UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION III
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Philadelphia, Pennsylvania 19103-2029

Decision Rationale
Total Maximum Daily Loads for the
Lower Ohio River Watershed, West Virginia

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Date: ______________________________

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I. Introduction

The Clean Water Act (CWA) requires a Total Maximum Daily Load (TMDL) be developed for those waterbodies identified as impaired by a state where technology-based effluent limits and other pollution controls do not provide for the attainment of water quality standards. A TMDL establishes a target for the total load of a particular pollutant that a water body can assimilate and divides that load into wasteload allocations (WLA), given to point sources, load allocations (LAs), given to nonpoint sources and natural background, and a margin of safety (MOS), which takes into account any uncertainty. Mathematically, a TMDL is commonly expressed as an equation, shown below.

$$TMDL = \sum WLAs + \sum LAs + MOS$$

This document sets forth the U.S. Environmental Protection Agency, Region III's (EPA's) rationale for approving TMDLs for total iron and fecal coliform bacteria in the Lower Ohio River Watershed submitted by the West Virginia Department of Environmental Protection (WVDEP). The TMDLs were developed to address impairments of water quality standards as identified on West Virginia's section 303(d) list of water quality-limited segments. WVDEP submitted TMDLs for 89 impaired streams in its report entitled *Total Maximum Daily Loads for the Lower Ohio River Watershed, West Virginia* (March 4, 2021) (hereinafter referred to as the "TMDL Report"), to EPA for final review and action on March 4, 2021. EPA's decision is based upon its administrative record, which includes the TMDL Report and information in supporting files provided to EPA by WVDEP. EPA has reviewed and determined that the TMDL meets the requirements of section 303(d) of the Clean Water Act and its implementing regulations at 40 CFR Part 130 including but not limited to:

1. TMDLs are designed to implement applicable water quality standards.
2. TMDLs include wasteload allocations and load allocations.
3. TMDLs consider natural background sources.
4. TMDLs consider critical conditions.
5. TMDLs consider seasonal variations.
6. TMDLs include a margin of safety.
7. TMDLs have been subject to public participation.

In addition, EPA has considered and finds acceptable the reasonable assurances set forth in the TMDL Report.

From this point forward, all references in this rationale can be found in West Virginia's TMDL Report, *Total Maximum Daily Loads for the Lower Ohio River Watershed, West Virginia* (March 4, 2021), unless otherwise noted.

II. Section 303(d) Listing Information

Table 3-3 of the TMDL document presents the waterbodies and impairments for which TMDLs have been developed in the Lower Ohio River Watershed. West Virginia identified 89 streams in the Lower Ohio River Watershed as impaired due to exceedances of the numeric water quality criteria for total iron and fecal coliform bacteria. In addition, as set forth below, the iron and fecal coliform TMDLs address the causes of biological impairment in certain waters in the Lower Ohio River Watershed that were listed as biologically impaired based on the narrative water quality criteria of 47 CSR §2-3.2.i. EPA notes the 2016 Section 303(d) list remains the operative list until West Virginia's 2018/2020 Section 303(d) list is approved. Nevertheless, it is appropriate for TMDLs to be established for waters in which an impairment is first identified in the course of pre-TMDL monitoring. It is also appropriate for no TMDL to be developed where pre-TMDL monitoring demonstrates a lack of impairment. In the latter instance, the pre-TMDL monitoring may be used as a basis for removing a previously listed impairment from a future Section 303(d) list. Attachment 1 of this Decision Rationale presents the impaired waterbodies in the Lower Ohio River Watershed for which TMDLs have been established.

The modeled portion of the Lower Ohio River Watershed lies within the Western Allegheny Plateau ecoregion of western West Virginia and occupies portions of Cabell, Mason, and Putnam Counties. Cities and towns near the study area are Point Pleasant, Gallipolis Ferry, Apple Grove, and Lesage. The dominant landuse is forest, which constitutes 77.49 percent of the total landuse area. Other important modeled landuse types are pasture (7.67 percent), grassland (7.50 percent), urban/residential (2.67 percent), oil and gas (2.55 percent) and cropland (1.29 percent). Individually, all other land cover types compose less than one percent of the total watershed area each. The total population living in the subject watersheds of this report is estimated to be 5,000 people.

