A HYDROGEOLOGICAL ASSESSMENT OF THE U.S. FOREST SERVICE/BUREAU OF LAND MANAGEMENT MOUNTAIN VALLEY PIPELINE AND EQUITRANS EXPANSION PROJECT SUPPLEMENTAL DRAFT ENVIRONMENTAL IMPACT STATEMENT DECEMBER 2022

January 24, 2023

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Prepared for The Wilderness Society

EXECUTIVE SUMMARY

The U.S. Forest Service (Forest Service) and Bureau of Land Management (BLM) prepared a Draft Supplemental Environmental Impact Statement (DSEIS), dated December 2022, in response to the U.S. Court of Appeals for the Fourth Circuit (Fourth Circuit or the Court) on January 25, 2022 decision that vacated and remanded the Forest Service's January 11, 2021 decision approving the Jefferson National Forest (JNF) plan amendment and the BLM's January 14, 2021 right-of-way (ROW) decision and ROW grant for construction of the Mountain Valley Pipeline (MVP) across approximately 3.5 miles of the JNF. The Fourth Circuit determined that "the Forest Service and BLM 1) inadequately considered the actual sedimentation and erosion impacts of the pipeline; 2) prematurely authorized the use of the conventional bore method to construct stream crossings; and 3) the Forest Service failed to comply with the Forest Service's 2012 Planning Rule."

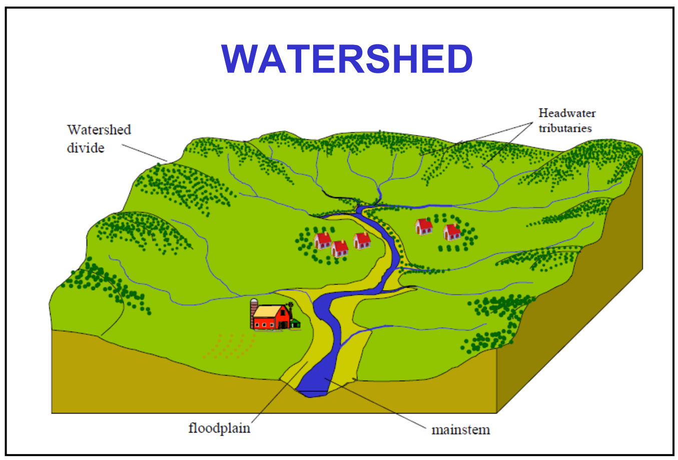
The Fourth Circuit previously decided, on July 27, 2018, to vacate and remand the Forest Service's decision to approve a Forest Plan amendment based on the Forest Service DSEIS dated September 2020. The Fourth Circuit found that the Forest Plan amendment lessened requirements protecting soil and riparian resources so the Mountain Valley Pipeline, LLC (MVP) construction project could meet those requirements.

The hydrogeological assessment presented herein addresses how the Forest Service's proposed project specific plan amendment would result in substantial adverse effects with respect to the substantive requirements directly related to the Forest Service's 2012 Planning Rule: 36 CFR § 219.8(a)(1) – Ecosystem integrity; § 219.8(a)(2)(ii) – Soils and soil productivity; § 219.8(a)(2)(iii) – Water quality; § 219.8(a)(2)(iv) – Water resources in the plan area, including … streams and wetlands; ground water…; § 219.8(a)(3)(i) – Ecological integrity of riparian areas. The Forest Service's decision to amend the Forest Plan, modifying standards related to ecosystem integrity, soils, water quality, and water resources, is based on 1) inadequate soil loss estimates; 2) inadequate Best Management Practices (BMPs) and Erosion Control Devices (ECDs); 3) disregard for the functions of headwater areas that would be crossed by the MVP pipeline construction on forested ridges; and 4) disregard of water resources, including seeps and springs, in the headwater areas that would be crossed by the MVP pipeline construction on forested ridges.

1.0 Adverse Impacts of the Proposed Project-Specific Plan Amendment with Respect to the Substantive Requirements Directly Related to § 219.8(a)(1) – Ecosystem Integrity and § 219.8(a)(3)(i) – Ecological Integrity of Riparian Areas

Watersheds of first order and second order streams occur on the forested ridges in the JNF where the MVP ROW is proposed. The definition of watershed provided in the Federal CFR at 33 CFR § 332.2, which is the section that applies to compensatory mitigation for losses of aquatic resources, Army Corps of Engineers is "Watershed means a land area that drains to a common waterway, such as a stream…". The definition of a watershed provided in "9VAC25-870-10. Definitions": "Watershed" means a defined land area drained by a river or stream…". In the Unified Stream Methodology (USACE, 2007), "watershed" is referenced as a "stream's watershed". **Figure 1.0-1** depicts a watershed, showing the watershed divide (or drainage divide) along the highest elevations, the headwater tributaries, and the larger stream receiving water from the headwater tributaries. Headwater areas are located upslope of the receiving streams, closer to the watershed divides.

Figure 1.0-1 – Headwaters of first order stream tributaries are located at the highest elevations on the watershed divides.



A watershed can refer to the overall system of streams that drain into a river or can pertain to a smaller tributary. Stream order is a measure of the relative size of streams. The smallest tributary is a first order stream, which originates in the highest elevations. Strahler (1952) defined a hierarchy of stream tributaries to depict the relationships of stream order. Where two first order streams connect, a second order stream is designated. Where two second order streams connect, a third order stream is designated **(Figure 1.0-2).**

Riparian Areas are defined by the Environmental Protection Agency as "Areas bordering streams, lakes, rivers, and other watercourses. These areas have high water tables and support plants that require saturated soils during all or part of the year. Riparian areas include both wetland and upland zones." Headwater areas within watersheds of first and second order streams are, therefore, riparian.

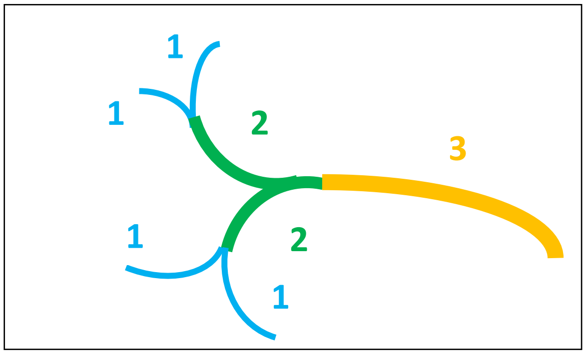


Figure 1.0-2 – Schematic diagram of the relationship of first order streams (designated “1”, shown in blue), second order streams (designated “2”, shown in green), and third order streams (designated “3”, shown in orange). First order streams form in headwater areas at the highest elevations in watersheds. (Diagram based on Strahler, 1952).

Because of the impacts of construction on the functions of headwater areas in the watersheds of upland first order high gradient streams, it is critical to evaluate these areas not simply as a small acreage within the area encompassing the construction project, but rather as functionally contributing areas which are the basis of water quality and aquatic habitat quality within the overall watershed. In order to evaluate the interactions of precipitation, stormwater discharge, groundwater recharge and retention, and stream baseflow, consideration must be given to functions of headwater areas for watersheds of first and second order streams. Because upland first order high gradient streams are well defined (Rosgen,1994) and are considered to provide the basis for watershed evaluation (USFWS, 2007), it is essential to select these smaller watersheds, typically 200 acres in size, to evaluate the impact of construction projects. **Figure 1.0-3** and **Figure 1.0-4** illustrate the locations of some of the watersheds for first and second order streams that would be crossed by MVP construction in a portion of JNF. The delineated watersheds range from 58 acres to 336 acres.

Hydraulic Unit Code (HUC) 12 and HUC 10 watersheds encompass a much larger area. For example, the entire Trout Creek-Craig Creek HUC 12 watershed is 33,173 acres (MVP Hydrologic Analysis of Sedimentation, JNF, June 2017). The Upper Craig Creek HUC 10 watershed encompasses 71,468 acres FS DSEIS, Dec. 2022). The watersheds of first and second order streams constitute only a small portion within a HUC 12 or HUC 10 watershed, but the functions of the headwater areas for these small tributaries are critical to water resources and ecosystem integrity.

In the Aquatic Resource Report for the FERC FEIS in US National Forest Service Lands, Monroe County, WV; Giles and Montgomery Counties, VA, dated June 2017, field sheets are provided that identify high gradient first order streams and also seeps, springs, and ephemeral or intermittent water sources in the headwater areas of the high gradient first order streams. However, it is stated in the December 2022 DSEIS that “No springs or swallets were identified within 500 feet of the MVP pipeline route crossing the JNF.” These headwater areas would be crossed by the MVP construction.

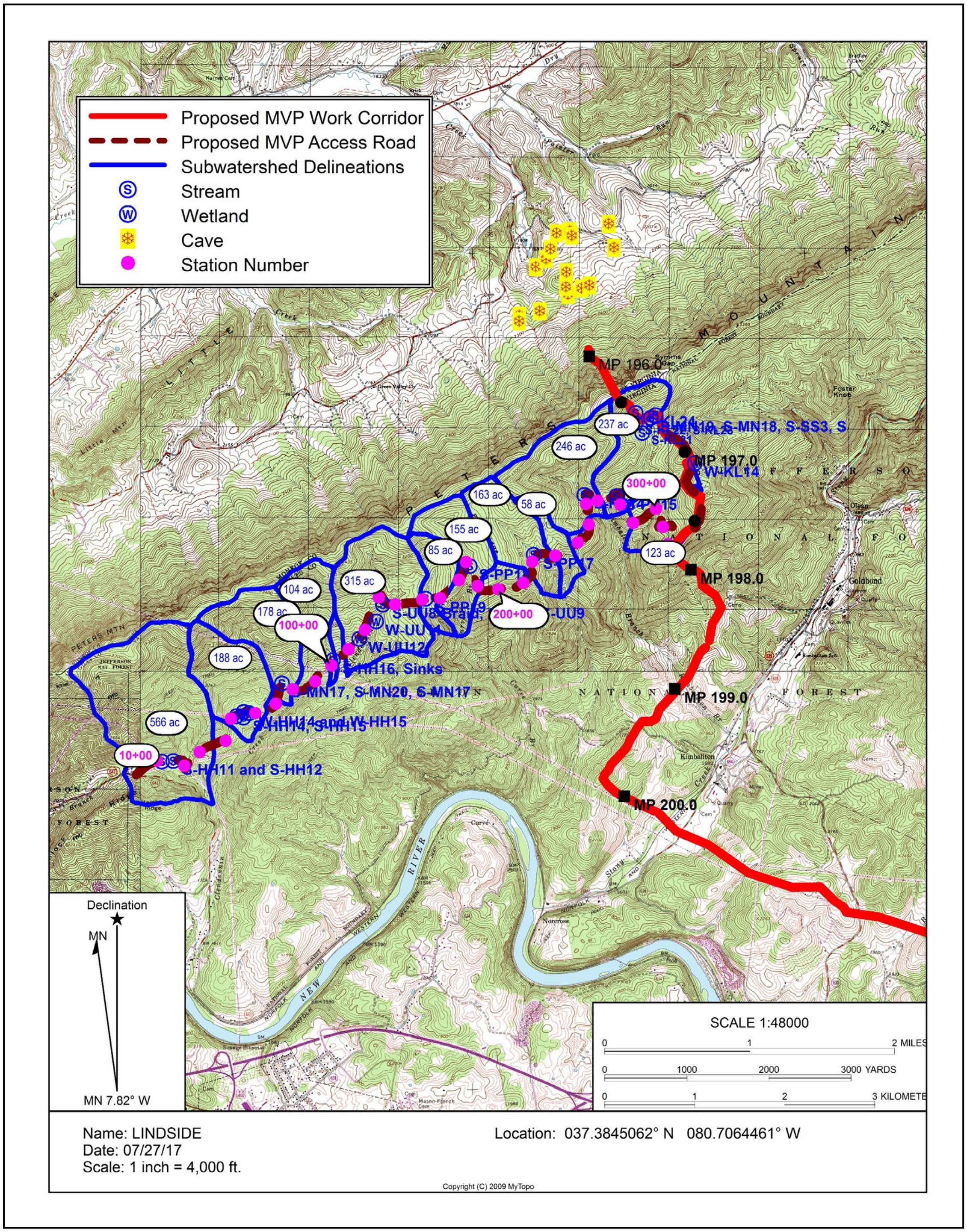


Figure 1.0-3 – Locations of streams and delineations of watersheds that would be crossed by the proposed MVP construction in a portion of JNF. Locations of springs and seeps were obtained from field sheets incorporated into the Aquatic Resource Report for the FERC FEIS in US National Forest Service Lands, Monroe County, WV; Giles and Montgomery Counties, VA, dated June 2017. (Delineations provided by PCD using Terrain Pro Navigator software).

