disturbance	alteration of summer roosting/foraging habitat & staging/swarming habitat, daytime arousal	vegetation removal, human presence	all life stages, spring-fall	kill, injure, harm, harass	breeding, sheltering	numbers, reproduction	LAA	Tree removal during winter in known use and unknown use summer habitat will result in predation, reduced pregnancy success, and/or reduced pup survival for a small percentage of individual Ibats. These effects will be greatest the first season after tree removal has occurred. Tree removal in April, May, August, and September in unknown use summer habitat is expected to affect Ibats using undocumented occupied roosts and foraging areas. Most tree removal in unknown use summer habitat will occur during winter and trees will not be removed between June 1 and July 31 when young cannot fly. We anticipate a small percentage of individual Ibats present with unknown use summer habitat will be injured or killed (adults and volant young) from the felling of an undocumented occupied roost tree, will experience reduced pregnancy success and/or reduced pup survival associated with increased energy expenditure from the loss of foraging habitat, and injury or death as a result of predation. Tree removal in known use and unknown use spring staging/fall swarming habitat during winter will remove foraging and roosting areas for a concentrated number of Ibats in an abbreviated season (i.e., spring emergence or fall swarming). We do not anticipate Ibats will be present during tree removal activities in known use spring staging/fall swarming habitat and no impacts are anticipated to Ibats hibernacula or hibernating bats based on the protections included in the Karst Mitigation Plan provided in the FEIS (FERC 2017a) and the information provided in the Potentially Suitable Hibernacula within the Action Area table (M.D. Stahl, EQT, email to T. Lennon, J. Stanhope, and S. Hoskin, Service, November 9, 2017). Additionally, we do not anticipate impacts to Tawney's Cave based on hydrologic and geologic analysis (FERC 2017b). However, tree clearing will result in temporary or permanent habitat loss, which we expect will cause decreased breeding success and survival (of WNS affected bats) of a small percentage of individual Ibats. Tree removal in unknown use spring staging/fall swarming habitat during the active season will disrupt bats engaging in fall swarming, spring staging, and roosting behavior. A small percentage of individual Ibats present with unknown use spring staging/fall swarming habitat will be injured or killed (adults and volant young) from the felling of an undocumented occupied roost tree, will experience reduced pregnancy success and/or reduced pup survival associated with increased energy expenditure from the loss of foraging habitat, and injury or death as a result of predation.
New Disturbance - Construction	Vegetation Disposal (upland) - dragging, chipping, hauling, piling, stacking	Human activity and disturbance, obstructed hibernacula entrances or vents	loss or alteration of hibernation conditions, hibernacula no longer suitable, daytime arousal	alteration of water or air flow in/out of hibernacula, human presence	all life stages, all seasons	NA	NA	NA	NLAA	AMMs avoid potential impacts to hibernacula; effects from noise are anticipated to be insignificant and not flush bats from adjacent roost trees. We do not anticipate impacts to bats when they are hibernating based on the protections included in the Karst Mitigation Plan provided in the FEIS (FERC 2017a) and the information provided in the Potentially Suitable Hibernacula within the Action Area table (M.D. Stahl, EQT, email to T. Lennon, J. Stanhope, and S. Hoskin, Service, November 9, 2017). Additionally, we do not anticipate impacts to Tawney's cave based on hydrologic and geologic analysis (FERC 2017b).
New Disturbance - Construction	Vegetation Disposal (upland) - brush pile burning	Human activity and disturbance, smoke	alteration of hibernating conditions, daytime arousal	smoke, human presence & noise	all life stages, all seasons	NA	NA	NA	NLAA	When burning brush piles within 0.25 mile of known or presumed occupied hibernacula from August 15 - May 15, brush piles will be no larger than 25-ft by 25-ft, spaced at least 100-ft apart, and located at least 100-ft from hibernacula entrances and associated sinkholes, fissures, or other karst features. Effects to bats from this smoke in summer are anticipated to be insignificant. AMMs will prevent smoke from entering hibernacula in the winter. We do not anticipate effects to bats when they are hibernating based on the protections included in the Karst Mitigation Plan provided in the FEIS (FERC 2017a) and the information provided in the Potentially Suitable Hibernacula within the Action Area table (M.D. Stahl, EQT, email to T. Lennon, J. Stanhope, and S. Hoskin, Service, November 9, 2017). Additionally, we do not anticipate impacts to Tawney's Cave based on hydrologic and geologic analysis (FERC 2017b).
New Disturbance - Construction	Vegetation Clearing - tree side trimming by bucket truck or helicopter	Human activity and disturbance	daytime arousal	human presence & noise	all life stages, spring-fall	NA	NA	NA	NLAA	Tree removal, limb trimming, or pruning will be conducted between November 15 and March 31 to avoid disturbance to bats, except in cases of human safety. If the seasonal restriction cannot be met, a qualified bat biologist will investigate the trees for presence of bats to avoid adverse affects (coordination with the Service will occur prior to this effort). Therefore, effects from noise are anticipated to be insignificant and not flush bats from adjacent roost trees.
New Disturbance - Construction	Grading, erosion control devices	Alteration of water flow, vegetation removal, human activity	altered water flow & humidity in hibernacula	altered water flow	all life stages, all seasons	NA	NA	NA	NLAA	Effects from noise are anticipated to be insignificant and not flush bats from adjacent roost trees. AMMs will prevent discharge of a significant amount of water into the recharge area of known hibernacula. We anticipate effects to hibernating bats from flooding will be insignificant.
New Disturbance - Construction	Trenching (digging, blasting, dewatering, open trench, sedimentation)	Human activity, ground disturbance, instream and riparian disturbance, temporary dewatering	loss or alteration of hibernacula, decreased aquatic invertebrates, daytime arousal	loss or alteration of hibernacula, instream sedimentation & water flow disruption, human presence & noise	all life stages, all seasons	NA	NA	NA	NLAA	AMMs limit potential impacts to hibernacula by restricting blasting within 0.5 mile of hibernacula; MVP's NPDES permit (WV) and Project Specific Standards & Specifications Plan (VA) are expected to limit the loss of aquatic invertebrates. Therefore, we anticipate that any loss of Ibat forage will be minor and effects to Ibats will be insignificant. We do not anticipate impacts to bats when they are hibernating based on the protections included in the Karst Mitigation Plan provided in the FEIS (FERC 2017a) and the information provided in the Potentially Suitable Hibernacula within the Action Area table (M.D. Stahl, EQT, email to T. Lennon, J. Stanhope, and S. Hoskin, Service, November 9, 2017). Additionally, we do not anticipate impacts to Tawney's Cave based on hydrologic and geologic analysis (FERC 2017b).
New Disturbance - Construction	Pipe Stringing - bending, welding, coating, padding and backfilling	Human activity	daytime arousal	human presence & noise	all life stages, spring-fall	NA	NA	NA	NLAA	Effects from noise are anticipated to be insignificant and not flush bats from adjacent roost trees.

Table 4. Analysis of effects on Indiana bat.