III. TMDL Overview

WVDEP developed TMDLs for iron and fecal coliform bacteria in the Lower Ohio River Watershed to address 89 streams in the Lower Ohio River Watershed identified as impaired because they are not achieving West Virginia's numeric water quality criterion for those parameters. The TMDLs for all impairments are shown as daily loads in Section 9 of the TMDL report. The TMDLs are also represented in Microsoft Excel allocation spreadsheets which provide detailed source allocations and successful TMDL scenarios. These allocation spreadsheets also present the TMDLs as annual loads because they were developed to meet TMDL endpoints under a range of conditions observed throughout the year. The annual loads are divided by 365 days per year to provide a daily load expression for each pollutant of concern. A technical report was included by West Virginia to describe the detailed technical approaches that were used during TMDL development and to display the data upon which the TMDLs were based. West Virginia provided an ArcGIS Viewer Project and ESRI StoryMap that explore the spatial relationships among the pollutant sources in the watershed.

In addition to the TMDLs above, the TMDL Report includes TMDLs addressing the causes of biological impairment in 29 streams (40 assessment units) within the watershed. As described in Section 4.0 of the TMDL Report, West Virginia utilized a stressor identification process to determine the primary causes of impairment in the streams listed as biologically impaired within the Lower Ohio River Watershed based on the narrative water quality criterion of 47 CSR 2–3.2.i. Stressor identification entails reviewing available information, forming and analyzing possible stressor scenarios and implicating causative stressors associated with benthic macroinvertebrate community impact. The primary data set used for the stressor identification was generated through pre-TMDL monitoring (Technical Report, Appendix K). Stressor identification was followed by stream-specific determinations of the pollutants for which TMDLs must be developed to address biological impairment. If that analysis demonstrated that impacts on the benthic macroinvertebrate community were caused by exceedance of numeric water quality criteria and could be resolved through attainment of numeric water quality criteria, then TMDLs were developed for those numeric water quality criteria, eliminating any need for biological TMDL development in the future.

Table 4-1 of the TMDL Report lists waters where the stressor identification process demonstrated that biological impairment caused by sedimentation and organic enrichment stressors will be resolved through the attainment of total iron and/or the fecal coliform bacteria numeric water quality criteria. The predominant sources of both organic enrichment and fecal coliform bacteria in this watershed are inadequately treated sewage and runoff from agricultural land uses. For the organic enrichment impairment identified in the watershed, it was determined that the implementation of fecal coliform TMDLs would require the elimination of the majority of existing fecal coliform sources and thereby resolve organic enrichment stress. Therefore, fecal coliform TMDLs will serve as a surrogate where organic enrichment was identified as a stressor.

In one stream, Lynn Fork (WV code: WVO-9-D-2, NHD Code: OL-12-M-5), high pH was identified as a stressor associated with organic enrichment, as evidenced by livestock access and manure in the stream. Organic enrichment leads to an abundance of periphyton/diatom growth, which in turn leads to high pH values as photosynthesis reduces carbon dioxide (and carbonic acid). WVDEP determined that implementation of fecal coliform TMDLs would remove untreated sewage and significantly reduce loadings in agricultural runoff and thereby resolve organic enrichment stress, including high pH due to photosynthesis.

For the sediment impairment identified in the watershed, it was determined that the sediment reductions necessary to ensure the attainment of iron water-quality criteria exceed those that would be needed to address the biological impairment in the Lower Ohio River Watershed. As such, iron TMDLs are acceptable surrogates for the sediment impairment in the watershed.[1]

[1] For biologically impaired streams where the stressor identification process did not indicate that TMDLs designed to achieve the numeric water quality criterion for fecal coliform or iron would resolve the biological impacts (Appendix K), West Virginia is deferring TMDL development for biological impairments and will retain those waters on the Section 303(d) list for future TMDL development. West Virginia has provided an explanation as to why it chose not to develop TMDLs for these waters at this time (Section 4.0). Because WVDEP has indicated that it is retaining these waters on the Section 303(d) list for future TMDL development, EPA considers WVDEP's explanation to be informational and not part of WVDEP's submission of TMDLs for approval.