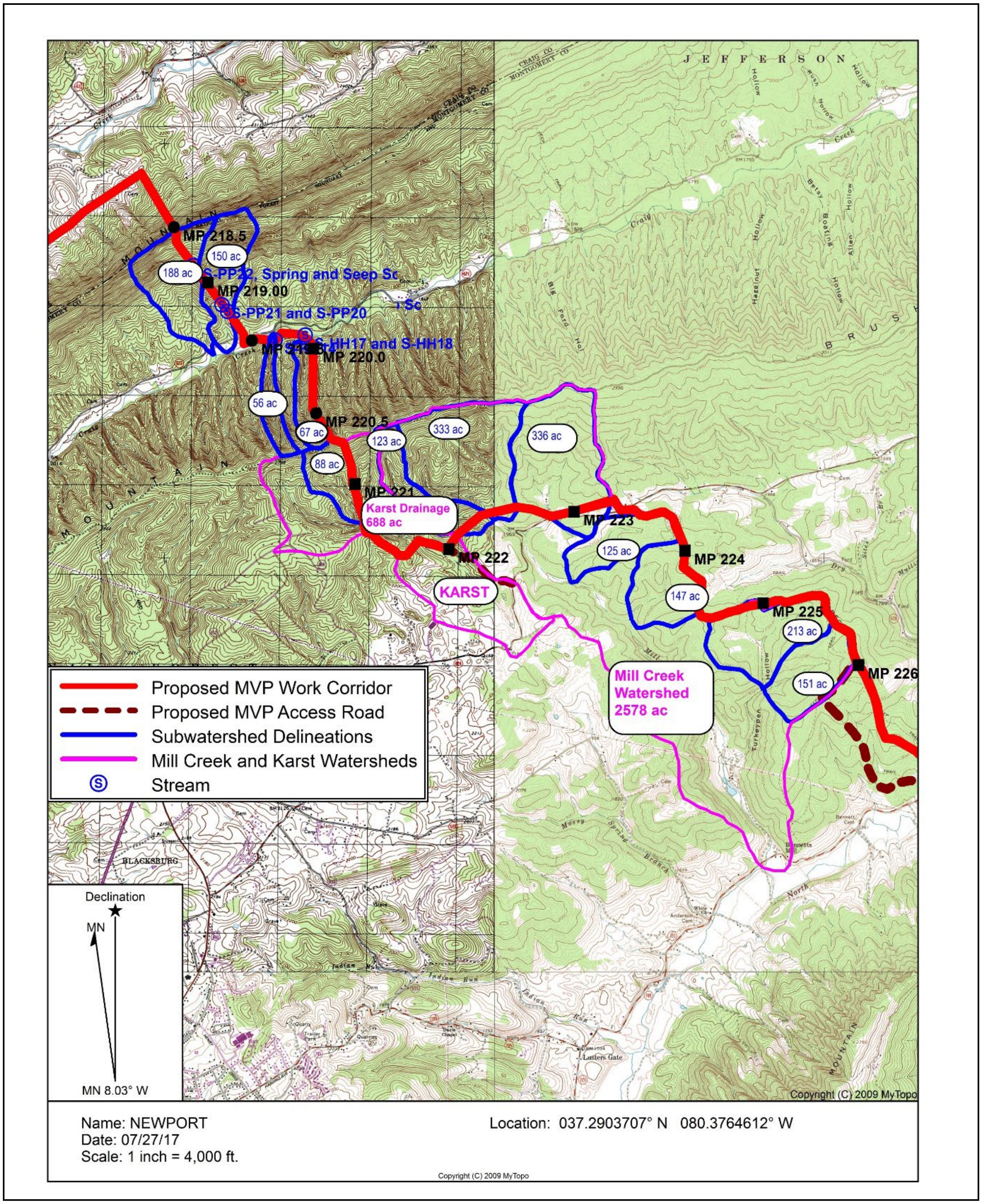


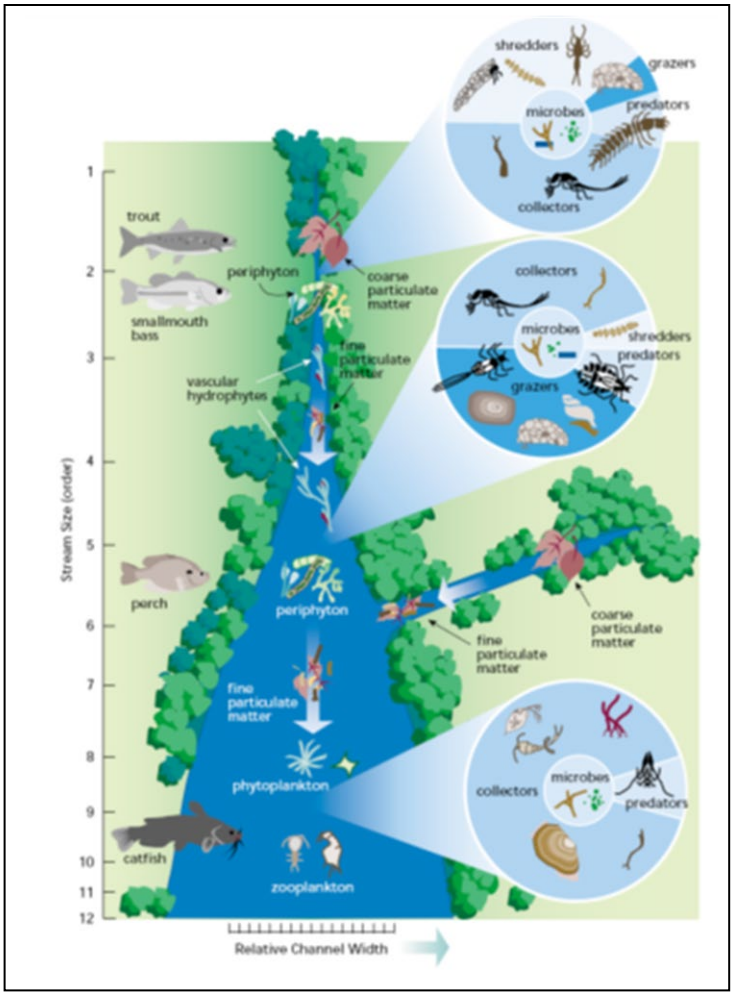
Figure 1.0-4 – Locations of streams and delineations of watersheds that would be crossed by the proposed MVP construction in a portion of JNF. Locations of springs and seeps were obtained from field sheets incorporated into the Aquatic Resource Report for the FERC FEIS in US National Forest Service Lands, Monroe County, WV; Giles and Montgomery Counties, VA, dated June 2017. (Delineations provided by PCD using Terrain Pro Navigator software).

Headwater areas of first order streams provide the essential aquatic habitats for aquatic species and associated terrestrial fauna and fowl within the entire length of the river continuum in the overall watershed. The soils which have formed in the headwater areas provide essential functions in the carbon cycle: when organic carbon in soil is disturbed by land clearing, a greater amount of organic carbon is released as carbon dioxide into the atmosphere (www.qld.gov.au). Nitrifying bacteria in headwater area soils also provide the essential function process of nitrification, facilitating the use of nitrate, nitrite, ammonia, and ammonium to be taken up from soils by plants and then used in the formation of plant and animal proteins (www.scienclearn.org.nz). Soil organic matter provides energy for soil microorganisms, nutrient storage, and the supply nitrogen, phosphorus, and sulfur (www.qld.gov.au).

The ecological communities in the headwater areas of first order high gradient streams and second order high gradient streams consist not only of the vegetation, but also aquatic benthic macroinvertebrates, fungi, and soil microbes. Insect larvae, commonly grouped as shredders, constitute most of the aquatic benthic macroinvertebrates in the headwater areas because they shred organic material into components used by collectors and predators downstream.

The River Continuum Concept was developed by Vannote, R.L., G. W. Minshall, K.W. Cummins, J.R. Sedell, and C.E. Cushing in 1980 and presented in the Canadian Journal of Fisheries and Aquatic Sciences 37: 130-137. The U.S. Environmental Protection Agency and the U.S. Department of Agriculture have embraced the River Continuum Concept as illustrating the strong connection between headwater areas on mountain ridges and various downstream areas. The River Continuum Concept diagram (**Figure 1.0-4**) provides pie diagrams of predominant benthic aquatic organisms associated with various locations, starting at the headwaters, along the river continuum. Shredders, predominant in the forested headwaters, break down coarse organic matter used downstream by collectors, predators, and filter-feeders. Collectors and grazers, including gastropods, are predominant downstream where the stream widens. Collectors, especially gastropods, and fish are predominant where the stream continues to widen. In areas where the stream is wider, the collectors and grazers are consumed by fish.

Functions within headwater areas are critical to the ecosystem integrity. The forest provides filtered light and lower temperatures required to maintain appropriate conditions for the benthic aquatic organisms in the headwater areas. Seeps and springs provide moisture required to maintain appropriate conditions for wetlands and for the benthic aquatic organisms in the headwater areas. Where headwater areas are destroyed by deforestation and construction, the habitat for benthic aquatic organisms is removed. This habitat cannot be reestablished downstream because the stream widens and the forest cover, providing filtered light and lower temperatures, is no longer available.



It is explained in DSEIS section "3.3.4.3 Step 3: Applying the Directly Related Substantive Requirements" that the "amended plan must contain plan components that maintain or restore ecosystem integrity." Further, it is explained that, "To "maintain" a resource is defined by the rule as "to keep in existence or net continuance of the desired ecological condition in terms of desired composition, structure, and processes" (36 CFR § 219.19)." Furthermore, the Forest Service Planning Rule requires § 219.8(a)(3)(i) – The plan must include plan components "to maintain or restore the ecological integrity of riparian areas in the plan area, including plan components to maintain or restore structure, function, composition, and connectivity". The function of the benthic aquatic organisms in breaking down organic matter as a food source for aquatic organisms downstream cannot be maintained when the habitat for the benthic aquatic organisms is destroyed. The benthic aquatic organisms constitute the base of the food chain for the river continuum ecosystem. The ecosystem integrity is compromised when the base of the food chain for the system is destroyed.

2.0 Adverse Impacts of the Proposed Project-Specific Plan Amendment with Respect to the Substantive Requirements Directly Related to § 19.8(a)(2)(iv) – Water Resources

As depicted in **Figure 2.0-1**, when rainwater is intercepted by trees on forested ridges, the rainfall gently penetrates the ground surface and migrates downward through the soil to bedrock. The water then flows along perched aquifers or through bedrock fractures and along bedding planes to continue migrating downward or to form seeps and springs where the fractures or bedding planes intercept the ground surface. Seeps and springs can occur at various elevations on mountain slopes, depending on the presence of perched aquifers and also where the bedrock fractures or bedding planes intercept the ground surface. Groundwater issuing from seeps and springs along streams and rivers constitutes the base level of the streams. As the quantity of groundwater accumulates beneath the ground surface, a hydraulic gradient forms, causing the groundwater to move downgradient to nearby streams and rivers or to lower areas where the water may reach streams and rivers that are farther away.

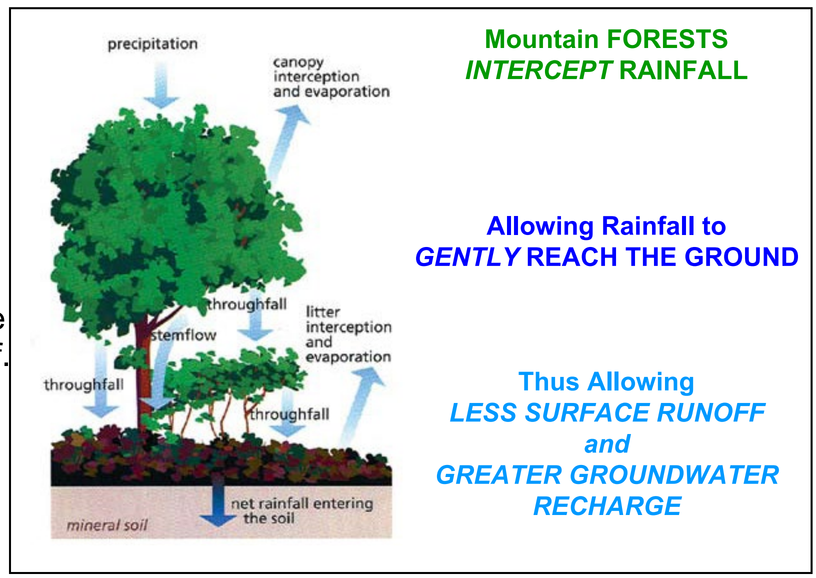


Figure 2.0-1 – Forested areas facilitate groundwater recharge and reduced stormwater runoff.

