Reducing Impacts of Pipelines Crossing Rivers and Streams

Addendum, Revised February 2022

Introduction

The report "Reducing Impacts of Pipelines Crossing Rivers and Streams" was produced by Trout Unlimited and West Virginia Rivers Coalition in 2020. Since the release of that report, additional information and pipeline project developments warrant an addendum to the original report.

Project Updates

The Atlantic Coast Pipeline was canceled in July of 2020 by the companies behind the project, Dominion and Duke Energy. In their joint press release on the project's cancellation, the companies cited "ongoing delays and increasing cost uncertainty". Additionally, the companies stated that recent U.S. Court decisions around the use of the Nationwide Permit ("NWP") 12 for pipeline construction was a factor in the decision to cancel the *project. The Mountain Valley Pipeline (MVP) continues through the regulatory process.

Stream Crossing Permits

All pipelines that will cross streams and other waterbodies are subject to both federal and state regulation to identify environmental impacts from the proposed pipeline and to mitigate those impacts. The Federal Energy Regulatory Commission (FERC) authorizes pipeline construction that crosses state lines through the issuance of a Certificate of Public Convenience and Necessity. Pipelines also frequently need a permit from the Army Corps of Engineers ("Corps") to cross streams and wetlands. The Corps has created a nationwide permit for waterbody crossings by utility lines, called Nationwide Permit 12 (NWP 12). If a project cannot meet the conditions for the use of NWP 12, it must obtain a project-specific, individual permit from the Corps.

*Dominion Energy and Duke Energy Cancel the Atlantic Coast Pipeline - Jul 5, 2020

Pipeline stream-crossing permits have been the subject of litigation not only in Appalachia, but also across the country. In a case challenging the Corps' NWP 12, a federal district court in Montana determined that the Corps' 2017 reissuance of NWP 12 was arbitrary and capricious and violated the Endangered Species Act. For a time, that decision limited the use of NWP 12 for oil and gas pipeline projects.

In Appalachia, a ruling by the U.S. Fourth Circuit Court of Appeals led the Corps to revoke authorizations it had issued to Mountain Valley Pipeline under NWP 12 due to the pipeline's inability to meet special conditions from West Virginia. For pipelines over 36 inches, West Virginia had placed restrictions on the NWP 12 prohibiting its use if in-stream construction lasts over 72 hours and blocks the movement of fish. The federal and state agencies then attempted to modify the permit so that pipeline companies could comply with the special conditions. However, after further litigation over whether the permit could be modified, MVP pulled its application for the general NWP 12 and instead applied for an individual permit from the Corps, a Clean Water Act Section 404 federal "dredge and fill" permit which also requires state regulatory agency approvals known as Clean Water Act Section 401 Water Quality Certifications.

Federal law also requires federal agencies to consult with the U.S. Fish and Wildlife Service (FWS) on the project's impacts to endangered species and detail these findings in a Biological Opinion (BiOp). The U.S. Fourth Circuit Court of appeals previously stayed MVP's 2017 BiOp and most recently rejected MVP's 2020 BiOp for failing to adequately assess the project's impact on the endangered Roanoke Logperch (Percina rex) and Candy Darter (Etheostoma osburni).

Stream Crossing Impacts

Stream crossings are areas where potential impacts must be identified and plans developed to minimize and/or mitigate the impacts. There has been much debate about two differing types of stream crossing techniques: Trenching stream beds above ground versus underground boring for pipes to cross under stream channels. Please refer to the previous report, "Reducing Impacts of Pipelines Crossing Rivers and Streams", for a detailed description of the different crossing methods and their potential impacts. Pipeline companies purport that trenched stream crossing impacts are temporary in nature. However, as discussed below, so-called temporary impacts can sometimes persist for several years.

