



# Numeric Turbidity Water Quality Standards: A Tool to Protect Aquatic Life

## Introduction

In recent years, West Virginia and Virginia have faced a major buildout of pipeline infrastructure. These large-scale, linear pipeline construction projects require earth disturbance along hundreds of miles of rugged and often highly erodible terrain. In-stream excavation is often required to cross the hundreds of streams and rivers along the pipeline route. Excavation adjacent to, and within, streams and rivers has the potential to cause significant sediment pollution if erosion control best management practices (BMPs) are ineffective in keeping sediment from leaving the worksite and/or right of way. Increased erosion and

sedimentation in streams harm aquatic life. Sediment pollution can smother spawning beds and fish eggs, reducing juvenile fish survival. Increased sedimentation also degrades habitat for benthic macroinvertebrates, aquatic insects that provide food for larger fish species, causing impacts to benthic community health and diversity, in addition to the species who feed on them.



Increased sediment loads in rivers used as sources of potable water can also impact downstream drinking water utilities. Water utilities may experience increased treatment costs by having to replace filters more often or change their treatment processes to remove the excess sediment. Excess sediment in drinking water is not only aesthetically displeasing but it interferes with the disinfection process. High organic matter content in source water can create harmful disinfection byproducts, placing a burden on water utilities and their customers.

With support from groups like Trout Unlimited (TU) and West Virginia Rivers Coalition, citizen observers have submitted hundreds of complaints to state agencies, detailing sediment pollution and failed or lacking erosion controls, resulting in numerous violations issued to pipeline companies requiring mitigation of sediment pollution impacts.



## How Are Streams Protected from Turbidity Impacts?

Turbidity, often referenced in sediment-related standards, is a measurement of water clarity; suspended organic materials/sediments affect water clarity. To protect aquatic resources and potable water sources, instream water quality standards are established. Standards can be “numeric” or “narrative.”  
*(Continued on next page.)*

West Virginia has a **numeric standard** explained in Figure 1. Essentially, this standard creates a numeric limit for suspended material that can be measured instream while allowing for a healthy aquatic community (referred to as “meeting its designed or existing use”). West Virginia also has **narrative water quality standards** as seen in Figure 2. The standard states that projects cannot discharge distinctly visible solids to state waters or create sediment deposits on stream bottoms.

## WV NUMERIC TURBIDITY STANDARD 8.33

No point or non-point source to West Virginia's waters shall contribute a net load of suspended matter such that the turbidity exceeds 10 NTU's over background turbidity when the background is 50 NTU or less, or have more than a 10% increase in turbidity (plus 10 NTU minimum) when the background turbidity is more than 50 NTUs. This limitation shall apply to all earth disturbance activities and shall be determined by measuring stream quality directly above and below the area where drainage from such activity enters the affected stream. Any earth disturbing activity continuously or intermittently carried on by the same or associated persons on the same stream or tributary segment shall be allowed a single net loading increase.

FIG. 1

### 8.33.1

This rule shall not apply to those activities at which Best Management Practices in accordance with the State's adopted 208 Water Quality Management Plan are being utilized, maintained and completed on a site-specific basis as determined by the appropriate 208 cooperative or an approved Federal or State Surface Mining Permit is in effect. This exemption shall not apply to Trout Waters.

Practices that disturb the land surface have the potential to cause increased turbidity and resultant sedimentation, therefore they are required to implement BMPs to assure sediments are not discharged to waters due to runoff/erosion. Permitted projects are allowed a one-time exceedance in water quality standards due to suspended material, but ongoing continuous or intermittent sedimentation issues are not allowed. The regulation provides an exemption to the numeric standards for projects with permitted, completed and maintained erosion BMPs, though this exemption is void in waters supporting trout populations.

## WV NARRATIVE STANDARD

### §47-2-3. Conditions Not Allowable In State Waters

- 3.2.a. Distinctly visible floating or settleable solids, suspended solids, scum, foam or oily slicks;
- 3.2.b. Deposits or sludge banks on the bottom;

FIG. 2

Virginia has a **narrative water quality standard**, shown in Figure 3, but no numeric water quality standard. The narrative standard states that turbidity cannot exist at concentrations that impair designated uses, such as swimming and boating or supporting trout populations. For example, turbidity cannot be of a level that would smother redds for trout reproduction. To implement this standard, the state is supposed to establish permit conditions that ensure the protection of designated uses of a given stream. These conditions typically include the use of erosion control BMPs. In Virginia, thanks to strong stakeholder action, the Virginia Water Quality Control Board has directed the Department of Environmental Quality to develop numeric turbidity standards.