Although there is no data provided in the December 2022 DSEIS for the depth to groundwater, this data was reported on page 66 of the September 2020 DSEIS to be greater than 80 inches along the MVP ROW traversing JNF. In the Aquatic Resource Report for the FERC FEIS in US National Forest Service Lands, Monroe County, WV; Giles and Montgomery Counties, VA, dated June 2017, field sheets are provided that identify seeps, springs, and ephemeral or intermittent water sources in the headwater areas of the first order streams (plotted along the MVP ROW in **Figure 1.0-3** and **Figure 1.0-4**). Larger scale maps of these areas are provided in **Figure 2.0-2** and **Figure 2.0-3**. These headwater areas would be crossed by the MVP construction.

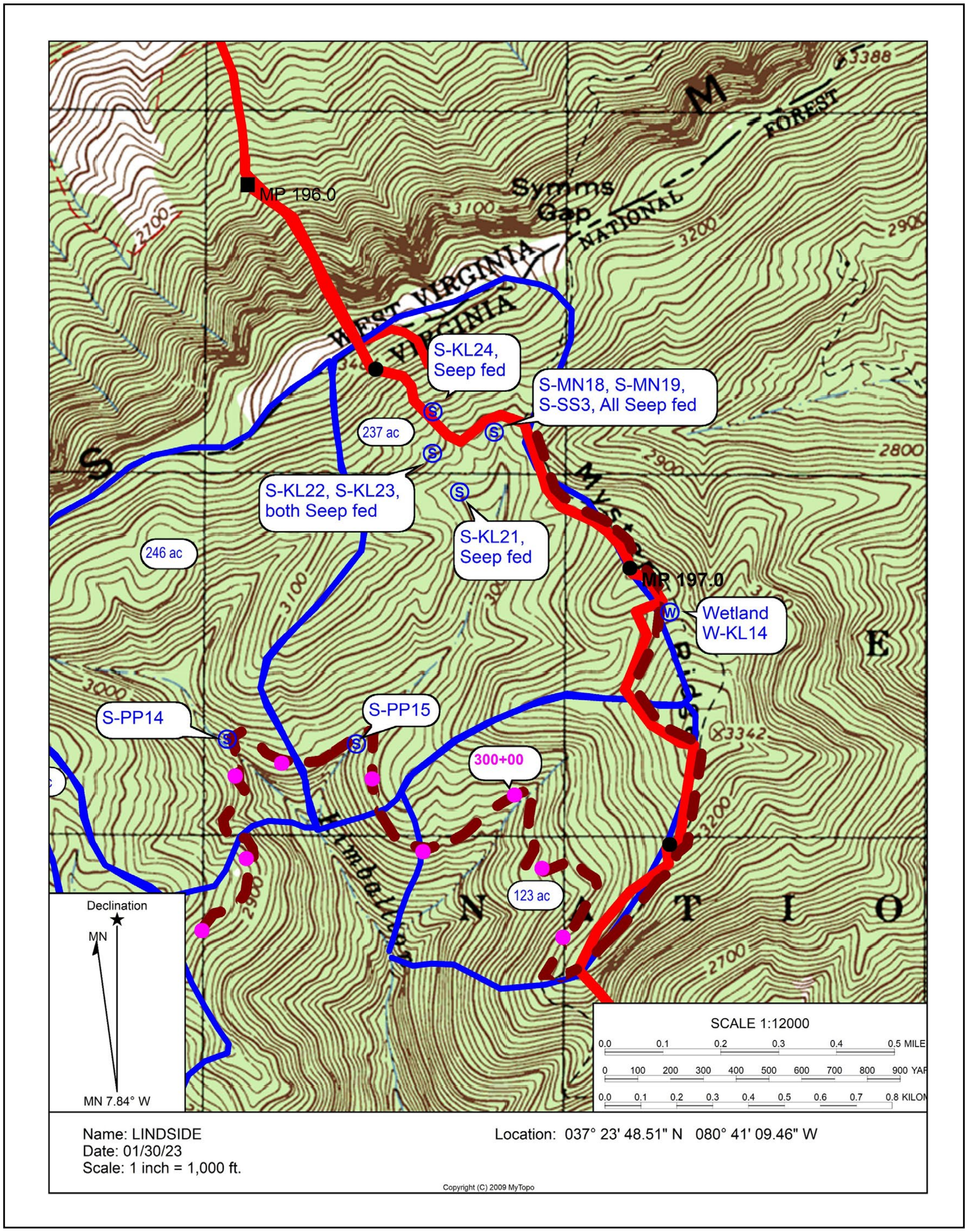


Figure 2.0-2 – Larger scale map showing the location of headwater streams crossed by the MVP construction between MP 196.5 and MP 197.2 in JNF. Locations of springs, seeps, and the wetland were obtained from field sheets incorporated into the Aquatic Resource Report for the FERC FEIS in US National Forest Service Lands, Monroe County, WV; Giles and Montgomery Counties, VA, dated June 2017.

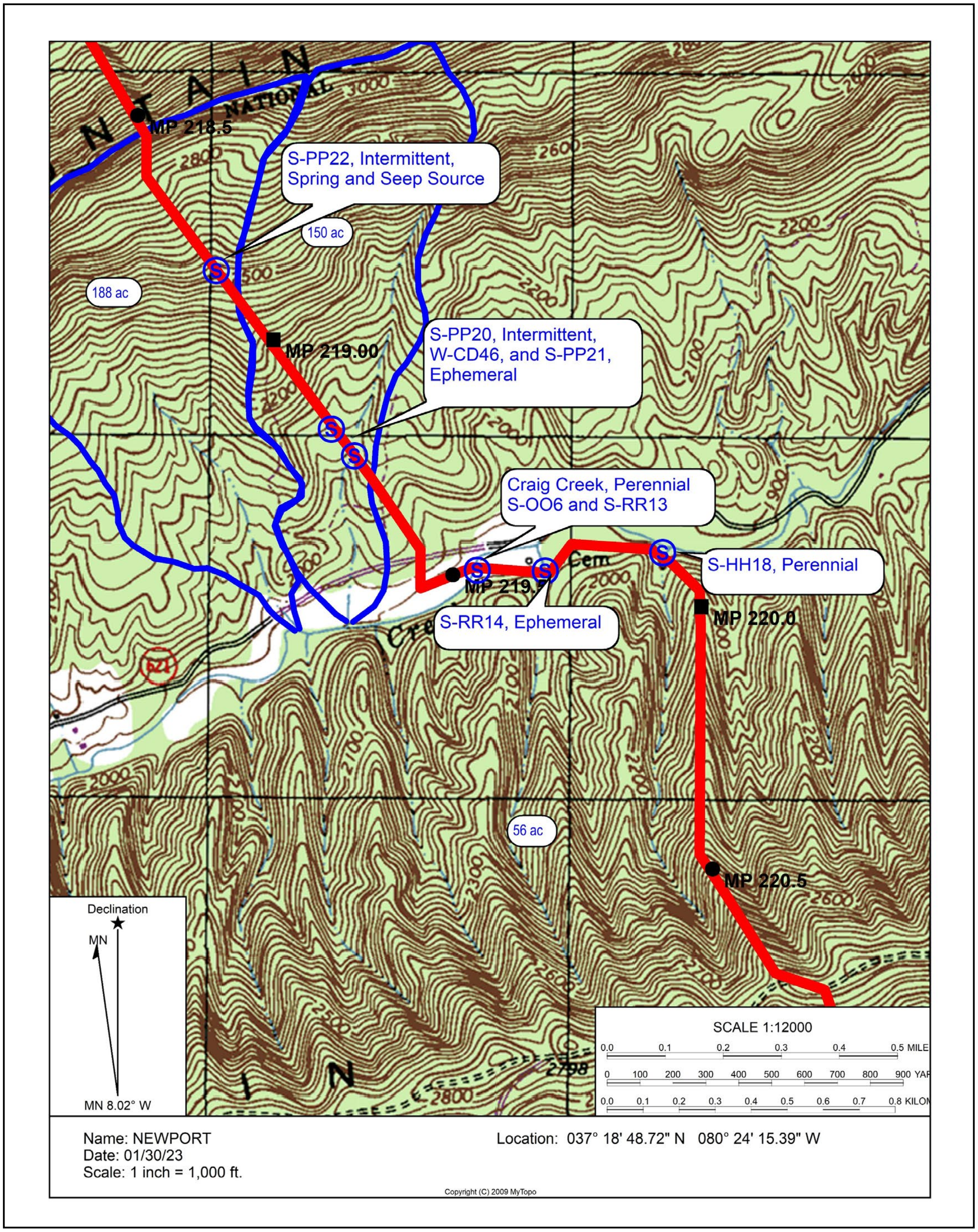


Figure 2.0-3 – Larger scale map showing the location of headwater streams crossed by the MVP construction between MP 218.5 and MP 220 in JNF. Locations of spring, seep, and the wetland were obtained from field sheets incorporated into the Aquatic Resource Report for the FERC FEIS in US National Forest Service Lands, Monroe County, WV; Giles and Montgomery Counties, VA, dated June 2017.

The seeps and springs in this area issue from perched aquifers formed on bedrock at depths of 20 inches to 60 inches (**Figure 2.0-4** and **Table 2.0-1**).

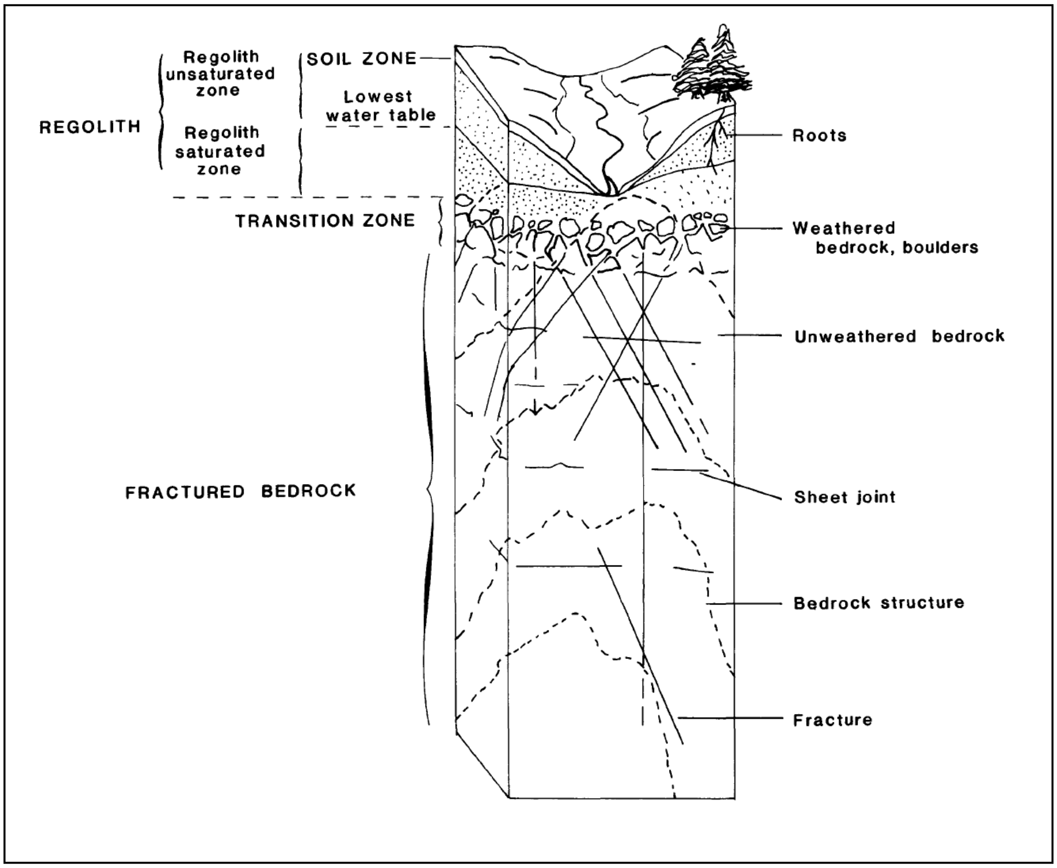


Figure 2.0-4 – Soil developed in weathered bedrock is coarse at the interface between the soil and the bedrock. The coarse material at this interface stores water as a perched aquifer. The groundwater then migrates downward into fractures. (Excerpted from D.A. Harned, 1989).

Groundwater flows downward through the soil, accumulating in coarse soil and weathered bedrock material above the soil/bedrock interface. The coarse sediment at the soil/bedrock interface serves as storage for water in a perched aquifer. The groundwater in the perched aquifer issues through seeps and springs where the underlying bedrock intercepts the ground surface, supplying water to wetlands and to streams. Groundwater in the perched aquifer also migrates downward through bedrock fractures to accumulate in the underlying aquifer, which is evidently greater than 80 inches below the ground surface where there are no perched aquifers and also beneath the perched aquifers.

