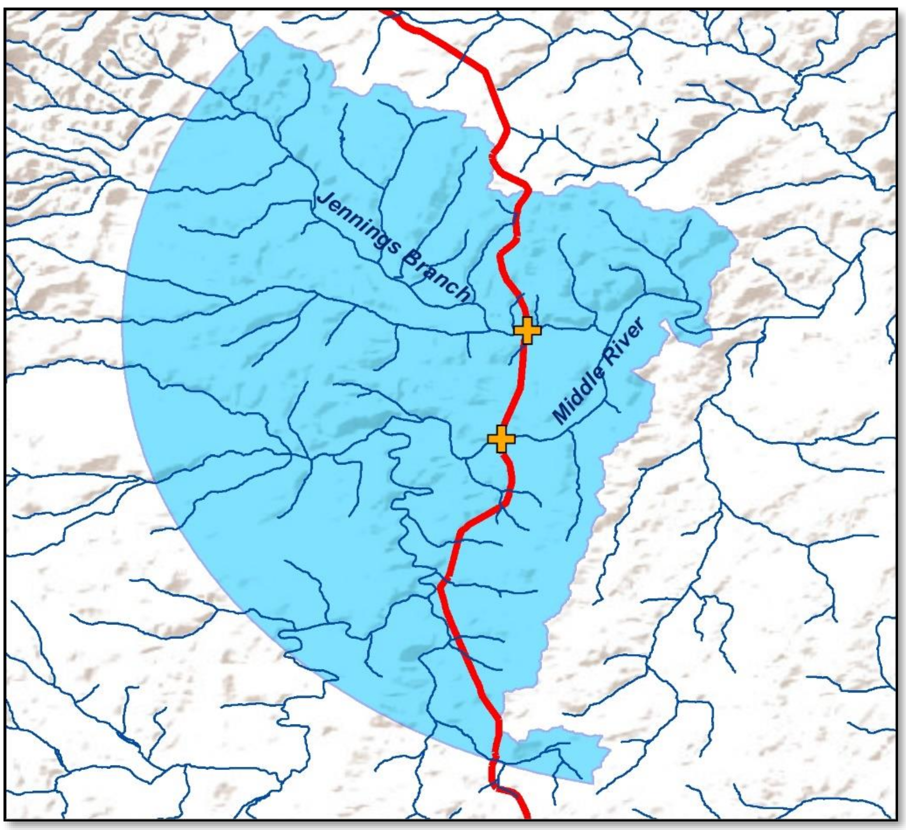
Impacts of Atlantic Coast Pipeline Stream Crossings within VMRC Jurisdiction



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ABBREVIATIONS

ACP	Atlantic Coast Pipeline
FEIS	Final Environmental Impact Statement
FERC	Federal Energy Regulatory Commission
HDD	horizontal directional drilling
TU	Trout Unlimited
VDCR	Virginia Department of Conservation & Recreation
VDEQ	Virginia Department of Environmental Quality
VDGIF	Virginia Department of Game and Inland Fisheries
VDOH	Virginia Department of Health
VMRC	Virginia Marine Resources Commission

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1. INTRODUCTION

If constructed, the Atlantic Coast Pipeline (ACP) would be 42 inches in diameter and cross 51 waterways under the Virginia Marine Resources Commission's (VMRC's) jurisdiction.[1] This report discusses impacts from these crossings on drinking water sources, fish and other aquatic life, recreation, and wetlands.

To construct and bury these crossings, operators would clear a 75 foot–wide right-of-way (ACP, 2017a). The permanent easement width would also be 75 feet (ACP, 2017b). ACP crossings would include a total buried pipeline length of almost two miles (9,149 feet) through or beneath VMRC-regulated waterbodies (Hammer, 2018).

VMRC's Subaqueous Guidelines point to the Virginia Constitution, which, in Article XI, Section 1 states:

> "To the end that the people have clean air, pure water, and the use and enjoyment for recreation of adequate public lands, waters, and other natural resources, it shall be the policy of the Commonwealth to conserve, develop, and utilize its natural resources, its public lands, and its historical sites and buildings. Further, it shall be the Commonwealth's policy to protect its atmosphere, lands, and waters from pollution, impairment, or destruction, for the benefit, enjoyment, and general welfare of the people of the Commonwealth."

In short, and as it pertains to the issue at hand: to ensure pure water and recreational use of public lands and waters, the Commonwealth's policy will be to protect its lands and waters from pollution, impairment, or destruction.

In addition to pointing to the Constitution, VMRC's Subaqueous Guidelines include additional detail. Section I-C states that: "…permitted encroachments will strive to minimize interference with the rights of all citizens of the Commonwealth to other appropriate uses" (VMRC, 2005) and that the Commission will consider "…the effect of the proposed project upon: other reasonable and permissible uses of State waters and State-owned submerged lands; marine and fisheries resources, wetlands, adjacent or nearby properties; anticipated public and private benefits, submerged aquatic vegetation, and water quality." (VMRC, 2005)

Additionally, in Section IV, the Guidelines state a preference for horizontal directional drilling (HDD): "In general, directional drill methodologies are preferred over trenching." (VMRC, 2005) Of the 51 ACP stream crossings under VMRC's jurisdiction, only six are proposed to use HDD, and 45 are proposed to be crossed using an open-trench method (ACP, 2017b). This crossing method would disrupt fish life and kill benthic macroinvertebrate organisms within the construction corridor of the crossing.

[1] See also Code of Virginia, §28.2, Fisheries and Habitat of the Tidal Waters, https://law.lis.virginia.gov/vacode/title28.2/.