Short-Term vs. Long-Term Impacts

While short-term impacts of pipeline construction have been well documented, long-term effects also occur. Some pipeline crossing studies have found that the effects of in-stream construction have been short-term, from 1 month to 2 years (Reid, 2002). Armitage and Gunn (1996) (cited in Levesque and Dube, 2007), however, indicated that adverse effects from suspended sediment continued for 4 years following pipeline construction. The now-canceled 2020 BiOp for the MVP estimated that effects to benthic invertebrates in aquatic areas that receive significant increased sedimentation as a result of the project will persist for up to 4 years. With a species such as the endangered candy darter whose lifespan is 2-3 years, 4 years of disruption in the food chain could be devastating to impacted populations. Since darters are also integral prey to higher trophic organisms such as fishes and amphibians, these impacts can cause collapse of food webs in these streams.

Trenching vs. Boring Impacts

According to the WV Department of Environmental Protection's Erosion and Sediment Control Best Management Practices Manual (Revised 2016), trenchless methods—such as "boring and jacking" and horizontal directional drilling of pipe under the streambed—are the least destructive and preferred methods. Additionally, Silvis (2021) concludes that trenchless methods are the least destructive approach for pipeline crossings of waterbodies absent special site-specific conditions.

In recent years, MVP has changed its crossing methods for some of the thousands of streams in its path. From trenching all but a few streams, MVP is now proposing to bore under 180 streams and wetlands in an attempt to reduce impacts. However, MVP's rationale for which streams are feasible to bore under has been inconsistent. In a November 2020 application for an amendment to its FERC certificate, MVP claimed it was feasible to bore under all streams and wetlands in the first 77 miles of the project . Just three months later, however, MVP changed its position on boring feasibility for those waterbodies. In a February 2021 certificate amendment request, all but three of the proposed borings in the first 77 miles of the project were changed back to trenching.

Brook trout.

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Introduction

Central Appalachia is home to a wealth of aquatic resources, with a widely distributed network of small streams and larger rivers hosting abundant diversity. The ongoing buildout of pipeline infrastructure involves major linear construction and earth disturbance, stretching hundreds of miles. Invariably, this requires the crossing of streams and rivers, including many that host high-quality fisheries, streams hosting sensitive or threatened organisms, and drinking water sources. The Atlantic Coast Pipeline (ACP) and Mountain Valley Pipeline (MVP) routes include over 2,600 waterbody crossings in West Virginia, Virginia and North Carolina (Federal Energy Regulatory Commission, 2017). This includes approximately 250 rivers and streams containing species of concern such as native and naturally reproducing trout, anadromous fish and sensitive mussels (Federal Energy Regulatory Commission, 2017). In WV and Western Virginia, the ACP and MVP traverse the headwaters of drinking water sources for the entire region. MVP crosses 22 source water protection areas and ACP crosses 6 source water protection areas (Federal Energy Regulatory Commission, 2017). In addition, the likelihood of future pipeline projects in the region put WV and VA streams at risk of increased degradation.

Impacts of Pipeline Stream Crossings

Pipeline stream crossings have the potential to impact streams in multiple ways, largely through water quality and habitat impacts. Construction activities can destabilize banks and stream beds, increasing erosion and harming aquatic life by covering habitat in fine sediments and degrading water quality. Some waterbody crossing methods also dewater streambeds for prolonged periods potentially causing mortality for species, such as mussels and some aquatic macroinvertebrates, that are not mobile and cannot be moved from the dewatered area, and can expose habitats vital for reproduction and feeding. The clearing and grading of stream banks increases exposure of the soil to erosional forces and reduces riparian vegetation along the cleared section of the waterbody, which can result in increased surface runoff from these areas. Increased surface runoff caused by removal of riparian vegetation facilitates transport of sediment into surface waters, which can result in increased turbidity levels and increased sedimentation in the receiving waterbody. Disturbances to stream channels and stream banks could also increase the likelihood of stream bank/bed erosion after construction due to increased runoff volumes to the stream, as well as increase instream temperatures, which can be lethal for many coldwater species. The potential also exists for accidental spills from the boring equipment, from refueling of vehicles and the storage of fuels or other substances near surface waters. Spills degrade water quality and cause acute and chronic toxic effects on aquatic organisms (Federal Energy Regulatory Commission, 2017).