Dewatering during construction directs groundwater away from the recharge area on the mountain ridges and from the headwater areas where seeps and springs are located. Dewatering of the pipeline trench during pipeline installation is essential for safety purposes, primarily to avoid collapse of the trench. As illustrated in **Figure 2.0-5**, water collects on the upslope side of the trench breakers is diverted to the adjacent land surface through drains. It is stated on page 6-12 of the MVP POD that "…trench drains will be installed on side slopes and steep slopes before the pipe is placed in order to channel water away … and these drains will not be removed after construction is complete. These permanent drains will consist of perforated tile or pipe surrounded with rock (1-inch stone or similar, which may be taken from excavated spoils) that will terminate at a riprap pad near the edge of the ROW. These drainage controls are not removed after pipeline installation." Thus, groundwater continues to be removed after completion of construction activities.

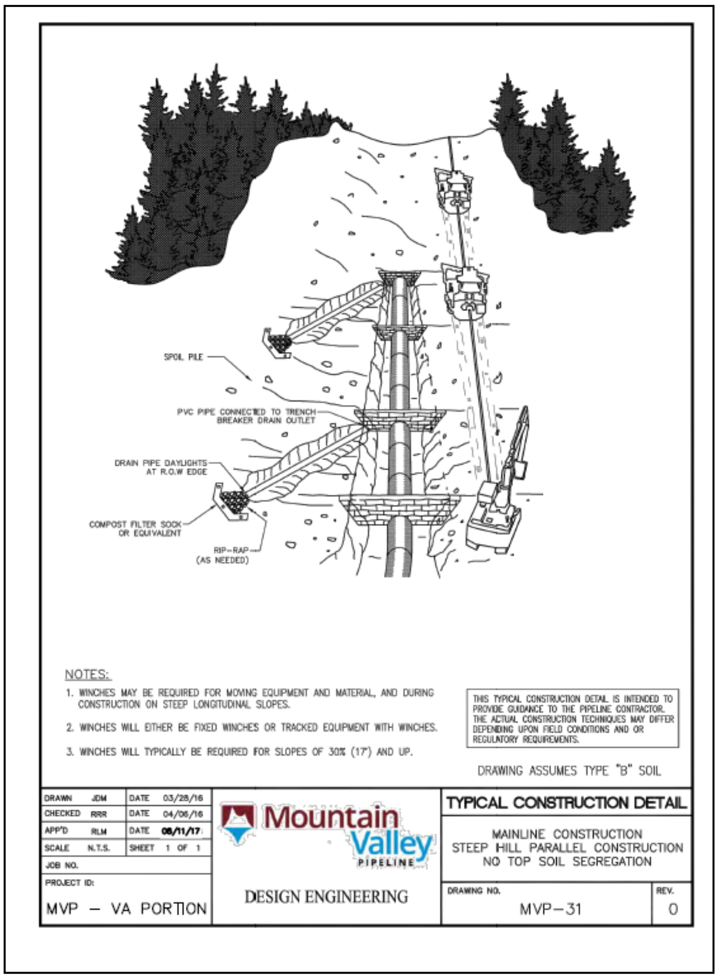


Figure 2.0-5 – Excerpt from POD Appendix C-3 E&S Plan Sheets of Environmental Detail MVP-31, illustrating the groundwater drainage from the pipeline trench, with groundwater directed to the land surface beyond the ROW.

Soils vary within the proposed MVP ROW in JNF, ranging in composition, depths to bedrock, drainage characteristics, and depths to perched aquifers or to groundwater. Table **2.0-1** provides descriptions of some of the soils within the JNF where the MVP pipeline construction is proposed.

Table 2.0-1 – Location and description of soils underlying the MVP ROW where there are perched aquifers on shallow bedrock. The perched aquifers supply groundwater to sustain wetlands, seeps, and springs which serve as the base level for receiving streams. Data is compiled from Appendix N "Soil Limitations" of the FERC FEIS and from the USDA Web Soil Surveys for the specific areas proposed by MVP to be crossed in the Jefferson National Forest (www.websoilsurvey.nrcs.usda.gov).

Mile Post Reference	Soil Description and Slope and Description of approximate overland flow distance	Depth to Bedrock
196.4 to 196.5	Lehew and Wallen soils, very stony, 35 - 65% On ridgeline in headwater area of Kimballton Branch within 170 to 200 feet of intermittent streams	20 to 40 inches
196.5 to 197.3	Lily-Bailegap complex, very stony, 35 – 65% On ridgeline in the headwater area of Kimballton Branch, crossing or within 200 feet of numerous intermittent streams, some reported as seep fed in the FERC FEIS and also crossing wetland W-KL14 reported in the FERC FEIS	20 to 40 inches
197.3 to 197.4	Lily-Bailegap complex, very stony, 15 – 35% On ridgeline within 270 feet from intermittent stream	20 to 40 inches
197.8 to 198.4	Bailegap sandy loam, 35 – 60% On ridgeline within 200 feet from intermittent streams	40 to 60 inches
218.5 to 218.6	Berks Rock outcrop complex, 25 – 70% On ridgeline within 140 to 340 feet from intermittent streams. Spring and seep source S-PP22 was reported at MP 218.7 in the FERC FEIS	20 to 40 inches
219.6 to 219.9	Berks and Weikert soils, 25 – 65% Along flood plain of Craig Creek, then traversing upslope on ridgeline within 215 to 270 feet of perennial and intermittent streams. Wetland W-CD46 was reported at MP 219.3 in the FERC FEIS	20 to 40 inches
219.9 to 220.1	Berks Weikert complex, 15 – 25% On ridgeline within 215 to 270 feet of perennial and intermittent streams	20 to 40 inches
220.1 to 220.6	Berks and Weikert soils, 25 – 65" On ridgeline within 250 to 390 feet of perennial and intermittent streams	20 to 40 inches
220.6 to 221.0	Berks and Weikert soils, very stony, 15 – 35% On ridgeline within 200 to 250 feet of perennial and intermittent streams	20 to 40 inches
221.0 to 221.4	Berks Rock outcrop comlex, 25 – 70% On ridgeline within 200 to 400 feet of perennial streams	20 to 40 inches

As an example, the proposed MVP pipeline construction crosses two first order stream watersheds, extending from the apex of Sinking Creek Mountain at approximately Mile Post (MP) 218.5 to Craig Creek at approximately MP 219.6. The soils crossed from approximately MP 218.5 to MP 218.6 developed on bedrock residuum, classified as the Berks Rock Outcrop Complex: 0 – 10 inches depth, loam with 30 percent rock fragments; 10 to 17 inches depth, loam with 35 percent rock fragments, slightly plastic; 17 to 21 inches depth, loam with 50 percent rock fragments, nonplastic; 21 to 26 inches, loam with 60 percent rock fragments, friable; 26 to 33 inches, loam with 75 percent rock fragments, friable; 33 inches, fractured shale bedrock. Data obtained from the USDA web site for soil surveys describes soil from MP 218.6 to MP 219.0 as Jefferson extremely stony soils developed on colluvial fans. Landslides are known to commonly cause colluvial fans. The Jefferson extremely stony soils consist of 0 – 8 inches gravelly loam; 8 – 31 inches gravelly clay loam, and 31 to 79 inches gravelly sandy clay loam. The soils crossed from approximately MP 219.0 to 219.3 developed on bedrock residuum as Berks and Weikert soils. Weikert soils consist of silt loam with 30 percent rock fragments grading downward to 70 percent rock fragments, with bedrock encountered at a depth of 18 inches. Berks soils are the only soils that exhibit slight plasticity, from 10 to 17 inches depth, along this section. Forest Service Plan standard FW-8 would be modified in accordance with the amendment to the 2012 Forest Plan, thereby allowing soil compaction by heavy equipment on plastic soils when the water table is within 12 inches of the surface. The perched aquifer water table is documented by field sheets (Aquatic Resource Report for the FERC FEIS in US National Forest Service Lands, Monroe County, WV; Giles and Montgomery Counties, VA, dated June 2017) where wetlands, seeps, and springs are located. Any plastic soils would be non-functional when compacted. More importantly, the groundwater would be adversely impacted because the wetlands, seeps, and springs are maintained by groundwater. This is a critical concern because it is stated in the December 2022 DSEIS that there are “no springs or swallets within 500 feet of the MVP pipeline route crossing the JNF”, even thought the locations of wetlands, springs, and seeps were provided in the Aquatic Resource Report for the FERC FEIS. These water resources will not be considered for protection if the Forest Service does not acknowledge their existence.

3.0 Adverse Impacts of the Proposed Project-Specific Plan Amendment with Respect to the Substantive Requirements Directly Related to §219.8(a)(2)(ii) – Soils and Soil productivity

It is stated in the DSEIS that Forest Plan Standard FW-5 (revegetation), “On all soils dedicated to growing vegetation, the organic layers, topsoil and root mat will be left place over at least 85% of the activity area and revegetation is accomplished within 5 years, would be modified to include “*with the exception of the MVP construction zone and right-of-way, for which the applicable mitigation measures identified in the approved Plan of Development (POD) (e.g., Appendix C-1 to C-3, Erosion and Sediment Control Plan; Appendix E, ANST Contingency Plan; Appendix H, Restoration Plan) and MVP Project design requirements must be implemented*.

In the Geosyntec Report presented in Appendix B of the MVP POD, it is stated there are two situations in which the MVP ROW crosses the mountain ridges: the Transverse Profile Category and the Perpendicular Profile Category. The forested ridges where the MVP ROW is located in JNF function as headwater areas in watersheds of first and second order streams, providing protected areas of filtered light, cooler temperatures, and seeps and springs where the groundwater intercepts the ground surface. Aquatic species within these forested, protected areas constitute the base of the aquatic food chain for areas downslope and downstream. Where Transverse Profile crossings are located, not only is the protective forest removed, but the headwater aquatic habitats are dewatered and removed in order to establish a relatively level surface for the MVP ROW (**Figure 3.0-1**).

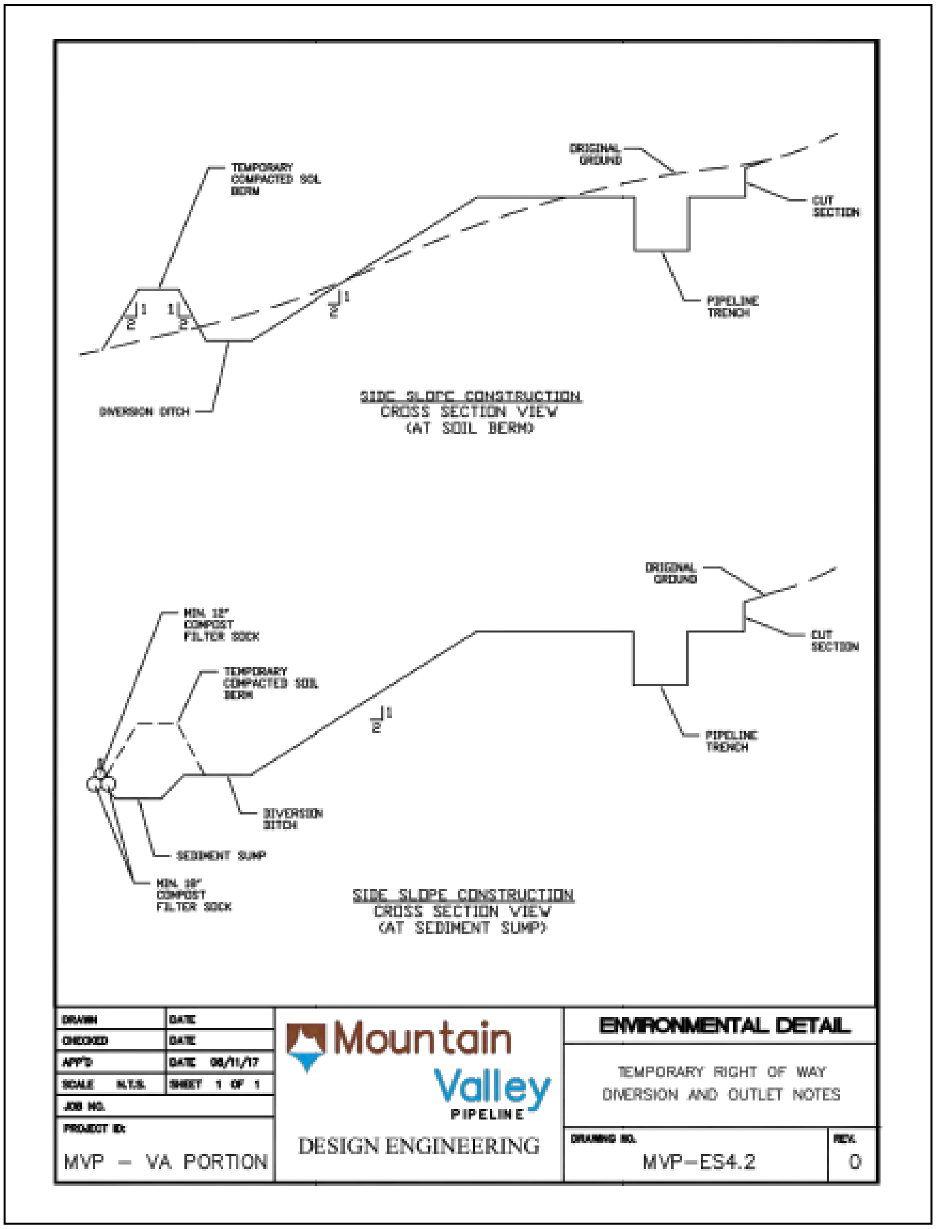


Figure 3.0-1 – Excerpt from MVP POD Appendix C-3 E&S Plan Sheets of Environmental Detail MVP-ES4.2, illustrating the cut slope construction for the MVP ROW.