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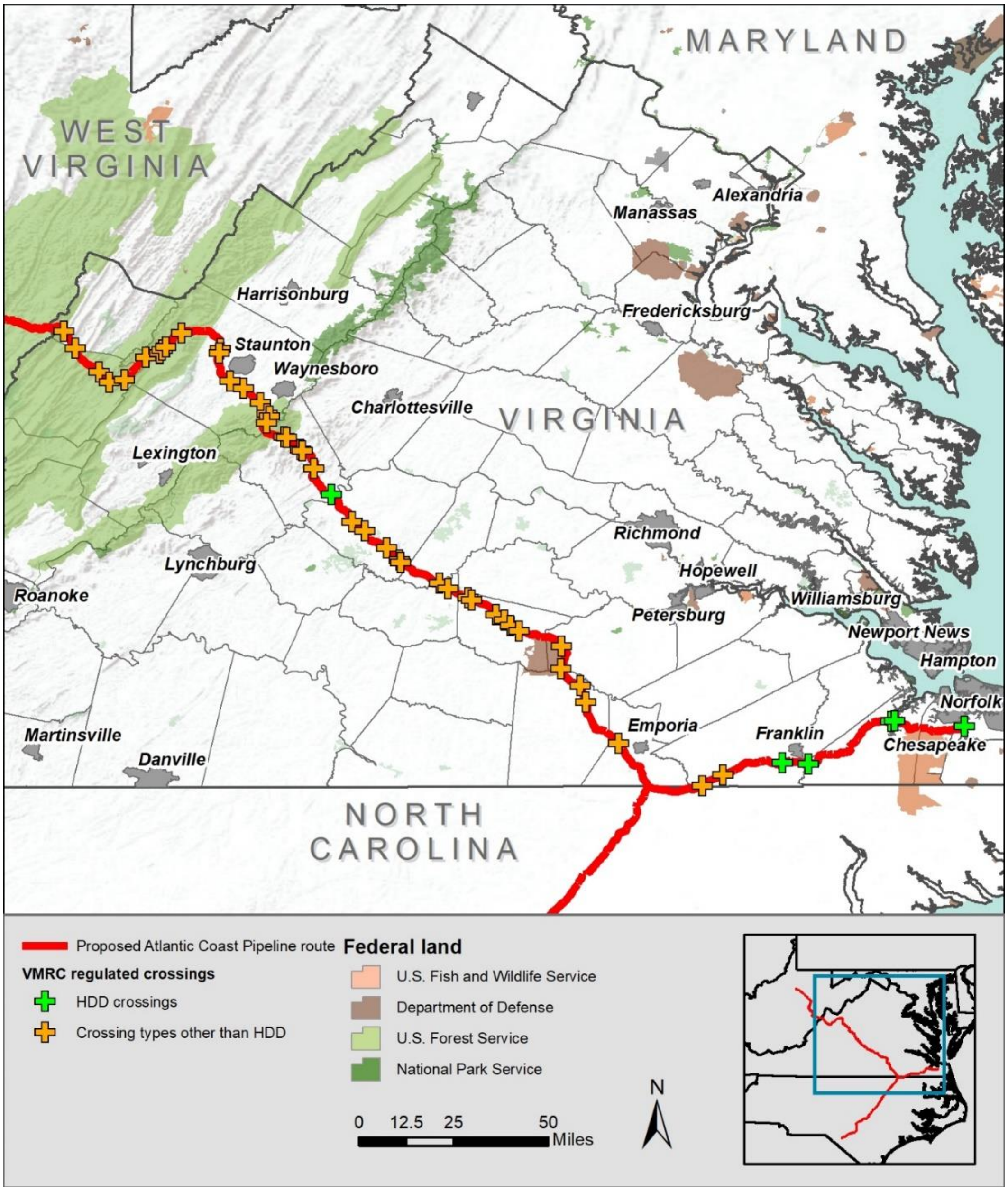
Figure 1: The proposed Atlantic Coast Pipeline route



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2. GENERAL IMPACTS OF THE ATLANTIC COAST PIPELINE

This section details the likely impacts of open-cut waterbody crossings that are proposed at 45 of the 51 VMRC-regulated water crossings. HDD will be utilized at six VMRC crossings. While the direct impacts to the waters crossed would likely be reduced, HDD crossings still bear other risks, including contamination from "frac-out" fluids.

2.1 Sediment

Even when best management practices are used, ACP pipeline and access road construction would cause erosion and sedimentation, which can be significant sources of water pollution. This includes stream crossings under VMRC's jurisdiction, other stream and wetland crossings, and upland pipeline and access road construction.

Increased sedimentation and turbidity has real impacts on aquatic life. According to the Federal Energy Regulatory Commission's (FERC's) Final Environmental Impact Statement (FEIS) for the ACP:

> "Increased sedimentation and turbidity resulting from in-stream and adjacent construction activities could displace and impact fisheries and aquatic resources. The [U.S. Environmental Protection Agency] considers both suspended and bedded sediments and their potential impacts to aquatic life for water quality standards. Suspended sediments may adversely affect submerged macrophytes by reducing light available for photosynthesis by plants and visual capacity for animals, while bedded sediments settle out on the bottom of the waterbody and smother spawning beds and other habitats. Sedimentation could smother fish eggs and other benthic biota and alter stream bottom characteristics, such as converting sand, gravel, or rock substrate to silt or mud. These habitat alterations could reduce juvenile fish survival, spawning habitat, and benthic community diversity and health. Increased turbidity could also temporarily reduce dissolved oxygen levels in the water column and reduce respiratory functions in-stream biota. Turbid conditions could also reduce the ability for biota to find food sources or avoid prey. The extent of impacts from sedimentation and turbidity would depend on sediment loads, stream flows, stream bank and stream bed composition, sediment particle size, and the duration of the disturbances...High and sustained levels of increased sediment may cause permanent alterations in invertebrate community structures, including diversity, density, biomass, growth, rates or reproduction, and mortality. Impacts on freshwater mussel species resulting from increased sedimentation is species-specific; some species can compensate for increased sedimentation by increasing filtration rates. Many endangered freshwater mussel species have evolved in fast flowing streams with historically low levels of suspended sediment and may not be able to compensate for increased sedimentation, which may result in reduced feeding, growth, and reproduction rates (EPA, 2003). Although freshwater mussels in the construction work area would be relocated by qualified biologists and in accordance with both West Virginia, Virginia, and North Carolina federal and state agency mussel protocols, downstream sessile species could be affected. Aquatic invertebrates, including insect larvae, would generally be unable to avoid work areas." (FERC, 2017, p. 4-228-229)

The open trench method is a particularly high-impact method of construction, and of the 51 stream crossings under VMRC's jurisdiction, 45 are proposed to be crossed using an open-trench method (ACP, 2017c). This crossing method would disrupt fish life and kill benthic macroinvertebrate organisms within the construction corridor of the crossing. HDD is planned for six crossings: the James, Nottoway, Blackwater, Western Branch Nansemond, Nansemond, and South Branch Elizabeth Rivers (FERC, 2017).

Regardless of method utilized and care taken during construction, the disturbance of the streambank and streambed would cause a marked increase in sedimentation and turbidity. These impacts can be long-term

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and lasting. Initially, there are impacts during the period of initial disturbance and when flow is reestablished over the construction area. In the medium-term, moderate (perhaps intermittent) increases in sedimentation and turbidity would continue from the streambed and stream bank until revegetation occurs in the area immediately adjacent to the construction site. In the long-term, the sediment contribution from upland pipeline corridors could still result in measurable long-term increases in sedimentation and turbidity, dependent upon soil type, slope, and success of revegetation in the upland corridor. Peer-reviewed journal articles have documented short-, medium-, and long-term impacts to benthic macroinvertebrates and fish; one article documented effects that lasted over four years (Lévesque and Dubé, 2007, citing Armitage and Gunn, 1996).