Sections 5.0 and 6.0 of the TMDL Report discuss the metals and fecal coliform bacteria source assessments in the Lower Ohio River Watershed, respectively. The technical report has expanded details of the source assessment in the Lower Ohio River Watershed.

The sources of metals and sediment in the watershed include non-mining point sources for industrial wastewater discharges (one water treatment plant, one Multisector stormwater general permit for industrial discharge, one WV DOH stormwater discharge, one municipal separate storm sewer system (MS4); as well as sediment sources including forestry, oil and gas wells, roads, agriculture, streambank erosion, and other land disturbance activities. As discussed above, iron TMDLs are appropriate surrogates for biological impairments caused by sediment.

The fecal coliform bacteria sources in the watershed include MS4s, general sewage permits, unpermitted sources, including on-site treatment systems, direct discharges of untreated sewage, stormwater runoff, agriculture, and natural background (wildlife). As discussed above, fecal coliform bacteria TMDLs are appropriate surrogates for biological impairments caused by organic enrichment.

There are two streams, Bryan Creek (WV-OL-12-L) and Crab Creek (WV-OL-18) in the Lower Ohio River Watershed that are impaired for both dissolved oxygen and fecal coliform bacteria, both commonly associated with organic enrichment. Excessive amounts of organic matter increase fecal coliform bacteria counts and reduce dissolved oxygen levels. Generally, point and non-point sources contributing to dissolved oxygen impairments are the same as those for fecal coliform. The sources of the fecal coliform in Bryan Creek appeared likely to be organic loading associated with agricultural runoff and cattle access, and in Crab Creek the sources of fecal coliform appeared likely to be agricultural and failing septic systems. Implementation of the fecal coliform TMDLs will reduce the organic loads from these sources and will resolve the dissolved oxygen impairment in the streams. Section 7.0 of the TMDL Report discusses the dissolved oxygen source assessment.

Computational Procedures

The Mining Data Analysis System (MDAS) was used to represent the source-response linkage in the Lower Ohio River Watershed TMDL for iron/sediment and fecal coliform bacteria. MDAS was developed to facilitate large scale, data intensive watershed modeling applications. The model is used to simulate watershed hydrology and pollutant transport as well as stream hydraulics and instream water quality. MDAS is capable of simulating different flow regimes and pollutant variations. A key advantage of the MDAS development framework is that it has no inherent limitations in terms of modeling size or upper limit model operations. Section 8.0 of the TMDL Report discusses the modeling process.

Configuration of the MDAS model involved subdividing the TMDL watershed into subwatershed modeling units connected by stream reaches. The TMDL watershed was divided to allow for the evaluation of water quality and flow at pre-TMDL monitoring stations. The subdivision process also ensures a proper stream network configuration within the basin. The physical characteristics of the subwatersheds, weather data, land use information, continuous discharges, and stream data were used as input for the MDAS model. Flow and water quality were continuously simulated into the model on an hourly time-step. Model setup consisted of configuring two separate MDAS models: iron/sediment and fecal coliform bacteria.

The calibrated model provides the basis for performing the allocation analysis. The first step is to simulate baseline conditions, which represent existing nonpoint source loadings and point source loadings at permit limits. Baseline conditions allow for an evaluation of instream water quality under the highest expected loading conditions. The MDAS model was run for baseline conditions using hourly precipitation data for a representative six-year simulation period. The precipitation experienced over this period was applied to the land uses and pollutant sources as they existed at the time of TMDL development. Predicted instream concentrations were compared directly with the TMDL endpoints. This comparison allowed for the evaluation of the magnitude and frequency of exceedances under a range of hydrologic and environmental conditions.

The MDAS model provided allocations for total iron and fecal coliform bacteria for the 89 impaired streams of the Lower Ohio River Watershed. The TMDLs are shown in Section 9.0 of the TMDL Report. EPA has determined that these TMDLs are consistent with statutory and regulatory requirements and EPA's policy and guidance. EPA's rationale for establishing these TMDLs is set forth according to the regulatory requirements listed below.

IV. Discussion of Regulatory Requirements

1) TMDLs are designed to meet the applicable water quality standards.