Pipeline Activity	Subactivity	Environmental Impact or Threat	Stressor	Stressor Pathway (optional)	Exposure (Resource Affected)	Range of Response	Conservation Need Affected	Demographic Consequences	NE, NLAA, or LAA	Comments
New Disturbance - Construction	Hydrostatic Testing (water withdrawal and discharge)	Withdrawal/discharge of water into aquatic habitats, human activity	decreased aquatic invertebrates, daytime arousal, altered water flow & humidity in hibernacula	water alterations, human presence & noise	all life stages, all seasons	NA	NA	NA	NLAA	Effects from noise are anticipated to be insignificant and not flush bats from adjacent roost trees. AMMs will prevent discharge of a significant amount of water into the recharge area of known hibernacula. We anticipate effects to hibernating bats from flooding will be insignificant. MVP's NPDES permit (WV) and Project Specific Standards & Specifications Plan (VA) are expected to limit the loss of aquatic invertebrates. Therefore, we anticipate that any loss of Ibat forage will be minor and effects to Ibats will be insignificant.
New Disturbance - Construction	Regrading and Stabilization - restoration of corridor	Human activity and disturbance, obstructed hibernacula entrances or vents	loss or alteration of hibernation conditions, daytime arousal	alteration of water or air flow in/out of hibernacula, human presence	all life stages, all seasons	NA	NA	NA	NLAA	AMMs will avoid potential impacts to hibernacula. Effects from noise are anticipated to be insignificant and not flush bats from adjacent roost trees. We do not anticipate impacts to bats when they are hibernating based on the protections included in the Karst Mitigation Plan provided in the FEIS (FERC 2017a) and the information provided in the Potentially Suitable Hibernacula within the Action Area table (M.D. Stahl, EQT, email to T. Lennon, J. Stanhope, and S. Hoskin, Service, November 9, 2017). Additionally, we do not anticipate impacts to Tawney's Cave based on hydrologic and geologic analysis (FERC 2017b).
New Disturbance - Construction	Facilities - noise, lights	Human activity and disturbance	daytime arousal	human presence and noise, lighting	all life stages, spring-fall	NA	NA	NA	NLAA	Effects from noise are anticipated to be insignificant and not flush bats from adjacent roost trees. Effects from lighting will be minimized by instituting a 7:00 a.m. to 7:00 p.m. work day and utilizing "full cut-off" lighting fixtures to maximize shielding to prevent unintentional lighting of surrounding areas.
New Disturbance - Construction	Access Roads - upgrading existing roads, new roads temp and permanent - grading, graveling	Alteration of surface water flow, vegetation removal, human activity	altered water flow & humidity in hibernacula, alteration of summer roosting/foraging habitat, & spring staging/fall swarming habitat, daytime arousal	removal of vegetation, altered surface water flow into hibernacula, human presence	all life stages, all seasons	NA	NA	NA	NLAA	AMMs limit potential impacts to hibernacula. Effects from noise are anticipated to be insignificant and not flush of bats from adjacent roost trees. We do not anticipate impacts to bats when they are hibernating based on the protections included in the Karst Mitigation Plan provided in the FEIS (FERC 2017a) and the information provided in the Potentially Suitable Hibernacula within the Action Area table (M.D. Stahl, EQT, email to T. Lennon, J. Stanhope, and S. Hoskin, Service, November 9, 2017). Additionally, we do not anticipate impacts to Tawney's Cave based on hydrologic and geologic analysis (FERC 2017b).
New Disturbance - Construction	Access Roads - upgrading existing roads, new roads temp and permanent - culvert installation	Human activity, ground disturbance, instream and riparian disturbance, temporary dewatering	altered water flow & humidity in hibernacula, decreased aquatic invertebrates, daytime arousal	instream sedimentation & water flow disruption, human presence & noise	all life stages, all seasons	NA	NA	NA	NLAA	AMMs limit potential impacts to hibernacula. Effects from noise are anticipated to be insignificant and not flush bats from adjacent roost trees. We do not anticipate impacts to bats when they are hibernating based on the protections included in the Karst Mitigation Plan provided in the FEIS (FERC 2017a) and the information provided in the Potentially Suitable Hibernacula within the Action Area table (M.D. Stahl, EQT, email to T. Lennon, J. Stanhope, and S. Hoskin, Service, November 9, 2017). Additionally, we do not anticipate impacts to Tawney's Cave based on hydrologic and geologic analysis (FERC 2017b). MVP's NPDES permit (WV) and Project Specific Standards & Specifications Plan (VA) are expected to limit the loss of aquatic invertebrates. Therefore, we anticipate that any loss of Ibat forage will be minor and effects to Ibats will be insignificant.
New Disturbance - Construction	Access Roads - upgrading existing roads, new roads temp and permanent - tree trimming and tree removal	Tree removal, loss or alteration of forested habitat, human disturbance	alteration of summer roosting/foraging habitat, & spring staging/fall swarming habitat, daytime arousal	vegetation removal, human presence	all life stages, spring-fall	kill, injure, harm, harass	breeding, sheltering	numbers, reproduction	LAA	Tree removal during winter in known use and unknown use summer habitat will result in predation, reduced pregnancy success, and/or reduced pup survival for a small percentage of individual Ibats. These effects will be greatest the first season after tree removal has occurred. Tree removal in April, May, August, and September in unknown use summer habitat is expected to affect Ibats using undocumented occupied roosts and foraging areas. Most tree removal in unknown use summer habitat will occur during winter and trees will not be removed between June 1 and July 31 when young cannot fly. We anticipate a small percentage of individual Ibats present with unknown use summer habitat will be injured or killed (adults and volant young) from the felling of an undocumented occupied roost tree, will experience reduced pregnancy success and/or reduced pup survival associated with increased energy expenditure from the loss of foraging habitat, and injury or death as a result of predation. Tree removal in known use and unknown use spring staging/fall swarming habitat during winter will remove foraging and roosting areas for a concentrated number of Ibats in an abbreviated season (i.e., spring emergence or fall swarming). We do not anticipate Ibats will be present during tree removal activities in known use spring staging/fall swarming habitat and no impacts are anticipated to Ibats hibernacula or hibernating bats based on the protections included in the Karst Mitigation Plan provided in the FEIS (FERC 2017a) and the information provided in the Potentially Suitable Hibernacula within the Action Area table (M.D. Stahl, EQT, email to T. Lennon, J. Stanhope, and S. Hoskin, Service, November 9, 2017). Additionally, we do not anticipate impacts to Tawney's Cave based on hydrologic and geologic analysis (FERC 2017b). However, tree clearing will result in temporary or permanent habitat loss, which we expect will cause decreased breeding success and survival (of WNS affected bats) of a small percentage of individual Ibats. Tree removal in unknown use spring staging/fall swarming habitat during the active season will disrupt bats engaging in fall swarming, spring staging, and roosting behavior. A small percentage of individual Ibats present with unknown use spring staging/fall swarming habitat will be injured or killed (adults and volant young) from the felling of an undocumented occupied roost tree, will experience reduced pregnancy success and/or reduced pup survival associated with increased energy expenditure from the loss of foraging habitat, and injury or death as a result of predation.
New Disturbance - Construction	Stream Crossings, flume	Tree removal, loss or alteration of forested habitat, human disturbance, instream and riparian disturbance, temporary dewatering	alteration of summer roosting/foraging habitat, & spring staging/fall swarming habitat, daytime arousal, decreased aquatic invertebrates, altered water flow & humidity in hibernacula	vegetation removal, instream sedimentation & water flow disruption, human presence & noise	all life stages, all seasons	NA	NA	NA	NLAA	AMMs will prevent discharge of a significant amount of water into the recharge area of known hibernacula and limit blasting activities so that karst features will not be altered or destroyed. Effects from noise are anticipated to be insignificant and not flush bats from adjacent roost trees. Impacts to stream biota will be temporary, limited, and localized and not expected to cause any noticeable decrease in Ibat foraging. We do not anticipate effects to bats when they are hibernating based on the protections included in the Karst Mitigation Plan provided in the FEIS (FERC 2017a) and the information provided in the Potentially Suitable Hibernacula within the Action Area table (M.D. Stahl, EQT, email to T. Lennon, J. Stanhope, and S. Hoskin, Service, November 9, 2017). Tree removal activities associated with this subactivity are analyzed in the subactivity "Crossings, wetlands and other water bodies (non-riparian) - clearing."

Table 4. Analysis of effects on Indiana bat.