These impacts are exacerbated as the cumulative negative effects of multiple pipeline and access road crossings are added (Ferguson, 2016). Cumulative impacts are especially pronounced in smaller headwater streams which are crossed multiple times and where much of the high quality coldwater habitat in West Virginia and Virginia exists
(Figure 1).

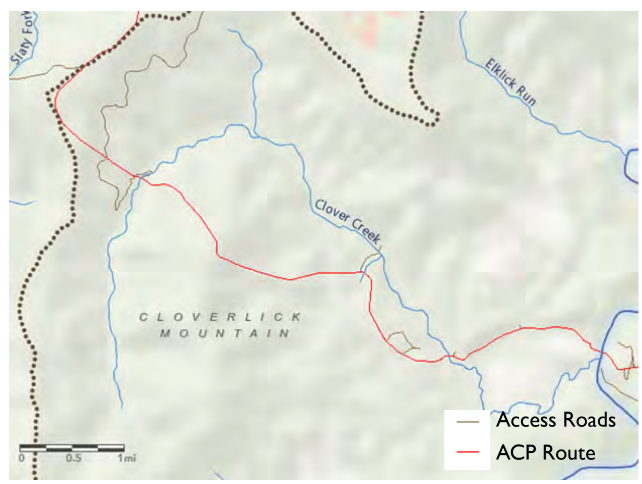

Fig. 1. Map of the route of the ACP through the Clover Creek Watershed in West Virginia. Degradation to Clover Creek, a tributary to the Greenbrier River along the ACP route, may be exacerbated due to the cumulative impacts of multiple pipeline and access road crossings as is illustrated in the figure.

Pipeline Construction Impacts	Potential Water Quality and Aquatic Life Impacts
Destabilize stream banks and stream beds	Destabilize stream banks and stream beds
Removal of riparian vegetation	Increased stormwater runoff and sedimentation
Dewatering stream beds for prolonged periods	Disrupt feeding and breeding, death if species are not removed from dewatered areas
Accidental spills of fuels or drilling mud	Degraded water quality
Multiple crossings within a watershed	Above impacts are compounded

Table 1. Pipeline Construction Impacts on Water Quality and Aquatic Life

Permitting Stream Crossings

In West Virginia and Virginia, stream crossing permits are issued by the US Army Corps of Engineers (ACOE). The ACOE regulates in-stream construction for utility line development through a permit required by the federal Clean Water Act in Section 404. This permit is called the Nationwide Permit 12 (NWP12); nationwide permits are classified by ACOE to be general permits. Construction projects covered under general permits, including NWP12, are assumed to have minimal impacts to water quality. During the re-certification of the general permit, each state may place special conditions on the permit. During the public comment period on WV's certification of the NWP12, it was discovered that the pipeline companies were unable to meet WV's special conditions regarding the length of time for stream crossing construction and obstructions to fish passage. A ruling by the U.S. Court of Appeals for the Fourth Circuit caused the Army Corps of Engineers to revoke NWP12 due to the pipeline companies' inability to meet WV's special conditions, so few stream crossings have been completed on the ACP and MVP. The Army Corps of Engineers have since approved WV's modification of the special conditions in question and the pipeline companies have re-applied for the permit which will contain the new conditions.

Another condition of the NWP12 requires that the ACOE consult with the Fish and Wildlife Service to issue a Biological Opinion (BO) on the project's impacts to endangered species. The U.S. Court of Appeals for the Fourth Circuit invalidated the previous BOs for ACP and MVP because they did not adequately address the projects' impacts on endangered species, such as the Rusty Patch Bumblebee and the Candy Darter. With the release of the new BO pending, there is the potential that hundreds of sensitive streams and rivers could have pipeline crossings established in the coming year (2020-2021).

