LOADING ANALYSIS INFORMATION
MOHICAN RIVER WATERSHED

D1 Background

D1.1 Report Summary

Thirty streams in the Mohican River watershed were evaluated for aquatic and recreation use potential in 2007 (see Figure D1-1 and Table D1-1 for sampling locations). All of the streams listed in the Ohio water quality standards for the Mohican River watershed are assigned the warmwater habitat (WWH) aquatic life use designation but uses for many of the smaller streams and the mainstem Mohican River were never verified via biological sampling. Based on the biological data collected in 2007, the exceptional warmwater habitat (EWH) use designation was found to be appropriate for the Mohican River mainstem. Several streams supported viable coldwater fish and/or macroinvertebrate faunas. Streams where the coldwater habitat (CWH) use was indicated included: Negro Run, Redhaw Creek, Oldtown Run, Quaker Springs Run, Newel Run, Katotawa Creek, Honey Creek (Black Fork tributary) -from the headwaters to RM 4.19, Pine Run, Switzer Creek, Slater Run, and Honey Creek (Clear Fork Trib.). One stream, Kiser Ditch, was deficient in typical warmwater habitat attributes and did not have adequately diverse biological communities to warrant the WWH use designation. Given the conditions encountered in Kiser Ditch, a modified warmwater habitat use (MWH) is recommended. Conditions of all other tributary streams evaluated in 2007 (14 waterbodies) were adequate to recommend maintaining the WWH aquatic life use. All streams in this study should retain the Primary Contact Recreation use, along with the Agricultural and Industrial uses.

A significant portion of the Mohican River basin is meeting the biological goals of the Clean Water Act with 67% of the surveyed area fully attaining, 16% partially attaining and 17% in non-attainment of the goals. The Mohican River mainstem fully attained the recommended EWH aquatic life use and the Clear Fork Mohican River met the WWH use. The remaining major tributaries supported lower quality biological communities by comparison. The most severe impairment was generally in areas affected by urban runoff, historical sediment contamination and major WWTP discharges. This was particularly evident in the Rocky Fork Mohican River. Siltation and alteration of the physical habitat were significant impairments on the Black Fork Mohican River. While many of the streams in the Mohican River watershed are meeting the goals of the Clean Water Act, activities such as direct access by cattle and livestock waste management pose a threat to biological communities in rural Mohican River tributaries. These potential sources of aquatic life impairment also likely contributed to elevated *E. coli* bacteria levels recorded throughout the watershed.

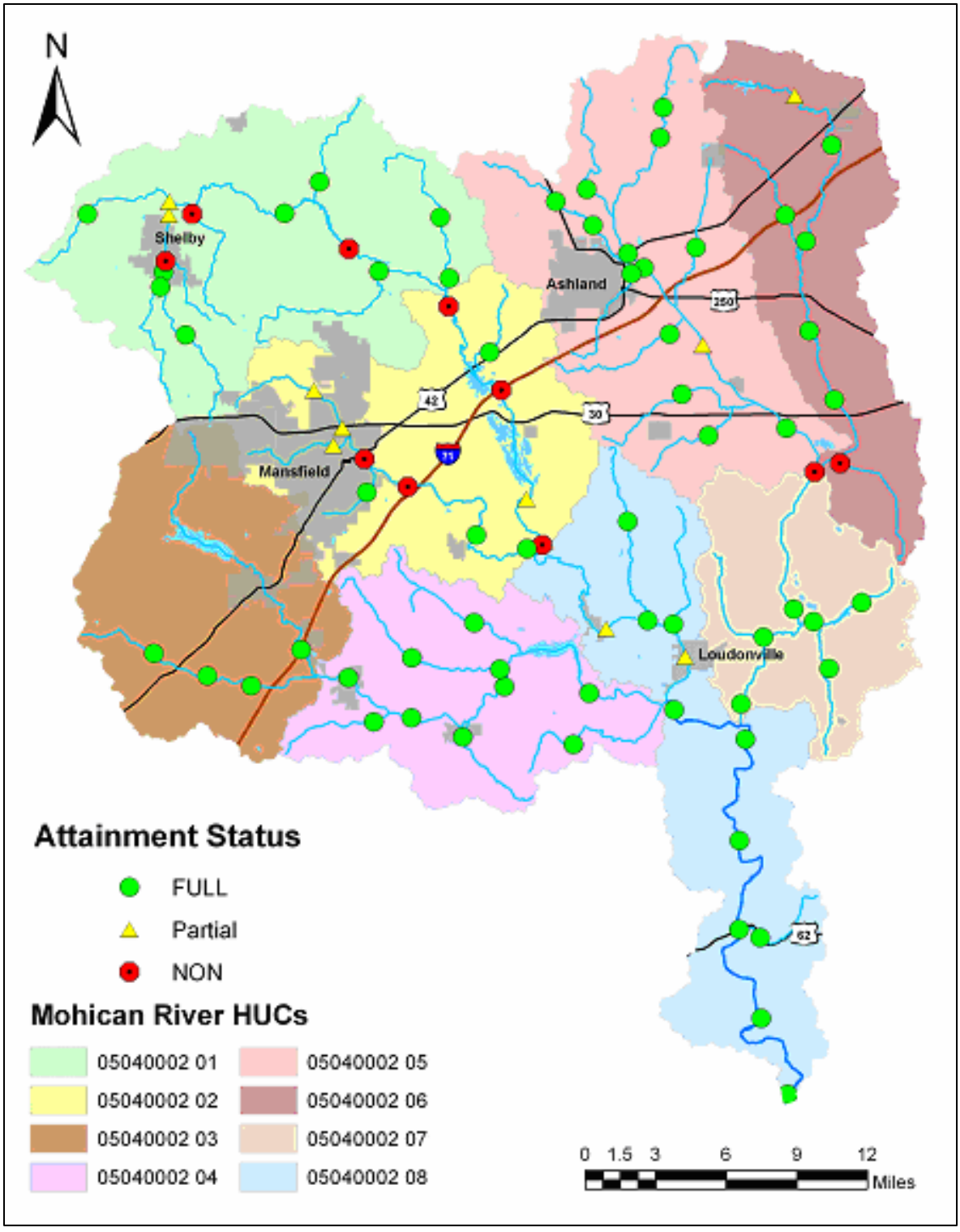

Figure D1-1. Mohican River watershed sampling locations and biological community performance, June 15 to October 15, 2007.

Table D1-1. Summary of impairments in the Mohican River watershed and methods used to address impairments.

Assessment Unit	Narrative Description	Causes of Impairment	Method to Address
Headwaters Black Fork Mohican River (05040002 01)			
01 01 *Priority points: 7*	Marsh Run	Sedimentation/siltation (ALU)	Sediment TMDL
		Bacteria (RU)	*E. coli* TMDL
		Insufficient data to assess use (PDWSU)	No action necessary
01 02 *Priority points: 6*	Headwaters Black Fork Mohican River	Organic enrichment (sewage) biological indicators (ALU)	Total phosphorus and *E. coli* TMDLs as surrogates
		Dissolved oxygen (ALU)	Total phosphorus TMDL
		Direct habitat alterations (ALU)	Habitat TMDL
		Total dissolved solids (ALU)	Total dissolved solids TMDL
		Insufficient data to assess use (PDWSU)	No action necessary
		Bacteria (RU)	*E. coli* TMDL
01 03 *Priority points: 1*	Brubaker Creek	Nutrient/eutrophication biological indicators (ALU)	Nitrate-nitrite TMDL
		Bacteria (RU)	*E. coli* TMDL
01 04 *Priority points: 3*	Whetstone Creek	No impairment (ALU)	No action necessary
		Bacteria (RU)	*E. coli* TMDL
01 05 *Priority points: 7*	Shipp Creek-Black Fork Mohican River	Direct habitat alterations (ALU)	Habitat TMDL
		Other flow regime alterations (ALU)	Habitat TMDL
		Turbidity (ALU)	Habitat TMDL as a surrogate
		Bacteria (RU)	*E. coli* TMDL
Rocky Fork-Black Fork Mohican River (05040002 02)			
02 01 *Priority points: 10*	Village of Pavonia-Black Fork Mohican River	Sedimentation/siltation (ALU)	Sediment TMDL
		Nutrient/eutrophication biological indicators (ALU)	Total phosphorus TMDL
		Direct habitat alterations (ALU)	Habitat TMDL
		Other flow regime alterations (ALU)	Habitat TMDL
		Dissolved oxygen (ALU)	Total phosphorus TMDL as a surrogate

Assessment Unit	Narrative Description	Causes of Impairment	Method to Address
		Turbidity (ALU)	Sediment TMDL as a surrogate
		Bacteria (RU)	*E. coli* TMDL
02 02 *Priority points: 0*	Seymour Run-Black Fork	No data (ALU)	No action necessary
		No data (RU)	No action necessary
02 03 *Priority points: 4*	Headwaters Rocky Fork	Natural conditions (flow or habitat) (ALU)	No action necessary
		Nutrient/eutrophication biological indicators (ALU)	Total phosphorus TMDL
		Metals (ALU)	Not addressed
		High flow regime (ALU)	Not addressed
		Unknown toxicity (ALU)	Not addressed
		Bacteria (RU)	*E. coli* TMDL
02 04 *Priority points: 10*	Outlet Rocky Fork	Nutrient/eutrophication biological indicators (ALU)	Total phosphorus TMDL
		Organic enrichment (sewage) biological indicators (ALU)	Total phosphorus and *E. coli* TMDLs
		Bacteria (RU)	*E. coli* TMDL
02 05 *Priority points: 3*	Charles Mill-Black Fork Mohican River	Suspended algae (ALU)	Total phosphorus TMDL as a surrogate
		Nutrient/eutrophication biological indicators (ALU)	Total phosphorus TMDL
		Other flow regime alterations (ALU)	Habitat TMDL
		Dissolved oxygen (ALU)	Total phosphorus TMDL
		No impairment (RU)	No action necessary
Headwaters Clear Fork Mohican River (05040002 03)			
03 01 *Priority points: 2*	Headwaters Clear Fork Mohican River	Insufficient data to assess (ALU)	No action necessary
		No impairment (RU)	No action necessary
		No impairment (PDWSU)	No action necessary
03 02 *Priority points: 4*	Cedar Fork	No impairment (ALU)	No action necessary
		Bacteria (RU)	*E. coli* TMDL

Assessment Unit	Narrative Description	Causes of Impairment	Method to Address
03 03 *Priority points: 8*	Town of Lexington-Clear Fork Mohican River	Sedimentation/siltation (ALU)	Sediment TMDL
		Direct habitat alterations (ALU)	Habitat TMDL
		Bacteria (RU)	*E. coli* TMDL
Possum Run-Clear Fork Mohican River (05040002 04)			
04 01 *Priority points: 6*	Honey Creek-Clear Fork Mohican River	No impairment (ALU)	No action necessary
		Bacteria (RU)	*E. coli* TMDL
04 02 *Priority points: 4*	Possum Run	No impairment (ALU)	No action necessary
		Bacteria (RU)	*E. coli* TMDL
04 03 *Priority points: 5*	Slater Run-Clear Fork Mohican River	No impairment (ALU)	No action necessary
		Bacteria (RU)	*E. coli* TMDL
04 04 *Priority points: 4*	Pine Run	No impairment (ALU)	No action necessary
		Bacteria (RU)	*E. coli* TMDL
04 05 *Priority points: 6*	Switzer Creek-Clear Fork Mohican River	No impairment (ALU)	No action necessary
		Bacteria (RU)	*E. coli* TMDL
Muddy Fork Mohican River (05040002 05)			
05 01 *Priority points: 6*	Upper Muddy Fork Mohican River	Flow alteration (Category 4C; ALU)	No action necessary
		Bacteria (RU)	*E. coli* TMDL
		Insufficient data to assess (PDWSU)	No action necessary
05 02 *Priority points: 1*	Middle Muddy Fork Mohican River	No impairment (ALU)	No action necessary
		Bacteria (RU)	*E. coli* TMDL
05 03 *Priority points: 6*	Lower Muddy Fork Mohican River	Sedimentation/siltation (ALU)	Sediment TMDL
		High flow regime (ALU)	Habitat TMDL
		Dissolved oxygen (ALU)	Habitat TMDL as surrogate
		Biological oxygen demand (ALU)	Habitat TMDL as surrogate
		Bacteria (RU)	*E. coli* TMDL
Jerome Fork-Mohican River (05040002 06)			
06 01 *Priority points: 3*	Lang Creek	No impairment (ALU)	No action necessary
		Bacteria (RU)	*E. coli* TMDL

Assessment Unit	Narrative Description	Causes of Impairment	Method to Address
06 02 *Priority points: 3*	Orange Creek	No impairment (ALU)	No action necessary
		Bacteria (RU)	*E. coli* TMDL
06 03 *Priority points: 4*	Katotawa Creek	No impairment (ALU)	No action necessary
		Bacteria (RU)	*E. coli* TMDL
06 04 *Priority points: 4*	Oldtown Run	No impairment (ALU)	No action necessary
		Bacteria (RU)	*E. coli* TMDL
06 05 *Priority points: 7*	Jerome Fork-Mohican River	Nutrient/eutrophication biological indicators (ALU)	Total phosphorus TMDL
		Sedimentation/siltation (ALU)	Sediment TMDL
		Bacteria (RU)	*E. coli* TMDL
06 06 *Priority points: 1*	Glenn Run-Jerome Fork Mohican River	No impairment (ALU)	No action necessary
		Bacteria (RU)	*E. coli* TMDL
Lake Fork Mohican River (05040002 07)			
07 01 *Priority points: 1*	Crab Run	No impairment (ALU)	No action necessary
		Bacteria (RU)	*E. coli* TMDL
07 02 *Priority points: 8*	Mohicanville Dam-Lake Fork Mohican River	Direct habitat alterations (ALU)	Habitat TMDL
		Other flow regime alterations (Category 4C; ALU)	No action necessary
		Dissolved oxygen (Category 4C; ALU)	No action necessary
		Sedimentation/siltation (ALU)	Sediment TMDL
		Nutrient/eutrophication biological indicators (ALU)	Total phosphorus TMDL
		Bacteria (RU)	*E. coli* TMDL
07 03 *Priority points: 5*	Plum Run-Lake Fork Mohican River	No impairment (ALU)	No action necessary
		Bacteria (RU)	*E. coli* TMDL
Mohican River (05040002 08)			
08 01 *Priority points: 3*	Honey Creek	No impairment (ALU)	No action necessary
		Bacteria (RU)	*E. coli* TMDL

Assessment Unit	Narrative Description	Causes of Impairment	Method to Address
08 02 *Priority points: 6*	Town of Perrysville-Black Fork Mohican River	Natural conditions (flow or habitat) (Category 4n; ALU)	No action necessary
		Bacteria (RU)	*E. coli* TMDL
08 03 *Priority points: 8*	Big Run-Black Fork Mohican River	Natural conditions (flow or habitat) (Category 4n; ALU)	No action necessary
		Bacteria (RU)	*E. coli* TMDL
08 04 *Priority points: 0*	Sigafoos Run-Mohican River	No data (ALU)	No action necessary
		No data (RU)	No action necessary
08 05 *Priority points: 6*	Negro Run-Mohican River	No impairment (ALU)	No action necessary
		Bacteria (RU)	*E. coli* TMDL
08 06 *Priority points: 2*	Flat Run-Mohican River	No data (ALU)	No action necessary
		No data (RU)	No action necessary
Mohican River Large River Assessment Unit (05040002 90 01)			
Large River *Priority points: 8*	Mohican River	No impairment (ALU)	No action necessary
		Bacteria (RU)	*E. coli* TMDL

ALU = aquatic life use
RU = recreation use
PDWSU = public drinking water supply use

D2 Linkage Discussion

D2.1 How the Identified Stressors Lead to Impaired Uses

Nutrients rarely approach concentrations in the ambient environment that are toxic to aquatic life, and are essential to the functioning of healthy aquatic ecosystems at appropriate concentrations. However, nutrient concentrations in excess of the needs of a balanced ecosystem (nutrient enrichment) can exert negative effects by causing excess primary production (USDA 2003). The excess primary production causes negative effects including large diel fluctuations of dissolved oxygen (DO) and potential for minimum DO violations when respiration and decomposition of dead algae (eutrophication) is high. Such changes shift fish species composition away from functional assemblages comprised of intolerant species, benthic insectivores and top carnivores typical of high quality streams towards less desirable assemblages of tolerant species, niche generalists, omnivores and detritivores typical of degraded streams (Ohio EPA 1999). Such a shift in community structure lowers the diversity of the system; the IBI and ICI scores reflect this shift and a stream may be precluded from achieving its aquatic-life use designation.

Phosphorus is selected as the focal point for nutrient TMDLs because it is typically the limiting nutrient to algal growth in the fresh water systems (McDowell et al. 2009). Therefore, by limiting the loading of phosphorus to streams, the impacts caused by nutrient enrichment, which are reflected in the negative fish population changes mentioned above, will be mitigated. Ohio EPA developed statewide total phosphorus (TP) targets for streams on the basis of basin size in order to address nutrient enrichment impacting aquatic life (Ohio EPA 2009). Ohio EPA has implemented phosphorus limitation in other watersheds and clearly documented how reducing TP loadings to streams mitigates in-stream nutrient enrichment (Ohio EPA 2007).

Though phosphorus can be the limiting factor in the growth of algae, nitrogen is also a critical component, so in some instances nitrogen or forms of nitrogen such as nitrate and nitrite can also be used to represent nutrients in TMDLs. Both nitrogen and phosphorus can enter waterways through soil erosion attached to soil particles, dissolved in crop field water via field tiles, failing home sewage treatment systems, and other routes.

D2.2 Direct Linkage

While the Ohio EPA does not currently have statewide numeric criteria for nutrients, potential targets have been identified in a technical report titled *Association Between Nutrients, Habitat, and the Aquatic Biota in Ohio Rivers and Streams* (Ohio EPA 1999). This document, herein referred to as the *Associations* document, provides the results of a study analyzing the effects of nutrients on the aquatic biological communities of Ohio streams and rivers. The study reaches a number of conclusions and stresses the importance of habitat and other factors, in addition to in-stream nutrient concentrations, as having an impact on the health of biological communities. The study also includes proposed total phosphorus target concentrations based on observed concentrations associated with acceptable ranges of expected biological communities. The total P and nitrogen targets used in this report are shown in Table D3-3. It is important to note that these nutrient targets are not codified in Ohio's water quality standards; therefore, there is a certain degree of flexibility as to how they can be used in TMDL development.

Ohio's standards also include narrative criteria that limit the quantity of nutrients that may enter state waters. Specifically, OAC Rule 3745-1-04 (E) states that all waters of the state, "…shall be free from nutrients entering the waters as a result of human activity in concentrations that create nuisance growths of aquatic weeds and algae." In addition, OAC Rule 3745-1-04 (D) states that all waters of the state, "…shall be free from substances entering the waters as a result of human activity in concentrations that are toxic or harmful to human, animal or aquatic life and/or are rapidly lethal in the mixing zone." Excess concentrations of nutrients that contribute to non-attainment of biological criteria may fall under either OAC Rule 3745-1-04 (D) or (E) prohibitions.

D2.2.1 Justification for Using Nitrate and Nitrite for the Brubaker Cr. TMDL

Brubaker Creek (05040002 01 03) is impaired due to nutrient/eutrophication biological indicators. The chemistry data for Brubaker Creek do not directly show a nutrient problem when sampling results are compared to target values, but the visual observations and impacts to fish do imply there are nutrient issues. At Brubaker Creek RM 0.3, nuisance algae were observed, indicating enrichment from total phosphorus.

Brubaker Creek at RM 0.3 was sampled 8 times for total phosphorus; no samples exceeded the 0.1 mg/l phosphorus target, but none of the eight samples occurred during a significant runoff event, where the soil becomes saturated and allows water to move across the surface and runoff into the stream. Phosphorus is moved from agriculture fields to the streams during significant precipitation events via surface runoff and field tiles. Without significant precipitation, in-stream concentrations will tend to decrease as algae use the phosphorus to grow.

Figure D2-1 shows that concentrations increase with flow but since flow levels did not increase significantly, neither did total phosphorus concentrations. Assuming that there is a linear relationship between in-stream phosphorus concentration and flow then based on Figure D2-1, the phosphorus target would be exceeded around 16.0 cfs. However, it is quite possible that the relationship is not linear and that runoff and thus a spike in total phosphorus concentration occurs somewhere between 8.0 cfs and 16.0 cfs. Significant precipitation for this site can be defined, in this instance, as the amount of precipitation it takes to bring the flow to somewhere between 8.0 cfs and 16.0 cfs.

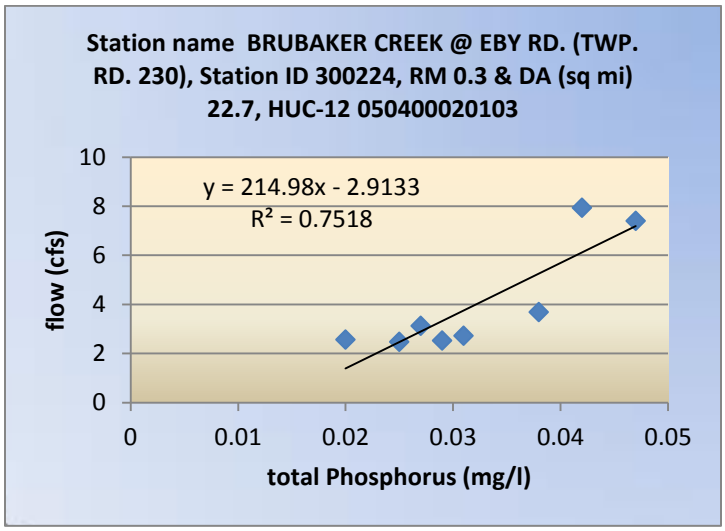

Figure D2-1. Comparison of total phosphorus to flow.