Clingerman and Hansen (2017) also estimated the sedimentation impact expected from ACP crossings in mountainous watersheds in Virginia and West Virginia, which were expected to have a high risk of sedimentation from pipeline construction. The crossings include Falls Run of Dutch Creek in the James River watershed in Nelson County. For each scenario assessed—pre-construction, during-construction, and post-construction—sedimentation loads were estimated. During-construction sedimentation was estimated to increase by 9,051% in Virginia.

FERC's FEIS for the ACP summarizes findings related to increased sedimentation in certain watersheds:

> "The [U.S. Forest Service] requested that Atlantic prepare a Soil Erosion and Sedimentation Model Report assessing the extent of sedimentation that could occur within priority subwatersheds within the [Monongahela National Forest] and [George Washington National Forest] during construction. Generally, the model results indicate a substantial increase in soil loss relative to baseline rates for the first year of construction. Soil rates are predicted to be higher where there are steeper slopes and higher soil erodibility values. The model results indicate a decline in soil erosion with time as the construction workspace is restored and becomes revegetated. Although according to the model, the predicted soil erosion rates returned to baseline by the third year, some of the model results were skewed to present a best case scenario, and likely underestimate short-term and long-term sediment loads." (FERC, 2017, p. 4-231)

To fully understand and thus mitigate these impacts in VMRC's jurisdictional waters, more study and review than is in the record is necessary.

2.2 Drinking water supply intakes

Drinking water providers rely on clean source water in rivers and streams to produce clean drinking water at the tap. The ACP will cause additional sedimentation and turbidity, which complicates drinking water treatment. In addition, should a spill of fuel or other pollutants occur upstream from an intake, it may flow downstream quickly. For example, a diesel fuel spill occurred at an equipment staging area for a contractor grading and seeding the right-of-way for a natural gas pipeline in Virginia and contaminated the drinking water for a community in nearby Monroe County, West Virginia (Adams, 2015).

Drinking water concerns are not explicitly discussed in VMRC's mission, but it is the policy of VMRC to protect "waters from pollution…for the…general welfare of the people of the Commonwealth." (VMRC, 2005) Clean drinking water is perhaps the most widespread interaction that the people of the Commonwealth have with Virginia waters, and as such, protecting drinking water sources is perhaps the most critical aspect of ensuring the general welfare of the people of the Commonwealth. It is therefore under the purview of VMRC to consider source water susceptibility as part of its review of subaqueous water crossings.

The ACP crosses four source water assessment areas in Virginia. Three crossings under VMRC jurisdiction are found in two source water assessment areas: (1) City of Staunton-Middle River and (2) City of Emporia-Meherrin River (see Figure 2). Source water assessment areas are not regulatory boundaries, but they include

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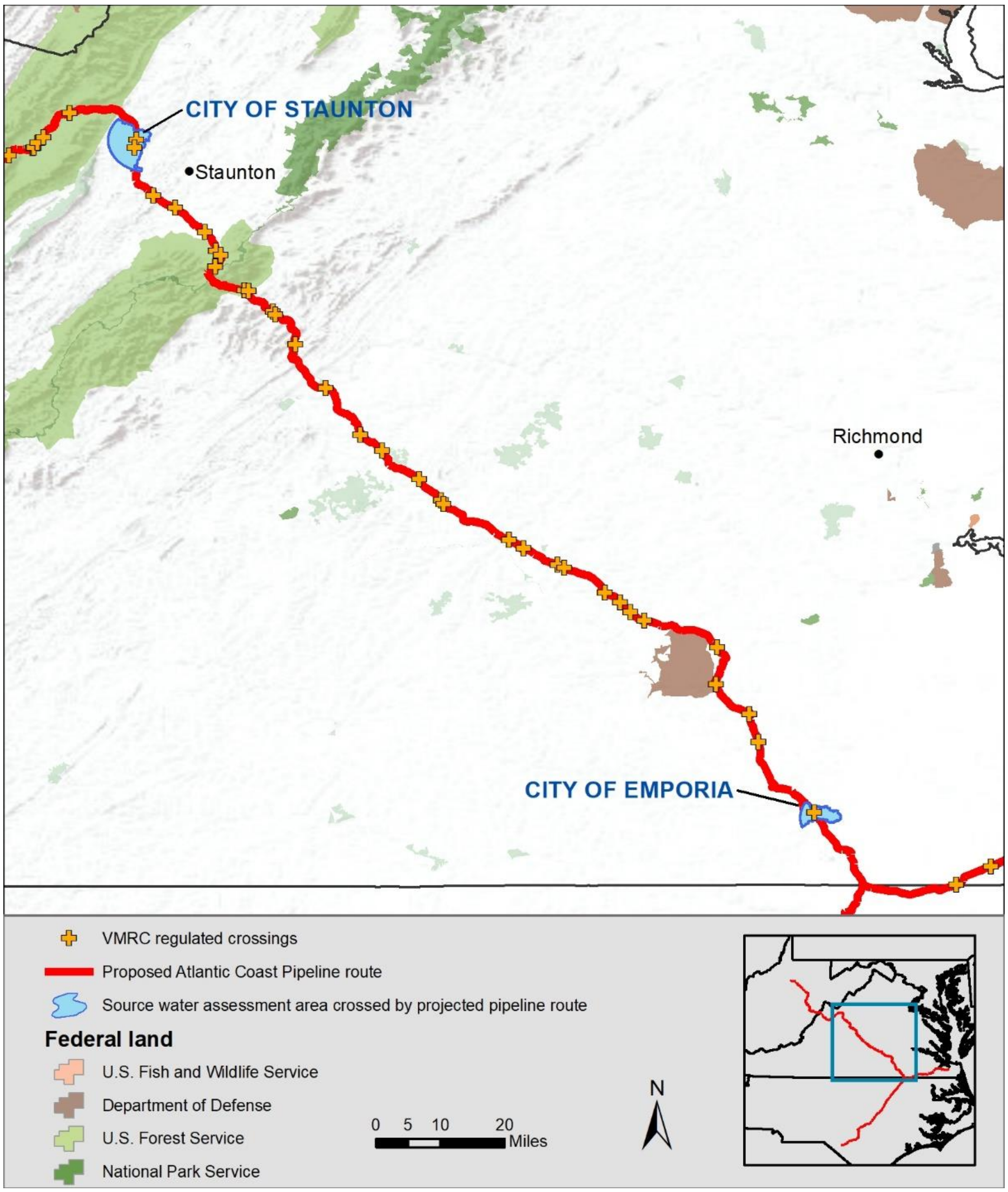
the area from which pollution can reach intakes quickly, and in which additional scrutiny of potential contaminant sources should be undertaken to protect drinking water sources. (VDOH, 2017)

FERC fails to account for all contaminants that threaten drinking water, such as such as equipment fuel. It also does not address the role that the pipeline corridor may play in creating preferred pathways for upland spills either during construction or operation. FERC's assessment assumes that the ACP's risks to drinking water are limited to sediment and turbidity and that these risks are confined primarily to the construction period. The FEIS acknowledges that the cofferdam method proposed on Middle River may result in higher turbidity levels than the dry cut methods proposed for other crossings of source water assessment areas.