However, recently a Montana District Court vacated the NWP12 for the Keystone Pipeline. The Court found that the ACOE failed to comply with the Endangered Species Act (ESA) when issuing the NWP12. The Court's order prohibits ACOE from issuing any NWP12 pending completion of the ESA consultation process with the Fish and Wild Service. The Order applies nationwide and impacts both the ACP and MVP permits.

Stream Crossing Methods

Strategies for crossing waterbodies depend on a number of site-specific factors, most importantly, the size and nature of the waterbody itself and the existing ecosystems. The success of a pipeline stream crossing depends on the selection of an appropriate crossing method to prevent or reduce the adverse effects of construction in the stream channel, stream banks and downstream waters.

Wet Crossing Method: Open Cut Wet Ditch
A wet ditch crossing simply involves excavating a trench across the stream without any diversion of in-stream flow.

- Advantages: The benefits of this method to pipeline companies are the low cost and a quick completion time, often making this the method of choice when existing regulations or policies do not require other techniques.

- Disadvantages: The drawback of this method to aquatic ecosystems is the potential for a significant increase in sediment runoff, increased sedimentation downstream, changes in channel morphology, and impacts to aquatic ecosystems (Pharris, 2007).

Fig. 2. Wet crossing.

Photo credit: notennenesseepipeline.org.

Dry Crossing Method: A dry crossing method involves diverting stream flow away from the work area. There are several different methods for dry stream crossings.

(A) Open-Cut Dry Ditch: A dry open cut entails crossing an intermittent or ephemeral stream while the stream is dry. There is no water flow in the stream and thus no flow-through device is used/needed. Dry open cuts may also occur when a stream is frozen.

- Advantages: No water diversion is needed.

- Disadvantages: Stream bed disturbance and scouring may still occur.

(B) Flume: In a flume crossing a dam is constructed to dry out the crossing work area. Large pipes are installed to move water from the upstream side to the downstream side. The flume pipes are like culverts that carry stream water under a road. When the trench has been excavated, the pipe laid and the trench backfilled, the dams and flume pipe(s) will be removed returning stream flow to the crossing site.

- Advantages: The flume method maintains streamflow and may allow fish passage.

- Disadvantages: Fish salvage, or the collection of fish species, may be required from the dried-up reach. Species that are not mobile, such as mussels and some aquatic macroinvertebrates, and reproductive habitats can be severely impacted. For pipeline companies and contractors, it can be difficult to trench and lay the large-diameter pipe needed for the stream crossing under the flume pipe (CAPP 2005).

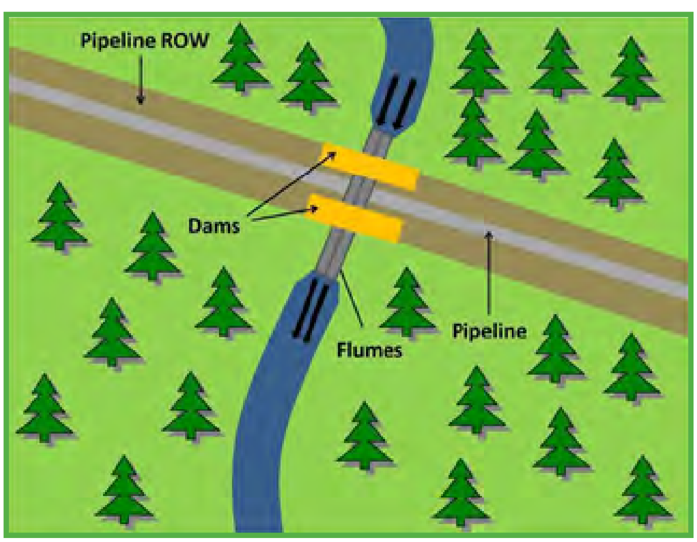

Fig. 3. Flume crossing.

(C) Dam and Pump: A dam and pump crossing entails damming the stream in a similar fashion to the flume method. In this case a pump is used to move water from the upstream section to the downstream section through hoses. Again, when the trench has been excavated, the pipe laid and trench backfilled, the pump, hoses and dams are removed to return flow to the work area.