It is likely that the abundance of algae contributed to the apparent discrepancy between observed biological effects from nutrient enrichment and lower water chemistry measurements. Single measurements in time can be a poor indicator of nutrient supply regime because of effects of dynamic biotic uptake and re-mineralization (Biggs 2000). Nutrients bound to organic matter (such as algae) might become available if the organic matter is deposited in quiescent areas, and therefore the projected dissolved nutrient supply could underestimate the actual supply. This is likely the case at this location.

Like total phosphorus, in-stream nitrate and nitrite concentrations increase with flow. Also like total phosphorus, nitrate and nitrite typically enters streams via surface runoff and field tiles. However unlike total phosphorus, nitrate and nitrite concentrations do not reach peak concentration until after the hydrograph peaks (Ohio EPA 1999) and therefore concentrations remained elevated in Brubaker Creek. In at least one of the three nitrate and nitrite exceedance dates (7/14/2008) the hydrograph had peaked and come down, the situation described above where total phosphorus concentrations would be low but nitrate and nitrite concentrations would still be high. Because of the similar sources and pathways into streams, nitrate and nitrite can be used in place of total phosphorus.

D2.3 Justification for the Use of Surrogates

D2.3.1 Headwaters Black Fork Mohican River (05040002 01 02)

The headwaters Black Fork Mohican River subwatershed is impaired due to organic enrichment (sewage) biological indicators, among other causes. Potential sources of organic enrichment in Bear Run noted from field staff include unrestricted livestock access, runoff from adjacent pastures, WWTPs, and failing HSTSs (one was observed).

Excerpts from the 2007 Mohican River report (Ohio EPA 2009) describe the sources:

> "Direct access by dairy cattle and past channelization affected both the fish and macroinvertebrate assemblages in Bear Run at RM 0.48 (Figure D2-2)."
>
> "A large number of white suckers (*Catostomus commersoni)* reflected both the contribution of cool groundwater to flow in the stream and enriched conditions. The macroinvertebrate community was more severely impacted and indicative of high enrichment and low diurnal dissolved oxygen levels. Facultative and tolerant taxa predominated and just five EPT taxa were recorded. Bear Run failed to attain the recommended WWH aquatic life use, as a result."
>
> "Bear Run at London West Road (RM 0.48) was the most impaired site with a geometric mean count of 14661 CFU/100 ml. This was likely due to a farm located here with cows that had unrestricted watering access to the stream (Figure D2-2). Two small package plants located further upstream are also potential sources."
>
> "Bear Run at London West Road (RM 0.48) was the only site that had a median phosphorus value above the target. This is the location of a farm with cows that have unrestricted watering access, along with a package plant that discharged further upstream."

Figure D2-2. Cows wading in Bear Run at London West Rd. (RM 0.48) on June 11, 2007.

Organic enrichment generally means the accumulation of organic (carbon-containing) materials in a stream. Organic materials naturally accumulate in streams in the form of detritus or debris from the surrounding area. It can also refer to bio-solid materials that have escaped from wastewater treatment processes (U.S. EPA 2004). The organic materials at this site, waste from cattle and solids from WWTPs, can contain phosphorus and *E. coli.* As bacteria decompose the organic material, oxygen is consumed (measured as 5-day carbonaceous biochemical oxygen demand, or CBOD5).

Table D2-1 shows how many times, between January 2006 and October 2012 these facilities have exceeded their CBOD5 permit limits, which shows they are contributing to the problem. To date enforcement actions are not being pursued on any of the facilities.

Because the potential sources of impairments are straightforward, total phosphorus and *E. coli* load duration curve (LDC) TMDLs, respectively, are used as surrogates for organic enrichment. In order to meet total phosphorus and *E. coli* targets, the sources will need to be addressed, i.e., closing livestock stream access, eliminating manure moving from pasture to stream, correcting WWTP problems to meet permit limits, and fixing failing HSTS. Manure and sewage sludge comprise organic enrichment so efforts to eliminate them will also eliminate the excessive organic enrichment.

Table D2-1. WWTP 30-day CBOD5 exceedances in the Headwaters Black Fork Mohican nested subwatershed (05040002 01 02).

Facility Name	Permit Number	Number of CBOD5 exceedances in a 5 year period from 2006 - 2012
Voisard Manufacturing Co.	2PR00139*BD	6
Shelby WWTP	2PD00036*KD	0
Lust Subdivision WWTP	2PG00077*DD	3

D2.3.2 Shipp Creek Black Fork Mohican River (05040002 01 05) and Village of Pavonia-Black Fork Mohican River (05040002 02 01)

Turbidity is the cloudiness or haziness of a fluid caused by individual particles (suspended solids) that are generally invisible to the naked eye. QHEI habitat metric scores were used as a surrogate for this HUC because the source of turbidity is directly related to the habitat quality at the impaired site, Black Fork Mohican R. at Ganges Rd. RM 36.6. Poor habitat scores can indicate a stream flood-plain system that can both generate and incompletely remove sources of turbidity. The habitat TMDL method is used here for turbidity instead of the sediment TMDL method because it more specifically addresses factors that result in turbidity. The habitat TMDL score is based on specific attributes that make up the total channelization score, such as channelization or no recovery, silt/muck substrate, sparse/no cover, only 1 or 2 cover types, extreme/moderate embeddedness, and more. How these habitat-related attributes contribute to turbidity is described below. For a list of all the attributes see Table D3-5.

As part of Appendix D an analysis of QHEI habitat was performed, the results of which are shown below in the Results section. These results show that this site performs very poorly in all three of the habitat TMDL tests—overall QHEI score, high influence metrics and modified metrics—scoring 0 points out of 3. Some of the narrative descriptors from this site's QHEI score sheet read: hardpan, muck substrate, heavy silt, extensive embeddedness, low sinuosity, channel recovering from channelization, poor channel development, riparian very narrow, row crop and pasture land uses, erosion moderate, and flow moderate to slow. Descriptors such as moderate erosion, adjacent row crop/pasture, channelization and heavy silt indicate sources of sediment that cause turbidity. Descriptors such as low sinuosity, poor channel development, narrow riparian are indicators of a system that may have difficulty removing sediment/turbidity.

Text from the Ohio EPA (2009) supports using habitat as a surrogate for turbidity:

> "One site on the Black Fork within the assessment unit that lacked typical WWH features was at the most downstream sampled location at RM 36.6 (St. Rt. 13). The QHEI score at RM 36.6 was 35.5. This reach suffered from previous channelization and low gradient which limited habitat diversity kept a heavy silt load confined within the banks of the stream."

D2.3.3 Village of Pavonia-Black Fork Mohican River (05040002 02 01)

Stream waters become impaired due to DO when there are large diurnal DO swings brought on by large amounts of algae in the system. Algal photosynthesis uses carbon dioxide and creates oxygen during the light phase; the process is reversed during the dark (night time) phase. This process creates minimum in-stream DO levels in the early morning just prior to the light phase. The magnitude of the DO swing is a function of the amount of algae and the rate of growth, which is a function of light and temperature levels and nutrient concentrations. These diel DO swings can lower DO concentrations below WQS, which limits vertebrate and invertebrate stream-life by directly causing mortality from oxygen deprivation. The algae are a result of excessive in-stream limiting nutrients, which in Ohio tends to be phosphorus. Therefore, phosphorus can be used as a surrogate for DO to address biological impairment.

D2.3.4 Charles Mill-Black Fork Mohican River (05040002 02 05)

The Black Fork Mohican River at RM 17.81 is impaired due to nutrient/eutrophication biological indicators, other flow alterations, suspended algae and DO. Total phosphorus is used as a surrogate for

suspended algae and D.O and directly for nutrients/eutrophication. For information on nutrient TMDLs see Section D3.1, Load Duration Curves. Other flow alterations is addressed using a QHEI habitat TMDL, see section D3.2. An excerpt from the Mohican River TSD (Ohio EPA 2009) states:

> "the macroinvertebrate community was significantly affected by impoundment and subsequent release of water from the Charles Mill dam. An ICI in the low fair range was recorded at RM 17.81. A high density of the midge genera *Glyptotendipes* and aquatic worms was reflective of the excessive amount of organic material suspended in water released from the dam. Algae that flourished within the reservoir provided a large food source for organisms that can tolerate the highly eutrophic condition and altered flow regime."

In this case total phosphorus is the limiting nutrient for algae in the Charles Mill dam reservoir and serves well as a surrogate for suspended algae. The LDC (Figure D4-41) shows that total phosphorus exceeds the water quality target in the lowest flow category and not at medium to higher flows. This is indicative of reservoir re-suspension of phosphorus and because the site is less than a mile from the lake outlet it receives a constant dose of phosphorus during the warm season. James and Barko (2004) measured the flux magnitudes in Lake Pepin (upper Mississippi River) and found both oxic and anoxic conditions to release total phosphorus to the water. Anoxic conditions, such as occur in the Charles Mill Lake, tend to release phosphorus at a higher rate than oxic conditions. Charles Mill Lake has a constant minimum flow release of around 11 cubic feet per section (cfs) that comes from the bottom waters (see Figure D2-3), so there is a constant source of re-suspended phosphorus to the river downstream from the lake, particularly during high temperature periods. Because reduction of total phosphorus will result in lower concentrations of algae, total phosphorus can serve as a good surrogate for algae. In addition, reductions of algae via total phosphorus reductions will aid in addressing dissolved oxygen issues, as discussed below.

Figure D2-3. Charles Mill Dam – shows bottom discharge.

Stream waters become impaired due to DO when there are large diurnal DO swings brought on by large amounts of algae in the system. The algae is a result of excessive in-stream limiting nutrients, which in Ohio tends to be phosphorus, so phosphorus can be used as a surrogate for DO. Refer to Section D2.3.3 for details on how algae affect in-stream DO Unlike the typical situation where total phosphorus enters the stream system directly from runoff waters, at this site it is introduced from the reservoir outlet water via release from the lake bed organic matter. It does, however, ultimately originate from runoff waters upstream from the reservoir. Implementation measures to reduce phosphorus inputs to the lake will be most effective at reducing the lake's releases of phosphorus to streams.

D2.3.5 Lower Muddy Fork Mohican River (05040002 05 03)

QHEI is used as a surrogate for DO and biological oxygen demand (BOD) because the measurement of habitat reveals the problem inherent in Kiser Cr. RM 0.4, the site in question. This section of the Mohican TSD describes the problem. "Kiser Ditch is a tributary of the Muddy Fork confluent at RM 0.92 that is about 6.0 miles in length and drains an area of 19.4 mi^2. It is within the EOLP ecoregion and is designated as WWH, PCR, AWS, and IWS in the 1978 WQS but the uses had not been verified. The 2007 sampling was the first time that biological sampling was utilized to assess the aquatic life use designations. The QHEI score for Kiser Ditch at RM 0.38 was 32.5. The stream was essentially a straight, deep channel that offered little in terms of habitat for aquatic communities. Gradient was low and the watershed was predominated by wetlands and flat agricultural fields. Operation of the Mohicanville Dam on the Lake Fork of the Mohican River for flood control results in periodic inundation of the surrounding area. Assigning of a modified warmwater habitat (MWH) aquatic life use for Kiser Ditch is recommended based on the combination of limited in-stream habitat and altered flow regime.

The Mohican River TSD (Ohio EPA 2009) discusses Kiser Ditch biological observations:

> "…Kiser Ditch failed to meet MWH use expectations. Flooding rains that preceded biological sampling of Kiser Ditch were impounded by the Mohicanville Dam and inundated agricultural fields and lowland areas along the stream. Decomposition of vegetative material rendered the water anoxic. This water eventually drained into Kiser Ditch. The stream was flowing with septic black water the first week of September 2007. Fish and macroinvertebrate communities were significantly affected as a result. The fish at RM 0.38 were rated as poor and the macroinvertebrates were in very poor condition. This acute condition likely is repeated when impounded floodwaters are subject to elevated temperature typical of the late summer season."

The source of DO impairment at this site is high BOD content. When aerobic biological organisms consume organic materials, oxygen is consumed, which limits oxygen available for macroinvertebrates and fish. BOD measures the amount of oxygen needed by aerobic biological organisms to consume organic material. Therefore, high BOD measurements are a function of high organic matter, which is expressed in the substrate metric (silty/mucky) in the QHEI measurement, so it makes sense to use the QHEI habitat analysis as a surrogate for these two sources of impairment. The habitat scores detailed in the Results section below show that Kiser Cr. scores well below the targets for the substrate and channel QHEI categories. Heavy silt, extensive embeddedness, logs and woody debris, no sinuosity, poor channel development and low stability are some of the narratives used in the QHEI field score to describe the area. Improving the problem can be accomplished by addressing the issues mentioned in the TSD text above. The lowland areas become inundated and move vegetative material to Kiser Cr. where decomposition occurs, using up oxygen and turning the stream water anoxic (high BOD, low DO). Eliminating water inundation or the buildup of vegetative material, e.g., crop residue, would improve the QHEI scores and thus the DO and BOD.

D2.3.6 Mohicanville Dam-Lake Fork Mohican River (05040002 07 02)

Lake Fork at river mile 14.04 is impaired by five causes stemming from three sources, as follows:

- Direct habitat alterations and sedimentation/siltation from channelization
- Nutrient/eutrophication biological indicators from non-irrigated crop production
- Other flow regime alterations and dissolved oxygen (DO) from a dam or impoundment

The direct habitat alterations will be addressed via a habitat TMDL. The sedimentation/siltation issues will be addressed via a sediment TMDL. Nutrient/eutrophication biological indicators will be addressed via a total phosphorus TMDL.

Other flow regime alterations and dissolved oxygen issues are directly related to the Mohicanville Dam. Because the dam is the remaining source of impairment (after habitat, sediment and total phosphorus TMDLs are completed), the nested subwatershed will change from category 5 to category 4C in Ohio's 303(d) list, so no TMDL will be required. This change will be reflected in the next 303(d) list following approval of this TMDL.

D3 Analysis Methods

Below, in Table D3-1, is a summary of the impairments for each HUC12 as described in Table D1-1. The table indicates whether impairments are addressed via TMDLs for the listed cause of impairment, though a surrogate parameter or not addressed.

Table D3-1. Summary of causes of impairment and actions taken to address them in assessment units within the 05040002 01 through 05040002 08 ten-digit hydrologic units and the large river assessment unit.

	Watershed Assessment Units									
	05040002 01					05040002 02				
Causes of Impairment	**01**	**02**	**03**	**04**	**05**	**01**	**02**	**03**	**04**	**05**
Aquatic Life Use										
Sedimentation/siltation	D					D				
Organic enrichment (sewage) biological indicators		S							S	
Dissolved oxygen		S				S				S
Direct habitat alterations		D			D	D				
Total dissolved solids		D								
Nutrient/eutrophication biological indicators				D		D		D	D	D
Other flow regime alterations					D	D				D
Turbidity					S	S				
Natural conditions (flow or habitat)								N		
Metals								N		
High flow regime (natural)								N		
Unknown toxicity								N		
Suspended algae										S
Recreation Use										
E. coli	D	D	D	D	D	D		D	D	

Causes of Impairment	Watershed Assessment Units							
	05040002 03			05040002 04				
	01	02	03	01	02	03	04	05
Aquatic Life Use								
Sedimentation/siltation			D					
Direct habitat alterations			D					
Recreation Use								
E. coli		D	D	D	D	D	D	D

Causes of Impairment	Watershed Assessment Units								
	05040002 05			05040002 06					
	01	02	03	01	02	03	04	05	06
Aquatic Life Use									
Flow alteration (category 4C)	N								
Sedimentation/siltation			D					D	
High flow regime			D						
Dissolved oxygen			S						
Biological oxygen demand			S						
Nutrient/eutrophication biological indicators								D	
Recreation Use									
E. coli	D	D	D	D	D	D	D	D	D

Causes of Impairment	Watershed Assessment Units									Mohican River Mainstem
	05040002 07			05040002 08						
	01	02	03	01	02	03	04	05	06	
Aquatic Life Use										
Direct habitat alterations		D								
Other flow regime alterations (category 4C)		4C								
Dissolved oxygen (category 4C)		4C								
Sedimentation/siltation		D								
Nutrient/eutrophication biological indicators		D								
Natural conditions (flow or habitat) (category 4n)					4n	4n				
Recreation Use										
E. coli	D	D	D	D	D	D		D		D

D – direct	Means that TMDLs are calculated for this parameter
N – not addressed	Means that the impairment is not addressed in this report.
Blank	Indicates that the assessment unit is not impaired for this cause.
4B	Means that the 4B option is being used to address impairment.
4C	Means that the aquatic life use category in Ohio's 303(d) list is 4C (impairment not caused by a pollutant).
4n	Natural conditions are causing impairment; no action necessary.
S – surrogate	Means a surrogate was used in lieu of specified cause of impairment.

D3.1 Load Duration Curves (*E. coli*, nutrients and total dissolved solids)

Recreation use was not supported in multiple assessment units in which at least one site's geometric mean did not attain the water quality standards criteria. A study was carried out to develop an *E. coli* total maximum daily load (TMDL) as required by Section 303(d) of the Clean Water Act and the United States Environmental Protection Agency's Water Quality Planning and Management Regulations (Title 40 of the Code of Federal Regulations, Part 130). Load duration curves (LDCs) are used in this TMDL report to define in-stream bacterial conditions, potential sources, bacteria targets and needed reductions.

Based on fish and macroinvertebrate results, the aquatic life use was not supported in a number of assessment units. Nutrients are the cause of impairment at six sites, phosphorus at five sites and nitrate and nitrite at one site. Total dissolved solids (TDS) is the cause of impairment at one site. As above with the *E. coli* TMDLs, LDCs are also used here to define in-stream nutrient or TDS conditions, potential sources, targets and needed reductions.

D3.1.1 Justification of Method

The method for analyzing loads for a cause of impairment should help to explain what the source of the cause of impairment is and define allocations to point sources, nonpoint sources, margin of safety (MOS) and allowance for future growth (AFG). Load duration curves are used as the method for bacteria, TDS, and nutrients for this report because they can assist in distinguishing between point and nonpoint sources that contribute to *E. coli* or nutrient loading by highlighting the flow conditions under which impairment occurs. At lower stream flow levels, little to no in-stream dilution of *E. coli* or nutrients is occurring due to dry conditions lacking runoff. Because of this, any point source *E. coli* or nutrient contributions to the stream will result in higher concentrations of *E. coli* or nutrients. If there are a high number of samples under dry weather or low flow conditions that fall above the target curve, there is a likelihood of nearby point sources of *E. coli* or nutrients. Examples of bacteria or nutrient point sources include combined sewer overflows (CSOs), municipal separate storm sewer systems (MS4s) or wastewater treatment plants. High bacteria or nutrient levels under low flow conditions may also indicate concentrated cattle in the stream channel, leaking sewer lines, or failing home sewage treatment systems.

The same spreadsheet program used to create the LDCs also divides the TMDL into allocations for point sources (WLA), nonpoint sources (LA), MOS and AFG.

There are several strengths of using LDCs for TMDLs. First, they use empirical data so they reflect actual observations and not predictions. Second, they do not require large amounts of data (because they use empirical data). Third, they are more easily explained to a general audience than more complex models. Finally, they address the required components of a TMDL (existing loads, WLAs and LAs, margin of safety, allowance for future growth, and seasonality).

There are also several weaknesses of using LDCs for TMDLs. First, they cannot predict how streams will respond to pollutants with land use changes such as BMPs. This limits the feasibility of creating implementation scenarios. Second, LDCs cannot predict pollutant loads in flow regimes for which there are no data.

In the case of TDS impairment on Tuby Run (in nested subwatershed 05040002 01 02), the source is likely a single point source: ArcelorMittal Tubular Products Shelby, Inc. In this case an empirical analysis of loads, such as that given by LDCs, is sufficient to analyze the contributions of the single source and a more complex model is unnecessary.

D3.1.2 Description of Method

In order to determine the magnitude of each type of impairment (bacteria, nutrients, and TDS) and differentiate between types of sources contributing to impairment, LDCs were calculated for analyzed sites following the methods described in U.S. EPA's *An Approach for Using Load Duration Curves in the Development of TMDLs* (U.S. EPA 2007). See Figure D3-1 and Table D3-2 for examples.

Under elevated flow conditions, point sources are assumed to be masked by in-stream dilution, therefore high loading of the pollutant is likely caused by precipitation washoff or erosion of contaminated land surfaces. For example, some typical nonpoint sources of bacteria and nutrients include manure spreading, stream bank erosion, and washoff from livestock feeding operations. Scenarios where high loads exist under mid-range flow conditions, or high loads occur under all conditions, can be attributed to a mixture of point and nonpoint sources. Site investigation using digital mapping, aerial photographs or an on-the-ground visit can help further develop priorities for implementation based on the LDC evidence for either point or nonpoint sources of bacteria, nutrient, and/or TDS.