Where the Perpendicular Profile crosses the JNF ridges, the protective forest cover for headwater aquatic habitats is removed and the ridgeline is excavated to form a relatively level surface (**Figure 3.0-2**).

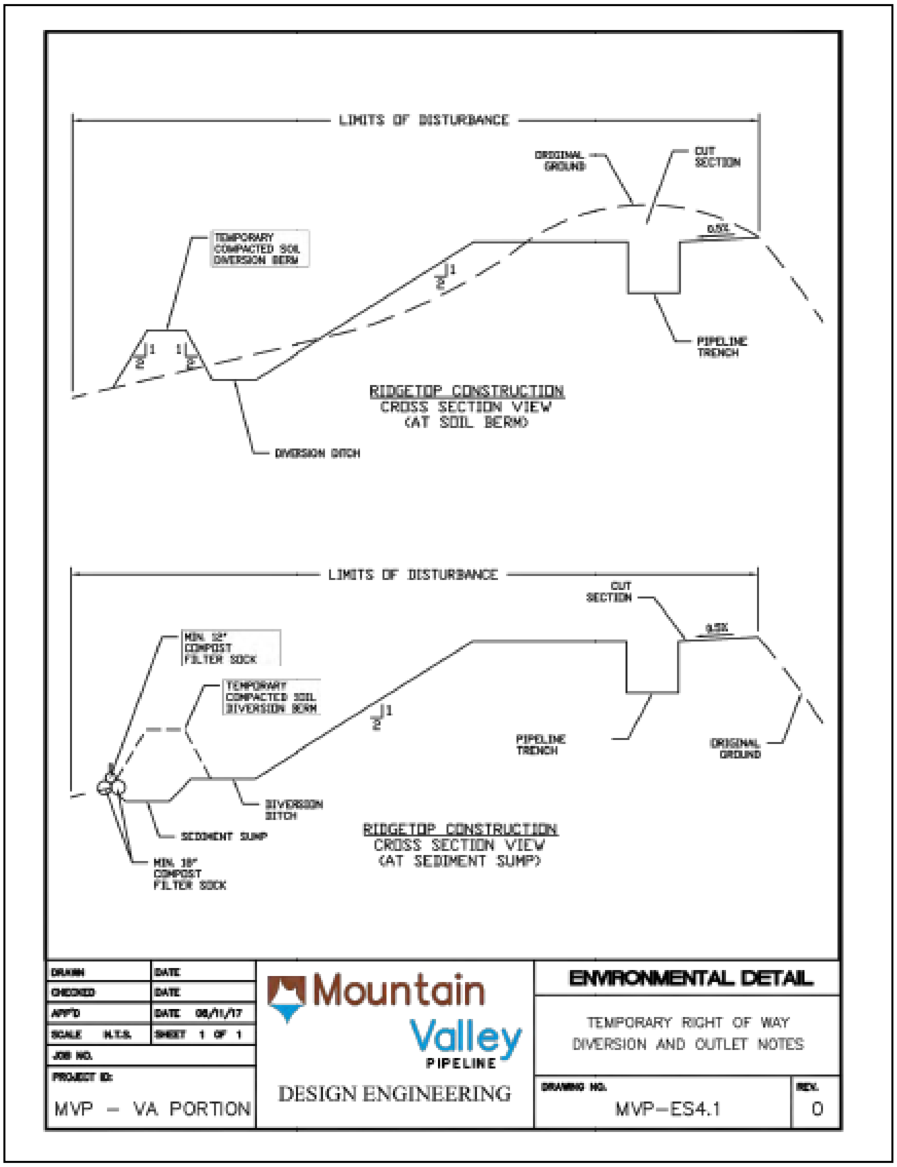


Figure 3.0-2 – Excerpt from MVP POD Appendix C-3 E&S Plan Sheets of Environmental Detail MVP-ES4.1, illustrating ridge leveling for construction in the MVP ROW.

With reference to the impacts of initial grading, stripping, and stockpiling of topsoil, it is stated on page 51 of the September 2020 DSEIS that "Disrupting, moving, and stockpiling soil for any amount of time degrades soil quality through loss of nutrient cycling and microbial activity, homogenization of soil layers, and loss of overall organic matter and organic carbon (Fink and Drohan 2015; Bradshaw et al. 2017)." and "Direct and indirect effects to soil resources are due to the disruption of soil structure by means of removing vegetation and root mass, as well as the physical crushing of aggregates through topsoil salvage, grading, and compaction by heavy equipment activities." The Virginia Stormwater Management Handbook (2013) states that: "When soil is disturbed by grading, stockpiling, and heavy equipment traffic, the soil becomes compacted, structure is lost and porosity decreases. When this happens, the soil's ability to take in water (permeability) is substantially reduced and surface runoff increases. Even if topsoil is stripped, stockpiled and reapplied following construction (a practice DEQ strongly recommends), the resultant loss of structure reduces the permeability of the topsoil. The loss of structure in the topsoil, together with compaction of the subsoil by construction equipment, is so profound that the bulk density of a lawn soil can approach that of concrete… The result is a surface that is *functionally impervious* because the soil's permeability is so greatly reduced."

Because a large portion of the MVP ROW in JNF has already been deforested and graded, and because the topsoil will be stockpiled and there will be heavy equipment traffic, the soil will be compacted, the soil structure and functions will be lost, and porosity will decrease. It is stated on page 56 of the September 2020 DSEIS that "The amended standard would allow MVP construction activities on soil surfaces to occur when either the water table is within 12 inches of the surface or when soil moisture exceeds the plastic limit, resulting in site-specific adverse effects associated where compaction occurs from heavy equipment or vehicle use. These effects would be mitigated by the POD's requirement that compacted soils be ripped to a depth of at least 6 to 8 inches." The result of ripping the soils would be gashes in the compacted soil that do not resemble the porosity of soils because porosity refers to spaces between soil particles, not gashes.

As in the case of determining adverse impacts to ecological integrity and water resources, no consideration has been given to the location of the MVP pipeline in the headwater areas of first and second order streams. The result of soil compaction and dewatering in the headwater areas of these watersheds is the destruction of habitats for benthic aquatic organisms at the base of the food chain for the riverine system. The statement in the December 2022 DSEIS (pertaining not only to modifying standard FW-8 for soil compaction in water saturated areas, but also FW-5 for revegetation, FW-9 for soil effects from heavy equipment use, FW-13 for exposed soil, and Management Prescription 11-003 for exposed soil in the riparian corridor) that the scale of acreage where soil compaction and loss of soil porosity would occur indicates a lack of recognition that the soils being disrupted are in a critical location for ecological integrity and habitat for the benthic aquatic organisms at the base of the river continuum food chain.

4.0 Adverse Impacts of the Proposed Project-Specific Plan Amendment with Respect to the Substantive Requirements Directly Related to §219.8(a)(2)(iii) – Water Quality

In addition to the Forest Service's failure to comply with the 2012 Planning Rule, the Fourth Circuit found that the Forest Service inadequately considered the actual sedimentation and erosion impacts of the pipeline and prematurely authorized the use of the conventional bore method to construct stream crossings. A soil loss analysis was previously provided in MVP POD Appendix B: "Hydrologic Analysis of Sedimentation for

Streams near Suitable Habitat for Threatened and Endangered Aquatic Species, Virginia and West Virginia, Report of Findings – Version 1.2" (Geosyntec Report), prepared by Geosyntec Consultants, Inc., for MVP, dated May 4, 2020. (It should be noted that a similar, less comprehensive report has been made available to the public: "Hydrologic Analysis of Sedimentation for the Jefferson National Forest, Virginia and West Virginia, Report of Findings, Geosyntec, dated May 8, 2020". The more comprehensive "Version 1.2", dated May 4, 2020, is referenced herein). The purpose of these reports was to partly to potential sediment effects (tons per acre, turbidity) to soil, water, and threatened and endangered species."

Stormwater discharge calculations based on soils and land cover were not discussed in the September 2020 DSEIS, the December 2022 DSEIS, or in the POD. However, the importance of calculating the stormwater discharge from a disturbed watershed is stated in Chapter 4 of the DEQ Virginia Stormwater Management Handbook (2013, Section "4.5.1.5 Increased Imperviousness of the Land Surface" that:

> "Impervious cover has emerged as a measurable, integrating concept used to describe the overall health or, conversely, degradation of a watershed. Research has established that when impervious cover in a watershed reaches between 10 and 25 percent …, ecological stress becomes apparent (Schueler et al., 2009). Beyond 25 percent impervious cover, stream stability is reduced, habitat is lost, water quality is degraded, and biological diversity is diminished."

Additionally, in Chapter 4 of the DEQ Virginia Stormwater Management Handbook (2013), it is stated in section "4.5.2. Stream Channel and Floodplain Impacts" that

> "Increased peak discharges for a developed watershed can be two to five times higher than those for an undisturbed watershed. As runoff velocities increase, it takes less time for water to run off the land and reach a stream or other water body (time of concentration). Streams in developed areas are often characterized as very "flashy" or "spiky" because of their response to these altered runoff characteristics… The combination of greater volumes of runoff more often and at higher flow rates can create altered stream flows, localized flooding, stream channel degradation and property damage, even in small storm events."

It is inappropriate to evaluate soil loss due to MVP construction activities on the scale of a Hydraulic Unit Code (HUC) 12 watershed (for example, the entire Trout Creek-Craig Creek HUC 12 watershed of 33,173 acres stated in the MVP "Revised Hydrologic Analysis of Sedimentation, JNF, June 2017) rather than the impact on the functional watersheds, approximately 200 acres in size, crossed by the MVP ROW. The MVP ROW is 2.3 miles long and 125 feet wide where it crosses the JNF in the Craig Creek watershed. This equates to approximately 35 acres disturbed by construction in the MVP ROW in the 33,173 acres comprising the Trout Creek-Craig Creek HUC 12 watershed, or 0.06 percent of the Trout Creek-Craig Creek HUC 12 watershed. However, the MVP ROW crosses at least 4 watersheds (each less than 200 acres) of first order streams which are tributaries to Craig Creek. **Figure 1.0-3** and provides delineations of high gradient first order stream tributaries proposed for crossing by the MVP work corridor and access roads. Stormwater discharge calculations would be appropriate for watersheds of first order streams.

It is stated in the Geosyntec Report that the MVP ROW was **hydrologically disconnected (Figure 4.0-1) from the surrounding area in order to estimate sediment loss** using the Revised Universal Soil Loss Equation Version 2 (RUSLE2) and previous versions.