Pipeline Activity	Subactivity	Environmental Impact or Threat	Stressor	Stressor Pathway (optional)	Exposure (Resource Affected)	Range of Response	Conservation Need Affected	Demographic Consequences	NE, NLAA, or LAA	Comments
New Disturbance - Construction	Stream Crossings, dam & pump	Tree removal, loss or alteration of forested habitat, human disturbance, instream and riparian disturbance, temporary dewatering	alteration of summer roosting/foraging habitat, & spring staging/fall swarming habitat, daytime arousal, decreased aquatic invertebrates, altered water flow & humidity in hibernacula	vegetation removal, instream sedimentation & water flow disruption, human presence & noise	all life stages, all seasons	NA	NA	NA	NLAA	AMMs will prevent discharge of a significant amount of water into the recharge area of known hibernacula and limit blasting activities so that karst features will not be altered or destroyed. Effects from noise are anticipated to be insignificant and not flush bats from adjacent roost trees. Impacts to stream biota will be temporary, limited, and localized and not expected to cause any noticeable decrease in Ibat foraging. We do not anticipate effects to bats when they are hibernating based on the protections included in the Karst Mitigation Plan provided in the FEIS (FERC 2017a) and the information provided in the Potentially Suitable Hibernacula within the Action Area table (M.D. Stahl, EQT, email to T. Lennon, J. Stanhope, and S. Hoskin, Service, November 9, 2017). Tree removal activities associated with this subactivity are analyzed in the subactivity "Crossings, wetlands and other water bodies (non-riparian) - clearing."
New Disturbance - Construction	Stream Crossings, cofferdam	Tree removal, loss or alteration of forested habitat, human disturbance, instream and riparian disturbance, temporary dewatering	alteration of summer roosting/foraging habitat, & spring staging/fall swarming habitat, daytime arousal, decreased aquatic invertebrates, altered water flow & humidity in hibernacula	vegetation removal, instream sedimentation & water flow disruption, human presence & noise	all life stages, all seasons	NA	NA	NA	NLAA	AMMs will prevent discharge of a significant amount of water into the recharge area of known hibernacula and limit blasting activities so that karst features will not be altered or destroyed. Effects from noise are anticipated to be insignificant and not flush bats from adjacent roost trees. Impacts to stream biota will be temporary, limited, and localized and not expected to cause any noticeable decrease in Ibat foraging. We do not anticipate effects to bats when they are hibernating based on the protections included in the Karst Mitigation Plan provided in the FEIS (FERC 2017a) and the information provided in the Potentially Suitable Hibernacula within the Action Area table (M.D. Stahl, EQT, email to T. Lennon, J. Stanhope, and S. Hoskin, Service, November 9, 2017). Tree removal activities associated with this subactivity are analyzed in the subactivity "Crossings, wetlands and other water bodies (non-riparian) - clearing."
New Disturbance - Construction	Stream Equipment Crossing Structures	Tree removal, loss or alteration of forested habitat, human disturbance, instream and riparian disturbance, temporary dewatering	alteration of summer roosting/foraging habitat, & spring staging/fall swarming habitat, daytime arousal, decreased aquatic invertebrates, altered water flow & humidity in hibernacula	vegetation removal, instream sedimentation & water flow disruption, human presence & noise	all life stages, all seasons	NA	NA	NA	NLAA	AMMs will prevent discharge of a significant amount of water into the recharge area of known hibernacula and limit blasting activities so that karst features will not be altered or destroyed. Effects from noise are anticipated to be insignificant and not flush bats from adjacent roost trees. Impacts to stream biota will be temporary, limited, and localized and not expected to cause any noticeable decrease in Ibat foraging. We do not anticipate effects to bats when they are hibernating based on the protections included in the Karst Mitigation Plan provided in the FEIS (FERC 2017a) and the information provided in the Potentially Suitable Hibernacula within the Action Area table (M.D. Stahl, EQT, email to T. Lennon, J. Stanhope, and S. Hoskin, Service, November 9, 2017). Tree removal activities associated with this subactivity are analyzed in the subactivity "Crossings, wetlands and other water bodies (non-riparian) - clearing."
New Disturbance - Construction	Crossings, wetlands and other water bodies (non-riparian) - clearing	Tree removal, loss or alteration of forested habitat, human disturbance	alteration of summer roosting/foraging habitat, & spring staging/fall swarming habitat, daytime arousal	vegetation removal, human presence	all life stages, spring-fall	kill, injure, harm, harass	breeding, sheltering	numbers, reproduction	LAA	Tree removal during winter in known use and unknown use summer habitat will result in predation, reduced pregnancy success, and/or reduced pup survival for a small percentage of individual Ibats. These effects will be greatest the first season after tree removal has occurred. Tree removal in April, May, August, and September in unknown use summer habitat is expected to affect Ibats using undocumented occupied roosts and foraging areas. Most tree removal in unknown use summer habitat will occur during winter and trees will not be removed between June 1 and July 31 when young cannot flv. We anticipate a small percentage of individual Ibats present with unknown use summer habitat will be injured or killed (adults and volant young) from the felling of an undocumented occupied roost tree, will experience reduced pregnancy success and/or reduced pup survival associated with increased energy expenditure from the loss of foraging habitat, and injury or death as a result of predation. Tree removal in known use and unknown use spring staging/fall swarming habitat during winter will remove foraging and roosting areas for a concentrated number of Ibats in an abbreviated season (i.e., spring emergence or fall swarming). We do not anticipate Ibats will be present during tree removal activities in known use spring staging/fall swarming habitat and no impacts are anticipated to Ibats hibernacula or hibernating bats based on the protections included in the Karst Mitigation Plan provided in the FEIS (FERC 2017a) and the information provided in the Potentially Suitable Hibernacula within the Action Area table (M.D. Stahl, EQT, email to T. Lennon, J. Stanhope, and S. Hoskin, Service, November 9, 2017). Additionally, we do not anticipate impacts to Tawney's Cave based on hydrologic and geologic analysis (FERC 2017b). However, tree clearing will result in temporary or permanent habitat loss, which we expect will cause decreased breeding success and survival (of WNS affected bats) of a small percentage of individual Ibats. Tree removal in unknown use spring staging/fall swarming habitat during the active season will disrupt bats engaging in fall swarming, spring staging, and roosting behavior. A small percentage of individual Ibats present with unknown use spring staging/fall swarming habitat will be injured or killed (adults and volant young) from the felling of an undocumented occupied roost tree, will experience reduced pregnancy success and/or reduced pup survival associated with increased energy expenditure from the loss of foraging habitat, and injury or death as a result of predation.
New Disturbance - Construction	Crossings, wetlands and other water bodies (non-riparian) - tree side trimming	Loss or alteration of forested habitat, human disturbance	alteration of summer roosting/foraging habitat, & spring staging/fall swarming habitat, daytime arousal, roost abandonment, increased predation due to daytime activity	vegetation removal, human disturbance	all life stages, spring-fall	NA	NA	NA	NLAA	AMMs minimize potential effects to bats from vegetation removal. Effects to bats from alterations to travel corridors and foraging habitat are anticipated to be insignificant. Effects from noise and activity are anticipated to be insignificant and not cause bats to flush from adjacent roost trees or hibernacula. Tree removal, limb trimming, or pruning will be conducted between November 15 and March 31 to avoid disturbance to bats, except in cases of human safety. If the seasonal restriction cannot be met, a qualified bat biologist will investigate the trees for the presence of bats to avoid adverse affects (coordination with the Service will occur prior to this effort).
New Disturbance - Construction	Crossings, wetlands and other water bodies (non-riparian) - grading, trenching, regrading	Alteration of surface water flow, vegetation removal, human activity, wetland disturbance	flooding hibernacula, decreased aquatic invertebrates, alteration of spring staging/fall swarming habitat and summer roosting and foraging habitat, daytime arousal	removal of wetland vegetation, water disruption, alteration of water or air flow in/out of hibernacula, human presence & noise	all life stages, all seasons	NA	NA	NA	NLAA	AMMs will limit potential impacts to hibernacula. Effects from noise are anticipated to be insignificant and not flush bats from adjacent roost trees. Impacts to wetland biota will be temporary, limited, and localized and not expected to cause any noticeable decrease in Ibat foraging.

Table 4. Analysis of effects on Indiana bat.