EPA regulations at 40 CFR 130.7(c)(1) states that TMDLs shall be established at levels necessary to attain and maintain the applicable narrative and numerical WQS. Water quality standards are state regulations that define the water quality goals of a waterbody. Water quality standards are comprised of three components: (1) designated uses, (2) criteria (numeric or narrative) necessary to protect those uses, and (3) antidegradation provisions that prevent the degradation of water quality.

The applicable numeric water quality criteria for iron and fecal coliform bacteria are discussed in Section 2.2 and shown in Table 2-1 of the TMDL Report, and Table 8-1 shows the TMDL endpoints used to attain water quality standards. Designated uses in the Lower Ohio River Watershed include propagation and maintenance of aquatic life in warmwater fisheries, water contact recreation, and public water supply. There are no trout waters identified in the Lower Ohio River Watershed. In various streams in the Lower Ohio River Watershed, warmwater fishery aquatic life use impairments have been determined pursuant to exceedances of dissolved oxygen and total iron numeric water quality criteria. Water contact recreation and/or public water supply use impairments have also been determined in various waters pursuant to exceedances of numeric water quality criteria for fecal coliform bacteria and total iron.

All West Virginia waters are subject to the narrative criteria in Section 3 of the West Virginia Water Quality Standards. That section, titled *Conditions Not Allowed in State Waters,* contains various general provisions related to water quality. The TMDLs presented in Section 9.0 of the TMDL Report are based upon the water quality criteria that are currently developed.

Where there is an applicable numeric criterion for a particular pollutant and uses, it is reasonable to use that criterion as the quantitative implementation of the narrative standard and designated uses. If the West Virginia Legislature adopts water quality standard revisions that alter the basis upon which the TMDL is developed, then the TMDL and allocations may be modified as warranted. Any future water quality standard revision and/or TMDL modification must receive EPA approval prior to implementation. Based on the foregoing, EPA finds the TMDL is designed to meet the applicable water quality standards.

2) TMDLs include wasteload allocations and load allocations.

EPA regulations at 40 CFR §130.2(i) define total maximum daily load (TMDL) as the sum of the wasteload allocations (WLAs) for point sources and load allocations (LAs) for nonpoint sources and natural background. The development of the WLAs and LAs is further discussed below.

Wasteload Allocations

According to Federal regulations at 40 CFR §130.2(h), a WLA is the portion of a receiving water's loading capacity that is allocated to one of its existing or future point sources of pollution. WLAs were developed and assigned[2] for all facilities permitted to discharge iron or fecal coliform bacteria as described in Sections 5.0 and 6.0.

There are 4 permitted point sources (3 non-mining permits; 1 general permit for stormwater) that discharge metals into the watershed, and there are 2 permitted point sources (2 general sewage permits) that discharge fecal coliform bacteria into the watershed. Point sources are discussed in sections 5.1 and 6.1 of the TMDL Report. Tables 9-1 and 9-2 of the TMDL Report provide the WLAs for the Lower Ohio River Watershed for iron and fecal coliform bacteria, respectively, with detailed WLAs shown in the allocation spreadsheets. Daily loads are based on the annual load divided by 365 days/year. Based on the foregoing, EPA finds that both annual and daily WLAs included in the TMDL satisfy the regulations at 40 CFR Part 130.

WVDEP is authorized to administer the National Pollutant Discharge Elimination System (NPDES) Program, which, among other duties, includes issuing NPDES permits to existing or futures point sources subject to the NPDES program. The effluent limitations in any new or revised NPDES permits must be consistent with "the assumptions and requirements of any available [WLA]" in an approved TMDL pursuant to 40 CFR §122.44 (d)(1)(vii)(B). EPA has authority to object to the issuance of an NPDES permit that is inconsistent with the assumptions and requirements of WLAs established for that point source. It is expected that WVDEP will require periodic monitoring of the point source(s), through the NPDES permit process, in order to monitor and determine compliance with the TMDL's WLAs.

[2] The fact that the TMDL does not assign WLAs to any other sources in the watershed should not be construed as a determination by either EPA or WVDEP that there are no additional sources in the watershed that are subject to the NPDES program.