Figure 2: Source water assessment areas with VMRC-regulated crossings intersected by the Atlantic Coast Pipeline



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2.3 Important aquatic species

The ACP route across Virginia crosses spawning areas for many types of fish, including important trout spawning areas. In Virginia, there is one native species of trout: the brook trout. Brook trout live and reproduce in only the cleanest, cold streams. Typically, in Virginia, these streams are small, have good forest canopy, and are found in higher elevations or in association with springs.

Rainbow and brown trout have also been introduced to many streams within Virginia. In some of the best streams, even brown and rainbow trout reproduce and survive without supplemental stockings. Wild trout streams containing any of the three trout species are highly regarded among anglers and conservationists, as they represent a nearly pristine aquatic environment. The Virginia Department of Environmental Quality (VDEQ) also considers trout, and the streams that contain them, as ecologically and economically significant resources for the state (VDGIF, 2017, p 62).

The Virginia Department of Game and Inland Fisheries (VDGIF) has requested strict adherence to time-of-year restrictions, which are periods in which no instream work is permissible. Additionally, VDGIF also recommends instream activities be performed during low flow conditions using non-erodible cofferdams or turbidity curtains (VDGIF, 2018), and will require mussels to be relocated from open-cut crossing construction areas. While these restrictions are important for the protection of aquatic species such as trout, they cannot ensure the complete elimination of impacts to fish and aquatic species. Even when utilizing time-of-year restrictions, mussel relocations, and instream activity restrictions, muddy water will still cause decreased feeding and increased stress in some fish, including trout. And sedimentation may still impact downstream fish, mussels, and benthic macroinvertebrates.

2.4 Recreation

Because public use and enjoyment of public lands and waters are referenced in VMRC's Subaqueous Guidelines, the recreational impacts of the ACP must be considered. Sediment and turbidity produced by open-trench stream crossings may impact fishing, boating, and swimming opportunities accessible from nearby stream access points.

2.5 Wetlands

Where the ACP crosses VMRC-regulated stream crossings, adjacent wetlands will also be impacted. Riparian, riverine wetlands will be impacted at each of the ACP's open-trench crossings subject to VMRC regulation. For many VMRC-regulated crossings, larger wetlands adjacent to the crossings will also be impacted (See Figure 3).

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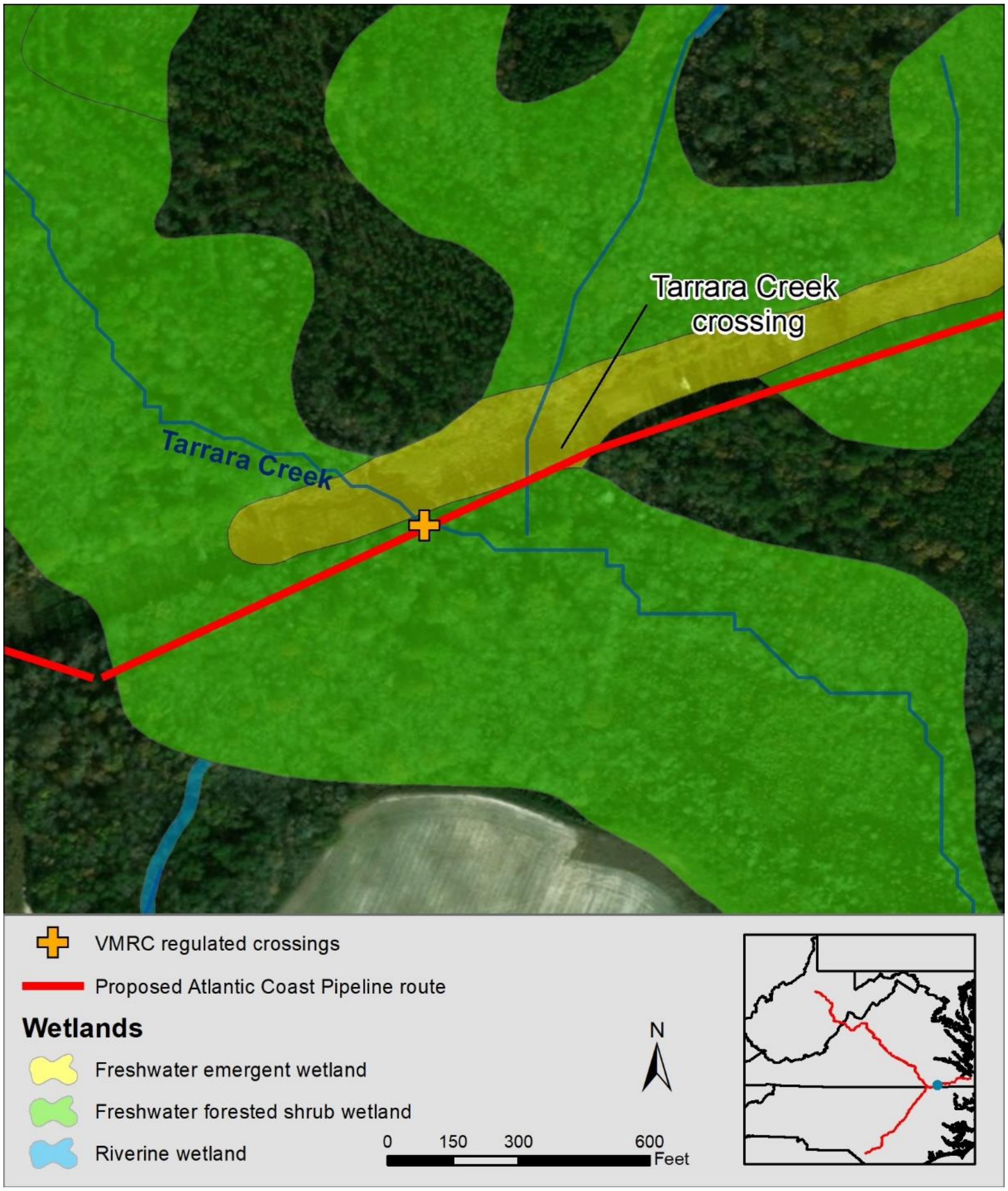
Figure 3: Example of wetland impacts in the vicinity of a VMRC-regulated crossing



Sources: Wetland data from U.S. Fish and Wildlife Service (2017).

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3. DETAILED IMPACTS ON CROSSED WATERBODIES

As discussed above, the ACP is projected to cross 51 streams subject to VMRC jurisdiction. In this chapter, detailed impacts are described for three areas that contain eight of these crossings.