## VA NARRATIVE STANDARD

A. State waters, including wetlands, shall be free from substances attributable to sewage, industrial waste, or other waste in concentrations, amounts, or combinations which contravene established standards or interfere directly or indirectly with designated uses of such water or which are inimical or harmful to human, animal, plant, or aquatic life. Specific substances to be controlled include, but are not limited to: floating debris, oil, scum, and other floating materials; toxic substances (including those which bioaccumulate); substances that produce color, tastes, turbidity, odors, or settle to form sludge deposits; and substances which nourish undesirable or nuisance aquatic plant life. Effluents which tend to raise the temperature of the receiving water will also be controlled. Conditions within mixing zones established according to 9VAC25-260- 20 B. do not violate the provisions of this subsection.

FIG. 3

## Enforcement of Turbidity Standards in WV and VA

In WV and VA, enforcement of sediment standards has focused on the permitting and inspection of erosion control BMPs and documentation of sediment entering streams causing exceedances of the WV narrative water quality criterion such as the example in Figure 4. To date, no pipeline company has been cited for exceeding numeric turbidity standards in WV. Inspectors do not take turbidity measurements in the field and instead rely on visual assessment of BMPs and documentation/evidence of sedimentation in streams.

There are a variety of erosion control techniques, such as silt fence, super silt fence, compost filter socks, slope drains, and slope breakers with sumps and terminus treatments, all designed to keep sediment within the worksite and out of streams and rivers. Practices for implementation of these methods are detailed in state guidance documents such as the Virginia Erosion and Sediment Control Handbook and the West Virginia Erosion and Sediment Control Field Manual. In some cases, where steep slopes and highly erodible terrain increase erosion potential, these BMPs have been proven to be ineffective. In addition, even when proper BMPs for site conditions are used, BMPs fail due to improper installation or a lack of maintenance.

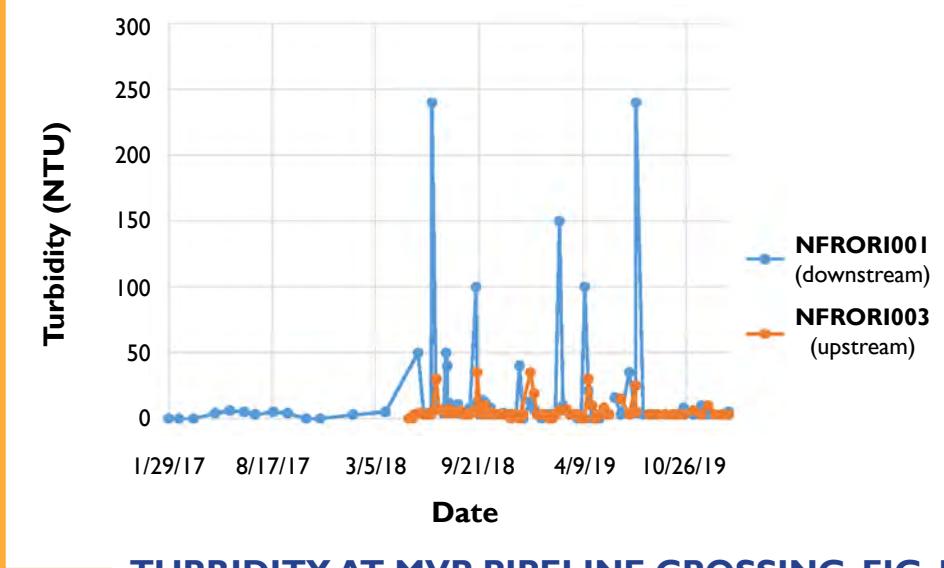


**FIG. 4** In this tributary to Georgescamp Run, distinctly visible settleable solids and deposits are considered “conditions not allowable” in the WV permit for the project. WVDEP issued a violation to the Mountaineer Xpress Pipeline for this incident.