Load Allocations

According to Federal regulations at 40 CFR §130.2(g), a LA is the portion of a receiving water's loading capacity that is attributed either to one of its existing or future nonpoint sources of pollution or to natural background sources. Load allocations are best estimates of the loading, which may range from reasonably accurate estimates to gross allotments, depending on the availability of data and appropriate techniques for predicting the loading. This requirement is addressed in Section 5.2 of the TMDL Report for metals, and in Section 6.2 of the TMDL Report for fecal coliform bacteria[3].

Total iron LAs were provided for the dominant nonpoint sources of iron in the watershed, including: abandoned mine lands, loading associated with sediment contributions from barren land, forestry skid roads and landings, oil and gas well operations, agricultural landuses, and residential/urban/road landuses and streambank erosion in non-MS4 areas, and loading from undisturbed forest and grasslands. Fecal coliform LAs were assigned to pasture/cropland, on-site sewage systems including failing septic systems, residential loadings associated with urban/residential runoff from non-MS4 areas, and background loadings associated with wildlife sources.

Tables 9-1 and 9-2 of the TMDL Report provide the iron and fecal coliform bacteria LAs, respectively, for the Lower Ohio River Watershed with detailed LAs shown in the allocation spreadsheets. Daily loads are based on the annual load divided by 365 days/year. Based on the foregoing, EPA finds that both annual and daily LAs included in the TMDL satisfy the regulations at 40 CFR Part 130.

3) TMDLs consider natural background sources.

According to Federal regulations at 40 CFR §130.2(g & i), natural background sources of pollutants are part of the LA and, wherever possible natural and nonpoint source loads should be distinguished. The Lower Ohio River Watershed TMDLs consider the impact of natural background pollutant contributions by evaluating loadings from background sources like undisturbed forest and grasslands and wildlife. MDAS also considers background pollutant contributions by modeling all land uses. Section 6.2.4 of the TMDL Report states that on the basis of the low fecal accumulation rates for forested areas, storm water sampling results, and model simulations, wildlife is not considered to be a significant source of fecal coliform bacteria in the watershed. Based on the foregoing, EPA finds the TMDL accounts for natural background sources consistent with the regulations at 40 CFR §130.2(g & i).

[3] EPA's approval of this TMDL does not mean that EPA has determined there are no point sources within the land use categories that are assigned load allocations in the TMDL. EPA's review and approval of this TMDL does not represent a determination whether some of the sources discussed in the TMDL, under appropriate conditions, might be subject to the NPDES program.

4) TMDLs consider critical conditions.

EPA regulations at 40 CFR §130.7(c)(1) require TMDLs to account for critical conditions for stream flow, loading, and water quality parameters. West Virginia's TMDL Report explains that a critical condition represents a scenario where water quality criteria are most susceptible to violation. Analysis of water quality data for the impaired streams addressed in the Lower Ohio River Watershed shows high pollutant concentrations during both high- and low-flow thereby precluding selection of a single critical condition. Both high-flow and low-flow periods were taken into account during TMDL development by using a long period of weather data that represented wet, dry, and average flow periods. The TMDL Report addresses this requirement in section 8.7.4. Based on the foregoing, EPA finds that the TMDL accounts for critical conditions consistent with the regulations at 40 CFR §130.7(c)(1).

5) TMDLs consider seasonal variations.

EPA regulations at 40 CFR §130.7(c)(1) require TMDLs to consider seasonal variations. Seasonal variation was considered in the formulation of the modeling analysis. Continuous simulation (modeling over a period of several years that captured precipitation extremes) inherently considers seasonal hydrologic and source loading variability. The pollutant concentrations simulated on a daily time step by the model were compared with TMDL endpoints. Allocations that met these endpoints throughout the modeling period were developed. The TMDL Report addresses this requirement in section 8.7.3. Based on the foregoing, EPA finds the TMDL has been established at levels necessary to attain and maintain the applicable water quality standards with seasonal variations consistent with the regulations at 40 CFR §130.7(c)(1).

6) TMDLs include a margin of safety.