3.1 Calfpasture River and Deerfield Valley

There are several risks to Virginia waters in the Calfpasture River watershed and in the Deerfield Valley that are unaddressed by ACP's application.

The Calfpasture River, located in Augusta County, Virginia, is a potential candidate for scenic river designation (VDCR, 2018). The proposed ACP route crosses the Calfpasture River and its tributaries numerous times in and upstream of the Deerfield Valley.

These crossings include five crossings under VMRC jurisdiction, including four crossings of Calfpasture River and one of Tizzle Branch, a tributary to Calfpasture River (see Figure 4). The large number of crossings of Calfpasture River and its tributaries, including the five under VMRC jurisdiction, will significantly impact the Calfpasture River and potentially threaten the drinking water source for the community of Deerfield.

A letter submitted to VMRC by a landowner in the Deerfield Valley (Ballin, 2018) and an accompanying hydrogeologic report (Jones, 2016) discuss the high potential for violent flooding in this area, which would be exacerbated by pipeline development. The letter describes two serious floods that occurred in 1985 and 1996. The water table in this area is very shallow and leads to routine flooding (Jones, 2016). Construction of a pipeline in this area would remove vegetation that naturally attenuates flooding and alter floodplain geology—both of which could exacerbate future floods. Residents fear that violent flooding, such as the 1985 and 1996 events, may cause serious damage to the pipeline due to the significant potential for bedload movement within the Calfpasture River (Ballin, 2018).

Additionally, the hydrogeologic report for this area notes several other unaddressed risks from the ACP in this area. The pipeline may be buried below the shallow water table for much of its course through Deerfield Valley, which could impact the quantity and quality of nearby groundwater—including private water wells and the large spring that supplies public water for the community of Deerfield. The groundwater "bathing" the pipeline may be somewhat acidic due to native geology, which could cause the integrity of the metal pipeline to be compromised over time (Jones, 2016).

VDEQ also recommended that the ACP route be adjusted to site a staging area away from a sinking stream thought to have direct connection to the municipal water supply for the community of Deerfield (VDEQ, 2017). It is uncertain whether that recommendation was carried out.

Additionally, Trout Unlimited (TU) identified the headwater portion of the Calfpasture watershed (including the area where the VMRC jurisdictional crossings occur) as an area of highest concern for impacts from ACP stream crossings. In this resilient brook trout patch, TU identified 28 highest-concern crossings by the pipeline or access roads; five of these highest concern crossings are under VMRC jurisdiction. Three more high-concern crossings are located within the headwaters of the Calfpasture watershed. (TU, 2017a)

Given the high number of stream crossings proposed by ACP in a relatively small area considered to be one of the most viable patches of brook trout in Virginia, it is likely that pipeline construction would have a cumulative impact on brook trout populations. This watershed is currently considered to be resilient, but the impacts caused by pipeline construction could threaten that status and cause the area's brook trout to be more susceptible to other impacts such as development, climate change, drought, or flooding. Recreational angling could also be harmed if brook trout populations are reduced as a result of ACP impacts.

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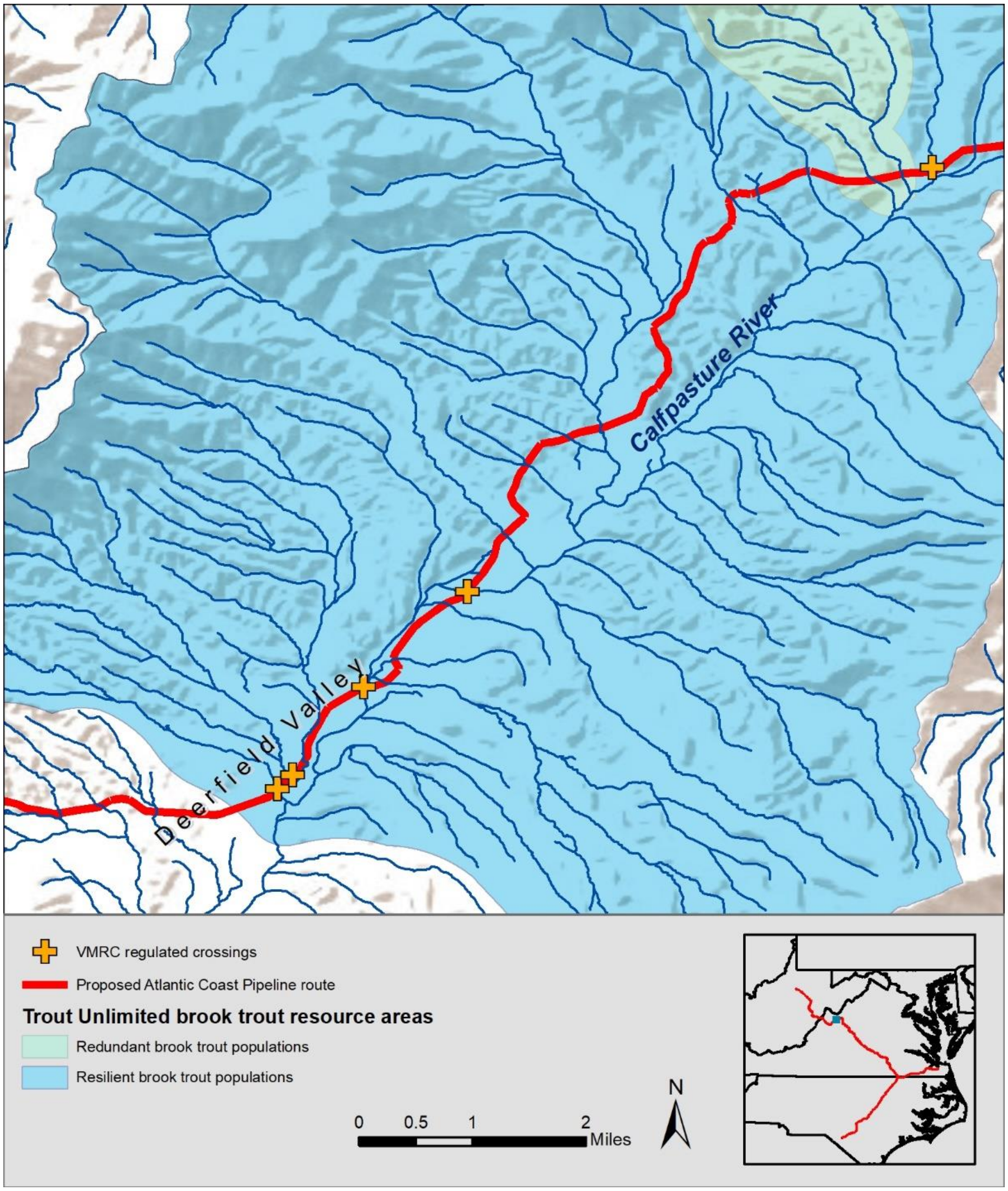
We find the information presented by ACP for this specific area to be insufficient to ensure that water quality, water uses, and the general welfare of the local residents will be protected, especially given the list of critical environmental concerns about this specific area: public water supplies, flooding, pipeline integrity, recreation, and trout populations.