In this case the LDC for TDS is used to verify that exceedance occurs during low flows, since the source is believed to be an upstream point source, and to determine needed load reductions.

It is important to note that the load duration curve method does not enable one to attribute impairment to any particular source; instead it is a tool used to determine the flow conditions under which impairment occurs and the probable types of sources contributing to that impairment.

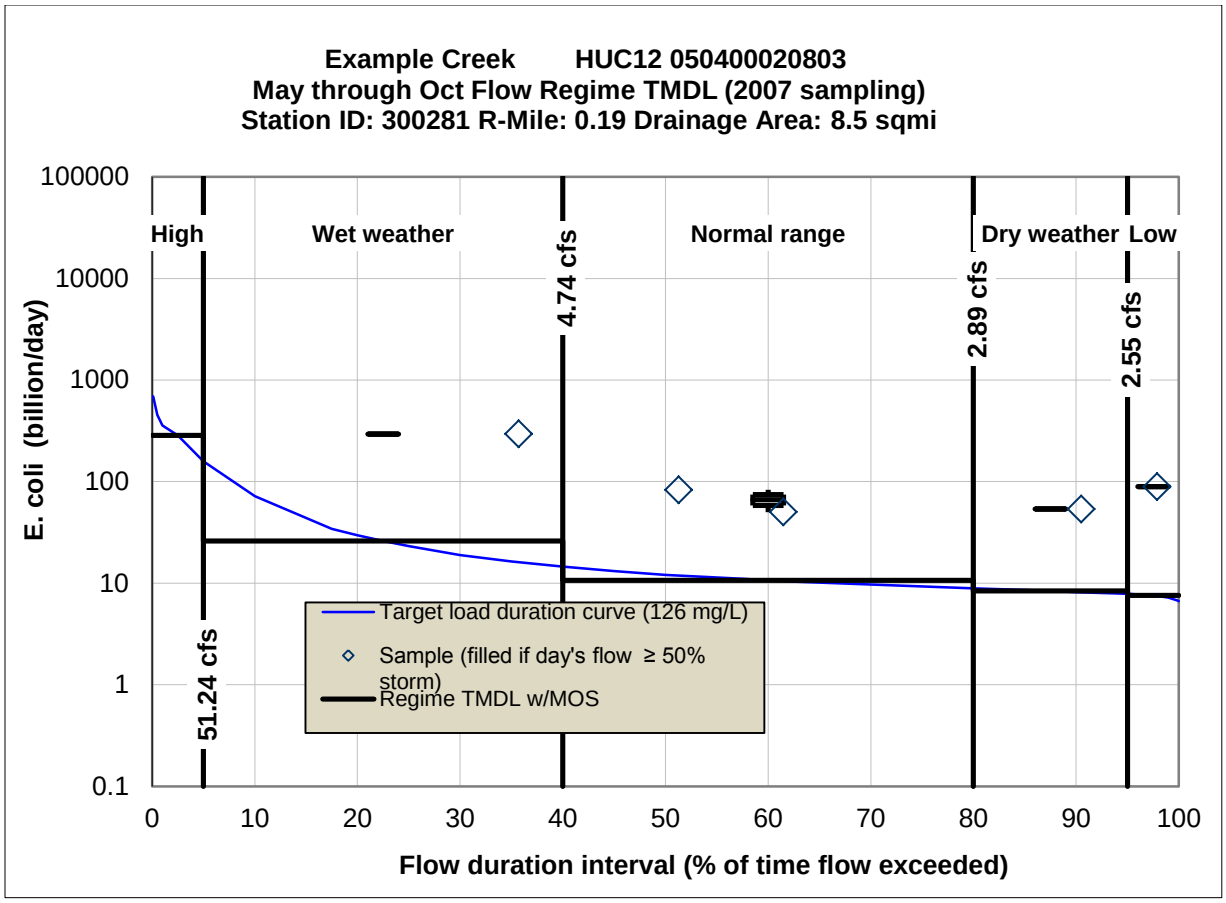

Figure D3-1. Example load duration curve.

Table D3-2. Example TMDL table calculations (from above load duration curve).

TMDL and Duration Intervals	High 0-5%	Wet Weather 5-40%	Normal Range 40-80%	Dry Weather 80-95%	Low 95-100%
Samples Per Regime		1	2	1	1
Median Sample load		294	66.49	53.64	89.01
Total Load Reduction Required	No Data	93.4%	88.0%	88.4%	93.7%
Total Maximum Daily Load	285.86	25.96	10.70	8.38	7.58
Margin of Safety: 20%	57.17	5.19	2.14	1.68	1.52
Allowance for future growth: 5.6%	16.01	1.45	0.60	0.47	0.42
Load Allocation	208.70	15.34	3.99	2.27	1.67
Wasteload Allocation Total	3.97	3.97	3.97	3.97	3.97
MS4	0.00	0.00	0.00	0.00	0.00
Example River Estates WWTP	0.10	0.10	0.10	0.10	0.10
Example Industry	2.86	2.86	2.86	2.86	2.86
Example WTP	1.02	1.02	1.02	1.02	1.02

In the Mohican River basin, over 30 sites received LDC TMDLs for *E. coli*. Sites were either considered Class A (highly recreated with a limit of 126 cfu/100 ml) or Class B (limit equals 161 cfu/100 ml). Also, LDC TMDLs were created for over 10 sites for total phosphorus, one site for nitrate and nitrite, and one site for TDS. Where NPDES dischargers exist, the WLA was assigned to all TMDLs downstream from the discharger.

A "TMDL table" is associated with each LDC detailing the information that is graphically presented in the LDC figure. Each table contains the following information for each hydrologic regime:

- number of samples
- median sample *E. coli,* nutrient, or TDS load
- total maximum daily load (TMDL)
- total wasteload allocation (WLA) and individual WLA for each point source
- nonpoint load allocation (LA)
- margin of safety (MOS) load
- allowance for future growth (AFG) load
- nonpoint (LA) percent load reduction required

In order to determine long-term flows for the LDC sites the drainage area (D.A.) yield method was used with the closest sentinel site long-term flow. The sentinel site long-term flows were calculated based on a regression formula between the measured flows at sentinel site and the Loudonville gage flows. The Loudonville gage presently reports only stage. Past flow data from the gage were used to develop a rating table, which was used to derive the flow data (1998 to 2009) used in the regressions.

D3.1.3 Target and Existing Deviation

For a given impaired site, each hydrologic condition (high flows, moist conditions, mid-range conditions, dry conditions or low flows) was assigned a target. For bacteria the target is a loading rate (cfu/day) calculated by multiplying the Class A *E. coli* water quality standard, 126 cfu/100 ml, or Class B standard, 161 cfu/100 ml, by the median flow of each hydrologic class at that site and a constant, used to convert cubic feet per second to milliliters per day: $T = Q_m * S * C$; where T = target bacteria load, Q_m = median flow for a specific hydrologic class, S = water quality standard (126 cfu/100 ml or 161 cfu/100 ml) and C = a unit conversion constant (cubic feet per second to milliliters per day).

The loading development for this study is based on statewide targets for total phosphorus and nitrate and nitrite concentrations (Ohio EPA 1999). Using this statewide reference, targets for specific impaired assessment units are assigned according to aquatic life use designation and drainage area class in Table D3-3. Assignment of target is based on the characteristics of the stream segment that drains each particular subbasin unit. It is important to note that these nutrient targets are not codified in Ohio's water quality standards; therefore, there is a certain degree of flexibility in how they can be used to establish load reductions.

The criterion used to establish the total dissolved solids TMDL, 1,500 mg/l at all locations, is located in Ohio's water quality standards.

Table D3-3. Statewide nutrient targets for warmwater habitat streams based on drainage area.

Watershed Size	Total Phosphorus (mg/l)	Nitrate & Nitrite (mg/l)
Headwaters (drainage area <20 mi^2)	0.08	1.0
Wadeable (drainage area ≥20 mi^2 <200 mi^2)	0.1	1.0
Small rivers (drainage area ≥ 200 mi^2 <1000 mi^2)	0.17	1.5

D3.1.4 Wasteload Allocation

For the bacteria LDCs, each discharger in the Mohican River basin is assigned a wasteload allocation (WLA) based upon the design flow of the treatment facility and the water quality standard applicable to its receiving water. The water quality standard is dependent upon the facility's designation, either Class A or Class B for the Mohican River basin, depending on its proximity to Class A designated stream reaches. None of the streams impaired for public recreation are designated Class C. If a facility is on or within 5 miles of a Class A stream segment, it is assigned the Class A limit of 126 cfu/100 ml, if not it is assigned the Class B standard of 161 cfu/100 ml.

WLAs are calculated for all facilities within the study area upstream from the TMDL site. Facilities that are located upstream from two TMDL sites (e.g., two sites on one stream that are separated by linear distance) will have their WLAs listed at both TMDL sites.

D3.1.5 Load Allocation

The load duration curve method was selected to assign in-stream *E. coli*, nutrient, and/or TDS loads at a given site to one or several potential *E. coli*, nutrient, and/or TDS sources (see U.S. EPA 2007). In a load duration curve, patterns of *E. coli*, nutrients, and/or TDS impairment can be examined and addressed relative to the flow conditions under which they occur which allows a set of potential sources specific to a given site to be highlighted. Under the highest flow conditions, point sources are likely to be masked by in-stream dilution; therefore high *E. coli*, nutrients, and/or TDS measurements in these conditions are associated with precipitation washoff or erosion of contaminated land surfaces. Impairments under mid-range flows can be caused by a mixture of point and nonpoint sources. Under the lowest flow conditions, recreation use impairments are generally attributable to sources not associated with runoff events, such as a failing HSTS or in-stream livestock.

Sampling locations were visited under a range of different flow conditions during the recreation season. Daily loading of *E. coli*, nutrients, and/or TDS were calculated for each site utilizing stream sample data. Existing in-stream loads, target loads and load duration curves were calculated from the collected data. Using these data and notes about land use, recommendations regarding sources and potential implementation were developed.

Where MS4 areas exist within TMDL areas the percent MS4 area is calculated and that percentage of LA is moved to an MS4 wasteload allocation.

D3.1.6 Margin of Safety

The Clean Water Act requires that a TMDL include a margin of safety (MOS) to account for any lack of knowledge concerning the relationship between load and wasteload allocations and water quality. U.S. EPA guidance explains that the MOS may be implicit (i.e., incorporated into the TMDL through conservative assumptions in the analysis) or explicit (i.e., expressed in the TMDL as loadings set aside for the MOS).

An implicit MOS is incorporated by not considering the die-off of pathogens as part of the TMDL calculations. The implicit MOS is also enhanced by the use of the geometric mean target (which is a seasonal target) to calculate daily loads. In addition, an explicit MOS has been applied as part of all of the bacteria TMDLs by reserving 20% of the allowable load because of the broad fluctuation of *E. coli* concentrations that occurs in nature and the relatively low numbers of data points available for this analysis.

For parameters with less broad fluctuations (total phosphorus, TDS and nitrate and nitrite) a MOS of 5% is used because these parameters are more predictable than *E. coli*. The explicit MOS in each allocation is shown in the TMDL allocation tables throughout Section D4.

Two sites—Rocky Fork Mohican River downstream Mansfield at RM 10.13 (Table D4-39) and Black Fork Mohican River at Crider Rd. at RM 23.31 (Table D4-6)—are influenced by a point source discharge that has a high load relative to the assimilative capacity at these sites. The point source load combined with MOS and AFG results in all of the assimilative capacity being used in one or more of the flow categories, prior to allocating to nonpoint sources.

At the Rocky Fork site (RM 10.13), the discharge overwhelms the assimilative capacity by so much that reducing the MOS and/or the AFG had minimal impact on freeing up assimilative capacity. The only way to free up enough capacity is to lower the discharge concentration from an average of 1.84 mg/l to 0.1 mg/l. The RM 23.31 site was not as dominated by the discharger as was the RM 10.14 site, so lowering the MOS and AFG to 1.0% in the lowest flow category was sufficient to create some assimilative capacity for the LA. Though the 5% MOS is recommended in all flow categories, the low flow categories are less likely to have fluctuations in loading and sources since large fluctuations tend to be a result of runoff, which occurs in varying amounts depending on how much precipitation occurs. In these lower flow categories runoff generally does not occur, so lowering the MOS to 1.0% in order to free needed assimilative capacity is reasonable.

D3.1.7 Critical Conditions and Seasonality

The critical condition can be thought of as the “worst case” scenario of environmental conditions in the waterbody in which the loading expressed in the TMDL for the pollutant of concern will continue to meet water quality standards. Critical conditions are the combination of environmental factors (e.g., flow, temperature, etc.) that results in attaining and maintaining the water quality criterion and has an acceptably low frequency of occurrence.

The critical conditions of impairment are determined by the source behavior. Often, sources of bacteria are diverse and occur in combination. For example, a stream may receive bacteria loads from such direct sources as watering livestock and illicit sewer connections and from runoff from agricultural areas. Varying sources can result in multiple critical conditions. In some cases, it may be necessary to

evaluate a TMDL under a variety of conditions to account for the different times of greatest impact from sources (e.g., low flow and high flow). Analysts may want to identify the different critical conditions and evaluate them separately. Another option is to develop the TMDL for a time period that encompasses all of the possible critical conditions, such as developing a TMDL based on various flow rates or developing separate TMDL allocations for different seasons.

Stream recreation occurs in a variety of forms, from wading to fishing to canoeing, and in a wide range of stream flow conditions. In order to ensure that recreation use is protected whenever recreation might occur, *E. coli* TMDLs are established for all flow conditions during the recreation season (May 1 through October 31), when people are most likely to fish, wade, swim and boat in streams.

In-stream bacteria loads vary by source and can occur across the hydrograph, from washoff of land-deposited bacteria under moist conditions to in-stream livestock and failing home sewage treatment systems (HSTSs) in low flow conditions. Nonpoint sources to which bacteria loads are allocated in the Mohican River basin include livestock, both manure washoff and in-stream animals, urban runoff and failing HSTSs. Potential sources for each LDC hydrograph condition (low through high) are detailed in Table D3-4.

Table D3-4. Load duration curve flow zones and typical contributing sources.

	Duration Curve Zone				
Contributing Source Area	**High**	**Moist**	**Mid-Range**	**Dry**	**Low**
Point source				M	H
Livestock direct access to streams				M	H
Home sewage treatment systems	M	M-H	H	H	H
Riparian areas		H	H	M	
Storm water: Impervious		H	H	H	
Combined sewer overflow (CSO)	H	H	H		
Storm water: Upland	H	H	M		
Field drainage: Natural condition	H	M			
Field drainage: Tile system	H	H	M-H	L-M	
Bank erosion	H	M			

The in-stream critical condition for nutrients is during summer low flow. It is then that the water heats up, and with adequate nutrients, algae grows at unnatural rates and creates great DO high to low swings during the photosynthesis phases (see Section D2.3.3 for more detail). However, since nutrient sources are varied—direct discharges (failing HSTS, CSOs, WWTPs) at all flows, field tiles at medium and higher flows, and field runoff during high flows—and because nutrients can be retained in a stream system over time in the sediment, all flow levels should be evaluated. This is done in the LDCs since sample data are evaluated across the hydrograph.

The critical condition for TDS is low flow since the source is a direct discharge to Tuby Run. Direct discharges tend to have stable flows and therefore have more impact on streams when the stream flow is low than when the stream flow is high because of less dilution in the stream. Other stressors such as high temperatures and lower reaeration, both which can cause DO to lower, occur during low flows exacerbating the effects of the TDS-laden direct discharger. Low flow is addressed in the LDC.

D3.1.8 Allowance for Future Growth

The Mohican River basin drains part of Ashland, Richland, Knox and Holmes counties, with the majority of the basin within Ashland and Richland counties. The long-term (2010 – 2030) average of the population increase for these two counties is 5.6% (based on data in ODD, 2003). Therefore, the assumed allowance for future growth assumption for all LDCs in the basin is 5.6%.

For all parameters using LDCs (bacteria, nutrients and TDS), the WLAs are listed in the TMDL table that corresponds with each sampling site. Because a given facility operates at most times at some fraction of its design flow, the WLA for each facility includes an amount of reserve capacity up to the design flow of the facility. Therefore, there is an implicit amount of future growth allowance.

D3.2 Habitat and Sediment Method (QHEI)

D3.2.1 Justification of method

Poor habitat quality is an environmental condition, rather than a pollutant load, so development of a load-based TMDL for habitat is not possible. Nonetheless, habitat is an integral part of stream ecosystems and has a significant impact on aquatic community assemblage and consequently on the potential for a stream to meet the biocriteria within Ohio's water quality standards (see below). In addition, U.S. EPA acknowledges that pollutants, conditions or other environmental stressors can be subject to the development of a TMDL to abate those stressors in order to meet water quality standards (U.S. EPA 1991). Thus, sufficient justification for developing habitat TMDLs is established.

The Qualitative Habitat Evaluation Index (QHEI) was developed by the Ohio EPA (Ohio EPA 1989) with one of the objectives being to create a means for distinguishing impacts to the aquatic community from pollutant loading versus poor stream habitat. The design of the QHEI in conjunction with its statistically strong correlation to the biocriteria makes it an appropriate tool for developing habitat TMDLs.

D3.2.2 Targets for QHEI Analysis

The QHEI assigns a numeric value to an individual stream segment (typically 150-200 m in length) based on the quality of its habitat. The actual number values of the QHEI scores do not represent the quantity of any physical properties of the system but provide a means for comparing the relative quality of stream habitat. However, even though the numeric value is derived qualitatively, subjectivity is minimized because scores are based on the presence and absence and relative abundance of unambiguous habitat features. Reduced subjectivity was an important consideration in developing the QHEI and has since been evidenced through minimal variation between scores from various trained investigators at a given site as well as consistency with repeated evaluations (Ohio EPA 1989). The QHEI evaluates six general aspects of physical habitat that include channel substrate, in-stream cover, riparian characteristics, channel condition, pool/riffle quality, and gradient. Within each of these categories or submetrics, points are assigned based on the ecological utility of specific stream features as well as their relative abundance in the system. Demerits (i.e., negative points) are also assigned if certain features or conditions are present that reduce the overall utility of the habitat (e.g., heavy siltation and embedded substrate). These points are summed within each of the six submetrics to give a score for that particular aspect of stream habitat. The overall QHEI score is the sum of all of the submetric scores.

Habitat TMDL Targets

Since its development the QHEI has been used to evaluate habitat at most biological sampling sites and currently there is an extensive database that includes QHEI scores and other water quality variables. Strong correlations exist between QHEI scores and its component submetrics and the biological indices used in Ohio's water quality standards such as the Index of Biotic Integrity (IBI). Through statistical analyses of data for the QHEI and the biological indices, target values have been established for QHEI scores with respect to the various aquatic life use designations (Ohio EPA 1999). For aquatic life use designations of warmwater habitat (WWH) and exceptional warmwater habitat (EWH), respective overall QHEI scores of 60 and 75 are targeted to provide reasonable certainty that habitat is sufficient to support biological community expectations.

One of the strongest correlations found through these statistical analyses described above is the negative relationship between the number of "modified attributes" and the IBI scores. Modified attributes are features or conditions that have low value in terms of habitat quality and therefore are assigned relatively fewer points or negative points in the QHEI scoring. A subgroup of the modified attributes shows a stronger impact on biological performance; these are termed high influence modified attributes.

In addition to the overall QHEI scores, targets for the maximum number of modified and high influence modified attributes have been developed. For streams designated as WWH, there should no more than four modified attributes, of which no more than one should be a high influence modified attribute. For EWH streams, there should be no more than two modified attributes and zero high influence attributes. Table D3-5 lists modified and high influence modified attributes and provides the QHEI targets used for this habitat TMDL.

Table D3-5. QHEI targets for the habitat TMDL.

	Overall QHEI Score		All Modified Attributes	
			High Influence Modified Attributes	**All Other Modified Attributes**
Range of Possibilities	12 to 100 points		- Channelized or No Recovery - Silt/Muck Substrate - Low Sinuosity - Sparse/No Cover - Max Pool Depth < 40 cm (wadeable streams only)	- Recovering Channel - Sand Substrate (boat sites) - Hardpan Substrate Origin - Fair/Poor Development - Only 1-2 Cover Types - No Fast Current - High/Moderate Embeddedness - Ext/Mod Riffle Embeddedness - No Riffle
Targets	**WWH**	Overall score ≥ 60	Total number < 2	Total number < 5[1]
	EWH	Overall score ≥ 75	Total number < 0	Total number < 3[1]
TMDL Points if Target Satisfied	+1		+1	+1

[1] Total number of modified attributes includes those counted towards the high influence modified attributes.

For simplicity, a pass/fail distinction is made to determine whether each of the three targets is being met. Targets are set for: 1) the total QHEI score; 2) maximum number of all modified attributes; and 3) maximum number of high influence modified attributes only. If the minimum target is satisfied, then that category is assigned a "1", if not, it is assigned a "0". To satisfy the habitat TMDL, the stream segment in question should achieve a score of three.

Sediment TMDL Targets

The QHEI is also used to develop the bedload (sediment) TMDL. Numeric targets for sediment are based on the metrics of the QHEI. Although QHEI evaluates the overall quality of stream habitat, some of the component metrics consider particular aspects of stream habitat that are closely related to and/or impacted by the sediment delivery and transport processes occurring in the system.