EPA regulations at 40 CFR §130.7(c)(1) require TMDLs to include a margin of safety (MOS). The MOS is an accounting of uncertainty about the relationship between pollutant loads and receiving water quality. It can be provided implicitly through analytical assumptions or explicitly by reserving a portion of loading capacity. In the Lower Ohio River Watershed TMDLs, an explicit five percent MOS was included to counter uncertainty in the modeling process. Long-term water quality monitoring data were used for model calibration. Although these data represented actual conditions, they were not of a continuous time series and might not have captured the full range of instream conditions that occurred during the simulation period. Section 8.6.1 discusses the explicit MOS used in these TMDLs. Based on the foregoing, EPA finds that WVDEP has incorporated a MOS into the TMDL consistent with the regulations at 40 CFR §130.7(c)(1).

7) TMDLs have been subject to public participation.

EPA regulations at 40 CFR §130.7(c)(1)(ii) requires TMDLs to be subject to public review and the State implements a process for involving the public in development of TMDLs.

This requirement is addressed in section 11.0 of the TMDL Report. Based on the foregoing, EPA finds that the TMDL has been subject to WVDEP's public participation process.

V. Discussion of Reasonable Assurance

The CWA section 303(d) requires that a TMDL be "established at a level necessary to implement the applicable water quality standard." Documenting adequate reasonable assurance increases the probability that regulatory and voluntary mechanisms will be applied such that the pollution reduction levels specified in the TMDL are achieved and, therefore, applicable water quality standards are attained.

Where a TMDL is developed for waters impaired by both point and nonpoint sources, in EPA's best professional judgment, determinations of reasonable assurance that the TMDL's LAs will be achieved could include whether practices capable of reducing the specified pollutant load: (1) exist; (2) are technically feasible at a level required to meet allocations; and (3) are likely to be implemented. Where there is a demonstration that nonpoint source load reductions can and will be achieved, a TMDL writer can determine that reasonable assurance exists and, on the basis of that reasonable assurance, allocate greater loadings to point sources.

Reasonable assurance is addressed in section 12.0 of the TMDL Report. Based on the foregoing, EPA finds acceptable the reasonable assurances set forth in the TMDL Report.

Attachment 1

Waterbodies and Impairments Addressed in in the Lower Ohio River Watershed TMDL

TMDL Watershed	NHD Code	Stream Name	WV Code	DO	Fe	FC
Sevenmile Creek	WV-OL-4	Sevenmile Creek	WVO-6		**M**	**X**
Sevenmile Creek	WV-OL-4-A	Little Sevenmile Creek	WVO-6-A		**M**	**X**
Sevenmile Creek	WV-OL-4-B	UNT/Sevenmile Creek RM 2.08			**M**	
Sevenmile Creek	WV-OL-4-E	UNT/Sevenmile Creek RM 3.11			**M**	
Ninemile Creek	WV-OL-5	Ninemile Creek	WVO-7		**M**	**X**
Ninemile Creek	WV-OL-5-A	UNT/Ninemile Creek RM 3.94	WVO-7-A		**M**	**X**
Ninemile Creek	WV-OL-5-A-4	UNT/UNT RM 1.61/Ninemile Creek RM 3.94			**M**	
Ninemile Creek	WV-OL-5-H	UNT/Ninemile Creek RM 5.75	WVO-7-H		**M**	**X**
Guyan Creek	WV-OL-12	Guyan Creek	WVO-9		**X**	**X**
Guyan Creek	WV-OL-12-C	Spurlock Creek	WVO-9-A		**M**	**X**
Guyan Creek	WV-OL-12-C-2	Left Fork/Spurlock Creek	WVO-9-A-2		**M**	**X**
Guyan Creek	WV-OL-12-C-2-C	Perry Creek	WVO-9-A-2-A		**M**	**X**
Guyan Creek	WV-OL-12-C-10	UNT/Spurlock Creek RM 3.39			**M**	
Guyan Creek	WV-OL-12-D	UNT/Guyan Creek RM 3.82			**M**	
Guyan Creek	WV-OL-12-K	McCowan Branch	WVO-9-B		**M**	
Guyan Creek	WV-OL-12-L	Bryan Creek	WVO-9-C	**X**	**M**	**X**
Guyan Creek	WV-OL-12-L-2	UNT/Bryan Creek RM 1.37	WVO-9-C-0.5		**M**	
Guyan Creek	WV-OL-12-L-6	UNT/Bryan Creek RM 3.25			**M**	
Guyan Creek	WV-OL-12-L-7	UNT/Bryan Creek RM 3.74	WVO-9-C-7		**M**	**X**
Guyan Creek	WV-OL-12-L-8	UNT/Bryan Creek RM 3.78			**M**	
Guyan Creek	WV-OL-12-L-10	UNT/Bryan Creek RM 4.67			**M**	
Guyan Creek	WV-OL-12-L-13	UNT/Bryan Creek RM 5.18			**M**	