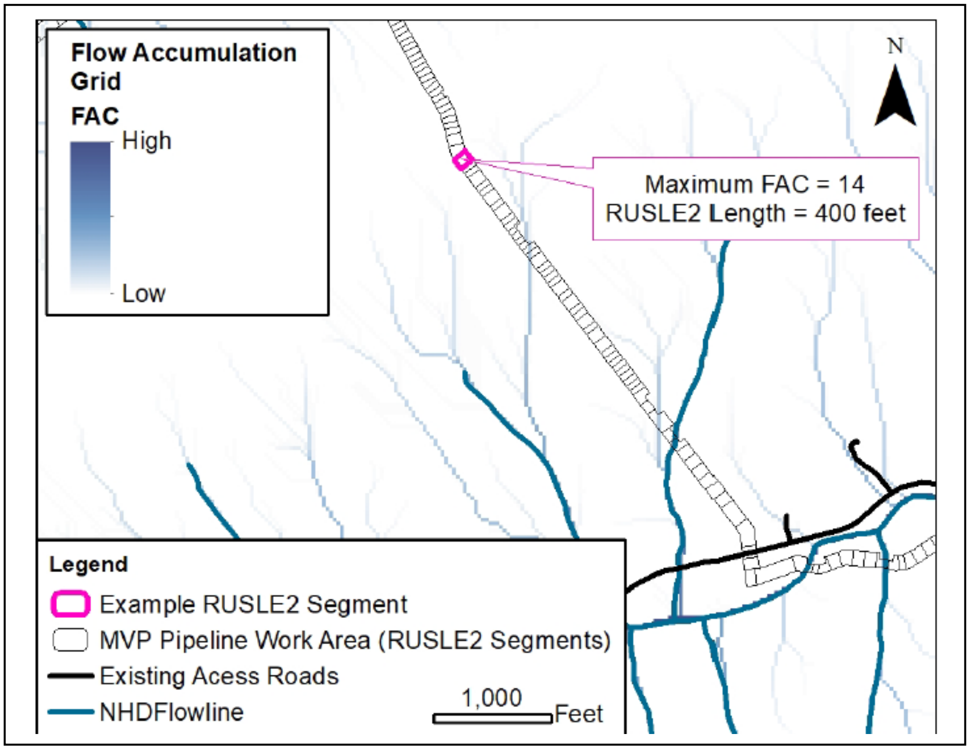


Figure 4.0-1 – Excerpt from Geosyntec Report's RUSLE2 Example Analysis. The polygons comprise the area for which RUSLE2 calculations were made. There is no information indicating that nearby ravines with ephemeral, intermittent, or perennial streams were incorporated to comply with determining the overland flow path to be from the ridge to the first order channel, concentration flow channel prescribed by the RUSLE2 User's Reference Guide (USDA-Agricultural Research Service, 2008).

In the Geosyntec Report, it is explained that "RUSLE2 is not applicable at the watershed scale due to the lack of defined slope lengths in the natural topography. By contrast, within the Project ROW, there are clear boundaries around the site where BMPs prevent run-on water, define slope boundaries, and hydrologically disconnect the site from the surrounding landscape." However, the RUSLE2 User's Reference Guide (USDA-Agricultural Research Service, 2008), illustrates the intended overland flow path to be used in determining the slope lengths (**Figure 4.0-2)**. An overland flow path is selected which represents the 1/4 to 1/3 most erodible part of the area. The slope length is defined as the overland flow path length and is the distance from the origin of overland flow to the first order channel and includes both the eroding and depositional portions of the overland flow path. The Geosyntec (2020) statement that the use of polygons (**Figure 4.0-1**) within the ROW hydrologically disconnects the site from the surrounding landscape is inconsistent with the RUSLE2 definitions and analyses. Using polygons along the MVP ROW rather than using the overland flow path to a "first order channel, concentration flow area" is not consistent with the intended use of the RUSLE2 equation.

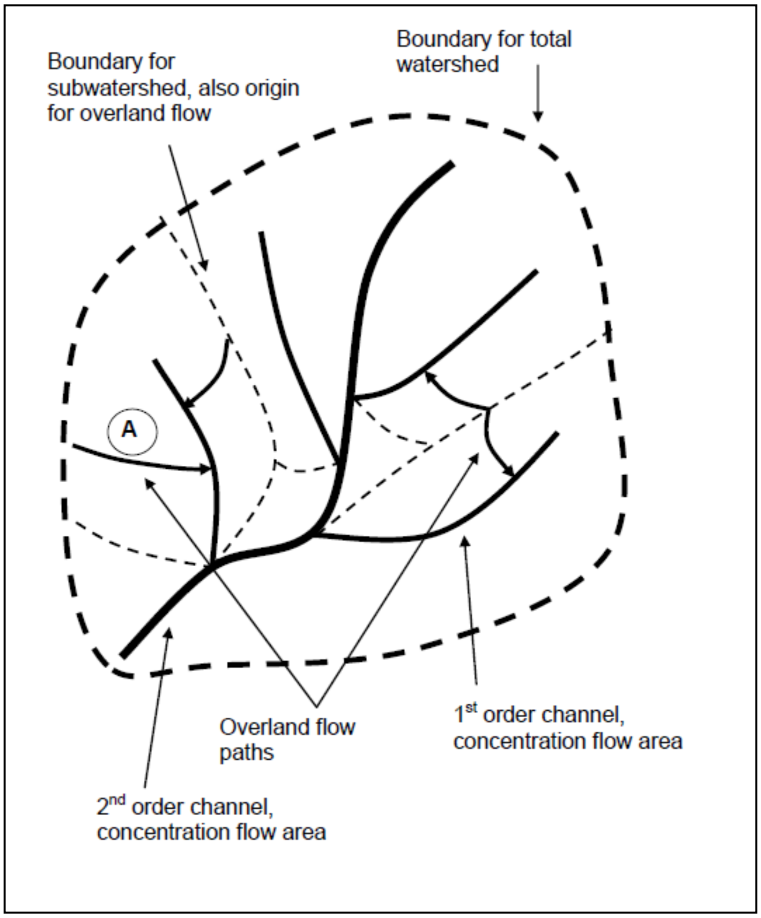


Figure 4.0-2 – Diagram excerpted from the RUSLE2 User's Reference Guide (USDA-Agricultural Research Service, 2008), clearly illustrating that overland flow path is measured from the ridge to a first order channel, concentration of flow area.

The first order watershed, approximately 150 acres, crossed by the MVP ROW extending from approximately MP 218.8 to approximately 219.3 crosses two streams (identified in the FERC FEIS as S-PP20, and intermittent stream, and S-PP21, an ephemeral stream) as well as a wetland (identified in the FERC FEIS as W-CD46). Intermittent streams and wetlands are maintained by groundwater issuing through seeps and springs. The MVP ROW (0.5 mile long x 125 feet wide) crossing this first order stream watershed is approximately 7.5 acres, which is 5.0 percent of this functional first order stream watershed. However, this acreage is only 0.02 percent of the Trout Creek-Craig Creek HUC 12 watershed.

For the “RUSLE2 Example Analysis” (Appendix A, Geosyntec Report), the sample polygon (illustrated as 100 feet long by 125 feet wide, or 0.29 acre) is located between MVP ROW MP 218.6 and MP 218.8 in the Trout Creek-Craig Creek HUC 12 watershed. At this location, the MVP ROW crosses a functional first order stream watershed approximately 188 acres in size. The MVP ROW crosses a stream (identified in the FERC FEIS as S-PP22 with a spring and seep source). The MVP crossing this first order stream watershed is approximately 3 acres, which is 1.6 percent of this functional first order stream watershed. However, this acreage is only 0.009 percent of the Trout Creek-Craig Creek HUC 12 watershed. “Figure A-26: Baseline Scenario Sediment Delivery in tons/ac/year” (Appendix A, Geosyntec Report) provides that the baseline sediment delivery for the 0.29 acre example polygon is 0.3 tons/ac/year. “Figure A-27: Felled Scenario Sediment Delivery in tons/ac/year” (Appendix A, Geosyntec Report) provides that the felled sediment delivery for the 0.29 acre example polygon is 1.41 tons/ac/year. “Figure A-29: During Construction Scenario Sediment Delivery in tons/ac/year” (Appendix A, Geosyntec Report) provides that the during construction sediment delivery for the 0.29 acre example polygon is 24.54 tons/ac/year. The Virginia Department of Transportation estimates one ton (2000 pounds) of sediment to 1 cubic yard, or 27 cubic feet, of sediment for purposes of estimating the amount of sediment transported in trucks for fill material. This calculation is also available at: https://www.gravelshop.com/gravel-calculator.asp?groupid=26&productid=412. Using the during construction value of 24.54 tons/ac/year in the Geosyntec Report polygon example, this would be approximately 24.54 cubic yards/ac/year or 662 cubic feet/ac/year of sediment that would be released during construction of 0.29 acre within a functional first order stream watershed. There are approximately 24 polygons between MP 218.6 and 218.8 of the MVP ROW. The Geosyntec Report does not provide the amounts of tons/ac/year for each polygon in the information made available to the public; however, there would be impacts to the first order stream resulting from such amounts of cubic yards of sediment released to the headwater areas of the receiving stream. It is important to provide such meaningful information in order for the Forest Service to effectively evaluate the impact of sediment loss from the MVP ROW on “ecological integrity of riparian areas in the plan area, including plan components to maintain or restore structure, function, composition, and connectivity” in accordance with the 36 CFR 219 planning rule requirement § 219.8(a)(3)(i).

Instead of revising the RUSLE2 approach presented in the September 2020 DSEIS, the Forest Service evidently used the results provided in the September 2020 DSEIS, summarizing previous results as baseline sediment yields varying from 0.15 to 0.43 tons/ac/yr at each HUC 12 watershed outlet. The HUC 12 watersheds are simply too large to apply meaningful parameters to the small watersheds of first and second order streams that would be impacted by the MVP pipeline construction. Sediment yields are further summarized as percentages of the estimated sediment yields.

The U.S. Geological Survey (USGS) conducted turbidity measurements at HUC 12 watershed discharge points. Again, these measurements are not meaningful for the small watersheds of first and second order streams that will be crossed by the MVP pipeline construction.

The reference to the USGS turbidity measurement results was simply stated in the December 2022 DSEIS: "The USGS data and other relevant information considered in this DSEIS do not indicate that the modeling used in the 2020 FSEIS is inconsistent with data about the actual impacts of the pipeline and its construction." It is further stated in the December 2022 DSEIS that MVP analyzed the USGS monitoring data, "concluding that the USGS data could not corroborate the RUSLE2 modeling." Instead, the Forest Service stated that "RUSLE2 is not designed to be validated with in-stream water quality monitoring data", but that the erosion control devices have been selected based on the RUSLE2 calculations.

Erosion and sedimentation occur not only from the watersheds where the MVP ROW corridor is located, but also from downstream stream bank erosion and scour of the stream bottom due to increases in stormwater discharge from disturbed areas within the watersheds. In the FERC FEIS, MVP described the post-construction land cover and soils as being the same as those existing as pre-construction, such that the stormwater discharge calculations did not need to be presented. Although the values for ground cover in stormwater discharge calculations are allowed to be the same for forests as for open areas, good engineering practices should incorporate the function of the forest tree canopy as intercepting rain more effectively than grasses or herbaceous ground covers, thereby resulting in greater stormwater discharge from deforested areas. Also, the Virginia DEQ explains that impervious soils result from construction activities, thereby changing the soil structure and soil porosity. The tilling or plowing of compacted soils to depths of 4 to 6 inches will not restore the porosity. The impervious soils must be considered in order to provide meaningful stormwater discharge estimates.

4.1 Meaningful Measurements for Determining Sedimentation in Streams

Stream water turbidity increases with the introduction of sediment to a stream. Stream embeddedness (**Figure 4.1-1**) increases when sediment is deposited within openings among cobbles within a stream bed. The U.S. Environmental Protection Agency (National Primary Drinking Water Regulations) identifies turbidity as a primary drinking water standard because it is recognized that chemicals and pathogenic contaminants are adsorbed onto sediment particles. It is important to evaluate and monitor streams prior to, during, and after any construction which will contribute sediment to streams.

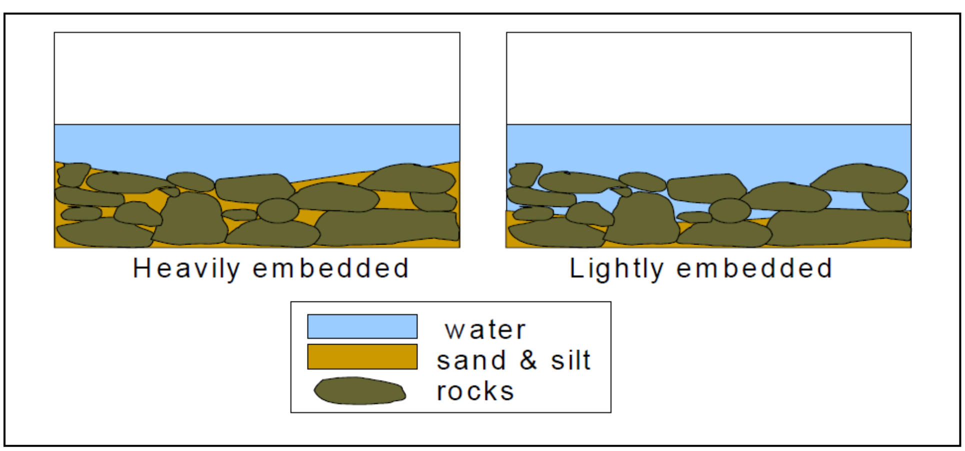


Figure 4.1-1 – Cobbles and pebbles provide aquatic habitats and protection for aquatic organisms. Insect larvae, which constitute the base of the river continuum food chain, reside on the cobbles and pebbles. Minnows and juvenile fish (including the Candy Darter) hide in the spaces between cobbles and pebbles for protection. When sand and silt fill the spaces between the cobbles and pebbles, the aquatic habitats and protection areas are destroyed. When the aquatic habitats become heavily embedded or are removed for trenching and stream crossing work spaces, they cannot be restored.