The QHEI metrics used in the bedload TMDL are the substrate, riparian, and channel metrics. All of these evaluate stream attributes related to substrate quality and the amount of fines in the sediment. Substrate is a QHEI category that measures the type, origin, quality, and degree of embeddedness of stream substrates. Degree of embeddedness refers to the extent to which gravel, cobble, and boulders are surrounded, buried by, or covered by fine materials such as sand or silt. The riparian QHEI category evaluates riparian width, quality, and bank erosion. The channel QHEI category describes stream physical morphology including sinuosity and extent of development. Each of these factors influences the degree to which siltation affects a stream, and cumulatively serves as its numeric target.

The targets were established based on a paired analysis of IBI scores with corresponding values of these QHEI metrics. The targets are set at the fiftieth percentile of the site that achieves a minimum IBI score of 40, which is meant to reflect a warmwater habitat fish community. Table D3-6 summarizes the sediment TMDL targets that are used to address sedimentation.

Table D3-6. Sediment (bedload) TMDL targets.

Sediment TMDL =	Substrate	+	Channel Morphology	+	Riparian Zone/Bank Erosion	Total Score
Target (MWH-channel mod)	≥9	+	≥10	+	≥4	≥23
Target (WWH)	≥ 13	+	≥ 14	+	≥ 5	≥ 32
Target (EWH)	≥ 15	+	≥ 15	+	≥ 5	≥ 35

The sedimentation scores can be thought of as a "concentration," as they measure the current amount of sediment in the stream. This means that the load allocations (LAs) and wasteload allocations (WLAs) are the same as the loading capacity (e.g., score = 32).

Because the QHEI scoring methods (Ohio EPA 1999) do not address target scores for modified warmwater habitat (MWH) submetrics they were derived for the purposes of this report based on the percent difference between WWH and MWH IBI scores for headwater streams. In this study basin there is only one MWH stream at issue, Kiser Ditch. For this size stream the WWH IBI target is 28 and MWH target is 20, therefore the percent difference is -28.6%. That proportion was then used to determine by how much the undefined MWH submetric targets for substrate, channel, and riparian should be reduced

from the defined WWH submetric targets. For instance, the WWH target score for substrate is ≥13; reduced by 28.6%, the resulting MWH target is ≥9.

D3.2.3 Margin of Safety

There is an implicit margin of safety applied to the habitat TMDLs based on conservative target values used. The targets from the *Association Between Nutrients, Habitat, and the Aquatic Biota in Ohio Rivers and Streams* (Ohio EPA 1999) are conservative because attainment of aquatic life uses has been demonstrated even when the targets are not met.

D3.2.4 Critical Conditions

The critical condition for the habitat and sediment TMDLs is the summer dry period when environmental stress upon aquatic organisms is the greatest. It is during this period that the presence of high-quality habitat features, such as deep pools and unembedded substrate, is essential to provide refuge for aquatic life. QHEI scores, the basis of the habitat and sediment TMDLs, are assessed during the summer field season. The habitat and sediment TMDLs are therefore reflective of the critical condition.

D3.2.5 Allowance for Future Growth

Since no explicit loads are calculated for the habitat and sediment TMDLs, no future growth load can be allotted.

D4 Results

D4.1 LDCs: Recreation Use Results

In the sequence of figures and tables below, the load duration curve for each site (Figures D4-1 through D4-43) is shown followed by the TMDL table for that site.

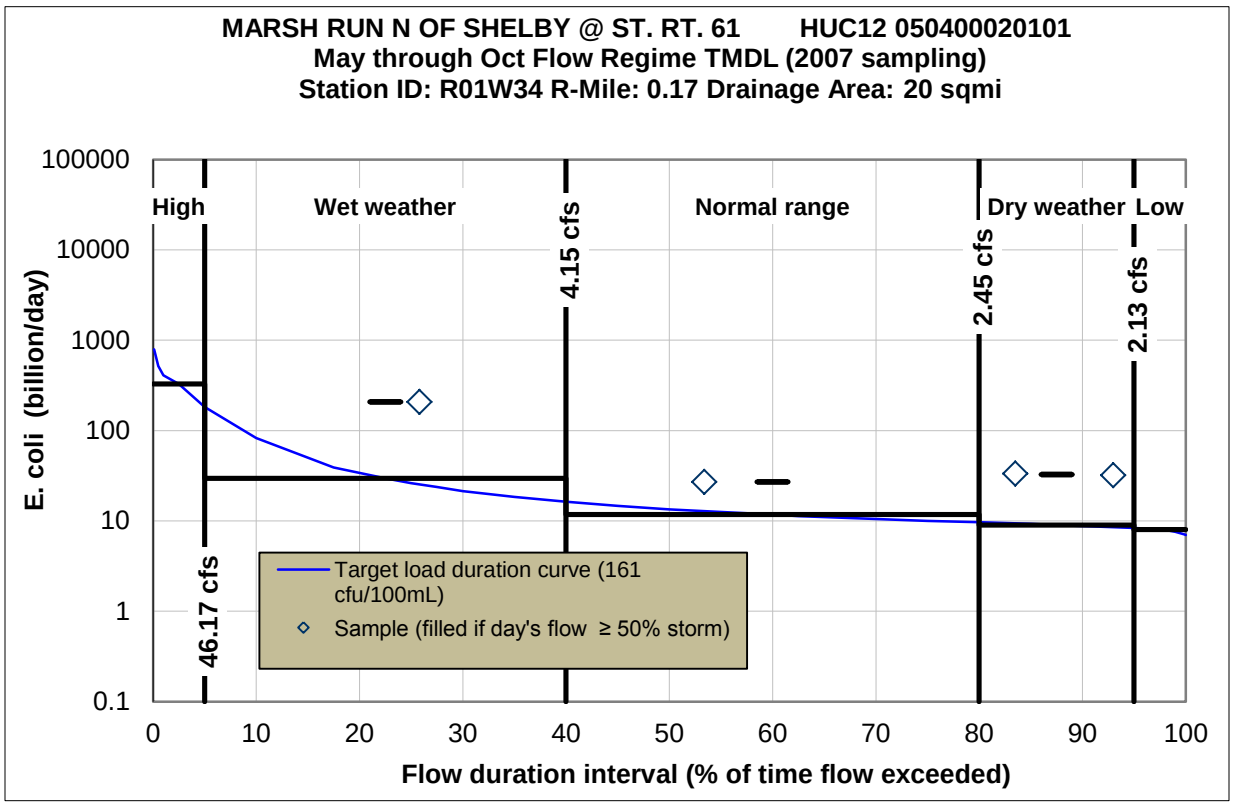

Figure D4-1. ***E. coli*** **load duration curve for site on Marsh Run N of Shelby at St. Rt. 61.**

Table D4-1. ***E. coli*** **TMDL for site on Marsh Run N of Shelby at St. Rt. 61 (in billion colony-forming units (cfu)/day).**

TMDL and Duration Intervals	High 0-5%	Wet weather 5-40%	Normal range 40-80%	Dry weather 80-95%	Low 95-100%
Samples per Regime		1	1	2	
Median Sample load		207	27.00	32.59	
Total Load Reduction Required	No Data	**89.4%**	**67.7%**	**79.4%**	No Data
Total Maximum Daily Load	327.96	29.62	11.74	9.02	8.04
Margin of Safety: 20%	65.59	5.92	2.35	1.80	1.61
Allowance for future growth: 5.6%	18.37	1.66	0.66	0.51	0.45
Load Allocation	244.00	22.04	8.73	6.71	5.98
Wasteload Allocation Total	0.00	0.00	0.00	0.00	0.00
MS4	0.00	0.00	0.00	0.00	0.00
No NPDES dischargers in basin	0.00	0.00	0.00	0.00	0.00

Values were adjusted for rounding.

Black Fork Mohican River at Ganges-Five Points Road is located in nested subwatershed 05040002 01 05 but represents nested subwatershed 05040002 01 02 because it is the closest downstream site with data on Black Fork. It is 6.2 river miles downstream from the 01 02 nested subwatershed outlet. Because it is downstream, it receives all the loading from nested subwatershed 01 02, and also some from nested subwatershed 01 05 and from the Shelby WWTP discharge.

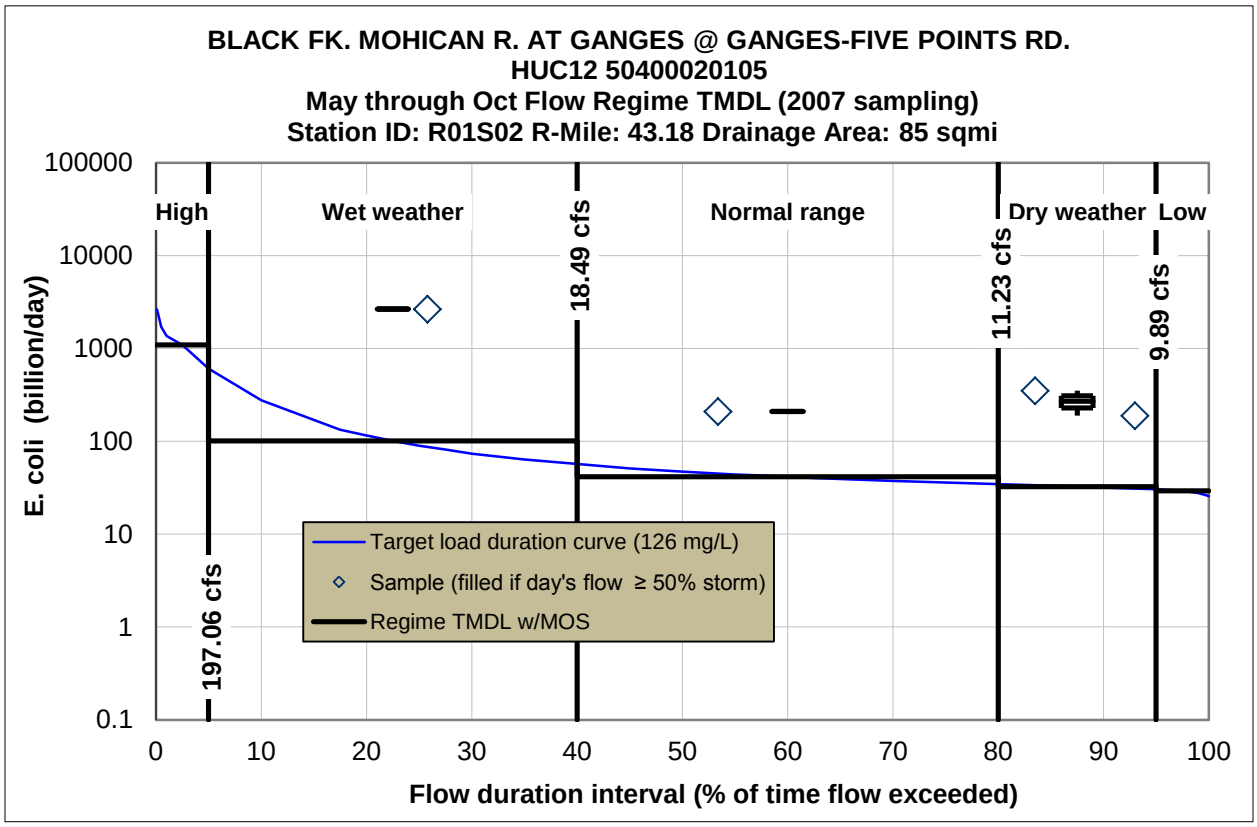

Figure D4-2. Load duration curve for site on Black Fk. Mohican R. at Ganges at Ganges-Five Points Rd.

Table D4-2. *E. coli* TMDL for site on Black Fk. Mohican R. at Ganges at Ganges-Five Points Rd (in billion cfu/day).

TMDL and Duration Intervals	High 0-5%	Wet weather 5-40%	Normal range 40-80%	Dry weather 80-95%	Low 95-100%
Samples Per Regime		1	1	2	
Median Sample load		2656.00	209.73	270.42	
Total Load Reduction Required	No Data	**97.2%**	**85.3%**	**91.0%**	No Data
Total Maximum Daily Load	1093.40	101.08	41.59	32.61	29.35
Margin of Safety: 20%	218.68	20.22	8.32	6.52	5.87
Allowance for future growth: 5.6%	61.23	5.66	2.33	1.83	1.64
Load Allocation	792.49	57.90	13.85	7.21	4.79
Wasteload Allocation Total	21.00	17.31	17.09	17.06	17.04
MS4 (0.5% of total area)	3.98	0.29	0.07	0.04	0.02
Cornell Abraxas Ohio 2GS00002	0.12	0.12	0.12	0.12	0.12
Shelby Welded Tube 2GS00009	0.01	0.01	0.01	0.01	0.01
Northside MHP 2GS00019	0.01	0.01	0.01	0.01	0.01
Briarwood Estates MHP 2PY00018	0.18	0.18	0.18	0.18	0.18
Lust Subdiv WWTP 2PG00077	0.05	0.05	0.05	0.05	0.05
Voisard Mg Co. Inc. Pit No. 2 2PR00139	0.01	0.01	0.01	0.01	0.01
Shelby Municipal Light Plant 2IN00225	0.00	0.00	0.00	0.00	0.00
ArcelorMittal Tubular Products 2ID00002	1.39	1.39	1.39	1.39	1.39
Shelby WWTP 2PD00036	15.24	15.24	15.24	15.24	15.24

Values were adjusted for rounding.

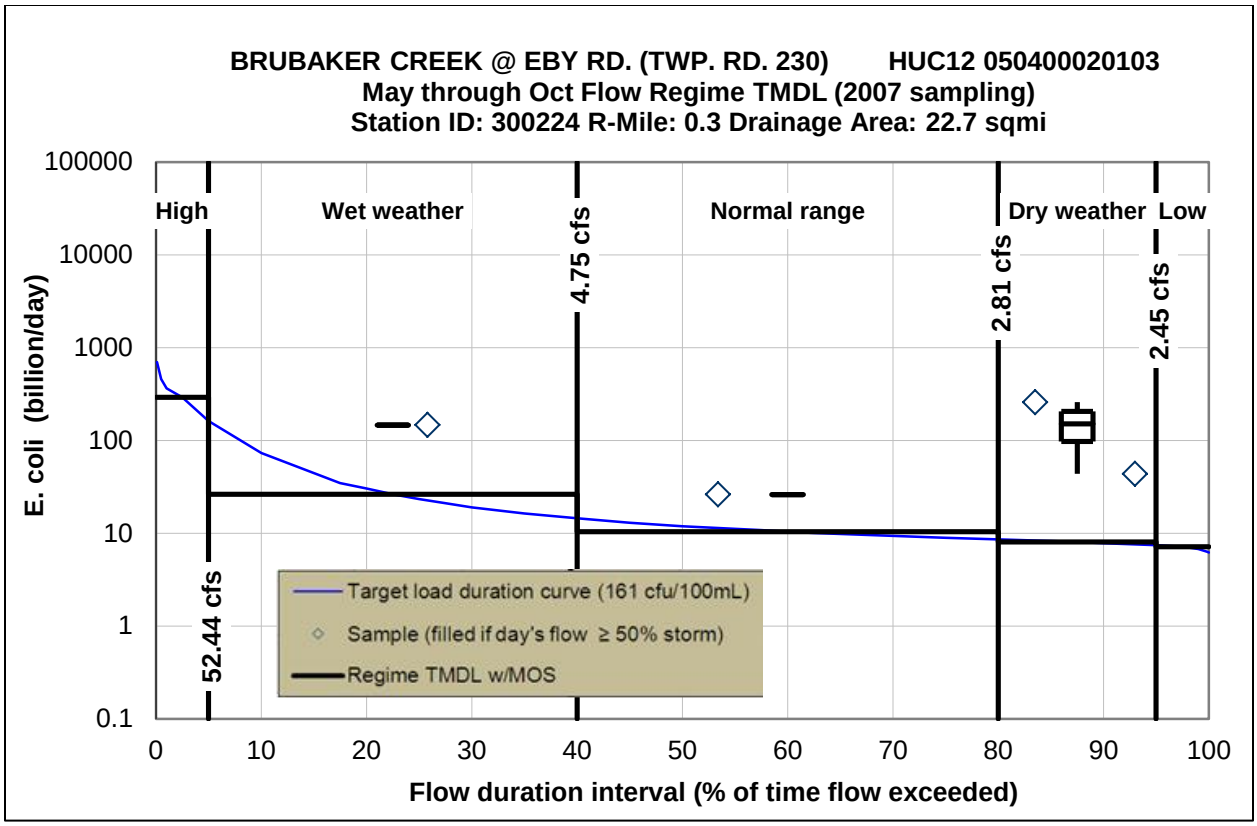

Figure D4-3. *E. coli* load duration curve for site on Brubaker Ck. at Eby Rd.

Table D4-3. *E. coli* TMDL for site on Brubaker Ck. at Eby Rd (in billion cfu/day).

TMDL and Duration Intervals	High 0-5%	Wet weather 5-40%	Normal range 40-80%	Dry weather 80-95%	Low 95-100%
Samples Per Regime		1	1	2	
Median Sample load		147.00	26.40	152.96	
Total Load Reduction Required	No Data	**86.7%**	**70.3%**	**96.0%**	No Data
Total Maximum Daily Load	291.44	26.42	10.54	8.14	7.28
Margin of Safety: 20%	58.29	5.28	2.11	1.63	1.46
Allowance for future growth: 5.6%	16.32	1.48	0.59	0.46	0.41
Load Allocation	216.69	19.51	7.70	5.91	5.27
Wasteload Allocation Total	0.14	0.14	0.14	0.14	0.14
MS4	0.00	0.00	0.00	0.00	0.00
Dayspring Assisted Living and Care Facility 2PG00114	0.14	0.14	0.14	0.14	0.14

Values were adjusted for rounding.

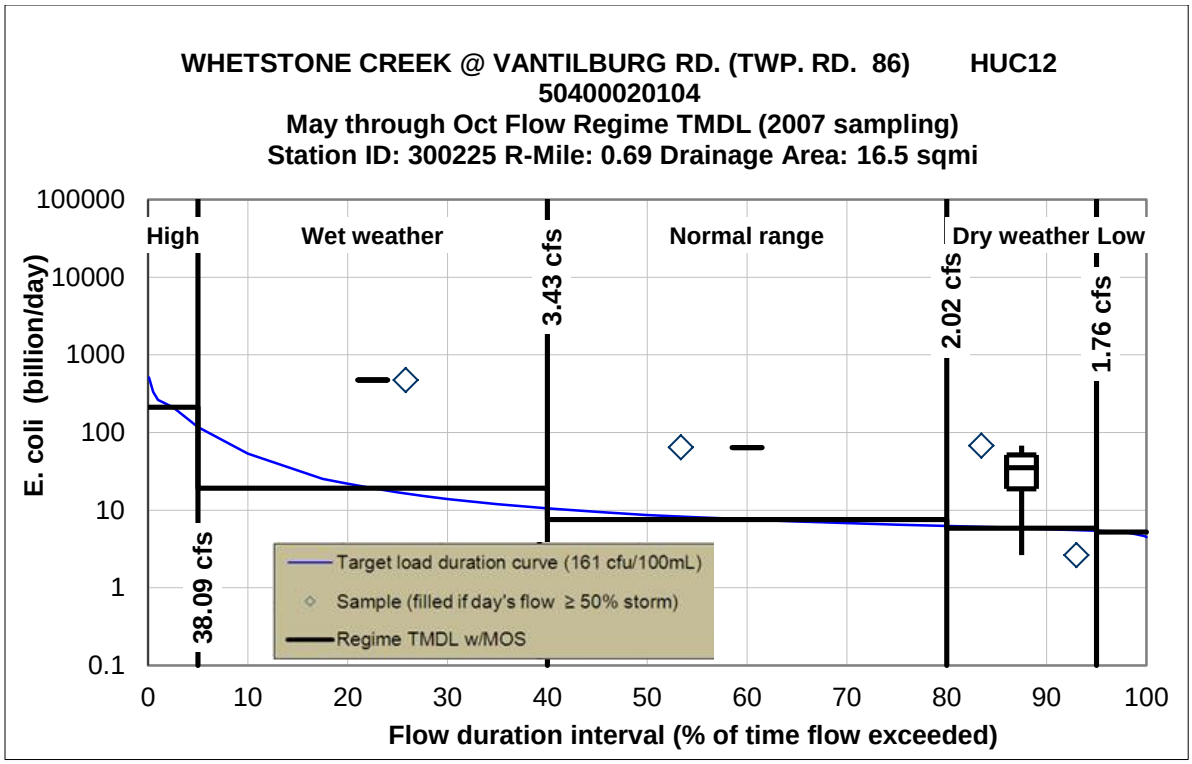

Figure D4-4. ***E. coli*** **load duration curve for site on Whetstone Ck. at Vantilburg Rd. (Twp. Rd. 86).**

Table D4-4. ***E. coli*** **TMDL for site on Whetstone Ck. at Vantilburg Rd. (Twp. Rd. 86) (in billion cfu/day).**

TMDL and Duration Intervals	High 0-5%	Wet weather 5-40%	Normal range 40-80%	Dry weather 80-95%	Low 95-100%
Samples Per Regime		1	1	2	
Median Sample load		474	64.20	35.01	
Total Load Reduction Required	No Data	**97.0%**	**91.2%**	**87.6%**	No Data
Total Maximum Daily Load	211.75	19.14	7.58	5.83	5.21
Margin of Safety: 20%	42.35	3.83	1.52	1.17	1.04
Allowance for future growth: 5.6%	11.86	1.07	0.42	0.33	0.29
Load Allocation	157.54	14.24	5.64	4.33	3.88
Wasteload Allocation Total	0.00	0.00	0.00	0.00	0.00
MS4	0.00	0.00	0.00	0.00	0.00
No NPDES dischargers	0.00	0.00	0.00	0.00	0.00

Values were adjusted for rounding.