Pipeline Activity	Subactivity	Environmental Impact or Threat	Stressor	Stressor Pathway (optional)	Exposure (Resource Affected)	Range of Response	Conservation Need Affected	Demographic Consequences	NE, NLAA, or LAA	Comments
New Disturbance - Construction	Crossings, wetlands and other water bodies (non-riparian) - pipe stringing	Human activity	daytime arousal	human presence & noise	all life stages, spring-fall	NA	NA	NA	NLAA	Effects from noise are anticipated to be insignificant and not flush bats from adjacent roost trees.
Operation & Maintenance	Facilities - vehicles, foot traffic, noise	Increased human activity and disturbance	daytime arousal	human presence	all life stages, (not hibernation)	NA	NA	NA	NLAA	Effects from noise are anticipated to be insignificant and not flush bats from adjacent roost trees or impact foraging bats or bats using travel corridors. NOTE vehicle impacts for all O&M subactivities are evaluated here (i.e., vehicle impacts will not be considered under the remaining O&M subactivities).
Operation & Maintenance	Vegetation Management - mowing	Vegetation removal, human activity, and disturbance	alteration of summer roosting/foraging habitat & staging/swarming habitat, daytime arousal	vegetation removal, human presence	all life stages, spring-fall	NA	NA	NA	NLAA	Effects from noise are anticipated to be insignificant and not flush bats from adjacent roost trees or impact foraging bats or bats using travel corridors. Mowing herbaceous vegetation while bats are present in habitat is expected to effect the quality, quantity, and timing of prey resources; however, the effect on bats foraging is anticipated to be insignificant due to the small area of impact within a bat's ~2.5 mile home range.
Operation & Maintenance	Vegetation Management - chainsaw, tree clearing, and tree side trimming	Tree removal, loss or alteration of forested habitat, human disturbance	alteration of travel corridors, summer roosting/foraging habitat, & spring staging/fall swarming habitat, increased arousal, daytime disturbance, roost abandonment, increased predation due to daytime activity	vegetation removal, human disturbance	all life stages, spring-fall	Kill, injure, harm, harass	breeding, sheltering	numbers, reproduction	LAA	Tree removal during winter in known use and unknown use summer habitat will result in predation, reduced pregnancy success, and/or reduced pup survival for a small percentage of individual Ibats. These effects will be greatest the first season after tree removal has occurred. Tree removal in April, May, August, and September in unknown use summer habitat is expected to affect Ibats using undocumented occupied roosts and foraging areas. Most tree removal in unknown use summer habitat will occur during winter and trees will not be removed between June 1 and July 31 when young cannot fly. We anticipate a small percentage of individual Ibats present with unknown use summer habitat will be injured or killed (adults and volant young) from the felling of an undocumented occupied roost tree, will experience reduced pregnancy success and/or reduced pup survival associated with increased energy expenditure from the loss of foraging habitat, and injury or death as a result of predation. Tree removal in known use and unknown use spring staging/fall swarming habitat during winter will remove foraging and roosting areas for a concentrated number of Ibats in an abbreviated season (i.e., spring emergence or fall swarming). We do not anticipate Ibats will be present during tree removal activities in known use spring staging/fall swarming habitat and no impacts are anticipated to Ibats hibernacula or hibernating bats based on the protections included in the Karst Mitigation Plan provided in the FEIS (FERC 2017a) and the information provided in the Potentially Suitable Hibernacula within the Action Area table (M.D. Stahl, EQT, email to T. Lennon, J. Stanhope, and S. Hoskin, Service, November 9, 2017). Additionally, we do not anticipate impacts to Tawney's Cave based on hydrologic and geologic analysis (FERC 2017b). However, tree clearing will result in temporary or permanent habitat loss, which we expect will cause decreased breeding success and survival (of WNS affected bats) of a small percentage of individual Ibats. Tree removal in unknown use spring staging/fall swarming habitat during the active season will disrupt bats engaging in fall swarming, spring staging, and roosting behavior. A small percentage of individual Ibats present with unknown use spring staging/fall swarming habitat will be injured or killed (adults and volant young) from the felling of an undocumented occupied roost tree, will experience reduced pregnancy success and/or reduced pup survival associated with increased energy expenditure from the loss of foraging habitat, and injury or death as a result of predation.
Operation & Maintenance	Vegetation Management - herbicides - hand, vehicle mounted, aerial applications	Chemical contamination, vegetation loss	lethal or sublethal exposure to toxins alteration of travel corridors, summer roosting/foraging habitat, & spring staging/fall swarming habitat	contamination of water & vegetation. loss of herbaceous vegetation	all life stages, all seasons	NA	NA	NA	NLAA	Implementation of AMMs makes potential impacts to hibernating bats extremely unlikely to occur; the amount of area to be treated that could be Ibat roosting, foraging, or traveling habitat is very small, making exposure extremely unlikely to occur. Aerial spraying will not be utilized for invasive species control along the ROW.
Operation & Maintenance	Vegetation Disposal (upland) - dragging, chipping, hauling, piling, stacking	Human activity and disturbance, obstructed hibernacula entrances or vents	loss or alteration of hibernation conditions, hibernacula no longer suitable, daytime arousal	alteration of water or air flow in/out of hibernacula, human presence	all life stages, all seasons	NA	NA	NA	NLAA	AMMs avoid potential impacts to hibernacula. Effects from noise are anticipated to be insignificant and not flush bats from adjacent roost trees. We do not anticipate impacts to bats when they are hibernating based on the protections included in the Karst Mitigation Plan provided in the FEIS (FERC 2017a) and the information provided in the Potentially Suitable Hibernacula within the Action Area table (M.D. Stahl, EQT, email to T. Lennon, J. Stanhope, and S. Hoskin, Service, November 9, 2017). Additionally, we do not anticipate impacts to Tawney's Cave based on hydrologic and geologic analysis (FERC 2017b).
Operation & Maintenance	Vegetation Disposal (upland) - brush pile burning	Human activity and disturbance, smoke disturbance	smoke inhalation during hibernation, increased arousal, daytime disturbance, roost abandonment, increased predation due to daytime activity	smoke in hibernacula or roosting habitat	all life stages, all seasons	NA	NA	NA	NLAA	When burning brush piles within 0.25 mile of known or presumed occupied hibernacula from August 15 - May 15, brush piles will be no larger than 25-ft by 25-ft, spaced at least 100-ft apart, and located at least 100-ft from hibernacula entrances and associated sinkholes, fissures, or other karst features. Effects to bats from this smoke in summer are anticipated to be insignificant. AMMs will prevent smoke from entering hibernacula in the winter. We do not anticipate effects to bats when they are hibernating based on the protections included in the Karst Mitigation Plan provided in the FEIS (FERC 2017a) and the information provided in the Potentially Suitable Hibernacula within the Action Area table (M.D. Stahl, EQT, email to T. Lennon, J. Stanhope, and S. Hoskin, Service, November 9, 2017). Additionally, we do not anticipate impacts to Tawney's Cave based on hydrologic and geologic analysis (FERC 2017b).
Operation & Maintenance	ROW repair, regrading, revegetation (upland) - hand, mechanical	Vegetation removal, loss or alteration of forested habitat, human disturbance	alteration of summer roosting/foraging habitat, & spring staging/fall swarming habitat, daytime arousal	vegetation removal, human disturbance	all life stages, spring-fall	NA	NA	NA	NLAA	Effects from noise are anticipated to be insignificant and not flush bats from adjacent roost trees. In accordance with FERC's Upland Erosion Control, Revegetation, and Maintenance Plan, vegetation maintenance/removal will not be done more frequently than every 3 years (FERC 2013a). We do not anticipate effects from vegetation removal because trees will not be large enough to support bats. Tree removal, limb trimming, or pruning will be conducted between November 15 and March 31 to avoid disturbance to bats, except in cases of human safety. If the seasonal restriction cannot be met, a qualified bat biologist will investigate the trees for the presence of bats to avoid adverse effects (coordination with the Service will occur prior to this effort).

Table 4. Analysis of effects on Indiana bat.