- Advantages: There is minimal release and transport of sediment downstream; however effects of crossing construction on substrate and invertebrate communities in a stream can persist for over 4 years (Armitage and Gunn, 1996)

- Disadvantages: This method creates a short-term barrier to fish movement and leaves the stream bed dry for a prolonged period. Species that are not mobile, such as mussels and some aquatic macroinvertebrates, and reproductive habitats can be severely impacted. This method is also susceptible to mechanical failure of the pumps, causing a safety issue and potential for pollution (CAPP, 2005).

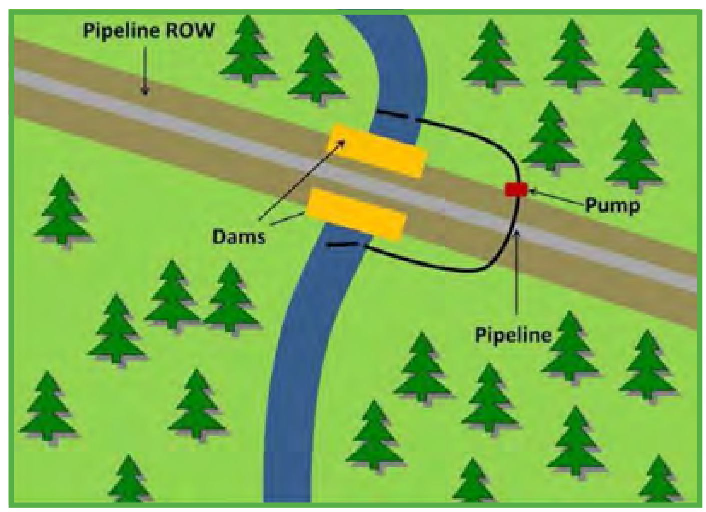

Fig. 4. Dam and pump crossing.

(D) Coffer Dam: In a coffer dam crossing, only a portion of the stream channel width is dammed at any given time. This is used for crossings on larger streams that preclude the use of flume or dam and pump methods. Typically coffer dam crossings are completed in two stages. The trench is dug in the dammed portion, the pipe laid, the trench backfilled and the dam removed, returning flow to the area. The next segment of stream will then be dammed the process repeated.

- Advantages: There is minimal release and transport of sediment downstream. This method is not likely to result in negative effects to fish and fish habitat (Reid, 2002).

- Disadvantages: This method involves extensive instream activity with heavy equipment required to install the dams, which could disrupt habitat and spawning. Species that are not mobile, such as mussels and some aquatic macroinvertebrates, and reproductive habitats can be severely impacted. There is a potential for washout of the dam during high flows (CAPP, 2005).

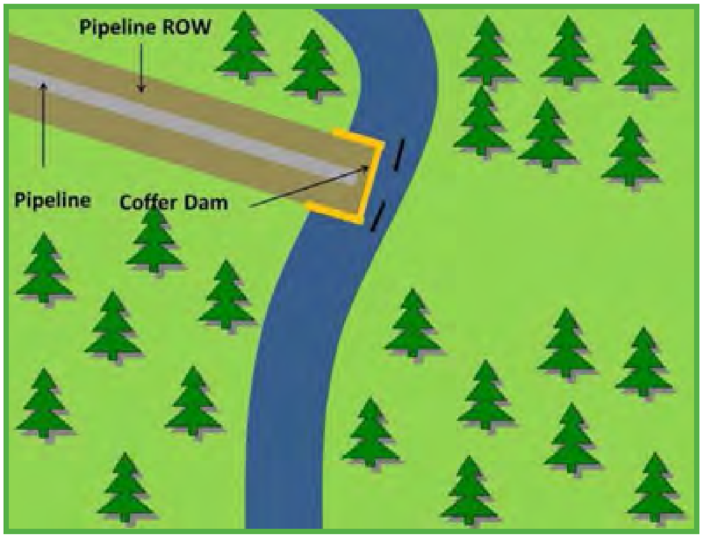

Fig. 5. Coffer dam crossing.