Figure 4: Proposed Atlantic Coast Pipeline corridor and VMRC-regulated crossings in the vicinity of Deerfield Valley



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3.2 City of Emporia

Certain risks to the City of Emporia's drinking water are not addressed by ACP's application. The City of Emporia, Virginia is located in Greensville County and has about 5,300 residents. It is made up of approximately 70 percent minorities, and the median household income is about $27,000, with 23 percent of people living in poverty (U.S. Census, 2012 and 2017b).

Emporia sources its raw drinking water from a 220-acre reservoir that is supplied by the Meherrin River (City of Emporia, 2015). In a 2001 source water assessment, the Virginia Department of Health (VDOH) found this reservoir to be highly susceptible to contamination (City of Emporia, 2015). As such, any additional threats to this reservoir should be closely examined. The ACP would cross the Meherrin River within Emporia's source water assessment area, approximately 4.7 miles from drinking water intake.[2] This crossing would be constructed using the cofferdam open-trench method (FERC, 2017).

We find the information presented by ACP for this area to be insufficient to ensure that water quality, water uses, and the general welfare of the local residents will be protected. Given the potential for this crossing of state-owned submerged land to impact a highly susceptible public water source, and given the policy of VMRC to protect "waters from pollution…for the…general welfare of the people of the Commonwealth" (VMRC, 2005), VMRC should require ACP to submit more detailed information documenting adequate protection of this water source before approving the project.

3.3 City of Staunton

Several threats to the City of Staunton's drinking water are not addressed by ACP's application, including the increased risk of karst geology. The City of Staunton, Virginia is located in Augusta County and has a population of 24,363 (U.S. Census, 2017a). Raw drinking water for the city is sourced from the Middle River, Gardner Spring, and Elkhorn Lake. Two of Staunton's three water sources will be impacted by ACP crossings. VMRC-regulated crossings are proposed on Middle River and Jennings Branch, with the Jennings Branch crossing approximately 2.5 miles upstream from the likely intake location (see Figure 6).

Middle River is noted in the FERC FEIS as likely to become turbid during installation of diversion structures for the cofferdam (FERC, 2017). Additionally, the high slope of the pipeline corridor for the northern approach to both Middle River and Jennings Branch would likely cause additional sedimentation at these crossings; comments have been received from the public noting the risk associated with these steep slopes in close proximity to regulated water crossings (Ravina and Ravina, 2018) The additional turbidity and sedimentation from the pipeline crossings in this source water assessment area could cause increased costs for water treatment by the water utility.

The crossings of Middle River and Jennings Branch are also underlaid by karst (Weary, 2008), which increases risk to the water resources in the vicinity of the City of Staunton. Gardner Spring, another source for drinking water for the City of Staunton and a karst spring, is at risk from the ACP, according to VDEQ and City of Staunton public officials (VDEQ, 2017). This spring is located very close to Middle River, downstream from the two VMRC-regulated crossings in this area (see Figure 6).

We find the information presented by ACP for this area to be insufficient to ensure that water quality, water uses, and the general welfare of the local residents will be protected. Given the potential for this crossing of state-owned submerged land (and the steep slopes adjacent) to impact a public water source, and given the policy of VMRC to protect "waters from pollution…for the…general welfare of the people of the Commonwealth" (VMRC, 2005), VMRC should require ACP to submit more detailed information documenting

[2] This and other distances in this report are measured to the likely intake locations based on the shapes of the source water assessment areas. Precise intake locations are not public information.

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adequate protection of this water source and the nearby groundwater resources before approving the project.

Figure 5: Meherrin River crossing within the Emporia Source Water Assessment Area