## The Case for Numeric Turbidity Standards

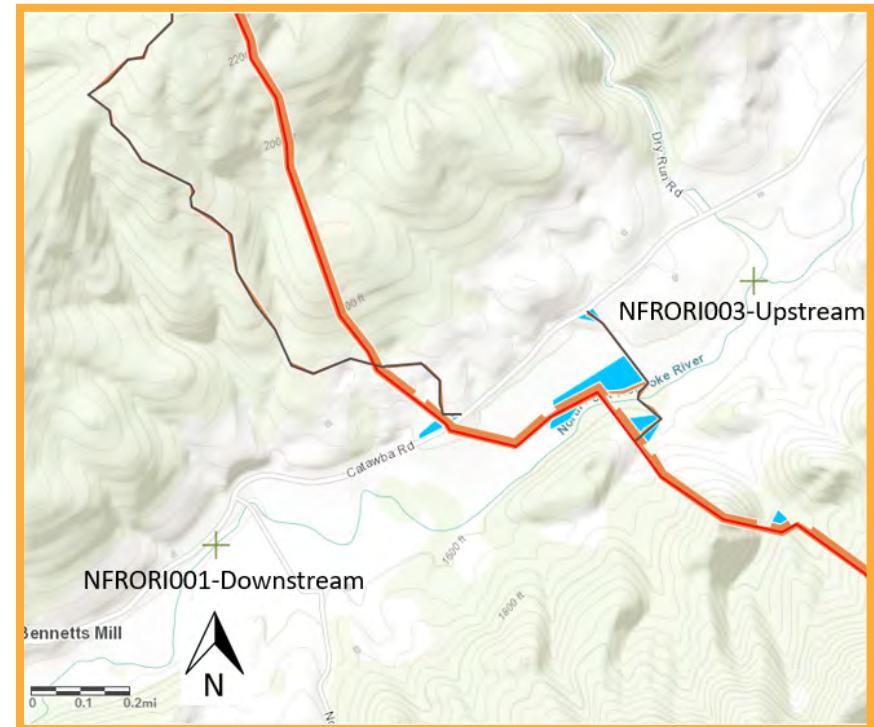
Turbidity can lead to adverse effects on fish and invertebrates. Researchers have identified numeric turbidity thresholds where aquatic life can be affected. For example, turbidity levels as low as 4 NTU have been shown to adversely affect invertebrate densities and diversity in flowing waters (Rosetta, 2005). Research has also shown that turbidity increases can affect fish feeding strategies and inhibit growth. One study showed that turbidity levels of 40 NTU caused a 62% decrease in brook trout growth rates when compared with clear water (Sweka, J.A. and Hartman, K.J., 2001). Enforcement of narrative turbidity standards is effective in reducing turbidity impacts on aquatic life but may still allow adverse impacts to aquatic life. Figure 5 illustrates citizen science data showing turbidity increases downstream of pipeline construction at levels that could impact aquatic life in the stream. Existing research can be used to identify numeric turbidity thresholds that protect aquatic life and designated uses. Setting and enforcing science-based numeric standards would provide a more effective tool for agencies to protect aquatic life in West Virginia and Virginia's streams and rivers.

## NORTH FORK ROANOKE RIVER



TURBIDITY AT MVP PIPELINE CROSSING, FIG. 5

On the North Fork Roanoke River in Montgomery County, Virginia, volunteers have been monitoring several sites near the Mountain Valley Pipeline crossing since 2017. During one notable event on June 22, 2018, a short but heavy downpour resulted in turbidity levels exceeding the maximum detection limit of the 120-centimeter secchi tube (>240 NTU). At the same time, upstream of pipeline construction turbidity levels on the North Fork Roanoke River only elevated to 30 NTU. Similar occurrences took place on September 15, 2018; February 23, 2019; April 13, 2019; and July 21, 2019. On July 19, 2018 turbidity downstream of the pipeline rose to 50 NTU, despite no rainfall in the past 48 hours and low water conditions in the stream. After this event, volunteers noted new sediment buildup on the streambed. Though Virginia has no numeric turbidity standards, these measurements far exceed numeric standards in nearby states such as West Virginia. The difference in turbidity values upstream and downstream of the pipeline crossing would suggest that the increased turbidity and resultant sedimentation instream is due to pipeline construction activities, even in absence of visual observation of construction activities.



## Recommendations

Numeric turbidity standards could be an effective tool for state agencies to more effectively protect aquatic life from adverse impacts of earth disturbance activities, such as pipeline construction. The following recommendations relative to numeric water quality standards would enhance the protection of waters in WV and VA, respectively.

- **Development of numeric turbidity standards in Virginia:** The VADEQ should prioritize the development of numeric turbidity criteria that protect existing and designated stream uses. With the current real-time monitoring partnership with USGS, the VADEQ would be equipped to enforce numeric turbidity standards on a number of important streams along the MVP and ACP.

Additional recommendations continued on next page.

- **Enforcement of already established numeric turbidity standards in West Virginia** as opposed to relying on narrative water quality standards: Numeric turbidity standards would be best enforced by continuous turbidity monitoring above and below construction activities. It is impractical for continuous monitoring to occur at all stream crossings, so it is recommended that WVDEP initiate continuous monitoring on high-priority streams, such as those that support naturally reproducing trout populations. This could potentially be conducted in partnership with the U.S. Geological Services (USGS), such as real-time continuous monitoring that currently occurs along the MVP and Atlantic Coast Pipeline (ACP) in Virginia. Continuous monitoring in select streams could provide additional data to be used in compliance monitoring where routine inspections are not practical, such as remote areas that are not easily accessible. Turbidity readings could be monitored remotely. Enforcement staff would be alerted when spikes in turbidity occur and field inspections are warranted. An alternative monitoring strategy could be developed for streams where continuous turbidity monitoring is not viable, possibly including field measurements above and below pipeline construction by field inspectors or citizen scientists.

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