Coffer dam.

Boring Techniques: There are several boring techniques used to crossing streams and other waterbodies. These methods involved drilling of a borehole under the streambed and running the pipe through the borehole.

(A) Conventional Bore: For a conventional bore, two pits are constructed, one on either side of the waterbody, a bore pit and a receiving pit. These pits are excavated to the depth needed for the pipeline to pass under the stream channel. A boring machine is lowered into the bore pit and drills a borehole under the waterbody using a rotating auger. Once excavated, the pipe is pulled through the bore pit to the receiving pit.

- Advantages: Streambed remains intact avoiding aquatic and riparian habitat disturbance.

- Disadvantages: Requires additional workspace and dewatering of the borehole. Potential for borehole cave-in and release of sediment laden water from de-watering device if not installed properly.

(B) Horizontal Directional Drilling (HDD): HDD involves drilling a small pilot hole, followed by a reaming device. The reaming device follows the pilot drill and enlarges the diameter of the borehole. While drilling the borehole, a slurry of bentonite clay and water, also known as drilling mud, is circulated to lubricate the drill bit, remove cuttings and stabilize the borehole. Once the borehole is drilled, pipe is run through the entry point on one side of the stream to an exit point on the other.

- Advantages: Streambed remains intact avoiding aquatic and riparian habitat disturbance.

- Disadvantages The drilling operation requires large volumes of water for mixing the drilling slurry, often withdrawn from the waterbody being crossed (Pharris, 2007). Improper handling of the drilling slurry has the potential to impact water quality (Reid, 2002). In addition to spills, drilling mud can enter the stream through a frac-out, sometimes known as a bentonite blowout or inadvertent return. This occurs when drilling mud returns to the surface through underground pathways or by exceeding the pressure the surrounding geology can withstand. In addition, HDD conducted in areas of karst topography can result in contamination of groundwater supplies with bentonite clay.

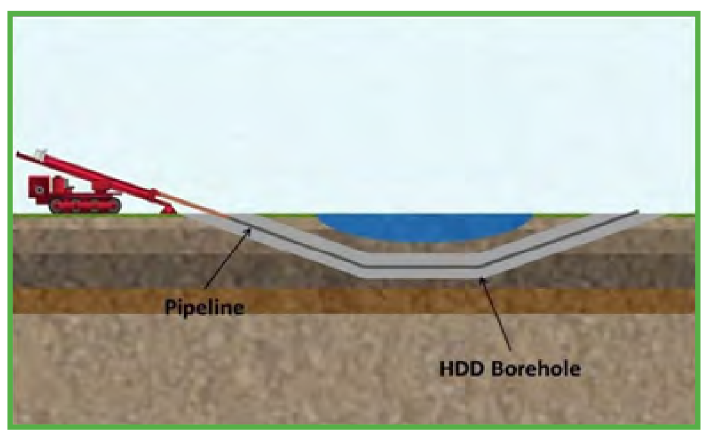

Fig. 6. HDD crossing.

Case Studies

WB XPRESS PIPELINE

The WB Xpress, a Columbia Gas Project, crosses northeast West Virginia and continues into northern Virginia. The project, which traversed steep terrain and headwater watersheds, received several notices of violation (NOVs) from West Virginia Department of Environmental Protection (WVDEP) due to erosion and sedimentation discharges. While crossing the North Fork of the South Branch of the Potomac River, a pump failure caused sediment laden water to impact the stream. The WVDEP fined Columbia $13,340 for the incident.

On October 22, 2018, a pump-around dam at the site of construction on the Seneca Rocks Compressor Station failed, and pumps were overwhelmed. This resulted in a sediment release to the North Fork of the South Branch of the Potomac River. The release violated West Virginia's water quality standards and three sections of the company's water pollution control permit. The NOV indicates that the company failed to report noncompliance to the state spill alert hotline and that the company failed to prevent sediment-laden water from leaving the site without going through an appropriate device.