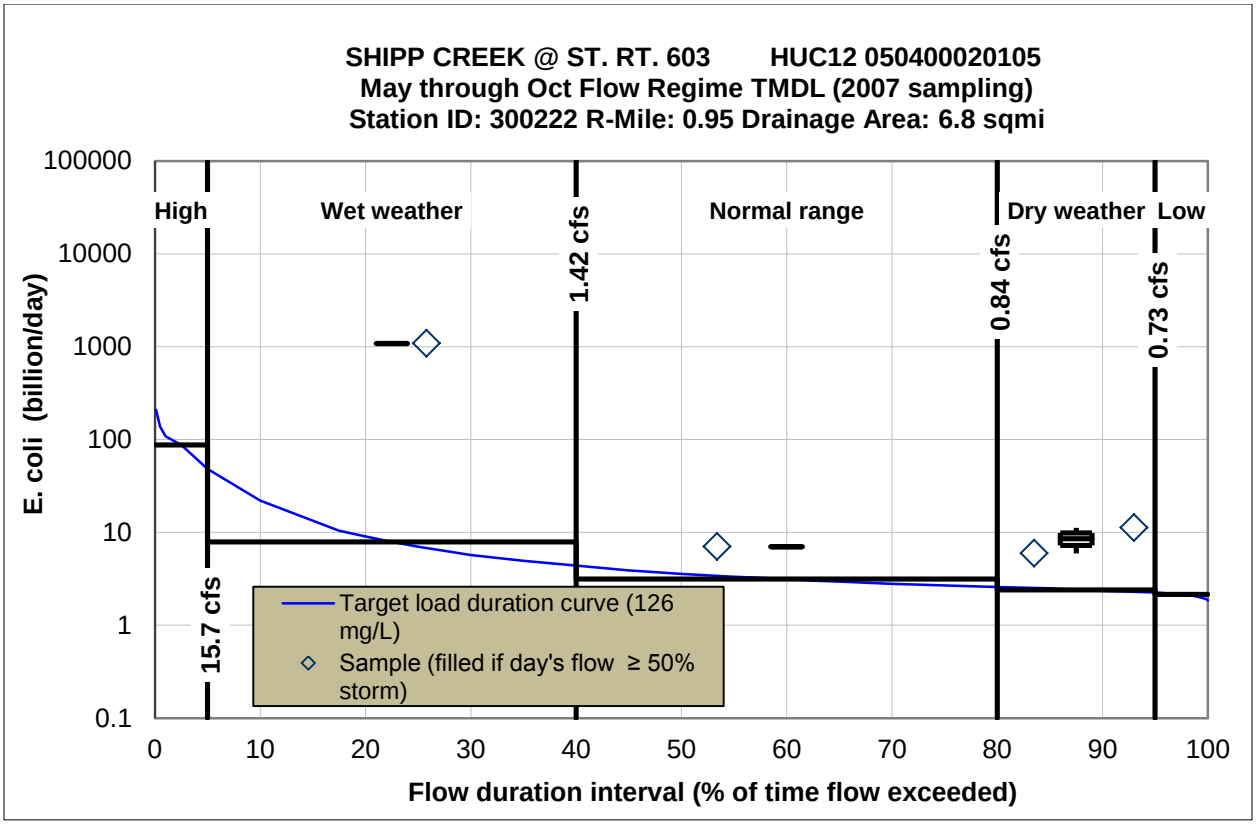

Figure D4-5. ***E. coli*** **load duration curve for site on Shipp Ck. at St. Rt. 603.**

Table D4-5. ***E. coli*** **TMDL for site on Shipp Ck. at St. Rt. 603 (in billion cfu/day).**

TMDL and Duration Intervals	High 0-5%	Wet weather 5-40%	Normal range 40-80%	Dry weather 80-95%	Low 95-100%
Samples Per Regime		1	1	2	
Median Sample load		1084	7.02	8.58	
Total Load Reduction Required	No Data	**99.5%**	**66.7%**	**79.2%**	No Data
Total Maximum Daily Load	87.27	7.89	3.14	2.40	2.16
Margin of Safety: 20%	17.45	1.58	0.63	0.48	0.43
Allowance for future growth: 5.6%	4.89	0.44	0.18	0.13	0.12
Load Allocation	64.93	5.87	2.34	1.79	1.61
Wasteload Allocation Total	0.00	0.00	0.00	0.00	0.00
MS4	0.00	0.00	0.00	0.00	0.00
No NPDES facilities	0.00	0.00	0.00	0.00	0.00

Values were adjusted for rounding.

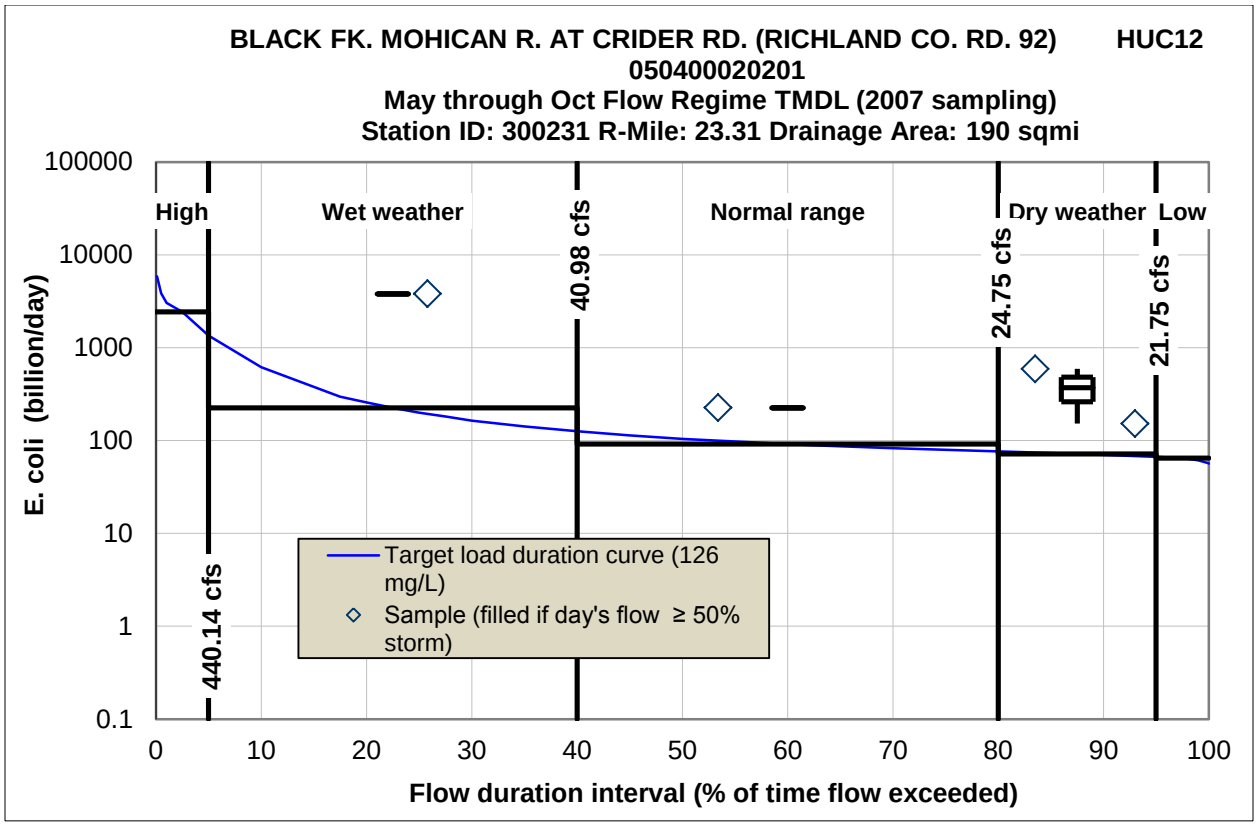

Figure D4-6. *E. coli* load duration curve for site on Black Fork Mohican R. at Crider Rd.

Table D4-6. *E. coli* TMDL for site on Black Fork Mohican R. at Crider Rd (in billion cfu/day).

TMDL and Duration Intervals	High 0-5%	Wet weather 5-40%	Normal range 40-80%	Dry weather 80-95%	Low 95-100%
Samples Per Regime		1	1	2	
Median Sample load		3804	225.85	372.22	
Total Load Reduction Required	No Data	**95.6%**	**69.7%**	**85.6%**	No Data
Total Maximum Daily Load	2443.03	224.91	91.86	71.83	64.55
Margin of Safety: 20%	488.61	44.98	18.37	14.37	12.91
Allowance for future growth: 5.6%	136.81	12.60	5.14	4.02	3.61
Load Allocation	1622.54	131.51	42.07	28.60	23.71
Wasteload Allocation Total	195.08	35.83	26.27	24.84	24.31
MS4 (9.65% of total area)	173.30	14.05	4.49	3.06	2.53
Hillside MHP 2PV00700	0.08	0.08	0.08	0.08	0.08
Eastview WWTP 2PH00005	4.29	4.29	4.29	4.29	4.29
Cornell Abraxas Ohio 2GS00002	0.12	0.12	0.12	0.12	0.12
Shelby Welded Tube 2GS00009	0.01	0.01	0.01	0.01	0.01
Northside MHP 2GS00019	0.01	0.01	0.01	0.01	0.01
Briarwood Estates MHP 2PY00018	0.18	0.18	0.18	0.18	0.18
Lust Subdiv WWTP 2PG00077	0.05	0.05	0.05	0.05	0.05
Voisard Mg Co. Inc. Pit No. 2 2PR00139	0.01	0.01	0.01	0.01	0.01
Shelby Municipal Light Plant 2IN00225	0.00	0.00	0.00	0.00	0.00
ArcelorMittal Tubular Products 2ID00002	1.39	1.39	1.39	1.39	1.39
Shelby WWTP 2PD00036	15.24	15.24	15.24	15.24	15.24
Dayspring Assisted Living and Care Facility 2PG00114	0.14	0.14	0.14	0.14	0.14
Crestview Local School 2GS00004	0.10	0.10	0.10	0.10	0.10
Pin Oak Estates MHP 2PR00072	0.14	0.14	0.14	0.14	0.14

Values were adjusted for rounding.

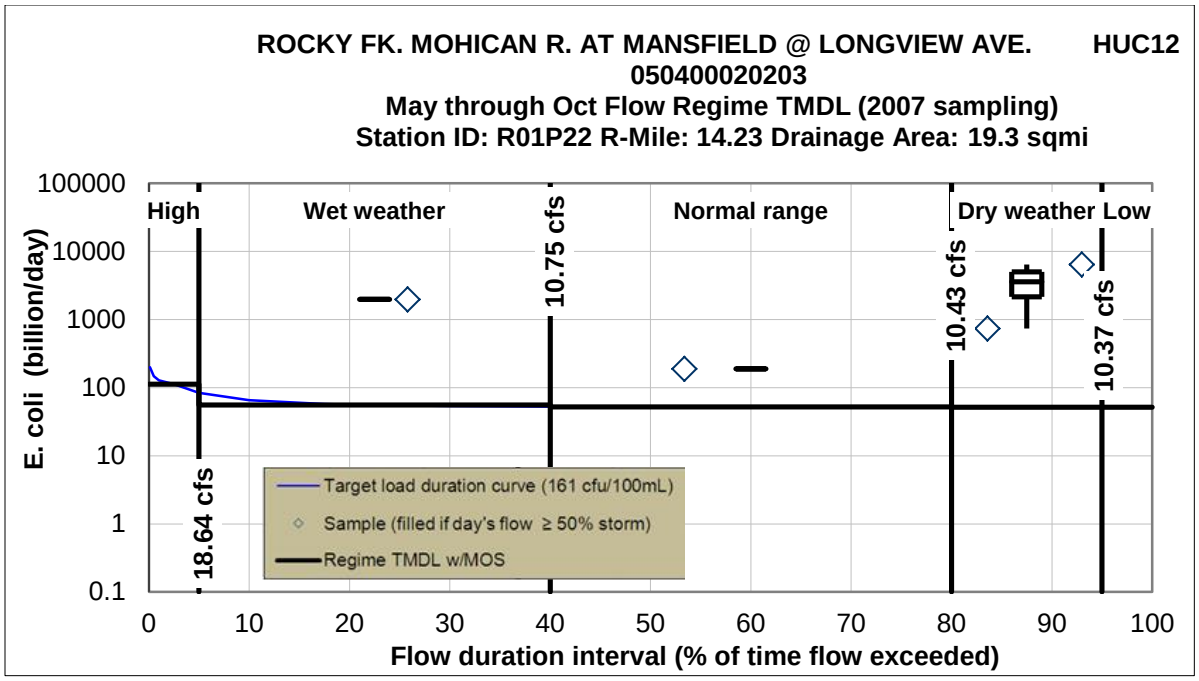

Figure D4-7. *E. coli* load duration curve for site on Rocky Fk. Mohican R. at Mansfield at Longview Ave.

Table D4-7. *E. coli* TMDL for site on Rocky Fk. Mohican R. at Mansfield at Longview Ave (in billion cfu/day).

TMDL and Duration Intervals	High 0-5%	Wet weather 5-40%	Normal range 40-80%	Dry weather 80-95%	Low 95-100%
Samples Per Regime		1	1	2	
Median Sample load		1587	150.07	2832.23	
Total Load Reduction Required	No Data	**97.9%**	**79.4%**	**98.9%**	No Data
Total Maximum Daily Load	101.25	44.85	41.54	41.03	40.87
Margin of Safety: 20%	20.24	8.96	8.30	8.19	8.16
Allowance for future growth: 5.6%	5.67	2.51	2.32	2.29	2.29
Load Allocation	33.63	13.54	12.36	12.18	12.12
Wasteload Allocation Total	41.76	19.84	18.56	18.36	18.30
MS4 (52.14% of total area)	36.63	14.75	13.47	13.27	13.21
Sensmeier & Sons Oil Co Inc 2GB00004	0.00	0.00	0.00	0.00	0.00
AK Steel Corporation 2ID00003	5.01	5.01	5.01	5.01	5.01
Tube City IMS, LLC 2IN00076	0.07	0.07	0.07	0.07	0.07
Ohio Air National Guard 179 Airlift Group 2IN00189	0.01	0.01	0.01	0.01	0.01

Values were adjusted for rounding.

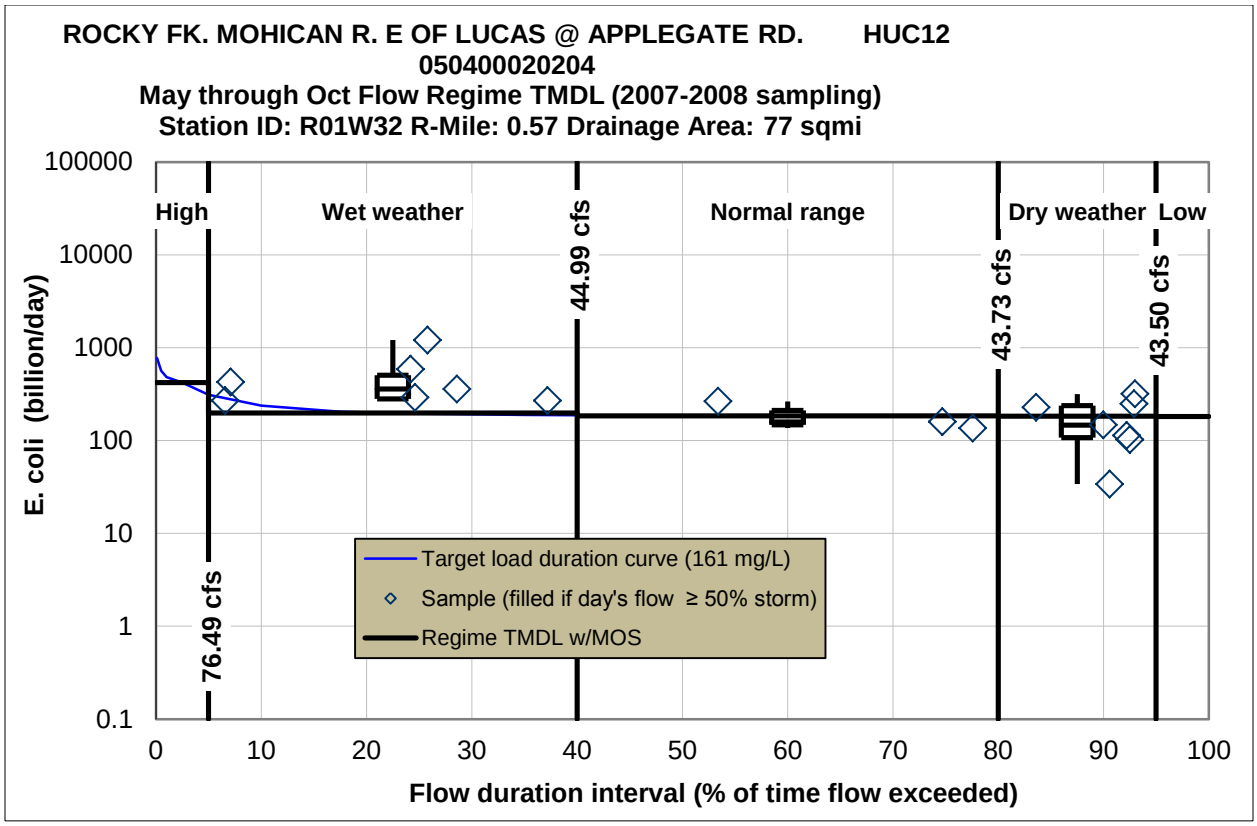

Figure D4-8. *E. coli* load duration curve for site on Rocky Fk. Mohican R. E of Lucas at Applegate Rd.

Table D4-8. *E. coli* TMDL for site on Rocky Fk. Mohican R. E of Lucas at Applegate Rd (in billion cfu/day).

TMDL and Duration Intervals	High 0-5%	Wet weather 5-40%	Normal range 40-80%	Dry weather 80-95%	Low 95-100%
Samples Per Regime		7	3	7	
Median Sample load		339	150.07	138.57	
Total Load Reduction Required	No Data	**59.0%**	**13.8%**	**7.7%**	No Data
Total Maximum Daily Load	412.08	187.08	173.85	171.88	171.13
Margin of Safety: 20%	82.40	37.40	34.76	34.36	34.21
Allowance for future growth: 5.6%	23.07	10.47	9.73	9.62	9.58
Load Allocation	127.18	33.43	27.92	27.10	26.79
Wasteload Allocation Total	179.42	105.77	101.44	100.79	100.55
MS4 (44% of total area)	99.92	26.27	21.94	21.29	21.05
Lucas WWTP 2PB00038	0.46	0.46	0.46	0.46	0.46
Therm-O-Disc Inc 2IS00028	0.37	0.37	0.37	0.37	0.37
Mansfield WWTP 2PE00001	73.13	73.13	73.13	73.13	73.13
Hyundai Ideal Electric Co 2IN00058	0.08	0.08	0.08	0.08	0.08
Harp Subdiv WWTP 2PG00075	0.24	0.24	0.24	0.24	0.24
Joez Lounge 2PR00238	0.13	0.13	0.13	0.13	0.13
Sensmeier & Sons Oil Co Inc 2GB00004	0.00	0.00	0.00	0.00	0.00
AK Steel Corporation 2ID00003	5.01	5.01	5.01	5.01	5.01
Tube City IMS, LLC 2IN00076	0.07	0.07	0.07	0.07	0.07
Ohio Air National Guard 179 Airlift Group 2IN00189	0.01	0.01	0.01	0.01	0.01

Values were adjusted for rounding.