The consequences of embeddedness are provided by Jessup and Dressing (2015) as: "1) Displacement of interstitial habitat space; 2) Clogging of water movement under the channel bed (hyporheic zone); 3) Decreased or altered primary algal productivity; 4) Increased macroinvertebrate drift; 5) Abrasion or smothering of gills and other organs; 6) Uptake of sediment-bound toxicants that are increasingly associated with fine particles; and 7) Larger scale homogenization or disturbance of habitat types."

Embeddedness particularly impacts the Threatened and Endangered Candy Darter, whose food source consists of the macroinvertebrates living on pebbly/cobbly substrate in cold water streams. Specifically, the Candy Darter consumes mostly mayfly and caddisfly larvae, which are indicators of high stream quality with low embeddedness. The Candy Darter is known to live in Stony Creek. The aquatic food chain that supports the Candy Darter starts in the headwater areas for the first order stream segments of Kimballton Branch. The MVP ROW crosses these headwater areas where MVP contractors reported in the FERC FEIS a wetland and also seeps and springs serving as groundwater supply for intermittent creeks flowing toward Kimballton Branch. Dewatering associated with diverting water from seeps and springs in the MVP ROW, along with trench dewatering, will divert the groundwater that sustains the aquatic habitats in the headwater areas of Kimballton Branch. Also, these creeks will receive sediment laden stormwater runoff directed from the MVP ROW/LOD to adjacent areas. Increased embeddedness will degrade or destroy the mayfly and caddisfly larvae aquatic habitats, thereby impacting the food source of the Candy Darter downstream in Stony Creek, which is also the protected area where the Candy Darter finds food and lays eggs.

4.2 Hydrogeological Assessment of Inadequate Best Management Practices (BMPS0 and Erosion Control Devices (ECDS) used for Grading in the MVP ROW and Construction of the MVP Pipeline

The Geosyntec Report lists the following BMPs to be used during construction on the MVP ROW:

"• Rock Construction Entrance,
• Temporary ROW Diversion Berm and Sediment Trap Outlet,
• Silt Fence, Super Silt Fence, and Belted Silt Retention Fence,
• Compost Filter Sock,
• Water Bars,
• Trench Plugs,
• Erosion Control Blanket/Flexterra/or equivalent, and
• Vegetative Stabilization."

The BMPs shown on the MVP construction sheets provided in Appendix C-3 of the Plan of Development, Mountain Valley Pipeline Project, Erosion and Sediment Control Details, include all of these except for the sediment trap or sediment trap outlet. Sediment basins constitute the only BMP capable of detaining the water quality volume for release over 48 hours, or detaining and releasing over a 24-hour period the expected rainfall resulting from the one-year, 24-hour storm. However, there are no sediment basins shown on the construction sheets provided in Appendix C-3 of the POD. This is inconsistent with Virginia §62.1-44.15:52 because of ineffective control of soil erosion and sediment deposition which will result in unreasonable degradation of stream water and stream channels. This is also inconsistent with Virginia Erosion and Sediment Control Regulations (9VAC25-840-40) Minimum Standard 19: "Properties and waterways downstream from development sites shall be protected from sediment deposition, erosion and damage due to increases in volume, velocity and peak flow rate of stormwater runoff for the stated frequency storm of 24-hour duration in accordance with the following standards and criteria. Stream restoration and relocation project that incorporate natural channel design concepts are not man-made channels and shall be exempt from any flow rate capacity and velocity requirements for natural or man-made channels:

> A. Concentrated stormwater runoff leaving a development site shall be discharged directly into an adequate natural or man-made receiving channel, pipe or storm sewer system. For those sites where runoff is discharged into a pipe or pipe system, downstream stability analyses at the outfall of the pipe or pipe system shall be performed.
>
> B. Adequacy of all channels and pipes shall be verified in the following manner:
>
> > 1. The applicant shall demonstrate that the total drainage area to the point of analyses within the channel is one hundred times greater than the contributing drainage area of the project in question; or
> >
> > 2. (a) Natural channels shall be analyzed by the use of a 2-year storm to verify that stormwater will not overtop channel banks nor cause erosion of channel bed or banks (b) All previously constructed man-made channels shall be analyzed by the use of a 10-year storm to verify that stormwater will not overtop its banks and by the use of a
> > 2-year storm to demonstrate that stormwater will not cause erosion of channel bed or banks…"

4.3 The BMPs Listed in the POD have Failed During Previous MVP Construction Activities. The DSEIS and Geosyntec Report Do Not Reflect Such Failures and the Resulting Potential for Excessive Sediment Release from the ROW.

Throughout the MVP project's history since issuance of the FERC FEIS to date, numerous instances of excessive sediment release into streams have been noted. This significant new information is not recognized in the DSEIS.

Failure of the MVP BMPs and ECDs used so far during construction on the MVP ROW is documented in West Virginia and in Virginia. In the "Consent Order Issued Under the Water Pollution Control Act, West Virginia Code, Chapter 22, Article 11" (April 19, 2019) issued by the West Virginia DEP against Mountain Valley, over 42 erosion and sediment control failures were observed and documented, leading to 26 Notices of Violations, issued between April 3, 2018 and November 30, 2018. Most of the BMP failures observed by West Virginia DEP personnel resulted in sediment-laden water leaving the construction site and being deposited in streams. Specific observations noted failures to construct BMPs, failures to properly construct BMPs, and ineffectiveness of the Storm Water Pollution Prevention Plan to achieve the general objectives of controlling sediment releases in stormwater discharges.

Mountain Valley signed the Consent Order on May 6, 2019. However, additional Notices of Violation for the same' field observations have been issued since then on the following dates: May 13, 2019; May 24, 2019; May 29, 2019; May 30, 2019; June 5, 2019; June 12, 2019; June 19, 2019; July 9, 2019; July 18, 2019; July 28, 2019; August 1, 2019; August 8, 2019; August 14, 2019 (2 violations in different counties); August, 26, 2019; September 9, 2019; September 11, 2019; November 7, 2019; and December 12, 2019.

Similar erosion and sedimentation control failures occurred within Virginia. On July 9, 2018, the Virginia DEQ issued a "Notice of Violation to Mountain Valley" based on DEQ Field Inspection Reports dated May 21, 23, 24, and 30, 2018 and June 13, 26, and 27, 2018 for lack of BMP installations, improperly installed BMPs, failure to provide corrective actions, failure to maintain or repair BMPS, releases of sediment laden water off the right-of-way (ROW), and sediment deposition in receiving waterbodies. On December 7, 2018, the Virginia DEQ and the State Water Control Board (SWCB) sued Mountain Valley for more than 300 violations related to improper erosion control and stormwater management observed between May 21, 2018 and November 15, 2018. Specific observations noted sediment release to receiving waters due primarily to failure to install adequate BMPs and failure to repair BMPs.

The Field Inspection Reports revealed continual failures of the BMPs and failure to maintain the BMPs, resulting in sediment-laden water by-passing the BMPs and depositing sediment off the ROW and, in numerous instances, into streams and wetlands. Areas draining to silt fence and compost filter socks are shown in photos provided in the Field Inspection Reports. There are excavated areas, referenced as sumps, at the base of these BMPs that are evidently intended to collect drainage water from the slopes. However, the photos indicate that sediment-laden water in the sumps overwhelmed the silt fence and compost filter socks at the sump perimeters, allowing sediment-laden water to breach the BMPs to areas beyond the ROW, including streams and wetlands. Such sumps do not constitute properly designed sediment traps or sediment basins because there were no stormwater discharge calculations to properly size the water collection area (or there were deficient stormwater discharge calculations) and there were no properly designed outlets for the water collection areas.

On August 2, 2019, the Virginia DEQ issued a Stop Work order on an approximately two-mile section of the Mountain Valley Pipeline construction project in Spread H in Montgomery County, Virginia. The Stop Work order was based on DEQ field inspections citing "insufficient erosion and sediment controls". It is stated in the DEQ Stop Work order that, "the agency has determined that an imminent and substantial adverse impact to water quality is likely to occur as a result of land-disturbing activities. Specifically, MVP has failed to construct and maintain erosion and sediment control or pollution prevention measures in accordance with approved site-specific plans and/or the erosion and sediment control measures that have been installed are not functioning effectively and MVP has not proposed any corrective action."

It is also notable that despite the continued patter of violation, MVP proposes the use of less-than-best available technology for erosion control within the JNF. As stated in the Geosyntec Report, Appendix F, "Although enhanced BMPs are useful to provide redundancy and provide additional support to the approved suite of BMPs, based on the modeling results, the effectiveness of the approved BMPs is sufficient to achieve a reduction in sediment yield as required by regulatory agencies."

4.4 Sediment Basins are Not Included for Detention of Sediment Laden Stormwater Runoff from the MVP ROW/LOD

Most of the failed BMPs noted in the West Virginia DEP Consent Order, West Virginia DEP Notice of Violations, Virginia DEQ Field Inspection Reports, and the VADEQ/SWCB lawsuit were silt fences and waterbars, both of which require peak stormwater discharge calculations in order to be properly sized and located. Because there were no sediment basins included as BMPs, the sediment-laden water entered streams. Although sediment basins are reported as only 60% to 80% effective, they do provide for some settling of sediment prior to the stormwater runoff being discharged to streams. Stormwater discharge calculations provide quantities of stormwater leaving the construction site. Diverting stormwater by using waterbars to direct the stormwater off the ROW/LOD does not decrease the amount of water flowing toward receiving streams. Stormwater discharge calculations are necessary to properly size sediment basins. However, the increased stormwater discharge entering the receiving streams will result in scour of the stream bottom and erosion of the downstream stream banks, thereby releasing additional sediment to the receiving streams.

In the Geosyntec Report, the stated hydraulic disconnection of the MVP ROW from the surrounding area is to be accomplished by diverting upland sheet flow and shallow concentrated flow to pipes traversing the MVP ROW and directing such concentrated flow downslope of the MVP ROW Limit of Disturbance (LOD) to headwater areas and receiving streams. This will result in increased discharge of water and sediment to the receiving area. This is inconsistent with Code of Virginia, Title 62.1. Waters of the State, Ports and Harbors" under "§ 62.1-11. Waters declared natural resource; state regulation and conservation; limitations upon right to use, F. The quality of state waters is affected by the quantity of water and it is the intent of the Commonwealth, to the extent practicable, to maintain flow conditions to protect instream beneficial uses and public water supplies for human consumption." This is also inconsistent with 9VAC25-840-40 Minimum Standard 19: "Properties and waterways downstream from development sites shall be protected from sediment deposition, erosion and damage due to increases in volume, velocity and peak flow rate of stormwater runoff for the stated frequency storm of 24-hour duration…"

4.5 The Purpose of Silt Fence is to Intercept and Detain Small Amounts of Sediment

Silt fence and compost filter socks are shown on the JNF SEIS Appendix C ES Plan Sheets as the predominant porous barriers to be used for sediment control. The Virginia Standard & Specification 3.05 for silt fence describes it purpose "To intercept and detain small amounts of sediment from disturbed areas during construction operations in order to prevent sediment from leaving the site." (Virginia DEQ Erosion and Sediment Control Handbook, 1992). The amount of sediment calculated by using the RUSLE2 is provided in tons per acre per year. The tons of sediment reported do not constitute small amounts. The failure of silt fence used in previous MVP construction activities attests to the failure of silt fence to detain the amount of sediment released from the MVP ROW during construction activities.

4.6 Compost Filter Socks are Porous Barriers Providing Some Filtration of Stormwater

Compost Filter Socks are shown as widely used in the DSEIS POD Appendix C-3 ES Plan Sheets. Although not included in the WV Department of Environmental Protection Erosion and Sediment Control Handbook (2006) or in the Virginia Erosion and Sediment Control Handbook (1992), Compost Filter Socks are described in the Agronomy Technical Note No 4 (Natural Resources Conservation Service, U.S. Department of

Agriculture, 2011:
https://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb1048852.pdf. Compost Filter Socks can reduce total suspended solids up to 76 percent effectiveness and can reduce turbidity up to 29 percent effectiveness. However, the quantity of partially filtered continues to pass through toward receiving streams, thereby allowing sediment laden water to enter the receiving streams.

The Geosyntec Report provides Appendix F – Enhanced BMP Analyses to use in areas of greater erosion risk. The use of Compost Filter Socks as an enhanced BMP was evaluated to have only minor additional benefit when more Compost Filter Socks were added. Geosyntec evaluated using one Compost Filter Sock as reducing sediment with 28% effectiveness and using three rows of Compost Filter Socks as reducing sediment with 25% effectiveness. Redundant Silt Fences and straw wattles were stated as additional enhanced BMPs; however, they were not evaluated.