Pipeline Activity	Subactivity	Environmental Impact or Threat	Stressor	Stressor Pathway (optional)	Exposure (Resource Affected)	Range of Response	Conservation Need Affected	Demographic Consequences	NE, NLAA, or LAA	Comments
Operation & Maintenance	ROW repair, regrading, revegetation (wetland) - hand, mechanical	Vegetation removal, loss or alteration of forested habitat, human disturbance	alteration of summer roosting/foraging habitat, & spring staging/fall swarming habitat, daytime arousal	vegetation removal, human disturbance	all life stages, spring-fall	NA	NA	NA	NLAA	Effects from noise are anticipated to be insignificant and not flush bats from adjacent roost trees. In accordance with FERC's Upland Erosion Control, Revegetation, and Maintenance Plan, vegetation maintenance/removal will not be done more frequently than every 3 years (FERC 2013a). We do not anticipate effects from vegetation removal because trees will not be large enough to support bats. Tree removal, limb trimming, or pruning will be conducted between November 15 and March 31 to avoid disturbance to bats, except in cases of human safety. If the seasonal restriction cannot be met, a qualified bat biologist will investigate the trees for the presence of bats to avoid adverse effects (coordination with the Service will occur prior to this effort).
Operation & Maintenance	ROW repair, regrading, revegetation - instream stabilization and/or fill	Vegetation removal, loss or alteration of forested habitat, human disturbance, instream and riparian disturbance	alteration of summer roosting/foraging habitat, & spring staging/fall swarming habitat, daytime arousal, decreased aquatic invertebrates	vegetation removal, human disturbance	all life stages, spring-fall	NA	NA	NA	NLAA	Effects from noise are anticipated to be insignificant and not flush bats from adjacent roost trees. In accordance with FERC's Upland Erosion Control, Revegetation, and Maintenance Plan, vegetation maintenance/removal will not be done more frequently than every 3 years (FERC 2013a). We do not anticipate effects from vegetation removal because trees will not be large enough to support bats. Tree removal, limb trimming, or pruning will be conducted between November 15 and March 31 to avoid disturbance to bats, except in cases of human safety. If the seasonal restriction cannot be met, a qualified bat biologist will investigate the trees for the presence of bats to avoid adverse effects (coordination with the Service will occur prior to this effort). MVP's NPDES permit (WV) and Project Specific Standards & Specifications Plan (VA) are expected to limit the loss of aquatic invertebrates. Therefore, we anticipate that any loss of Ibat forage will be minor and effects to Ibats will be insignificant.
Operation & Maintenance	Access Road Maintenance - grading, graveling	Vegetation removal, loss or alteration of forested habitat, human disturbance	alteration of summer roosting/ foraging habitat, & spring staging/fall swarming habitat, daytime arousal	vegetation removal, human disturbance	all life stages, spring-fall	NA	NA	NA	NLAA	Effects from noise are anticipated to be insignificant and not flush bats from adjacent roost trees. In accordance with FERC's Upland Erosion Control, Revegetation, and Maintenance Plan, vegetation maintenance/removal will not be done more frequently than every 3 years (FERC 2013a). We do not anticipate effects from vegetation removal because trees will not be large enough to support bats. Tree removal, limb trimming, or pruning will be conducted between November 15 and March 31 to avoid disturbance to bats, except in cases of human safety. If the seasonal restriction cannot be met, a qualified bat biologist will investigate the trees for the presence of bats to avoid adverse effects (coordination with the Service will occur prior to this effort).
Operation & Maintenance	Access Road Maintenance - culvert replacement	Vegetation removal, loss or alteration of forested habitat, human disturbance, instream and riparian disturbance, temporary dewatering	decreased aquatic invertebrates, daytime arousal	vegetation removal, instream sedimentation & water flow disruption, human disturbance	all life stages, spring-fall	NA	NA	NA	NLAA	Effects from noise are anticipated to be insignificant and not flush bats from adjacent roost trees. In accordance with FERC's Upland Erosion Control, Revegetation, and Maintenance Plan, vegetation maintenance/removal will not be done more frequently than every 3 years (FERC 2013a). We do not anticipate effects from vegetation removal because trees will not be large enough to support bats. Tree removal, limb trimming, or pruning will be conducted between November 15 and March 31 to avoid disturbance to bats, except in cases of human safety. If the seasonal restriction cannot be met, a qualified bat biologist will investigate the trees for the presence of bats to avoid adverse effects (coordination with the Service will occur prior to this effort). MVP's NPDES permit (WV) and Project Specific Standards & Specifications Plan (VA) are expected to limit the loss of aquatic invertebrates. Therefore, we anticipate that any loss of Ibat forage will be minor and effects to Ibats will be insignificant.
Operation & Maintenance	General Appurtenance and Cathodic Protection Construction - Off ROW Clearing	Tree removal, loss or alteration of forested habitat, human disturbance	alteration of summer roosting/foraging habitat, & spring staging/fall swarming habitat, daytime arousal	vegetation removal, human presence	all life stages, spring-fall	kill, injure, harm, harass	breeding, sheltering	numbers, reproduction	LAA	Tree removal during winter in known use and unknown use summer habitat will result in predation, reduced pregnancy success, and/or reduced pup survival for a small percentage of individual Ibats. These effects will be greatest the first season after tree removal has occurred. Tree removal in April, May, August, and September in unknown use summer habitat is expected to affect Ibats using undocumented occupied roosts and foraging areas. Most tree removal in unknown use summer habitat will occur during winter and trees will not be removed between June 1 and July 31 when young cannot fly. We anticipate a small percentage of individual Ibats present with unknown use summer habitat will be injured or killed (adults and volant young) from the felling of an undocumented occupied roost tree, will experience reduced pregnancy success and/or reduced pup survival associated with increased energy expenditure from the loss of foraging habitat, and injury or death as a result of predation. Tree removal in known use and unknown use spring staging/fall swarming habitat during winter will remove foraging and roosting areas for a concentrated number of Ibats in an abbreviated season (i.e., spring emergence or fall swarming). We do not anticipate Ibats will be present during tree removal activities in known use spring staging/fall swarming habitat and no impacts are anticipated to Ibats hibernacula or hibernating bats based on the protections included in the Karst Mitigation Plan provided in the FEIS (FERC 2017a) and the information provided in the Potentially Suitable Hibernacula within the Action Area table (M.D. Stahl, EQT, email to T. Lennon, J. Stanhope, and S. Hoskin, Service, November 9, 2017). Additionally, we do not anticipate impacts to Tawney's Cave based on hydrologic and geologic analysis (FERC 2017b). However, tree clearing will result in temporary or permanent habitat loss, which we expect will cause decreased breeding success and survival (of WNS affected bats) of a small percentage of individual Ibats. Tree removal in unknown use spring staging/fall swarming habitat during the active season will disrupt bats engaging in fall swarming, spring staging, and roosting behavior. A small percentage of individual Ibats present with unknown use spring staging/fall swarming habitat will be injured or killed (adults and volant young) from the felling of an undocumented occupied roost tree, will experience reduced pregnancy success and/or reduced pup survival associated with increased energy expenditure from the loss of foraging habitat, and injury or death as a result of predation.
Operation & Maintenance	General Appurtenance and Cathodic Protection Construction - trenching, anode, bell hole	Human activity and disturbance	daytime arousal	human presence	all life stages, spring-fall	NA	NA	NA	NLAA	Effects from noise are anticipated to be insignificant and not flush bats from adjacent roost trees or impact foraging bats or bats using travel corridors.
Operation & Maintenance	Inspection Activities - ground and aerial	Human activity and disturbance	daytime arousal	human presence	all life stages, spring-fall	NA	NA	NA	NLAA	Effects from noise are anticipated to be insignificant and not flush bats from adjacent roost trees.

Table 5. Analysis of effects on Northern long-eared bat.