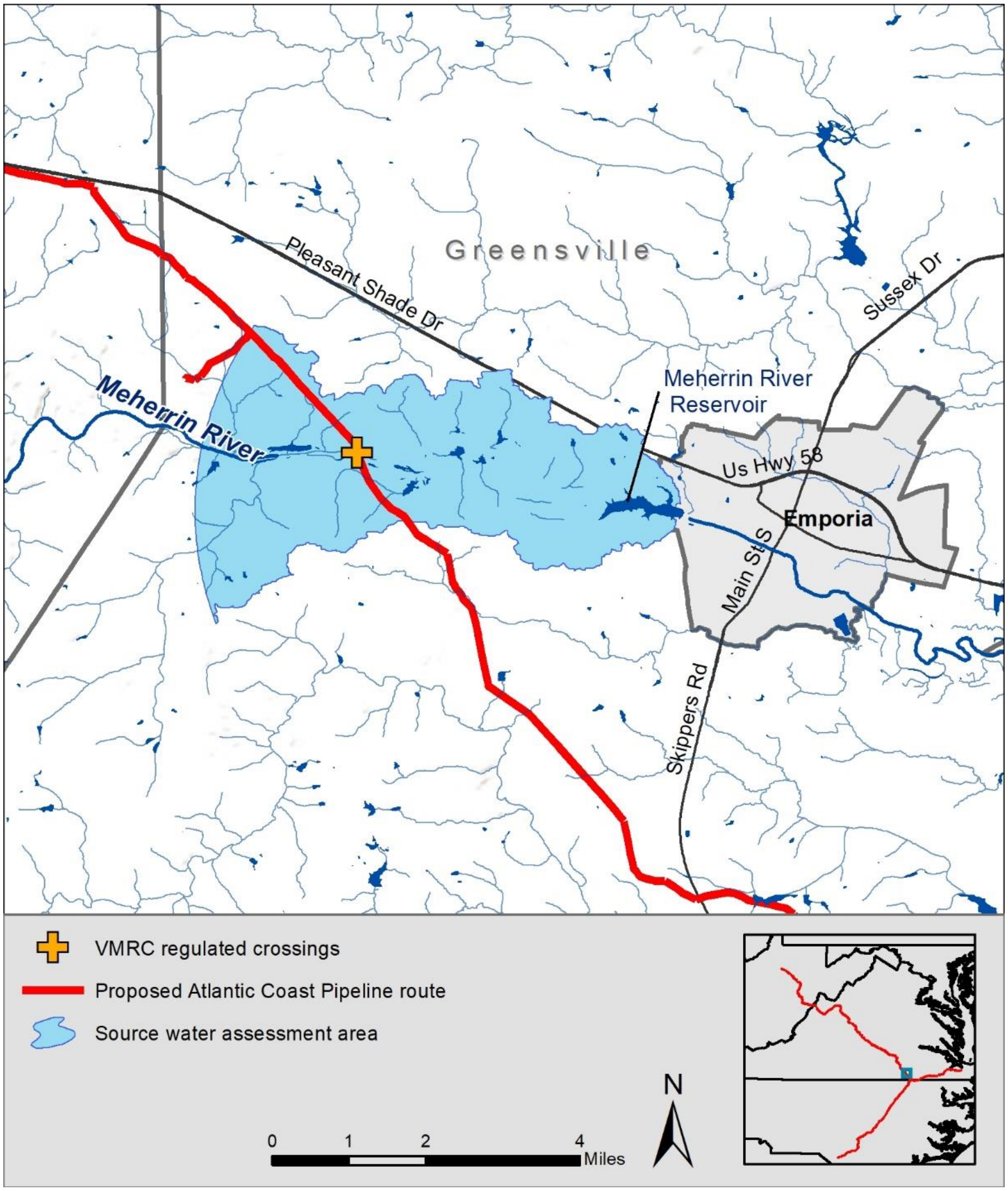

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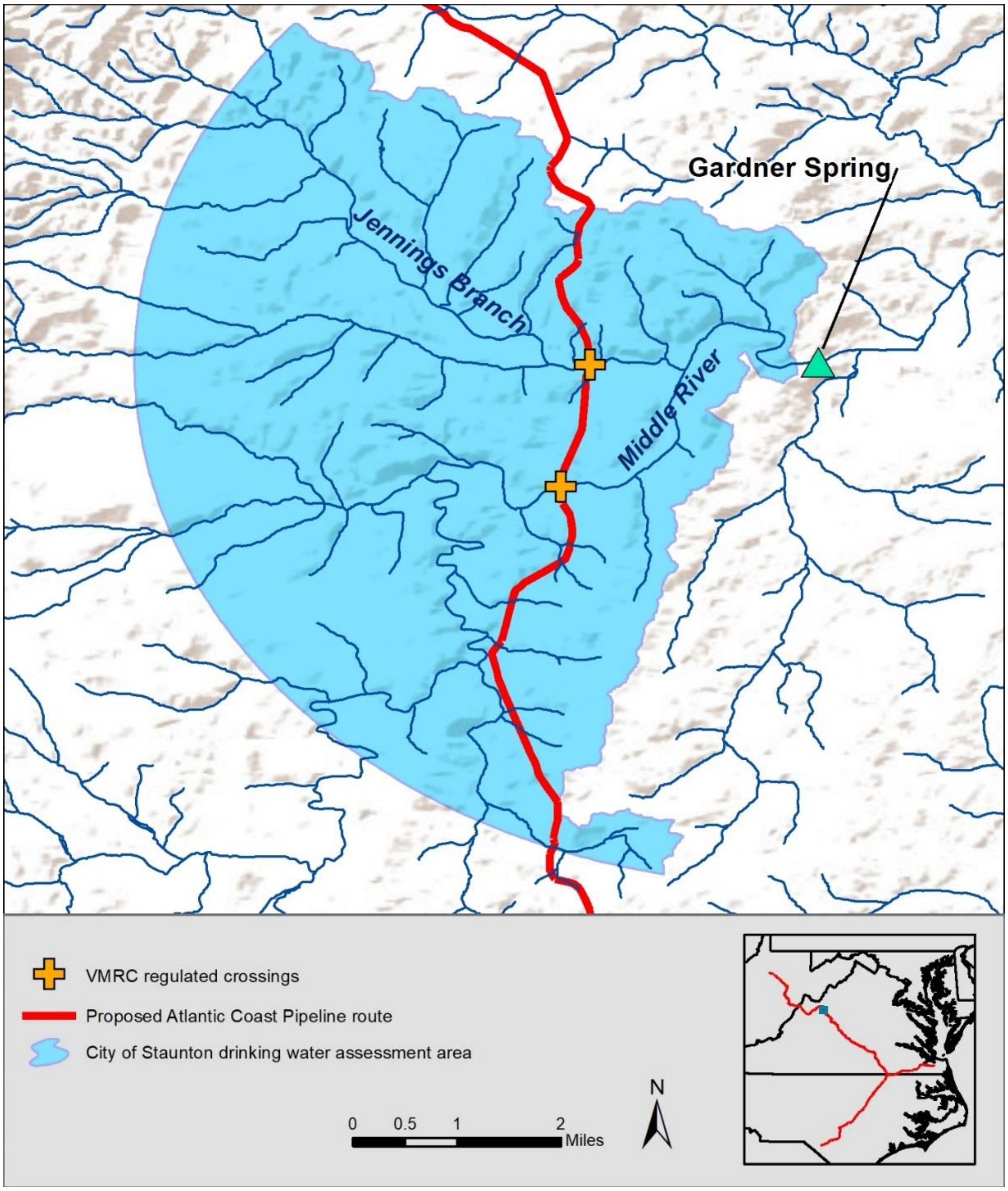
Figure 6: Proposed Atlantic Coast Pipeline corridor and VMRC-regulated crossings within the Staunton Source Water Assessment Area



Note: The Gardner Spring location is approximated from VWCB (1978), p. 59.

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4. OTHER DEFICIENCIES

State and federal agencies have requested, recommended, or required that ACP provide additional information or changes to proposed plans, pursuant to each agency's mission and regulatory purview. This includes hundreds of pages of such comments. The authors have not been able to confirm whether the following comments have been addressed by ACP:

- VDGIF noted that, for five crossing locations, locational information has not been adequately provided to allow the agency to make accurate recommendations for time-of-year restrictions waivers (VDGIF, 2018).
- VDGIF requested that ACP provide more details about each stream crossing, including crossing site photos, maps of each crossing site, and additional information about the substrate conditions at every proposed crossing location (VDGIF, 2017).
- Virginia Institute of Marine Sciences (VIMS) suggests that HDD be utilized for the pipeline to cross four VMRC-regulated tidal wetlands to minimize impacts to those habitats (VIMS, 2018).

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5. SUMMARY AND CONCLUSIONS

5.1 General impacts

- ACP will cross 45 streams regulated by VMRC using an open-trench method.
- ACP will cross six streams regulated by VMRC using HDD.

5.2 Drinking water

- The ACP would cross VMRC-regulated waters for two source water assessment areas upstream from drinking water intakes: (1) City of Staunton-Middle River and (2) City of Emporia- Meherrin River.
- These source water assessment areas contain eight crossings under VMRC's jurisdiction, with crossings as close as 2.5 miles from a drinking water supply intake.
- Impacts of crossings on these nearby, downstream drinking water intakes have not been adequately addressed by regulatory agencies or the pipeline proponent.