The North Fork of the South Branch of the Potomac River flows through the popular Seneca Rocks Recreation Area and is a highly utilized trout fishery. Settleable solids from this release were observed 19 miles downstream in the South Branch of the Potomac River.

Failed dam with approximately 20 intake lines upstream of the dam.

Construction continued and sediment-laden water caused violations of water quality standards in the North Fork of the South Branch of the Potomac River.

Source: WVDEP (2019b).

MARINER EAST II PIPELINE

The ME2 proposed using HDD at 230 sites along its 350 miles across southern Pennsylvania. The Pennsylvania Department of Environmental Protection (PADEP) issued 107 NOVs for the ME2, with 96 involving at least one inadvertent release of drilling fluid. Tens to hundreds of thousands of gallons of drilling fluid were released into surrounding areas, including streams and wetlands, during construction of the ME2 (Downstream Strategies, 2019). A major concern of these releases was to drinking water supplies, including private water wells. This included impacts to water clarity, loss of water pressure and loss of water supplies (Downstream Strategies, 2019).

Drilling fluid releases via IRs were a significant source of violations for the ME2 Pipeline. One specific instance in Franklin Township of Blair County resulted in drilling fluids being released into the Frankstown Branch of the Juniata River (PADEP, 2018). The drilling fluid was visible in the river for 1.5 miles downstream. This occurred when drilling activities caused groundwater to be released into the drill pit at a rate of 500 gallons per minute, which exceeded the onsite capacity to manage it effectively. The drill pit overflowed. The water table was higher on the landscape than expected according to the HDD feasibility study. The construction method at this site was then reevaluated, and the permit was modified to utilize a different approach. (Blosser, 2019.)

Drilling mud released during an IR in Middletown (Dauphin County).

Sand bags used to contain leak of drilling fluid on Chester Creek in Brookhaven (Delaware County).

Sources: Laura Evangelisto and Middletown Coalition for Community Safety.

Recommendations

The following recommendations are designed to mitigate the impact of pipeline development on sensitive aquatic resources.

- **Route Selection.** Planning a pipeline project involves many steps, starting with route selection. Care should be taken on the front end of the project to avoid and minimize impacts to high quality rivers and streams and habitat for sensitive, threatened and endangered species. A Risk Management Framework (See Appendix A) should be adopted to provide consistency in the determination of potential effects of development projects, including pipeline associated watercourse crossings, on fish and fish habitat (CAPP 2005). TU developed a mapping tool to aid in pipeline siting in the Delaware River Basin. This tool could be used as a template for similar analysis in other areas with planned pipeline infrastructure.

- **Watershed-scale Cumulative Impact Analysis.** During the route selection and permitting process, a cumulative impact analysis should be performed to look at the number of crossings and length of access roads within a watershed. Efforts should be made to minimize tributary crossings and access road development within watersheds to prevent the cumulative impacts of multiple stream crossings.

- **Site-specific Stream Crossing Analysis.** To determine the least impactful stream crossing method, a site-specific stream crossing analysis should be performed taking into consideration the crossing location, species of concern, designated uses, hydrology and geomorphology of stream reach. WVDEP Erosion and Sediment Control Best Management Practices Manual states, "The least damaging and preferred method is "boring and jacking" or horizontal directional drilling."

- **Scour Analysis for Trenched Crossings.** For all streams proposed to cross by open trench, a scour analysis should be performed to determine the depth of pipe burial and prevent pipeline exposure in the stream bed.

- **Geotechnical Analysis for Trenchless Crossings.** For all trenchless crossings, a geotechnical analysis should be performed to ensure the success of the boring and to protect against inadvertent returns. The geotechnical analysis should take into account soil type, soil moisture, and geology.