Pipeline Activity	Subactivity	Environmental Impact or Threat	Stressor	Stressor Pathway (optional)	Exposure (Resource Affected)	Range of Response	Conservation Need Affected	Demographic Consequences	NE, NLAA, MA, or LAA	Comments
New Disturbance - Construction	Vehicle Operation and Foot Traffic	Human activity and disturbance	daytime arousal	human presence	all life stages, spring-fall	NA	NA	NA	NLAA	These effects have been previously addressed in the Service's programmatic biological opinion implementing the final 4(d) rule dated January 5, 2016. Additionally, effets of noise from this activity are anticipated to be insignificant and not flush bats from adjacent roost trees.
New Disturbance - Construction	Clearing - herbaceous vegetation and ground cover	Clearing of forested habitat, Human activity, and disturbance	alteration of summer roosting habitat, & staging/swarming habitat, daytime arousal	vegetation removal, human presence	all life stages, spring-fall	NA	NA	NA	MA	Effects from tree clearing beyond 0.25 mile of a hibernacula have been previously addressed in the Service's programmatic biological opinion implementing the final 4(d) rule dated January 5, 2016.
New Disturbance - Construction	Clearing - trees and shrubs	clearing of forested habitat; human activity & disturbance	alteration of summer roosting habitat, & staging/swarming habitat; daytime arousal	vegetation removal; human presence	all life stages; spring-fall	kill, harm, harass	breeding, sheltering	numbers, reproduction	LAA	Effects from this activity will occur within 0 25 mile of 3 known hibernacula, Canoe Cave, Tawney's Cave, and PS-WV3-Y-P1, and take is not exempt by the final 4(d) rule. Approximately 16.8 acres of forest clearing will occur within 0.25 mile of the hibernaculas. Mountain Valley will implement a TOYR around documented hibernacula, therefore we do not anticipate direct impacts to bats during spring staging/fall swarming. Clearing trees around hibernacula will permanently decrease foraging and roosting habitat, requiring bats to spend more time searching for food, which could result in bats entering hibernation with less fat reserves resulting in decreased overwinter survival or poorer spring body condition or result in less time on social interactions, which could result in decreased survival or breeding success of a small percentage of NLEBs. The spring emergence period (April through May) is also a sensitive time period for bats because WNS affected bats that do not die during hibernation may be weakened by the effects of the disease and may have reduced fat reserves and damage to wing membranes. WNS affected bats may have difficulty flying and may be less likely to survive long-distance migrations to summer areas. They may also emerge from hibernation sites earlier and may be more likely to stay closer to the hibernation site for a longer time period following spring emergence which could result in decreased survival or breeding success of a small percentage of NLEBs. We anticipate that effects will be greatest to WNS affected bats emerging in the spring the first season after tree removal has occurred. NLEBs are expected to acclimate to this change and shift to alternative habitat. AMMs minimize potential effects; vegetation alterations to travel corridors and foraging habitat should be small; noise created from this activity is covered by the final 4(d) rule. Impacts from lighting will be minimized by instituting a 7am-7pm work day and permanent outdoor lighting will be "full cut-off" directed down.
New Disturbance - Construction	Vegetation Disposal (upland) - dragging, chipping, hauling, piling, stacking	Human activity and disturbance, Obstructed hibernacula entrances or vents	loss or alteration of hibernation conditions, hibernacula no longer suitable, daytime arousal	alteration of water or air flow in/out of hibernacula, human presence	all life stages, all seasons	NA	NA	NA	MA	Effects from tree clearing beyond 0.25 mile of a hibernacula have been previously addressed in the Service's programmatic biological opinion implementing the final 4(d) rule dated January 5, 2016. Additionally, AMMs avoid potential impacts to hibernacula; noise created from this activity is anticipated to be insignificant and would not result in the flushing of bats from adjacent roost trees. We do not anticipate impacts to bats from when they are hibernating based on the protections included in the Karst Mitigation Plan provided in the FEIS (FERC 2017a). Additionally, we do not anticipate impacts to hibernacula PS-WV3-Y-1based on the AMM regarding PS-WV3-Y-1 (M. Stahl, EQT, email to P. Friedman, FERC, and J. Stanhope, Service, November 17, 2017). We do not anticipate impacts to Canoe and Tawney's Cave based on hydrologic and geologic analysis (FERC 2017b).
New Disturbance - Construction	Vegetation Disposal (upland) - brush pile burning	Human activity and disturbance, Obstructed hibernacula entrances or vents	loss or alteration of hibernation conditions, hibernacula no longer suitable, daytime arousal	alteration of water or air flow in/out of hibernacula, human presence	all life stages, all seasons	NA	NA	NA	MA	Effects from tree clearing beyond 0.25 mile of a hibernacula have been previously addressed in the Service's programmatic biological opinion implementing the final 4(d) rule dated January 5, 2016. When burning brush piles within 0.25 mile of known or presumed occupied hibernacula from August 15 - May 15, the brush piles will be no more than 25-ft by 25-ft, will be spaced at least 100-ft apart, and located at least 100-ft from hibernacula entrances and associated sinkholes, fissures, or other karst features. The direct loss of bats from smoke caused by burning brush piles in summer is insignificant. AMMs will prevent smoke from entering hibernacula in the winter. We do not anticipate impacts to bats when they are hibernating based on the protections included in the Karst Mitigation Plan provided in the FEIS (FERC 2017a) and the information provided in the November 9, 2017, Potentially Suitable Hibernacula within the Action Area table. Additionally, we do not anticipate impacts to hibernacula PS-WV3-Y-1based on the AMM regarding PS-WV3-Y-1 (M. Stahl, EQT, email to P. Friedman, FERC, and J. Stanhope, Service, November 17, 2017). We do not anticipate impacts to Canoe and Tawney's Cave based on hydrologic and geologic analysis (FERC 2017b).
New Disturbance - Construction	Vegetation Clearing - tree side trimming by bucket truck or helicopter	human activity	daytime arousal	human presence & noise	all life stages; all seasons	NA	NA	NA	MA	Effects from tree clearing beyond 0.25 mile of a hibernacula have been previously addressed in the Service's programmatic biological opinion implementing the final 4(d) rule dated January 5, 2016.
New Disturbance - Construction	Grading, erosion control devices	alteration of water flow; vegetation removal; human activity	altered water flow & humidity in hibernacula	altered water flow	all life stages; all seasons	NA	NA	NA	MA	Effects from tree clearing beyond 0.25 mile of a hibernacula have been previously addressed in the Service's programmatic biological opinion implementing the final 4(d) rule dated January 5, 2016. Additionally, noise created from this activity is anticipated to be insignificant and would not result in the flushing of bats from adjacent roost trees; AMMs prevent discharge of a significant amount of water into the recharge area of known hibernacula potentially flooding hibernating bats. Additionally, we do not anticipate impacts to hibernacula PS-WV3-Y-1based on the AMM regarding PS-WV3-Y-1 (M. Stahl, EQT, email to P. Friedman, FERC, and J. Stanhope, Service, November 17, 2017). We do not anticipate impacts to Canoe and Tawney's Cave based on hydrologic and geologic analysis (FERC 2017b).
New Disturbance - Construction	Trenching (digging, blasting, dewatering, open trench, sedimentation)	human activity:ground disturbance; instream & riparian disturbance; temporary dewatering	decreased aquatic invertebrates; daytime arousal	instream sedimentation & water flow disruption; human presence & noise	all life stages; all seasons	NA	NA	NA	MA	These effects have been previously addressed in the Service's programmatic biological opinion implementing the final 4(d) rule dated January 5, 2016. Additionally, if blasting is necessary within 0.5 miles of a known or potential hibernacula, Mountain Valley will develop site-specific blasting plans that would specify mitigation measure to prevent damage to hibernacula or other underground features.
New Disturbance - Construction	Pipe Stringing - bending, welding, coating, padding and backfilling	human activity	daytime arousal	human presence & noise	all life stages; spring-fall	NA	NA	NA	MA	These effects have been previously addressed in the Service's programmatic biological opinion implementing the final 4(d) rule dated January 5, 2016.

Table 5. Analysis of effects on Northern long-eared bat.