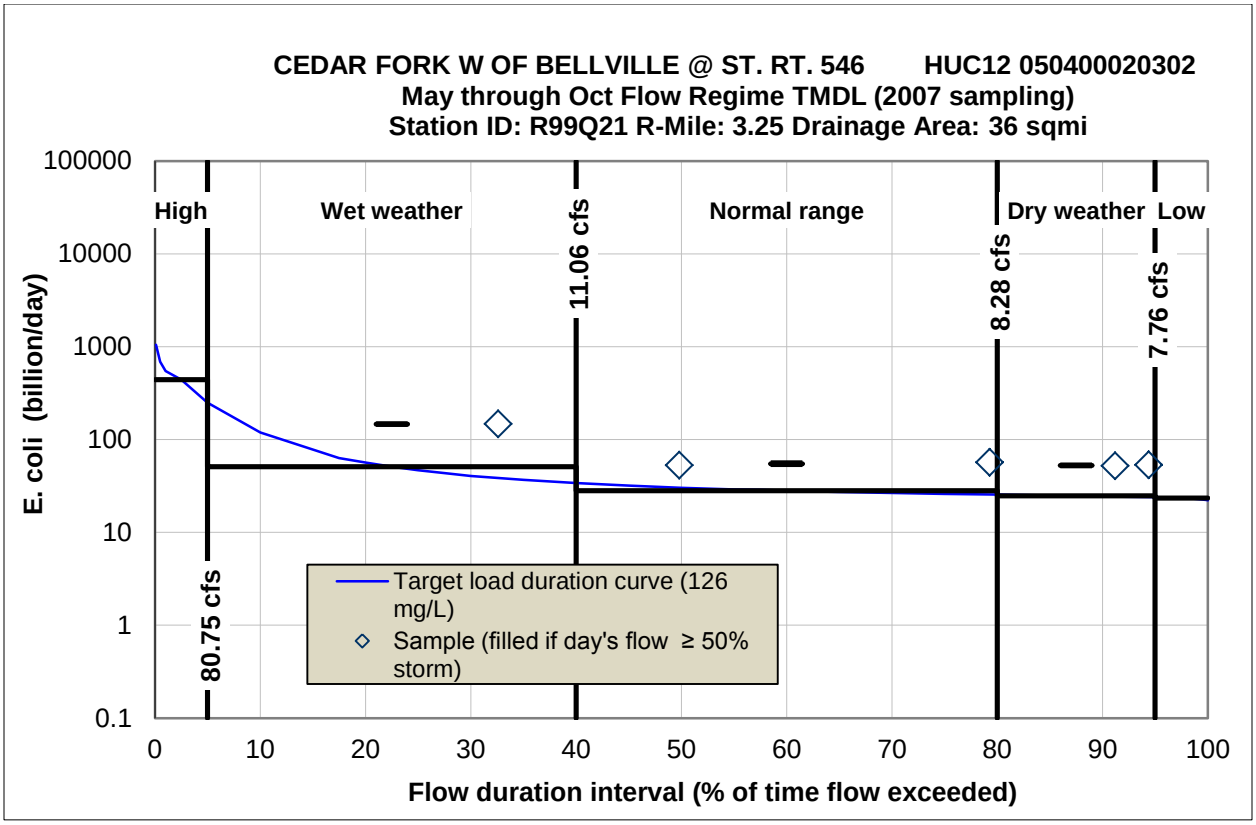

Figure D4-9. *E. coli* load duration curve for site on Cedar Fork W of Bellville at St. Rt. 546.

Table D4-9. *E. coli* TMDL for site on Cedar Fork W of Bellville at St. Rt. 546 (in billion cfu/day).

TMDL and Duration Intervals	High 0-5%	Wet weather 5-40%	Normal range 40-80%	Dry weather 80-95%	Low 95-100%
Samples Per Regime		1	2	2	
Median Sample load		147	54.96	52.73	
Total Load Reduction Required	No Data	**74.2%**	**61.9%**	**65.1%**	No Data
Total Maximum Daily Load	440.64	51.08	28.18	24.75	23.52
Margin of Safety: 20%	88.13	10.22	5.64	4.95	4.70
Allowance for future growth: 5.6%	24.68	2.86	1.58	1.39	1.32
Load Allocation	327.34	37.50	20.46	17.92	17.00
Wasteload Allocation Total	0.50	0.50	0.50	0.50	0.50
MS4	0.00	0.00	0.00	0.00	0.00
Hickory Grove MHP 4PY00005	0.12	0.12	0.12	0.12	0.12
Johnsville WWTP - Morrow Co 4PG00052	0.24	0.24	0.24	0.24	0.24
Cedar Creek Court MHP 2PY00068	0.10	0.10	0.10	0.10	0.10
BRAMARJAC Inc DBA Pebble Creek Golf Club 2PR00255	0.03	0.03	0.03	0.03	0.03

Values were adjusted for rounding.

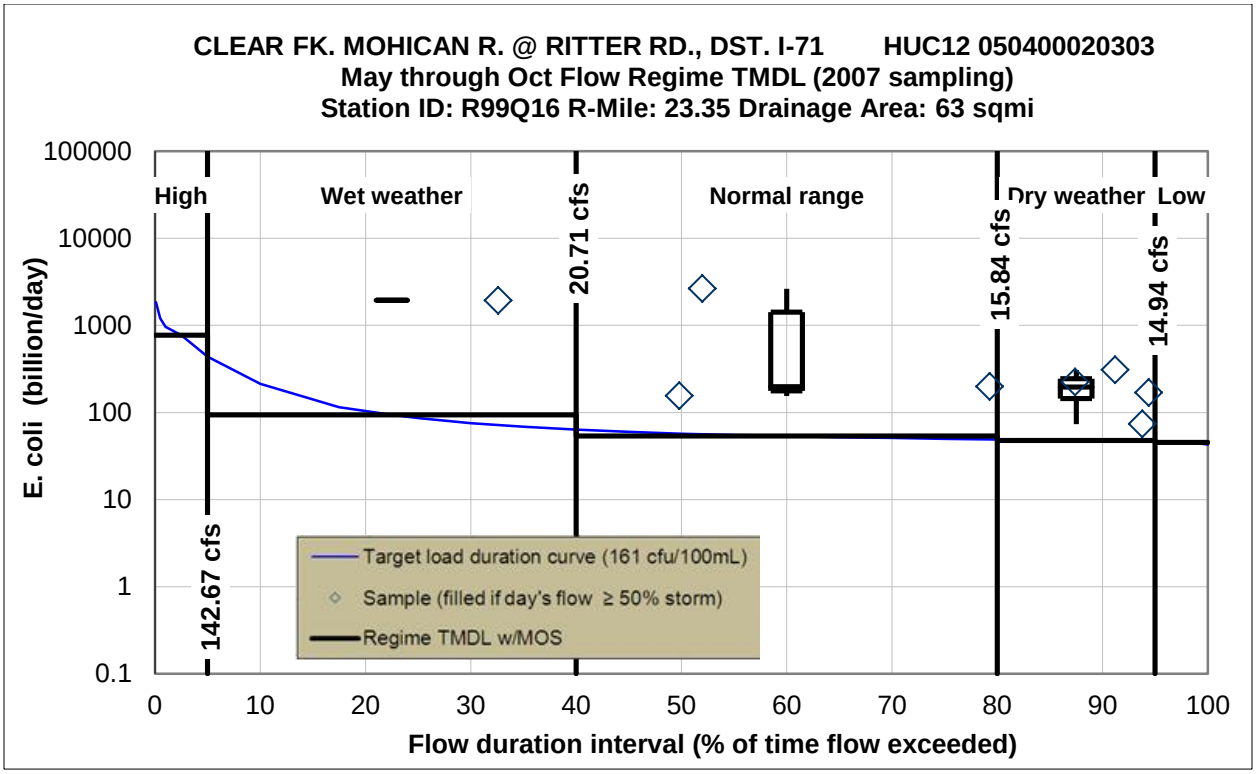

Figure D4-10. ***E. coli*** **load duration curve for site on Clear Fork Mohican R. at Ritter Rd.**

Table D4-10. ***E. coli*** **TMDL for site on Clear Fork Mohican R. at Ritter Rd (in billion cfu/day).**

TMDL and Duration Intervals	High 0-5%	Wet weather 5-40%	Normal range 40-80%	Dry weather 80-95%	Low 95-100%
Samples Per Regime		1	3	4	
Median Sample load		1937	198.39	195.57	
Total Load Reduction Required	No Data	**96.4%**	**79.9%**	**81.9%**	No Data
Total Maximum Daily Load	775.30	93.56	53.48	47.50	45.32
Margin of Safety: 20%	155.06	18.71	10.70	9.50	9.06
Allowance for future growth: 5.6%	43.42	5.24	3.00	2.66	2.54
Load Allocation	412.54	42.27	20.51	17.26	16.07
Wasteload Allocation Total	164.26	27.32	19.27	18.06	17.62
MS4 (27% of total area)	152.58	15.64	7.59	6.38	5.94
Lexington WWTP 2PB00019	7.15	7.15	7.15	7.15	7.15
Hamilton Standard Controls United Technologies 2IN00107	0.00	0.00	0.00	0.00	0.00
Mid-Ohio Sports Car Course 4PX00053	0.14	0.14	0.14	0.14	0.14
42 Motel 2PR00219	0.01	0.01	0.01	0.01	0.01
Mansfield WTP 2IV00052	0.14	0.14	0.14	0.14	0.14
General Motors LLC 2IS00045	4.24	4.24	4.24	4.24	4.24

Values were adjusted for rounding.

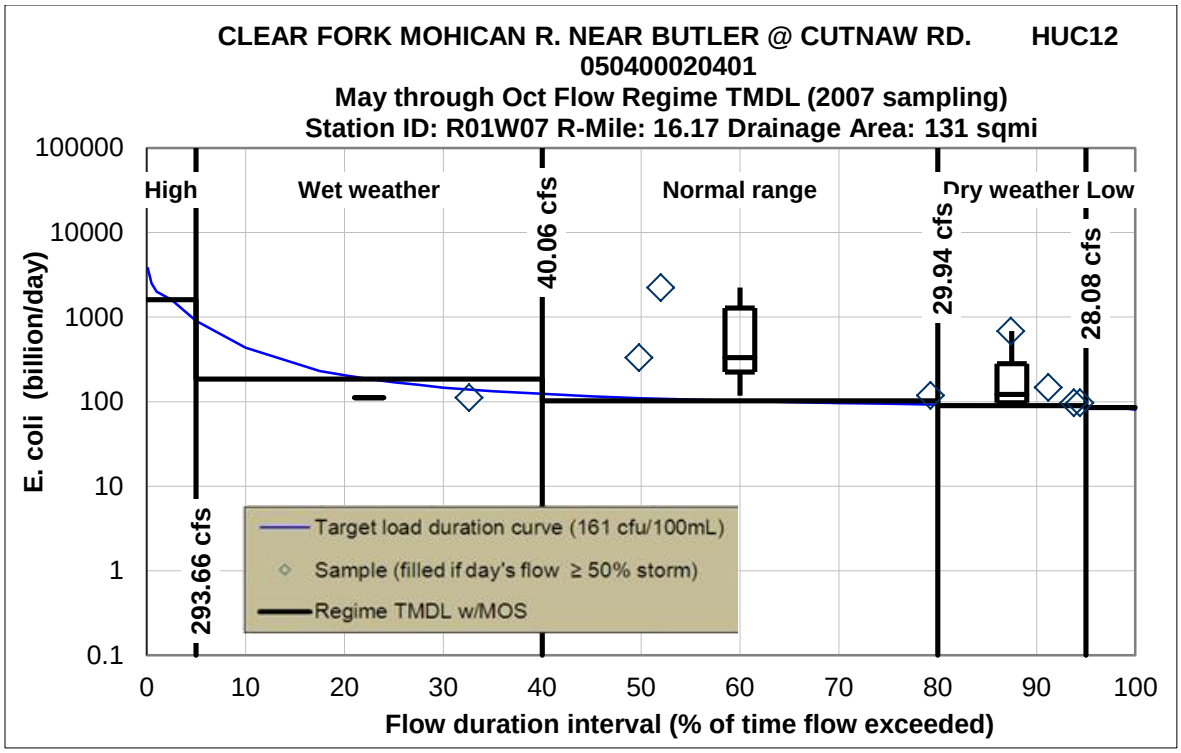

Figure D4-11. ***E. coli*** **load duration curve for site on Clear Fork Mohican R. near Butler at Cutnaw Rd.**

Table D4-11. ***E. coli*** **TMDL for site on Clear Fork Mohican R. near Butler at Cutnaw Rd (in billion cfu/day).**

TMDL and Duration Intervals	High 0-5%	Wet weather 5-40%	Normal range 40-80%	Dry weather 80-95%	Low 95-100%
Samples Per Regime		1	3	4	
Median Sample load		111	331.65	121.81	
Total Load Reduction Required	No Data	**NA**	**77.1%**	**45.3%**	No Data
Total Maximum Daily Load	1602.90	185.30	101.98	89.52	84.99
Margin of Safety: 20%	320.58	37.06	20.40	17.90	17.00
Allowance for future growth: 5.6%	89.76	10.38	5.71	5.01	4.76
Load Allocation	1186.43	131.73	69.74	60.47	57.10
Wasteload Allocation Total	6.13	6.13	6.13	6.13	6.13
MS4	0.00	0.00	0.00	0.00	0.00
SDD Holdings II LLC 2GS00016	0.01	0.01	0.01	0.01	0.01
Clear Fork High School 2GS00017	0.10	0.10	0.10	0.10	0.10
Ashford-Mansfield LLC dba Clear Fork MHP 2PY00024	0.14	0.14	0.14	0.14	0.14
Bellville WWTP 2PB00057	1.57	1.57	1.57	1.57	1.57
DH Bowman & Sons Inc 2IJ00101	0.00	0.00	0.00	0.00	0.00
BP Amoco Oil Corp Bulk Plant Bellville 2IN00175	0.0024	0.0024	0.0024	0.0024	0.0024
General Motors LLC 2IS00045	4.24	4.24	4.24	4.24	4.24
Lake Timberland Camp Resort 2GV00004	0.06	0.06	0.06	0.06	0.06

Values were adjusted for rounding.

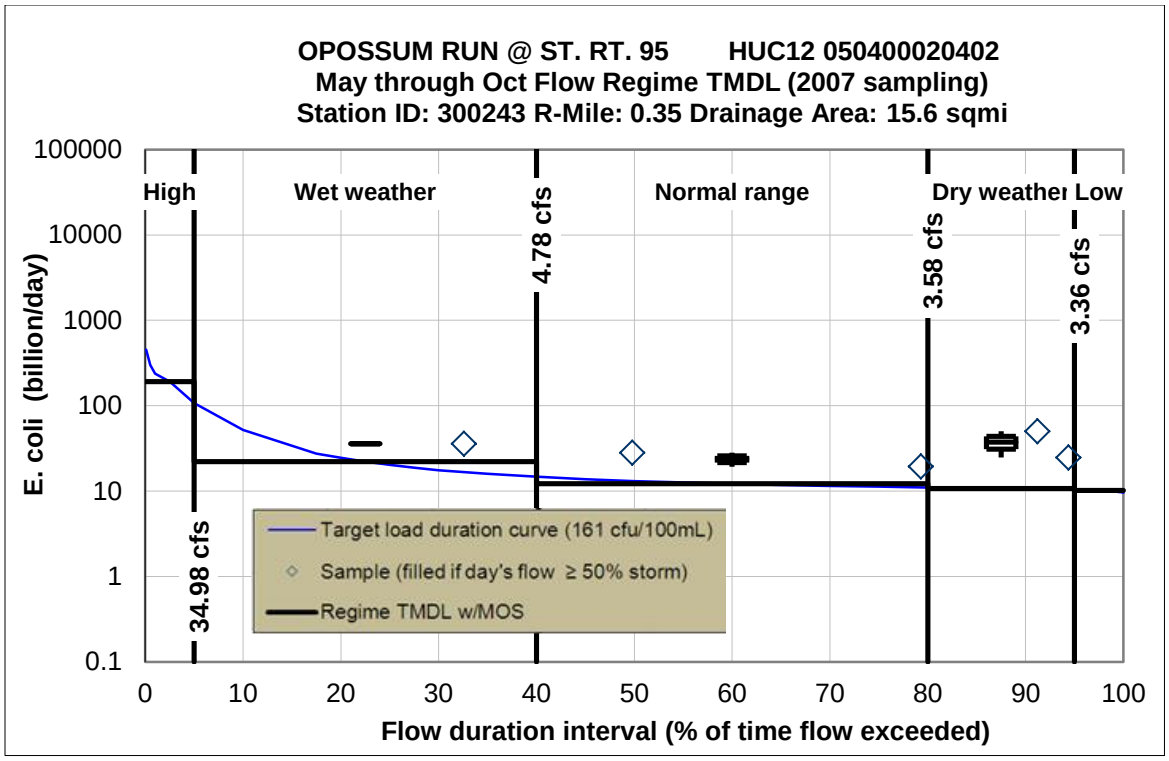

Figure D4-12. ***E. coli*** **load duration curve for site on Opossum Run at St. Rt. 95.**

Table D4-12. ***E. coli*** **TMDL for site on Opossum Run at St. Rt. 95 (in billion cfu/day).**

TMDL and Duration Intervals	High 0-5%	Wet weather 5-40%	Normal range 40-80%	Dry weather 80-95%	Low 95-100%
Samples Per Regime		1	2	2	
Median Sample load		36	23.72	37.36	
Total Load Reduction Required	No Data	**54.1%**	**61.8%**	**78.7%**	No Data
Total Maximum Daily Load	190.91	22.10	12.18	10.70	10.17
Margin of Safety: 20%	38.18	4.42	2.44	2.14	2.03
Allowance for future growth: 5.6%	10.69	1.24	0.68	0.60	0.57
Load Allocation	141.96	16.37	8.99	7.89	7.50
Wasteload Allocation Total	0.07	0.07	0.07	0.07	0.07
MS4	0.00	0.00	0.00	0.00	0.00
Ohio Ski Slopes Inc. DBA Snow Trails 2PR00220	0.07	0.07	0.07	0.07	0.07

Values were adjusted for rounding.

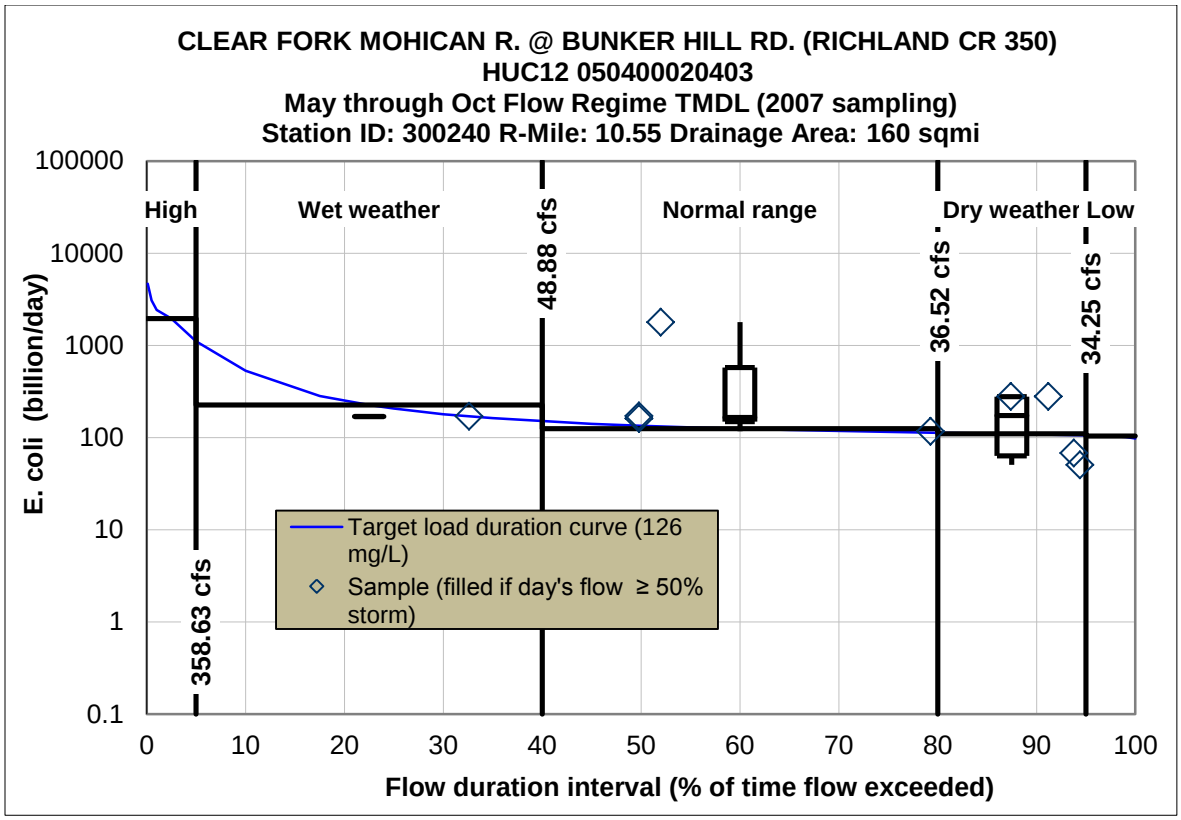

Figure D4-13. ***E. coli*** **load duration curve for site on Clear Fork Mohican R. at Bunker Hill Rd.**

Table D4-13. *E. coli* TMDL for site on Clear Fork Mohican R. at Bunker Hill Rd (in billion cfu/day).