4.7 Slope Breakers/Right-of-Way Diversions/Waterbars Direct Concentrated Stormwater Flows Off the MVP ROW/LOD Toward Receiving Streams

The use of diversion dikes (VADEQ STD & SPECS 3.09) is specified in MVP POD Appendix C ES Plan Sheets as the method for intercepting clean water from the area upslope of the ROW/LOD perimeter where the upslope water would flow onto the ROW/LOD. The clean water would be directed along the upslope perimeter of the ROW/LOD by the diversion dikes to clean water diversion pipes which cross the ROW/LOD, directing water into plunge pools (MVP-ES51 and MVP-ES51.1). This would be the method to satisfy the Geosyntec (2020) statement that the ROW would be hydrologically disconnected from the surrounding upslope landscape. In areas where clean water from upslope areas flows parallel to the ROW/LOD, compost filter socks are shown at some locations along the upslope perimeter of the ROW/LOD.

It is stated in the VADEQ STD & SPEC 3.09 that this Temporary Diversion Dike is vegetated, compacted soil with a minimum height of 18 inches, a minimum width of 4.5 feet, and which has a cross-section in the shape of a parabola or trapezoid to avoid a “V” shape. If the channel slope is greater than 2 percent, then it must be stabilized and designed in accordance with STD & SPEC 3.17, which states: “Channels should be designed so that the velocity of flow expected from a 2-year frequency storm shall not exceed the permissible velocity for the type of lining used.” Using the scale on the construction sheets (MVP POD Appendix C-3), the channel slope at some locations is evidently greater than 2 percent. However, STD & SPEC 3.17 is not shown on the construction sheets at any of these locations. The Virginia Department of Transportation Drainage Manual specifies that, for designing minor channels such as diversion ditches, “Design discharges (peak flows) should be determined by the Rational Method… Velocity should be based on normal depth computed using Manning’s equation. Manning’s equation requires information on the ditch geometry, such as side slopes, the longitudinal grade, and the appropriate Manning’s n-value.” There is no mention of such calculations used in the MVP POD to design the diversion ditches. Proper design is important because it governs which lining to use in the ditch to control erosion of the ditch.

In the Project Specific Standards and Specifications for Virginia Appendix B (Mountain Valley Pipeline, LLC, 2017), the Permanent Slope Breaker/ROW Diversion/Water Bar details are provided as MVP-17. The Slope Breaker/Right-of-Way Diversion/Waterbar Construction Detail MVP-17.2 specifies that "Outlet protection/compost filter sock should be installed at the outlet of all waterbars" and "Sump filters to be installed at end of waterbars. Refer to sump filter detail on Sheet 0.09 for more detail." The BMPs on the construction sheets also indicate plunge pool outlets where water draining toward the LOD is diverted across the ROW/LOD to areas downslope of the ROW/LOD. For example, on Sheet 12.02JNF, two clean water diversion pipes are shown near station 10301+00, draining downslope to the headwater area for stream SS3, with the note, "Install Plunge Pool Outlet Per MVP-ES51 and MVP-ES51.1".

Where outlets direct water downslope of the MVP ROW/LOD, the water is specified to go through porous barriers such as compost filter socks. The concentrated flow from the pipes or from waterbars transports sediment laden water to the porous barriers which will allow sediment laden water to flow into headwater areas and into receiving streams. This is inconsistent with the 36 CFR 219 planning rule requirement § 219.8(a)(3)(i) – The plan must include plan components "to maintain or restore the ecological integrity of riparian areas in the plan area, including plan components to maintain or restore structure, function, composition, and connectivity". This is also inconsistent with 9VAC25-840-40 Minimum Standard 19: "Properties and waterways downstream from development sites shall be protected from sediment deposition, erosion and damage due to increases in volume, velocity and peak flow rate of stormwater runoff for the stated frequency storm of 24-hour duration…". The Minimum Standards are included in the MVP POD Appendix C-2, "Erosion and Sediment Control Plan for Virginia"; however, no stormwater management calculations have been submitted to comply with Minimum Standard 19.

The MVP POD Appendix C-3 provides detail drawings MVP-17, MVP-17.1, and MVP-17.2 of "Slope Breakers/Right-of-Way Diversions/Waterbar", consisting of compacted sediment 9 inches high/24 inches wide for temporary installation and 18 inches high/36 inches wide for permanent installation. These are comparable to "Temporary Right-of-Way Diversion[s]" presented as "Std. & Spec. 3.11" in the Virginia DEQ Erosion and Sediment Control Handbook (1992), which illustrates the structure as compacted sediment 18 inches high and minimum of 6 feet wide, with the purpose of shortening the flow length within a sloping right-of-way where there will be little or no construction traffic within the right-of-way. Because Pocahontas Road and Mystery Ridge Road are no longer going to be used for access to the MVP ROW, other public roads are being used to provide access to the MVP ROW in order to direct most of the traffic onto the MVP ROW. The heavy traffic and heavy equipment traversing the MVP row will degrade the diversions/waterbars because diversions/waterbas are intended for use where there is minimal traffic. The heavy traffic will cause erosion of the diversions/waterbars. Although the diversions/waterbars direct water flow away from the MVP ROW, the water still flows outside of the ROW/LOD toward receiving streams, transporting sediment laden water toward headwater areas and toward the receiving streams.

5.0 CONCLUSIONS

1) The Fourth Circuit found that the Forest Service and BLM inadequately considered the actual sedimentation and erosion impacts of the pipeline. In the December 2022 DSEIS, the Forest Service has not provided a meaningful method for determining sedimentation impacts. Instead, the RUSLE2 calculations were used to determine which BMPs and ECDs to use. A meaningful method is available to measure the amount of sedimentation in streams: the measurement of embeddedness. Such measurements should be obtained prior to construction and during construction. If embeddedness increases during construction, there must be an upgrade to more effective ECDs.

2) The Fourth Circuit determined that the Forest Service failed to comply with the Planning Rule. Headwater areas within watersheds of first and second order streams are to be crossed by the MVP pipeline construction along the forested ridges. Springs, seeps, and wetlands have been identified in the FERC FEIS at these headwater areas. Habitats for benthic aquatic organisms will be degraded or destroyed by construction of the MVP pipeline. The benthic aquatic organisms in the headwater areas constitute the base of the food chain for the entire riverine ecosystem. Such destruction will result in adverse impacts of the Proposed Project-Specific Plan Amendment with respect to the Substantive Requirements Directly Related to § 219.8(a)(1) – Ecosystem Integrity and § 219.8(a)(3)(i) – Ecological Integrity of Riparian Areas.

3) Based on review of the Construction Plan Sheets (Appendix C-3 of the MVP POD) prepared by Tetra Tech for Mountain Valley Pipeline, LLC (MVP), MVP proposes to continue using only minimal BMPs. Additionally, some of the specified BMPs are not in compliance with the Virginia Erosion and Sediment Control Handbook. Also, use of sediment basins is not included as a BMP, even though Virginia Code § 62.1-44.15:28.A.10 requires that stormwater management practices be “designed to (i) detain the water quality volume and to release it over 48 hours; (ii) detain and release over a 24-hour period the expected rainfall resulting from the one year, 24-hour storm….”. Sediment basins constitute the only BMP which can provide the mandatory water detention.

4) Silt fence and compost filter socks constitute the predominant BMPs along the lower MVP Limit of Disturbance (LOD). In the Geosyntec Report, these porous barrier BMPs were assigned a value of 50% effectiveness. The result is that sediment laden water does flow through the porous barriers toward headwater areas and toward receiving streams. However, stormwater and sediment transport downslope of the MVP LOD was not considered or evaluated. The Geosyntec Report provides that the sediment laden water would be directed into sediment traps; however, there are no sediment traps or sediment basins shown on the Construction Plan Sheets (Appendix C-3 of the MVP POD).

5) Experience to date has demonstrated that MVP has failed to control sedimentation and erosion effectively. Significant numbers of MVP BMP failures, resulting in sediment laden water leaving the construction site and being deposited in streams, led to 1) numerous Notices of Violation issued by the West Virginia Department of Environmental Protection, culminating in the "Consent Order Issued Under the Water Pollution Control Act, West Virginia Code, Chapter 22, Article 11" (April 19, 2019) issued to MVP; and 2) the legal suit by the Virginia Department of Environmental Quality and the State Water Control Board (SWCB) against MVP for more than 300 violations related to improper erosion control and stormwater management observed between May 21, 2018 and November 15, 2018. Violations have continued to accrue since these actions were taken. This significant new information is not recognized in the DSEIS.

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My education includes a bachelor's degree in Geology and a doctoral degree in Marine Science (specializing in Marine Geology), both from the College of William and Mary in Williamsburg, VA. I have a Credential in Ground Water Science from Ohio State University and I am a Licensed Professional Geologist. I have held teaching positions at the high school level and at the college level, and have provided geology and hydrogeology presentations, workshops, and classes to state and federal environmental employees, to participants in the Regional Conference in Cumberland, MD for the American Planning Association, and to participants in the WV Master Naturalist classes. I have served as an expert witness in hydrogeology before West Virginia government agencies.

As a Hydrogeological Consultant (2000 – Present), I have conducted hydrogeological investigations, provided hydrogeological assessment reports, served as an expert witness in hydrogeology before the West Virginia Public Service Commission in three cases and before the West Virginia Environmental Quality Board in one case, and provided numerous presentations and workshops in hydrogeology to state and federal environmental employees (including USFWS and WV FEMA Managers), participants in the Regional Conference in Cumberland, MD for the American Planning Association, participants at civic and landowner meetings, and participants in the WV Master Naturalist classes.

As a Senior Geologist for the Virginia Department of Environmental Quality (1997-1999), I determined direction of groundwater flow and the pollution impacts to surface water and groundwater at petroleum release sites and evaluated corrective actions conducted where petroleum releases occurred. At sites where the Commonwealth of Virginia assumed responsibility for the pollution release investigation and corrective action implementation, I managed the site investigations for the Southwest Regional Office of the Virginia Department of Environmental Quality (DEQ). This included project oversight from contract initiation through closure.

As a Senior Geologist and Project Manager for the Environmental Department at S&ME, Inc. (Blountville, TN, 1992-1997), I conducted geology and groundwater investigations. I supervised technicians, drill crews, geologists, and subcontractors. The investigations were conducted in order to obtain permits for landfill sites and to satisfy regulatory requirements for corrective actions at petroleum release sites. My duties also included conducting geophysical investigations using seismic, electrical resistivity, and ground penetrating radar techniques. I conducted numerous environmental assessments for real estate transactions. I also conducted wetlands delineations and preparation of wetlands mitigation permits.

As the District Geologist for the Virginia Department of Transportation (1985-1992), my job duties included obtaining and interpreting geologic data from fieldwork and review of drilling information in order to provide foundation recommendations for bridge and road construction. My duties included supervision of the drill crew and design of asphalt and concrete pavements for highway projects. Accomplishments included preliminary foundation investigations for interstate bridges and successful cleanup of leaking underground gasoline storage tanks and site closures at numerous VDOT facilities.

While earning my doctoral degree at the College of William and Mary, I worked as a graduate assistant on several grant-funded projects. My work duties included measuring tidal current velocities and tidal fluctuations at tidal inlets; land surveying to determine the geometry and morphology of numerous tidal inlets; determining pollution susceptibilities of drainage basins using data from surface water flow parameters, hydrographs, and chemical analyses; developing a predictive model for shoreline erosion during hurricanes based on calculations of wave bottom orbital velocities resulting from various wind velocities and directions; performing sediment size and water quality analyses on samples from the Chesapeake Bay and James River; conducting multivariate statistical analyses for validation of sediment laboratory quality control measures; reconnaissance mapping of surficial geologic materials in Virginia, North Carolina, and Utah for publication of USGS Quaternary geologic maps; teaching Introductory Geology laboratory classes at the College of William and Mary; and serving as a Sea Grant intern in the Department of Commerce and Resources, Virginia.

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JOB-RELATED TRAINING COURSES:

2007: Certified Volunteer Stream Monitor, West Virginia (Dept. of Environmental Protection)
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1996: Karst Hydrology, Western Kentucky University
1996: Global Positioning Systems (GPS) for Geographic Information Systems (GIS) applications, seminar conducted by Duncan-Parnell/Trimble
1995: Safe Drinking Water Teleconference, sponsored by the American Water Works Association
1992-1998: OSHA Hazardous Waste Site Supervisor training with annual updates
1990: Credential in Ground Water Science, Ohio State University

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PROFESSIONAL ORGANIZATIONS

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National Speleological Society