Pipeline Activity	Subactivity	Environmental Impact or Threat	Stressor	Stressor Pathway (optional)	Exposure (Resource Affected)	Range of Response	Conservation Need Affected	Demographic Consequences	NE, NLAA, MA, or LAA	Comments
New Disturbance - Construction	Hydrostatic Testing (water withdrawal and discharge)	withdrawal/discharge of water into aquatic habitats; human activity	decreased aquatic invertebrates; daytime arousal	water alterations; human presence & noise	all life stages; all seasons	NA	NA	NA	MA	These effects have been previously addressed in the Service's programmatic biological opinion implementing the final 4(d) rule dated January 5, 2016.
New Disturbance - Construction	Regrading and Stabilization - restoration of corridor	human activity & disturbance;obstructed cave entrances or vents	loss or alteration of hibernation conditions; daytime arousal	alteration of water or air flow in/out of caves; human presence	all life stages; all seasons	NA	NA	NA	MA	Effects from tree clearing beyond 0.25 mile of a hibernacula have been previously addressed in the Service's programmatic biological opinion implementing the final 4(d) rule dated January 5, 2016. AMMs avoid potential impacts to hibernacula; noise created from this activity is anticipated to be insignificant and would not result in the flushing of bats from adjacent roost trees. We do not anticipate impacts to bats when they are hibernating based on the protections included in the Karst Mitigation Plan provided in the FEIS (FERC 2017a) and the information provided in the November 9, 2017, Potentially Suitable Hibernacula within the Action Area table. Additionally, we do not anticipate impacts to hibernacula PS-WV3-Y-1based on the AMM regarding PS-WV3-Y-1 (M. Stahl, EQT, email to P. Friedman, FERC, and J. Stanhope, Service, November 17, 2017). We do not anticipate impacts to Canoe and Tawney's Cave based on hydrologic and geologic analysis (FERC 2017b).
New Disturbance - Construction	Facilities - noise, lights	noise disturbance	daytime arousal	human presence	all life stages; spring-fall	NA	NA	NA	MA	Effects from tree clearing beyond 0.25 mile of a hibernacula have been previously addressed in the Service's programmatic biological opinion implementing the final 4(d) rule dated January 5, 2016. Noise created from this activity is anticipated to be insignificant and would not result in the flushing of bats from adjacent roost trees. Additionally, adverse effects from lighting will be minimized by instituting a 7:00 a.m. to 7:00 p.m. work day and utilizing "full cut-off" lighting fixtures to maximize shielding to prevent unintentional lighting of surrounding areas.
New Disturbance - Construction	Access Roads - upgrading existing roads, new roads temp and permanent - grading, graveling	alteration of surface water flow; vegetation removal; human activity	altered water flow & humidity in hibernacula; alteration of summer roosting habitat, & staging/swarming habitat; daytime arousal	removal of forested habitat; altered surface water flow into caves; human presence	all life stages;	NA	NA	NA	MA	Effects from tree clearing beyond 0.25 mile of a hibernacula have been previously addressed in the Service's programmatic biological opinion implementing the final 4(d) rule dated January 5, 2016. AMMs limit potential impacts to hibernacula; noise created from this activity is anticipated to be insignificant and would not result in the flushing of bats from adjacent roost trees. We do not anticipate impacts to bats when they are hibernating based on the protections included in the Karst Mitigation Plan provided in the FEIS (FERC 2017a) and the information provided in the November 9, 2017, Potentially Suitable Hibernacula within the Action Area table.
New Disturbance - Construction	Access Roads - upgrading existing roads, new roads temp and permanent - culvert installation	tree removal; loss or alteration of forested habitat; human disturbance	alteration of summer roosting habitat, & staging/swarming habitat; increased daytime arousal	vegetation removal;human presence	all life stages	NA	NA	NA	MA	These effects have been previously addressed in the Service's programmatic biological opinion implementing the final 4(d) rule dated January 5, 2016.
New Disturbance - Construction	Access Roads - upgrading existing roads, new roads temp and permanent- tree trimming and tree removal	Clearing of forested habitat, Human activity and disturbance	alteration of summer roosting habitat, & spring staging/fall swarming habitat, daytime arousal	vegetation removal, human presence	all life stages, spring-fall	kill, harm, harass	breeding, sheltering	numbers, reproduction	LAA	Effects from this activity will occur within 0.25 mile of 3 known hibernacula, Canoe Cave, Tawney's Cave, and PS-WV3-Y-P1, and take is not exempt by the final 4(d) rule. Approximately 16.8 acres of forest clearing will occur within 0.25 mile of the hibernaculas. Mountain Valley will implement a TOYR around documented hibernacula, therefore we do not anticipate direct impacts to bats during spring staging/fall swarming. Clearing trees around hibernacula will permanently decrease foraging and roosting habitat, requiring bats to spend more time searching for food, which could result in bats entering hibernation with less fat reserves resulting in decreased overwinter survival or poorer spring body condition or result in less time on social interactions, which could result in decreased survival or breeding success of a small percentage of NLEBs. The spring emergence period (April through May) is also a sensitive time period for bats because WNS affected bats that do not die during hibernation may be weakened by the effects of the disease and may have reduced fat reserves and damage to wing membranes. WNS affected bats may have difficulty flying and may be less likely to survive long-distance migrations to summer areas. They may also emerge from hibernation sites earlier and may be more likely to stay closer to the hibernation site for a longer time period following spring emergence which could result in decreased survival or breeding success of a small percentage of NLEBs. We anticipate that effects will be greatest to WNS affected bats emerging in the spring the first season after tree removal has occurred. NLEBs are expected to acclimate to this change and shift to alternative habitat. AMMs minimize potential effects; vegetation alterations to travel corridors and foraging habitat should be small; noise created from this activity is covered by the final 4(d) rule. Impacts from lighting will be minimized by instituting a 7am-7pm work day and permanent outdoor lighting will be "full cut-off" directed down. The flushing of bats from roost trees as they are being cut during daylight hours would increase the likelihood that the bats would become prey for predators.
New Disturbance - Construction	Stream Crossings, flume	Tree removal, Loss or alteration of forested habitat, Human disturbance, Instream and riparian disturbance	alteration of summer roosting habitat, & spring staging/fall swarming habitat, increased daytime arousal, decreased aquatic invertebrates	vegetation removal, instream sedimentation & water flow disruption, human presence & noise	all life stages	NA	NA	NA	MA	These effects have been previously addressed in the Service's programmatic biological opinion implementing the final 4(d) rule dated January 5, 2016.
New Disturbance - Construction	Stream Crossings, dam & pump	Tree removal, Loss or alteration of forested habitat, Human disturbance, Instream and riparian disturbance	alteration of summer roosting habitat, & spring staging/fall swarming habitat, increased daytime arousal, decreased aquatic invertebrates	vegetation removal, instream sedimentation & water flow disruption, human presence & noise	all life stages	NA	NA	NA	MA	These effects have been previously addressed in the Service's programmatic biological opinion implementing the final 4(d) rule dated January 5, 2016.
New Disturbance - Construction	Stream Crossings, cofferdam	Tree removal, Loss or alteration of forested habitat, Human disturbance, Instream and riparian disturbance	alteration of summer roosting habitat, & spring staging/fall swarming habitat, increased daytime arousal, decreased aquatic invertebrates	vegetation removal, instream sedimentation & water flow disruption, human presence & noise	all life stages	NA	NA	NA	MA	These effects have been previously addressed in the Service's programmatic biological opinion implementing the final 4(d) rule dated January 5, 2016.
New Disturbance - Construction	Stream Equipment Crossing Structures	Human activity, Instream and riparian disturbance	increased daytime arousal, decreased aquatic invertebrates	instream sedimentation & changes in water flow, human presence & noise	all life stages	NA	NA	NA	MA	These effects have been previously addressed in the Service's programmatic biological opinion implementing the final 4(d) rule dated January 5, 2016.

Table 5. Analysis of effects on Northern long-eared bat.