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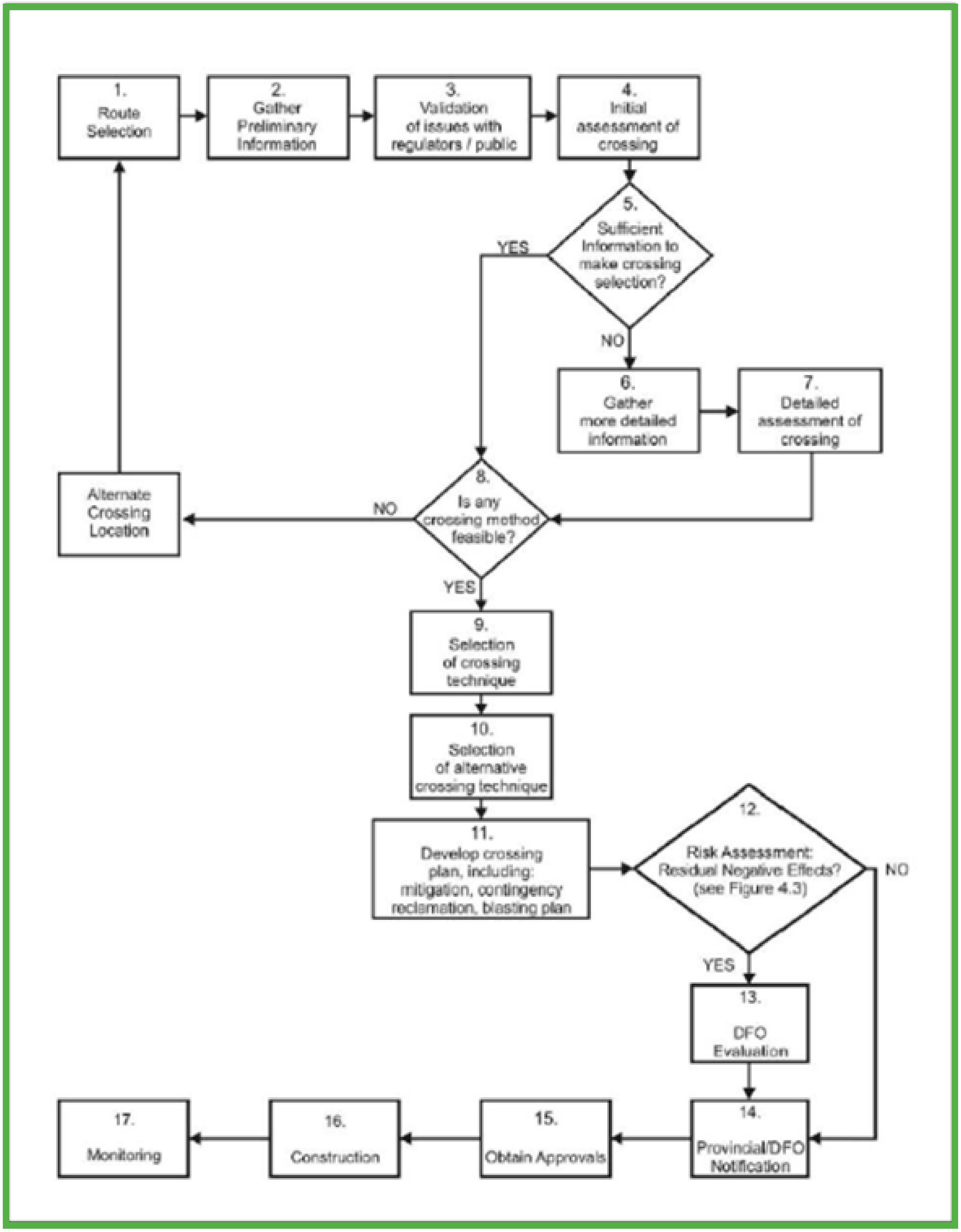
Appendix A: Planning Summary for Watercourse Crossings (CAPP, 2005)



Acknowledgements

This report was developed by Trout Unlimited and the West Virginia Rivers Coalition with support from the Appalachian Stewardship Foundation.

Appalachian Stewardship Foundation