Guyan Creek	WV-OL-12-M	Trace Fork	WVO-9-D		**M**	
Guyan Creek	WV-OL-12-M-5	Lynn Fork	WVO-9-D-2		**M**	**X**
Guyan Creek	WV-OL-12-M-6	Jenkins Branch	WVO-9-D-1		**M**	
Guyan Creek	WV-OL-12-M-6-C	UNT/Jenkins Branch RM 0.75	WVO-9-D-1-C		**M**	
Guyan Creek	WV-OL-12-P	Knife Branch	WVO-9-E		**M**	X
Guyan Creek	WV-OL-12-Q	Bear Hollow Creek	WVO-9-F		**M**	X
Guyan Creek	WV-OL-12-Q-2	UNT/Bear Hollow Creek RM 1.20	WVO-9-F-2		**M**	X
Guyan Creek	WV-OL-12-Q-7	UNT/Bear Hollow Creek RM 3.97			**M**	
Guyan Creek	WV-OL-12-W	UNT/Guyan Creek RM 13.17	WVO-9-W		**M**	X
Eighteenmile Creek	WV-OL-15	Eighteenmile Creek	WVO-10		**X**	X
Eighteenmile Creek	WV-OL-15-D	Rocky Fork	WVO-10-A		**M**	X
Eighteenmile Creek	WV-OL-15-D-4	UNT/Rocky Fork RM 1.29			**M**	
Eighteenmile Creek	WV-OL-15-H	UNT/Eighteenmile Creek RM 4.64			**M**	
Eighteenmile Creek	WV-OL-15-I	Hughes Branch	WVO-10-B		**M**	
Eighteenmile Creek	WV-OL-15-J	Fees Branch	WVO-10-C		**M**	X
Eighteenmile Creek	WV-OL-15-J-1	UNT/Fees Branch RM 0.87	WVO-10-C-1		**M**	
Eighteenmile Creek	WV-OL-15-K	UNT/Eighteenmile Creek RM 6.73			**M**	
Eighteenmile Creek	WV-OL-15-L	Mud Run	WVO-10-D		**M**	X
Eighteenmile Creek	WV-OL-15-N	UNT/Eighteenmile Creek RM 7.85			**M**	
Eighteenmile Creek	WV-OL-15-O	Right Fork/Eighteenmile Creek	WVO-10-D.5		**M**	X
Eighteenmile Creek	WV-OL-15-O-3	UNT/Right Fork RM 1.82/Eighteenmile Creek			**M**	
Eighteenmile Creek	WV-OL-15-R	Road Fork	WVO-10-E		**X**	
Eighteenmile Creek	WV-OL-15-S	White Pine Creek	WVO-10-F		**M**	
Eighteenmile Creek	WV-OL-15-S-1	Spring Branch	WVO-10-F-1		**X**	X
Eighteenmile Creek	WV-OL-15-V	UNT/Eighteenmile Creek RM 11.29			**M**	
Eighteenmile Creek	WV-OL-15-W	UNT/Eighteenmile Creek RM 11.85			**M**	
Sixteenmile Creek	WV-OL-16	Sixteenmile Creek	WVO-11		**X**	X