TMDL and Duration Intervals	High 0-5%	Wet weather 5-40%	Normal range 40-80%	Dry weather 80-95%	Low 95-100%
Samples Per Regime		1	4	4	
Median Sample load		170	165.59	172.98	
Total Load Reduction Required	No Data	**0.8%**	**43.9%**	**52.8%**	No Data
Total Maximum Daily Load	1957.60	226.18	124.42	109.22	103.67
Margin of Safety: 20%	391.52	45.24	24.88	21.84	20.73
Allowance for future growth: 5.6%	109.63	12.67	6.97	6.12	5.81
Load Allocation	1449.64	161.46	85.76	74.45	70.32
Wasteload Allocation Total	6.81	6.81	6.81	6.81	6.81
MS4	0.00	0.00	0.00	0.00	0.00
Butler WWTP 2PA00044	0.57	0.57	0.57	0.57	0.57
Camp Otyokwah 2PR00226	0.05	0.05	0.05	0.05	0.05
SDD Holdings II LLC 2GS00016	0.01	0.01	0.01	0.01	0.01
Clear Fork High School 2GS00017	0.10	0.10	0.10	0.10	0.10
Ashford-Mansfield LLC dba Clear Fork MHP 2PY00024	0.14	0.14	0.14	0.14	0.14
Bellville WWTP 2PB00057	1.57	1.57	1.57	1.57	1.57
DH Bowman & Sons Inc 2IJ00101	0.00	0.00	0.00	0.00	0.00
BP Amoco Oil Corp Bulk Plant Bellville 2IN00175	0.0024	0.0024	0.0024	0.0024	0.0024
General Motors LLC 2IS00045	4.24	4.24	4.24	4.24	4.24
Lake Timberland Camp Resort 2GV00004	0.06	0.06	0.06	0.06	0.06
Clear Fork Resort 2PR00285	0.06	0.06	0.06	0.06	0.06

Values were adjusted for rounding.

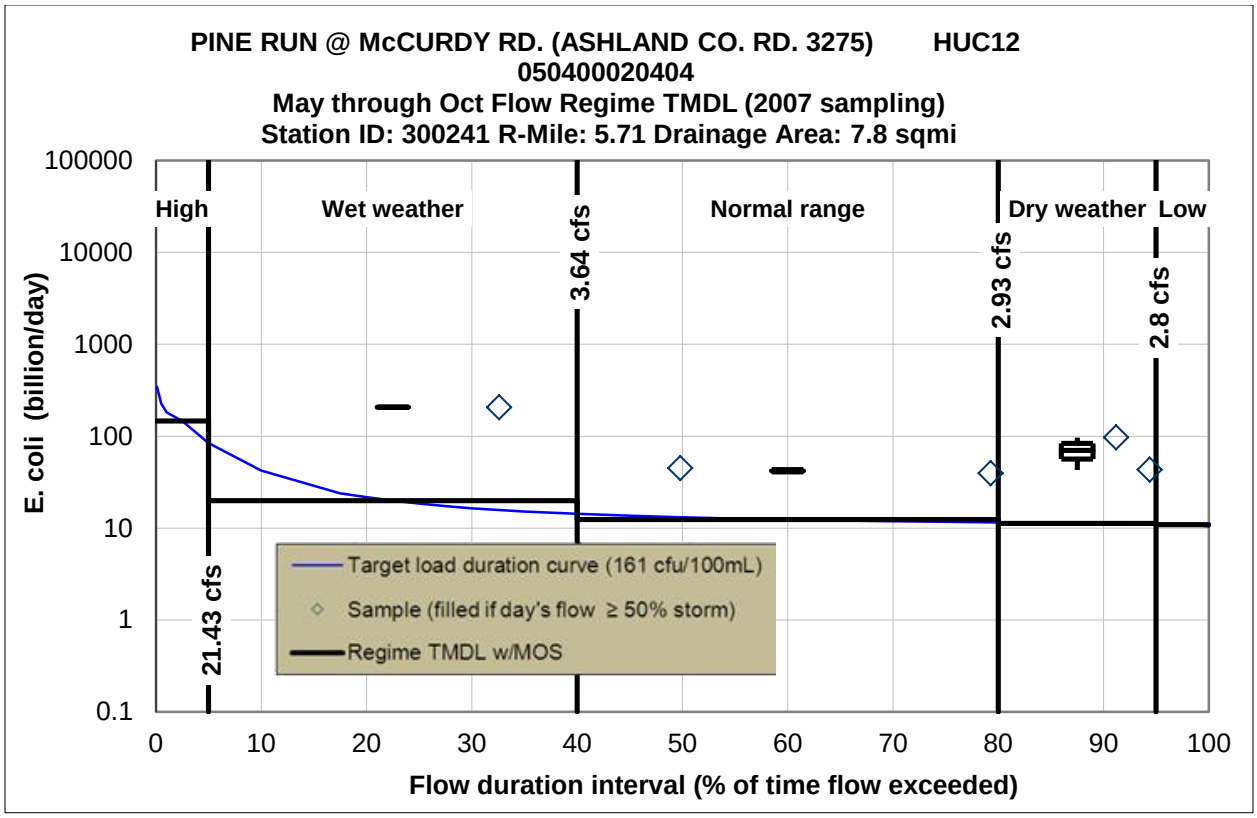

Figure D4-14. ***E. coli*** **load duration curve for site on Pine Run at McCurdy Rd. (Ashland Co. Rd. 3275).**

Table D4-14. ***E. coli*** **TMDL for site on Pine Run at McCurdy Rd. (Ashland Co. Rd. 3275) (in billion cfu/day).**

TMDL and Duration Intervals	High 0-5%	Wet weather 5-40%	Normal range 40-80%	Dry weather 80-95%	Low 95-100%
Samples Per Regime		1	2	2	
Median Sample load		206	42.13	70.02	
Total Load Reduction Required	No Data	**92.8%**	**78.1%**	**88.0%**	No Data
Total Maximum Daily Load	146.92	19.89	12.41	11.30	10.87
Margin of Safety: 20%	29.38	3.98	2.48	2.26	2.17
Allowance for future growth: 5.6%	8.23	1.11	0.69	0.63	0.61
Load Allocation	109.27	14.75	9.19	8.37	8.04
Wasteload Allocation Total	0.05	0.05	0.05	0.05	0.05
MS4	0.00	0.00	0.00	0.00	0.00
Butler Mohican KOA 2PR00266	0.05	0.05	0.05	0.05	0.05

Values were adjusted for rounding.

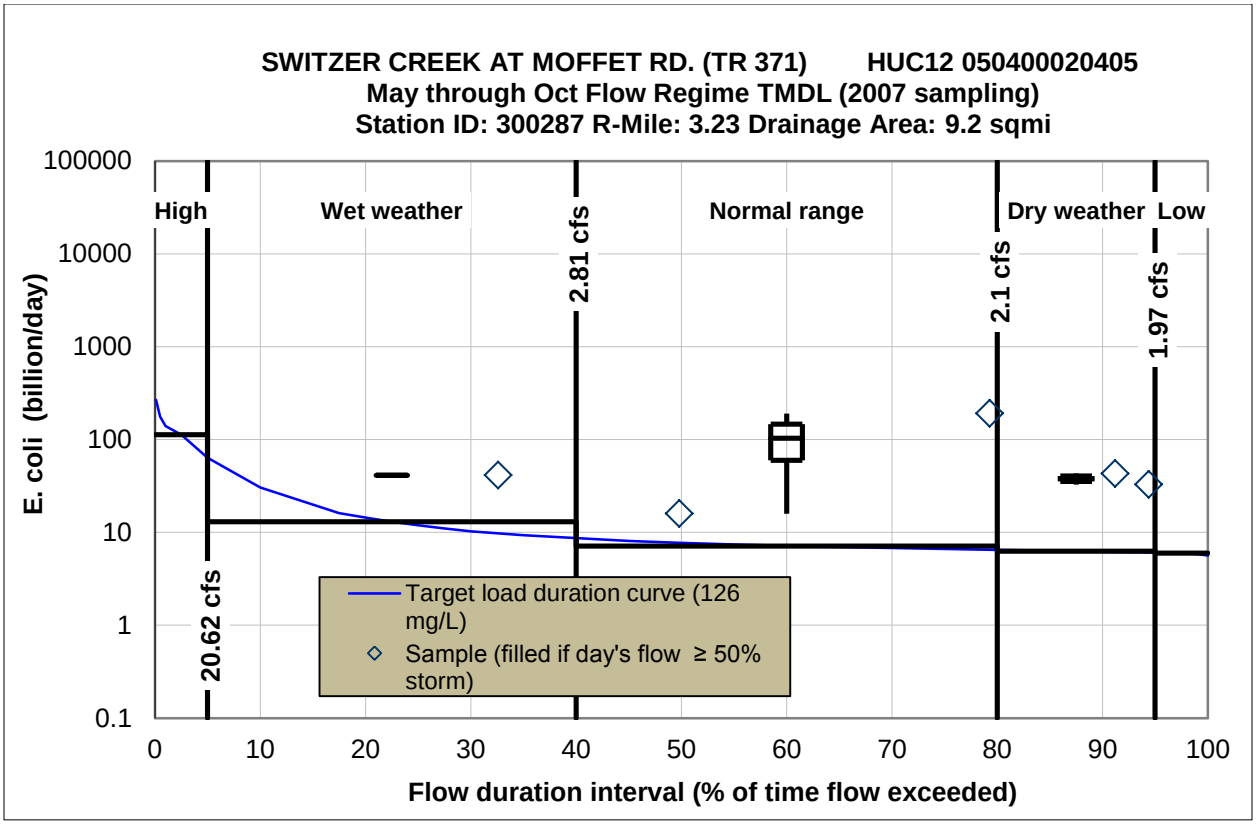

Figure D4-15. ***E. coli*** **load duration curve for site on Switzer Ck. at Moffet Rd. (TR 371).**

Table D4-15. ***E. coli*** **TMDL for site on Switzer Ck. at Moffet Rd. (TR 371) (in billion cfu/day).**

TMDL and Duration Intervals	High 0-5%	Wet weather 5-40%	Normal range 40-80%	Dry weather 80-95%	Low 95-100%
Samples Per Regime		1	2	2	
Median Sample load		41	103.33	37.95	
Total Load Reduction Required	No Data	**76.6%**	**94.9%**	**87.7%**	No Data
Total Maximum Daily Load	112.58	13.01	7.15	6.29	5.98
Margin of Safety: 20%	22.52	2.60	1.43	1.26	1.20
Allowance for future growth: 5.6%	6.30	0.73	0.40	0.35	0.33
Load Allocation	83.76	9.68	5.32	4.68	4.45
Wasteload Allocation Total	0.00	0.00	0.00	0.00	0.00
MS4	0.00	0.00	0.00	0.00	0.00
No NPDES facilities	0.00	0.00	0.00	0.00	0.00

Values were adjusted for rounding.

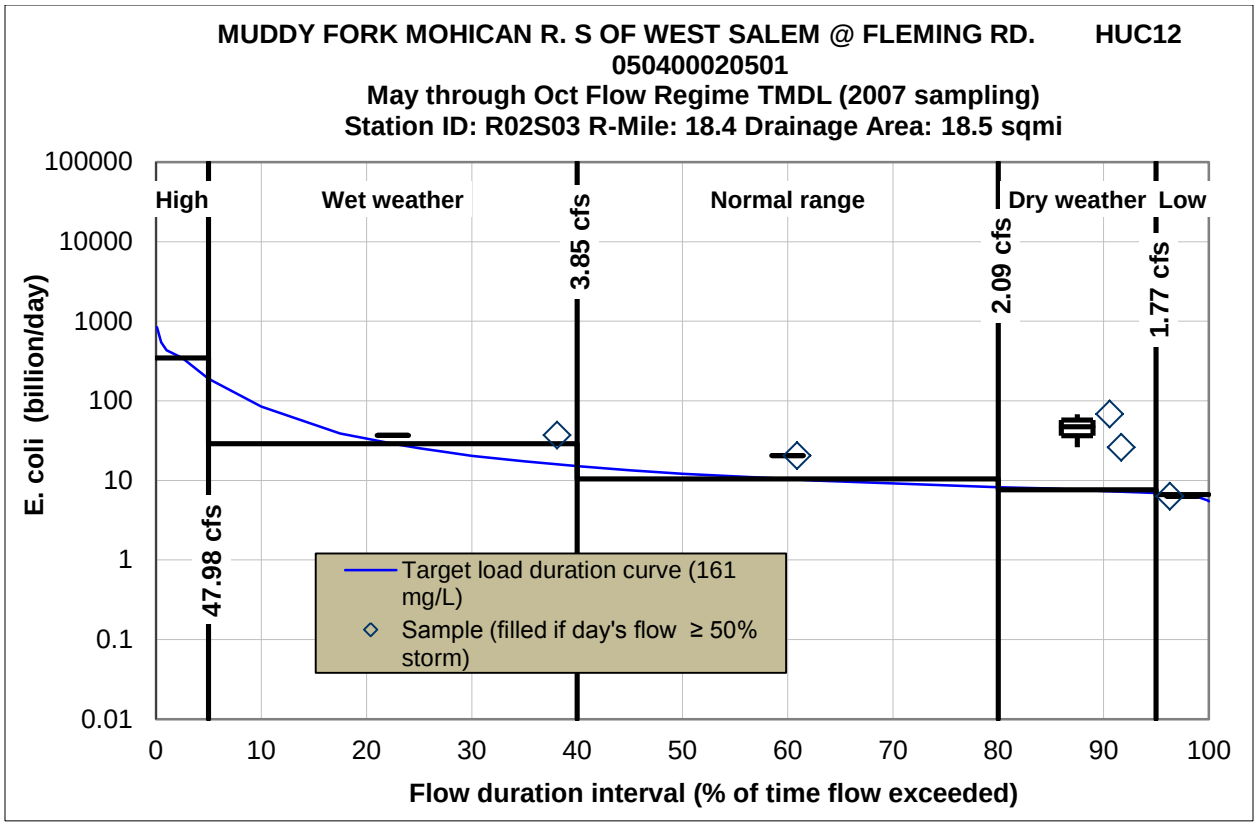

Figure D4-16. ***E. coli*** **load duration curve for site on Muddy Fork Mohican R. S of West Salem at Fleming Rd.**

Table D4-16. ***E. coli*** **TMDL for site on Muddy Fork Mohican R. S of West Salem at Fleming Rd (in billion cfu/day).**

TMDL and Duration Intervals	High 0-5%	Wet weather 5-40%	Normal range 40-80%	Dry weather 80-95%	Low 95-100%
Samples Per Regime		1	1	2	1
Median Sample load		37	20.43	47.03	6.31
Total Load Reduction Required	No Data	**41.7%**	**62.1%**	**88.0%**	**22.0%**
Total Maximum Daily Load	344.07	28.91	10.40	7.60	6.62
Margin of Safety: 20%	68.81	5.78	2.08	1.52	1.32
Allowance for future growth: 5.6%	19.27	1.62	0.58	0.43	0.37
Load Allocation	253.83	19.35	5.58	3.50	2.77
Wasteload Allocation Total	2.16	2.16	2.16	2.16	2.16
MS4	0.00	0.00	0.00	0.00	0.00
West Salem WWTP 3PB00053	1.24	1.24	1.24	1.24	1.24
Cinnamon Lake Association WWTP 2PR00009	0.91	0.91	0.91	0.91	0.91

Values were adjusted for rounding.

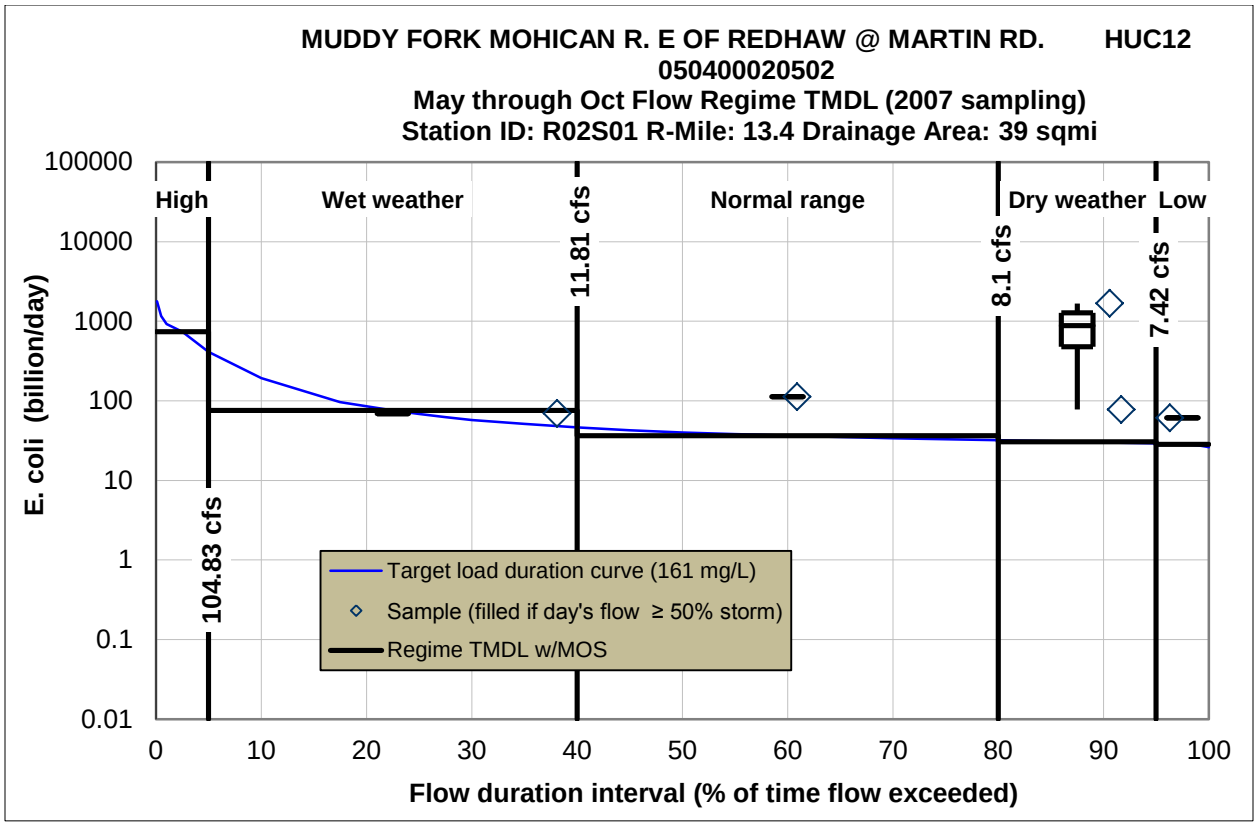

Figure D4-17. ***E. coli*** **load duration curve for site on Muddy Fork Mohican R. E of Redshaw at Martin Rd.**

Table D4-17. ***E. coli*** **TMDL for site on Muddy Fork Mohican R. E of Redshaw at Martin Rd (in billion cfu/day).**

TMDL and Duration Intervals	High 0-5%	Wet weather 5-40%	Normal range 40-80%	Dry weather 80-95%	Low 95-100%
Samples Per Regime		1	1	2	1
Median Sample load		69	112.58	876.78	60.97
Total Load Reduction Required	No Data	**18.8%**	**75.9%**	**97.4%**	**65.2%**
Total Maximum Daily Load	739.90	75.51	36.48	30.61	28.48
Margin of Safety: 20%	147.98	15.10	7.30	6.12	5.70
Allowance for future growth: 5.6%	41.43	4.23	2.04	1.71	1.59
Load Allocation	547.98	53.67	24.63	20.26	18.68
Wasteload Allocation Total	2.51	2.51	2.51	2.51	2.51
MS4	0.00	0.00	0.00	0.00	0.00
American Augers Inc 2PR00172	0.05	0.05	0.05	0.05	0.05
Northwestern Local Sch Dist WWTP 3PT00009	0.09	0.09	0.09	0.09	0.09
Hidden Acres MHP 2PR00239	0.09	0.09	0.09	0.09	0.09
ODOT Rest Area 3-36 3PP00029	0.12	0.12	0.12	0.12	0.12
West Salem WWTP 3PB00053	1.24	1.24	1.24	1.24	1.24
Cinnamon Lake Association WWTP 2PR00009	0.91	0.91	0.91	0.91	0.91

Values were adjusted for rounding.