5.3 Fish and other aquatic life

- Open-trench stream crossings will harm fish and other aquatic life, including native and wild trout.
- Benthic macroinvertebrates will be killed within the construction corridor.
- Sediment from open-trench stream crossings will harm fish and other aquatic life both at the crossing and downstream—directly and as a result of increased instream turbidity. Sediment fills spaces in the streambed that benthic macroinvertebrates need for habitat and smothers the eggs of spawning fish. Muddy water causes decreased feeding and increased stress in some fish, including trout. Sediment and muddy water impact downstream mussels.
- Several trout streams, both wild and stocked, will be impacted by open-trench crossings.

5.4 Recreation

- Sediment and increased turbidity produced by the open-trench stream crossings may impact fishing, boating, and swimming opportunities accessible from nearby stream access points.

5.5 Wetlands

- Riparian, riverine wetlands will be impacted at each of the open-trench crossings.
- Several of these crossings will also impact larger, non-riparian wetlands immediately adjacent to VMRC crossings.

5.6 Watershed-specific conclusions

- In the watersheds discussed below, the VMRC-regulated crossings would disrupt fish life and kill benthic macroinvertebrate organisms within the construction corridor of the crossing, and the disturbance of the streambank and streambed would cause a marked increase in sedimentation and turbidity. Adding to the cumulative impacts of the ACP would be the sediment generated from upslope, where the pipeline right-of-way would be cleared and where access roads would be built.

5.6.1 *Calfpasture River and Deerfield Valley*

- Five VMRC-regulated crossings are located in the vicinity of Deerfield Valley.
- The shallow water table could result in impacted drinking water wells.
- The shallow water table could result in accelerated corrosion to pipeline.

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- The integrity of the pipeline at the VMRC-regulated crossings of the Calfpasture River will be at risk due to documented bedload movement during flood events.
- The placement of a staging area will put the municipal water supply for the community of Deerfield at risk.
- One of the most resilient populations of brook trout (and the recreational angling opportunities for these trout) will be put at risk by the crossings and upland impacts of the ACP.

5.6.2 *City of Emporia*

- Emporia's drinking water is supplied by a reservoir that VDOH has determined to be highly susceptible to contamination. The Meherrin River is the source of water in this reservoir, and the ACP would cross this VMRC-regulated river less than five miles upstream from the water intake. This is a significant threat to the drinking water source that has not been adequately addressed by regulatory agencies or the pipeline proponent's application.

5.6.3 *City of Staunton*

- The City of Staunton has three water supply sources, two of which will be placed at risk of contamination by upstream VMRC-regulated stream crossings.
- Middle River, one of the sources for municipal water for Staunton, is identified by FERC as likely to see high levels of turbidity, a significant cause of water pollution, due to the installation of the cofferdam for the VMRC-regulated stream crossing.
- Steep slopes crossed by the ACP adjacent to the VMRC crossings would exacerbate sedimentation and turbidity issues in Middle River.
- The risks to the City of Staunton's drinking water sources has not been adequately addressed by regulatory agencies or the pipeline proponents.

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APPENDIX A: CROSSING LOCATIONS

Table 1: Crossing locations

Feature ID	Waterbody name	County	Construction method
saux005	Back Creek	Augusta County	Cofferdam or Dam and Pump
sauc131	Benson Run	Augusta County	Dam and Pump or Flume
sauc124	Calfpasture River	Augusta County	Dam and Pump or Flume
saup004	Calfpasture River	Augusta County	Dam and Pump or Flume
sauy004	Calfpasture River	Augusta County	Dam and Pump or Flume
saub007	Christian`s Creek	Augusta County	Dam and Pump or Flume
saua442	Folly Mills Creek	Augusta County	Dam and Pump or Flume
sauf003	Hamilton Branch	Augusta County	Dam and Pump or Flume
saua413	Jennings Branch	Augusta County	Cofferdam or Dam and Pump
saua070	Middle River	Augusta County	Cofferdam or Dam and Pump
saua052	Mills Creek	Augusta County	Flume or Dam and Pump
saua067	Orebank Creek	Augusta County	Dam and Pump or Flume
sauc113	South River	Augusta County	Flume or Dam and Pump
sauc130	Tizzle Branch	Augusta County	Dam and Pump or Flume
sbaa015	Cowpasture River	Bath County	Cofferdam or Dam and Pump
sbar008	Mill Creek	Bath County	Dam and Pump or Flume
sbaa001	Stuart Run	Bath County	Dam and Pump or Flume
sdic007	Nottoway River	Brunswick County	Cofferdam
sbrr007	Sturgeon Creek	Brunswick County	Flume or Dam and Pump
sbrr014	Waqua Creek	Brunswick County	Flume or Cofferdam
sbuc106	Gills Creek	Buckingham County	Dam and Pump or Flume
sbup015	James River	Buckingham County	HDD
sbuk037	Little Willis River	Buckingham County	Dam and Pump or Flume
sbuc005	North River	Buckingham County	Dam and Pump or Flume
sbuk012	Slate River	Buckingham County	Dam and Pump or Flume
sbul009	Willis River	Buckingham County	Dam and Pump or Flume
schp001	South Branch Elizabeth River	City of Chesapeake	HDD
ssoa010	Blackwater River	City of Suffolk	HDD
ssup130	Nansemond River	City of Suffolk	HDD
ssup013	Western Branch Nansemond River	City of Suffolk	HDD
scuk011	Appomattox River	Cumberland County	Cofferdam
wdic013f	Butterwood Creek	Dinwiddie County	Dam and Pump or Flume
sgro002	FontaineCreek	Greensville County	Open Cut
sgra007	Meherrin River	Greensville County	Cofferdam
sgrp001	Meherrin River	Greensville County	Cofferdam
shie061	Back Creek	Highland County	Cofferdam or Dam and Pump
shix002	Jackson River	Highland County	Cofferdam or Dam and Pump
snee510	Davis Creek	Nelson County	Dam and Pump or Flume
snec056	Dutch Creek	Nelson County	Dam and Pump or Flume
snea422	Muddy Creek	Nelson County	Cofferdam or Dam and Pump
snee501	South Fork Rockfish River	Nelson County	Dam and Pump or Flume
snex006	Spruce Creek	Nelson County	Dam and Pump or Flume
snoc003	Cellar Creek	Nottoway County	Flume or Dam and Pump
snok100	Deep Creek	Nottoway County	Dam and Pump or Flume
snok005	Ellis Creek	Nottoway County	Dam and Pump or Flume
snok008	Flat Creek	Nottoway County	Dam and Pump or Flume
snok011	Winningham Creek	Nottoway County	Dam and Pump or Flume
snok019	Woody Creek	Nottoway County	Dam and Pump or Flume
spea401	Little Saylers Creek	Prince Edward County	Dam and Pump or Flume
ssol015	Nottoway River	Southampton County	HDD
wsop018c	Tarrara Creek	Southampton County	Open Cut