Sixteenmile Creek	WV-OL-16-A	UNT/Sixteenmile Creek RM 0.55	WVO-11-0.8A		**M**	
Sixteenmile Creek	WV-OL-16-B	UNT/Sixteenmile Creek RM 1.44			**M**	
Sixteenmile Creek	WV-OL-16-C	UNT/Sixteenmile Creek RM 1.96	WVO-11-0.9A		**X**	
Sixteenmile Creek	WV-OL-16-D	Stonecoal Run	WVO-11-A		**M**	
Sixteenmile Creek	WV-OL-16-G	Jerrys Run	WVO-11-B		**M**	X
Sixteenmile Creek	WV-OL-16-H	Daves Run	WVO-11-C		**M**	
Sixteenmile Creek	WV-OL-16-J	Millstone Creek	WVO-11-D		**M**	X
Sixteenmile Creek	WV-OL-16-J-3	UNT/Millstone Creek RM 1.19			**M**	
Sixteenmile Creek	WV-OL-16-K	Righthand Fork	WVO-11-E		**M**	X
Sixteenmile Creek	WV-OL-16-K-3	UNT/Righthand Fork RM 1.77	WVO-11-E-3		**M**	
Sixteenmile Creek	WV-OL-16-K-4	UNT/Righthand Fork RM 2.10	WVO-11-E-4		**M**	X
Sixteenmile Creek	WV-OL-16-K-5	UNT/Righthand Fork RM 3.44			**M**	
Sixteenmile Creek	WV-OL-16-P	Potts Hollow (Righthand Fork)	WVO-11-F		**X**	
Sixteenmile Creek	WV-OL-16-P-2	UNT/Potts Hollow RM 1.31			**M**	
Sixteenmile Creek	WV-OL-16-Y	UNT/Sixteenmile Creek RM 13.56	WVO-11-G.1		**M**	X
Sixteenmile Creek	WV-OL-16-AA	Willow Branch	WVO-11-H		**M**	X
Sixteenmile Creek	WV-OL-16-AB	Wolfpen Run	WVO-11-I		**M**	X
Sixteenmile Creek	WV-OL-16-AD	UNT/Sixteenmile Creek RM 15.47	WVO-11-K		**X**	X
Sixteenmile Creek	WV-OL-16-AD-3	UNT/UNT RM 1.39/Sixteenmile Creek RM 15.47			**M**	
Flatfoot Creek	WV-OL-17	Flatfoot Creek	WVO-12		**M**	X
Flatfoot Creek	WV-OL-17-B	UNT/Flatfoot Creek RM 3.42	WVO-12-B		**X**	X
Flatfoot Creek	WV-OL-17-D	UNT/Flatfoot Creek RM 5.40	WVO-12-D		**M**	X
Crab Creek	WV-OL-18	Crab Creek	WVO-13	X	**X**	X
Crab Creek	WV-OL-18-B	Mud Run	WVO-13-A		**X**	X
Crab Creek	WV-OL-18-B-1	UNT/Mud Run RM 1.29			**M**	
Crab Creek	WV-OL-18-C	UNT/Crab Creek RM 2.22	WVO-13-A.3		**M**	
Crab Creek	WV-OL-18-D	Sand Fork	WVO-13-B		**M**	X

Crab Creek	WV-OL-18-D-1	UNT/Sand Fork RM 0.33			**M**	
Crab Creek	WV-OL-18-D-3	UNT/Sand Fork RM 1.86			**M**	
Crab Creek	WV-OL-18-D-6	UNT/Sand Fork RM 2.90			**M**	
Crab Creek	WV-OL-18-E	Middle Fork/Crab Creek	WVO-13-D		**M**	X
Crab Creek	WV-OL-18-E-3	UNT/Middle Fork RM 2.10/Crab Creek			**M**	
Crab Creek	WV-OL-18-E-6	UNT/Middle Fork RM 3.52/Crab Creek	WVO-13-D-6		**M**	
Crab Creek	WV-OL-18-I	Righthand Fork	WVO-13-E		**M**	
Crab Creek	WV-OL-18-J	UNT/Crab Creek RM 7.00	WVO-13-F		**M**	X
Crab Creek	WV-OL-18-L	UNT/Crab Creek RM 7.81			**M**	
Threemile Creek	WV-OL-21	Threemile Creek	WVO-15		**M**	X
Twomile Creek	WV-OL-22	Twomile Creek	WVO-16		**X**	X
Salt Creek	WV-OL-23	Salt Creek	WVO-17		**M**	
Salt Creek	WV-OL-23-B	UNT/Salt Creek RM1.14			**M**	

Note:
RM river mile
UNT unnamed tributary
Trout trout stream cold-water fishery
Fe iron impairment
Se selenium impairment
FC fecal coliform bacteria impairment
M impairment determined via modeling
X impairment determined via sampling
X DMR impairment determined via discharge monitoring reports provided by the Division of Mining and Reclamation