Pipeline Activity	Subactivity	Environmental Impact or Threat	Stressor	Stressor Pathway (optional)	Exposure (Resource Affected)	Range of Response	Conservation Need Affected	Demographic Consequences	NE, NLAA, MA, or LAA	Comments
New Disturbance - Construction	Crossings, wetlands and other water bodies (non-riparian) - clearing	Clearing of forested habitat, Human activity and disturbance	alteration of summer roosting habitat, & spring staging/fall swarming habitat, daytime arousal	vegetation removal, human presence	all life stages, spring-fall	kill, harm, harass	breeding, sheltering	numbers, reproduction	LAA	Effects from this activity will occur within 0.25 mile of 3 known hibernacula, Canoe Cave, Tawney's Cave, and PS-WV3-Y-P1, and take is not exempt by the final 4(d) rule. Approximately 16.8 acres of forest clearing will occur within 0.25 mile of the hibernaculas. Mountain Valley will implement a TOYR around documented hibernacula, therefore we do not anticipate direct impacts to bats during spring staging/fall swarming. Clearing trees around hibernacula will permanently decrease foraging and roosting habitat, requiring bats to spend more time searching for food, which could result in bats entering hibernation with less fat reserves resulting in decreased overwinter survival or poorer spring body condition or result in less time on social interactions, which could result in decreased survival or breeding success of a small percentage of NLEBs. The spring emergence period (April through May) is also a sensitive time period for bats because WNS affected bats that do not die during hibernation may be weakened by the effects of the disease and may have reduced fat reserves and damage to wing membranes. WNS affected bats may have difficulty flying and may be less likely to survive long-distance migrations to summer areas. They may also emerge from hibernation sites earlier and may be more likely to stay closer to the hibernation site for a longer time period following spring emergence which could result in decreased survival or breeding success of a small percentage of NLEBs. We anticipate that effects will be greatest to WNS affected bats emerging in the spring the first season after tree removal has occurred. NLEBs are expected to acclimate to this change and shift to alternative habitat. AMMs minimize potential effects; vegetation alterations to travel corridors and foraging habitat should be small; noise created from this activity is covered by the final 4(d) rule. Impacts from lighting will be minimized by instituting a 7am-7pm work day and permanent outdoor lighting will be "full cut-off" directed down. The flushing of bats from roost trees as they are being cut during daylight hours would increase the likelihood that the bats would become prey for predators.
New Disturbance - Construction	Crossings, wetlands and other water bodies (non-riparian) - tree side trimming	Tree removal, Loss or alteration of forested habitat, Human disturbance	alteration of summer roosting/foraging habitat, & spring staging/fall swarming habitat, increased arousal, daytime disturbance, roost abandonment, increased predation due to daytime activity	vegetation removal, human disturbance	unlikely	kill, harm, harass	breeding, sheltering	numbers, reproduction	MA	These effects have been previously addressed in the Service's programmatic biological opinion implementing the final 4(d) rule dated January 5, 2016.
New Disturbance - Construction	Crossings, wetlands and other water bodies (non-riparian) - grading, trenching, regrading	alteration of surface water flow; vegetation removal; human activity; wetland disturbance	flooding hibernacula; decreased aquatic invertebrates; alteration of staging/swarming habitat; daytime arousal	removal of wetland vegetation; water disruption; alteration of water or air flow in/out of caves; human presence & noise	all life stages; all seasons	NA	NA	NA	MA	These effects have been previously addressed in the Service's programmatic biological opinion implementing the final 4(d) rule dated January 5, 2016.
New Disturbance - Construction	Crossings, wetlands and other water bodies (non-riparian) - pipe stringing	human activity	daytime arousal	human presence & noise	all life stages; spring-fall	NA	NA	NA	MA	These effects have been previously addressed in the Service's programmatic biological opinion implementing the final 4(d) rule dated January 5, 2016.
Operation & Maintenance	Facilities - vehicles, foot traffic, noise	Increased human activity and disturbance	increased daytime arousal	human presence	all life stages, (not hibernation)	NA	NA	NA	MA	These effects have been previously addressed in the Service's programmatic biological opinion implementing the final 4(d) rule dated January 5, 2016.
Operation & Maintenance	Vegetation Management - mowing	Loss or alteration of forested habitat, Increased human activity and disturbance	decreased foraging & travel efficiency, increased predation	alteration of spring- summer-fall travel corridors, vegetation removal	all life stages, (not hibernation)	NA	NA	NA	MA	These effects have been previously addressed in the Service's programmatic biological opinion implementing the final 4(d) rule dated January 5, 2016.
Operation & Maintenance	Vegetation Management - chainsaw, tree clearing, tree side trimming	Loss or alteration of forested habitat	alteration of travel corridors, summer roosting/foraging habitat, & staging/swarming habitat, increased arousal, daytime disturbance, roost abandonment, increased predation due to daytime activity	vegetation removal, human disturbance	all life stages, (not hibernation)	Kill, harm, harass	breeding, sheltering	numbers, reproduction	NLAA	Effects from this activity will occur within 0.25 mile of 3 known hibernacula, Canoe Cave, Tawney's Cave, and PS-WV3-Y-P1, and take is not exempt by the final 4(d) rule. Approximately 16.8 acres of forest clearing will occur within 0.25 mile of the hibernaculas. Mountain Valley will implement a TOYR around documented hibernacula, therefore we do not anticipate direct impacts to bats during spring staging/fall swarming. AMMs minimize potential effects; vegetation alterations to travel corridors and foraging habitat should be small, Mountain Valley will mow at the maximum time interval required to prevent woody encroachment and therefore we do not anticipate new trees will reach a size that will provide habitat before being removed. Noise created from this activity is covered by the final 4(d) rule. Impacts from lighting will be minimized by instituting a 7am-7pm work day and permanent outdoor lighting will be "full cut-off" directed down.
Operation & Maintenance	Vegetation Management - herbicides - hand, vehicle mounted, aerial applications	Chemical contamination, Vegetation loss	lethal or sublethal exposure to toxins alteration of travel corridors, summer roosting/foraging habitat, & spring staging/fall swarming habitat	contamination of water & vegetation, loss of herbaceous vegetation	unlikely	NA	NA	NA	MA	These effects have been previously addressed in the Service's programmatic biological opinion implementing the final 4(d) rule dated January 5, 2016.
Operation & Maintenance	Vegetation Disposal (upland) - dragging, chipping, hauling, piling, stacking	Human activity and disturbance, Obstructed hibernacula entrances or vents	loss or alteration of hibernation conditions, hibernacula no longer suitable, daytime arousal	alteration of water or air flow in/out of hibernacula, human presence	all life stages, spring-fall	NA	NA	NA	MA	These effects have been previously addressed in the Service's programmatic biological opinion implementing the final 4(d) rule dated January 5, 2016.
Operation & Maintenance	Vegetation Disposal (upland) - brush pile burning	Human activity and disturbance, Smoke disturbance	smoke inhalation during hibernation, increased arousal, daytime disturbance, roost abandonment, increased predation due to daytime activity	smoke in hibernacula or roosting habitat	all life stages, all seasons	NA	NA	NA	MA	These effects have been previously addressed in the Service's programmatic biological opinion implementing the final 4(d) rule dated January 5, 2016.
Operation & Maintenance	ROW repair, regrading, revegetation (upland) - hand, mechanical	Tree removal, Loss or alteration of forested habitat, Human disturbance	alteration of summer roosting habitat, & spring staging/fall swarming habitat, increased daytime arousal	vegetation removal, human disturbance	unlikely	NA	NA	NA	MA	These effects have been previously addressed in the Service's programmatic biological opinion implementing the final 4(d) rule dated January 5, 2016.
Operation & Maintenance	ROW repair, regrading, revegetation (wetland) - hand, mechanical	Tree removal, Loss or alteration of forested habitat, Human disturbance	alteration of summer roosting habitat, & spring staging/fall swarming habitat, increased daytime arousal	vegetation removal, human disturbance	unlikely	NA	NA	NA	MA	These effects have been previously addressed in the Service's programmatic biological opinion implementing the final 4(d) rule dated January 5, 2016.
Operation & Maintenance	ROW repair, regrading, revegetation - instream stabilization and/or fill	Tree removal, Loss or alteration of forested habitat, Human disturbance	alteration of summer roosting habitat, & spring staging/fall swarming habitat, increased daytime arousal	vegetation removal, human disturbance	unlikely	NA	NA	NA	MA	These effects have been previously addressed in the Service's programmatic biological opinion implementing the final 4(d) rule dated January 5, 2016.

Table 5. Analysis of effects on Northern long-eared bat.

Pipeline Activity	Subactivity	Environmental Impact or Threat	Stressor	Stressor Pathway (optional)	Exposure (Resource Affected)	Range of Response	Conservation Need Affected	Demographic Consequences	NE, NLAA, MA, or LAA	Comments
Operation & Maintenance	Access Road Maintenance - grading, graveling	Tree removal, Loss or alteration of forested habitat, Human disturbance	alteration of summer roosting habitat, & spring staging/fall swarming habitat, increased daytime arousal	vegetation removal, human disturbance	unlikely	harm, harass	breeding, sheltering	numbers, reproduction	MA	These effects have been previously addressed in the Service's programmatic biological opinion implementing the final 4(d) rule dated January 5, 2016. Additionally, in accordance with FERC's Upland Erosion Control, Revegetation, and Maintenance Plan, vegetation maintenance/removal will not be done more frequently than every 3 years (FERC 2013a).
Operation & Maintenance	Access Road Maintenance - culvert replacement	Tree removal, Loss or alteration of forested habitat, Human disturbance	alteration of summer roosting habitat, & spring staging/fall swarming habitat, increased daytime arousal	vegetation removal, human disturbance	all life stages	NA	NA	NA	MA	These effects have been previously addressed in the Service's programmatic biological opinion implementing the final 4(d) rule dated January 5, 2016.
Operation & Maintenance	General Appurtenance and Cathodic Protection Construction - Off ROW Clearing	tree removal; loss or alteration of forested habitat; human disturbance	alteration of summer roosting habitat, & staging/swarming habitat; increased daytime arousal	vegetation removal;human presence	all life stages	kill, harm, harass	breeding, sheltering	numbers, reproduction	NLAA	Effects from this activity will occur within 0.25 mile of 3 known hibernacula, Canoe Cave, Tawney's Cave, and PS-WV3-Y-P1, and take is not exempt by the 4 (d) rule. Approximately 16.8 acres of forest clearing will occur within 0.25 mile of the hibernaculas. Mountain Valley will implement a TOYR around documented hibernacula, therefore we do not anticipate direct impacts to bats during spring staging/fall swarming. AMMs minimize potential effects, vegetation alterations to travel corridors and foraging habitat should be small, Mountain Valley will mow at the maximum time interval required to prevent woody encroachment and therefore we do not anticipate new trees will reach a size that will provide habitat before being removed. Noise created from this activity is covered by the final 4(d) rule. Impacts from lighting will be minimized by instituting a 7am-7pm work day and permanent outdoor lighting will be "full cut-off" directed down.
Operation & Maintenance	General Appurtenance and Cathodic Protection Construction - trenching, anode, bell hole	Human disturbance	increased daytime arousal	human presence	all life stages	NA	NA	NA	MA	These effects have been previously addressed in the Service's programmatic biological opinion implementing the final 4(d) rule dated January 5, 2016.
Operation & Maintenance	Inspection Activities - ground and aerial	Human activity and Disturbance	daytime arousal	human presence	all life stages, spring-fall	NA	NA	NA	MA	These effects have been previously addressed in the Service's programmatic biological opinion implementing the final 4(d) rule dated January 5, 2016.

Document Content(s)