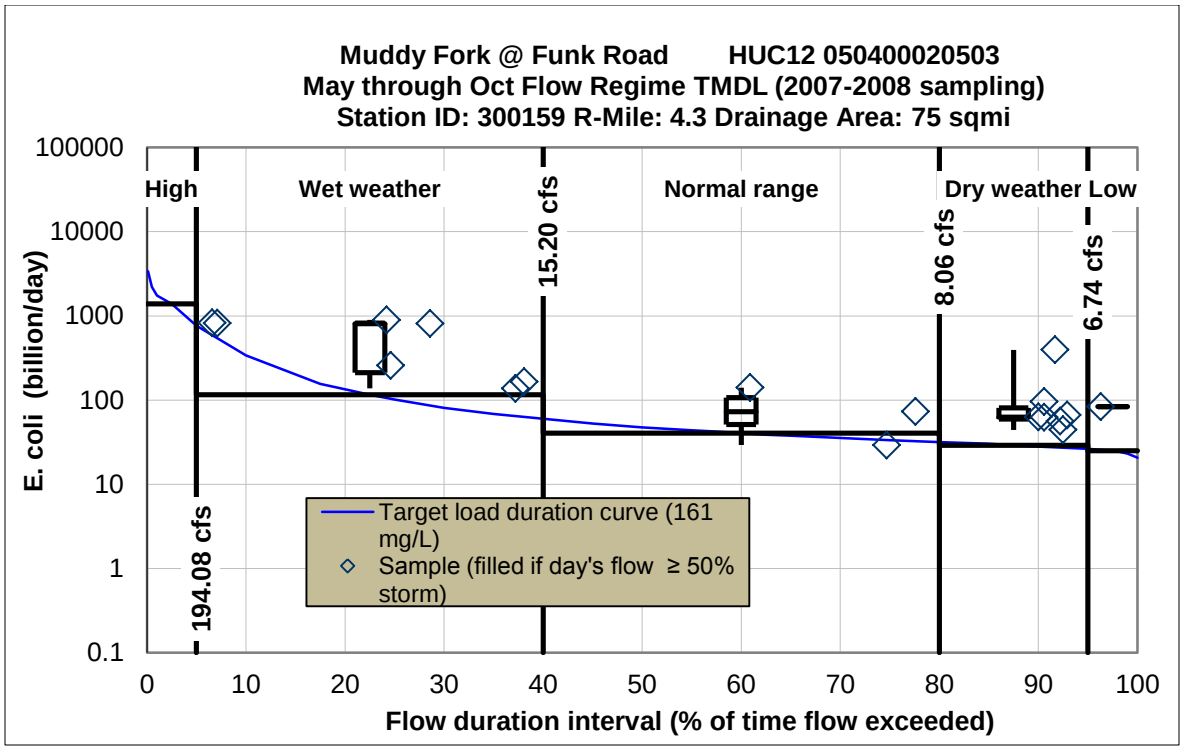

Figure D4-18. ***E. coli*** **load duration curve for site on Muddy Fork at Funk Rd.**

Table D4-18. ***E. coli*** **TMDL for site on Muddy Fork at Funk Rd (in billion cfu/day).**

TMDL and Duration Intervals	High 0-5%	Wet weather 5-40%	Normal range 40-80%	Dry weather 80-95%	Low 95-100%
Samples Per Regime		7	3	7	1
Median Sample load		810	73.07	63.10	83.65
Total Load Reduction Required	No Data	**89.4%**	**58.8%**	**65.5%**	**77.6%**
Total Maximum Daily Load	1393.26	115.57	40.49	29.23	25.17
Margin of Safety: 20%	278.65	23.11	8.10	5.85	5.03
Allowance for future growth: 5.6%	78.02	6.47	2.27	1.64	1.41
Load Allocation	1033.79	83.19	27.34	18.96	15.94
Wasteload Allocation Total	2.79	2.79	2.79	2.79	2.79
MS4	0.00	0.00	0.00	0.00	0.00
Country Pointe Health Care Inc LLC, 001 3PR00488	0.17	0.17	0.17	0.17	0.17
Koenig's Korner 3PR00423	0.0034	0.0034	0.0034	0.0034	0.0034
American Augers Inc 2PR00172	0.05	0.05	0.05	0.05	0.05
Northwestern Local Sch Dist WWTP 3PT00009	0.09	0.09	0.09	0.09	0.09
Hidden Acres MHP 2PR00239	0.09	0.09	0.09	0.09	0.09
ODOT Rest Area 3-36 3PP00029	0.12	0.12	0.12	0.12	0.12
West Salem WWTP 3PB00053	1.24	1.24	1.24	1.24	1.24
Cinnamon Lake Assn. WWTP 2PR00009	0.91	0.91	0.91	0.91	0.91
Country Pointe Health Care Inc LLC, 002 3PR00488	0.17	0.17	0.17	0.17	0.17

Values were adjusted for rounding.

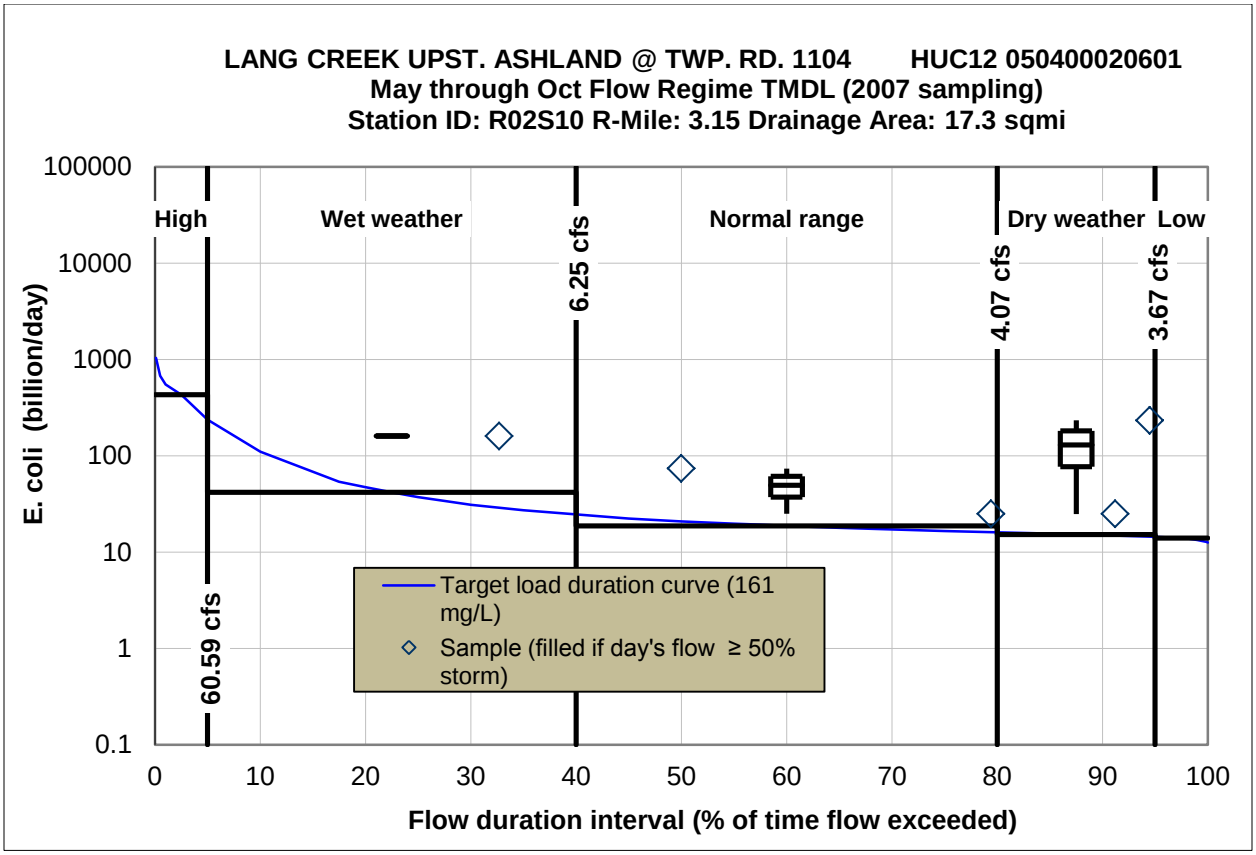

Figure D4-19. ***E. coli*** **load duration curve for site on Lang Ck. Ashland at Twp. Rd. 1104.**

Table D4-19. ***E. coli*** **TMDL for site on Lang Ck. Ashland at Twp. Rd. 1104 (in billion cfu/day).**

TMDL and Duration Intervals	High 0-5%	Wet weather 5-40%	Normal range 40-80%	Dry weather 80-95%	Low 95-100%
Samples Per Regime		1	2	2	
Median Sample load		161	49.41	129.50	
Total Load Reduction Required	No Data	**80.7%**	**71.8%**	**91.2%**	No Data
Total Maximum Daily Load	430.85	41.79	18.71	15.28	14.02
Margin of Safety: 20%	86.17	8.36	3.74	3.06	2.80
Allowance for future growth: 5.6%	24.13	2.34	1.05	0.86	0.79
Load Allocation	230.80	22.39	10.02	8.19	7.51
Wasteload Allocation Total	89.75	8.71	3.90	3.18	2.92
MS4 (28% of total area)	89.75	8.71	3.90	3.18	2.92
No NPDES facilities	0.00	0.00	0.00	0.00	0.00

Values were adjusted for rounding.

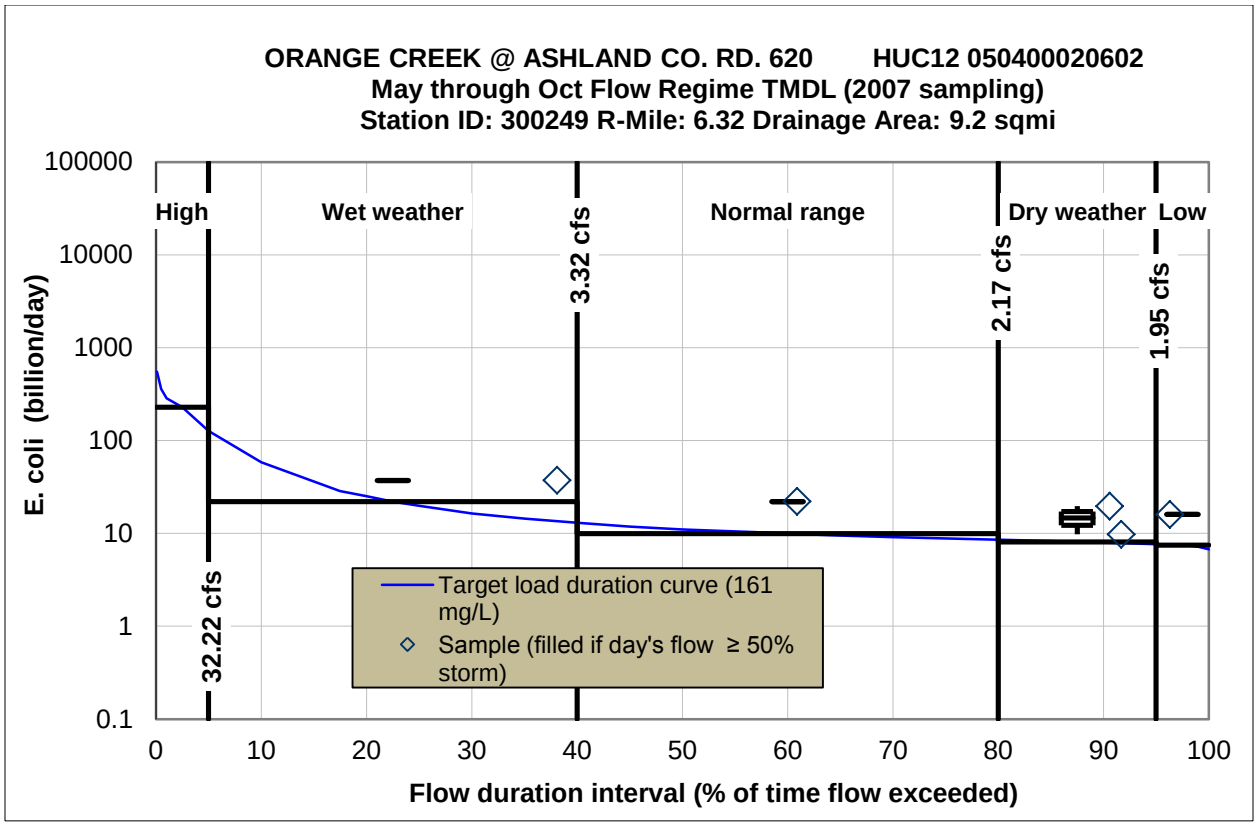

Figure D4-20. ***E. coli*** **load duration curve for site on Orange Ck. at Ashland Co. Rd. 620.**

Table D4-20. ***E. coli*** **TMDL for site on Orange Ck. at Ashland Co. Rd. 620 (in billion cfu/day).**

TMDL and Duration Intervals	High 0-5%	Wet weather 5-40%	Normal range 40-80%	Dry weather 80-95%	Low 95-100%
Samples Per Regime		1	1	2	1
Median Sample load		37	22.05	14.71	15.98
Total Load Reduction Required	No Data	**56.0%**	**66.5%**	**59.0%**	**65.2%**
Total Maximum Daily Load	228.50	22.06	9.93	8.11	7.48
Margin of Safety: 20%	45.70	4.41	1.99	1.62	1.50
Allowance for future growth: 5.6%	12.80	1.24	0.56	0.45	0.42
Load Allocation	170.00	16.41	7.39	6.04	5.57
Wasteload Allocation Total	0.00	0.00	0.00	0.00	0.00
MS4	0.00	0.00	0.00	0.00	0.00
No NPDES facilities	0.00	0.00	0.00	0.00	0.00

Values were adjusted for rounding.

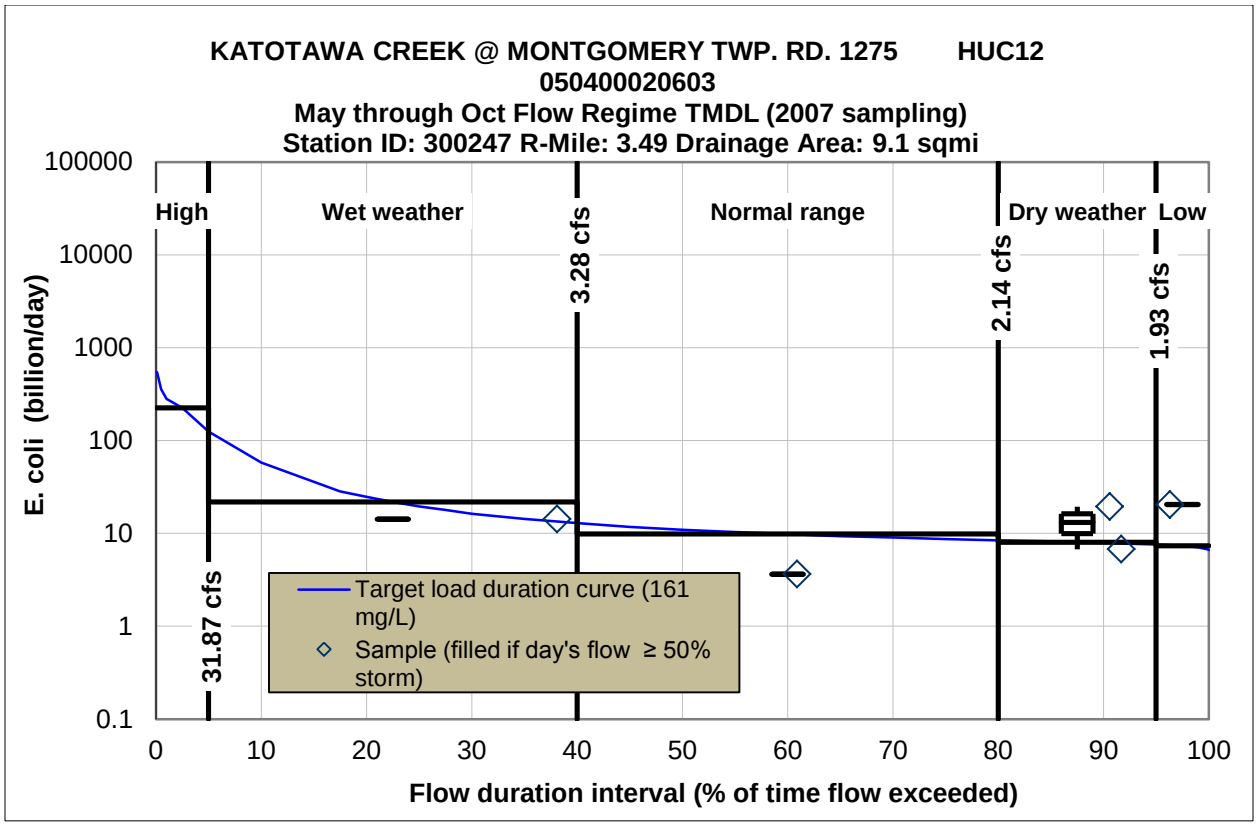

Figure D4-21. ***E. coli*** **load duration curve for site on Katotawa Ck. at Montgomery Twp. Rd. 1275.**

Table D4-21. ***E. coli*** **TMDL for site on Katotawa Ck. at Montgomery Twp. Rd. 1275 (in billion cfu/day).**

TMDL and Duration Intervals	High 0-5%	Wet weather 5-40%	Normal range 40-80%	Dry weather 80-95%	Low 95-100%
Samples Per Regime		1	1	2	1
Median Sample load		14	3.64	13.10	20.46
Total Load Reduction Required	No Data	**NA**	**NA**	**54.4%**	**73.2%**
Total Maximum Daily Load	226.02	21.82	9.85	8.04	7.37
Margin of Safety: 20%	45.20	4.36	1.97	1.61	1.47
Allowance for future growth: 5.6%	12.66	1.22	0.55	0.45	0.41
Load Allocation	168.16	16.24	7.33	5.98	5.48
Wasteload Allocation Total	0.00	0.00	0.00	0.00	0.00
MS4	0.00	0.00	0.00	0.00	0.00
No NPDES facilities	0.00	0.00	0.00	0.00	0.00

Values were adjusted for rounding.

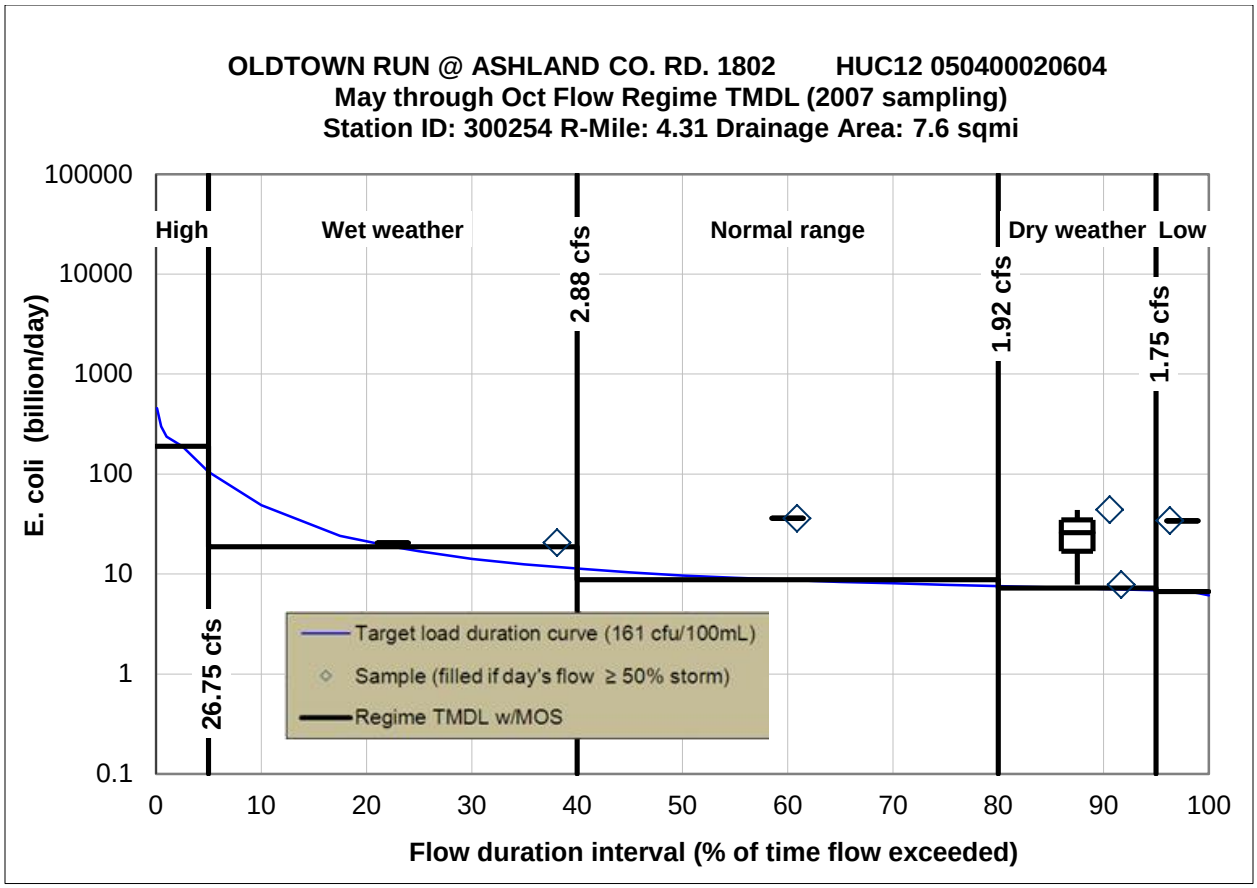

Figure D4-22. ***E. coli*** **load duration curve for site on Oldtown Run at Ashland Co. Rd. 1802.**

Table D4-22. ***E. coli*** **TMDL for site on Oldtown Run at Ashland Co. Rd. 1802 (in billion cfu/day).**

TMDL and Duration Intervals	High 0-5%	Wet weather 5-40%	Normal range 40-80%	Dry weather 80-95%	Low 95-100%
Samples Per Regime		1	1	2	1
Median Sample load		21	36.09	25.86	34.10
Total Load Reduction Required	No Data	**32.0%**	**82.0%**	**79.1%**	**85.4%**
Total Maximum Daily Load	189.31	18.75	8.74	7.25	6.70
Margin of Safety: 20%	37.86	3.75	1.75	1.45	1.34
Allowance for future growth: 5.6%	10.60	1.05	0.49	0.41	0.37
Load Allocation	140.15	13.25	5.81	4.69	4.28
Wasteload Allocation Total	0.70	0.70	0.70	0.70	0.70
MS4	0.00	0.00	0.00	0.00	0.00
Coburn Inc. 2PR00140	0.03	0.03	0.03	0.03	0.03
Hayesville WWTP 2PA00089	0.37	0.37	0.37	0.37	0.37
Hillsdale High School 2PR00269	0.06	0.06	0.06	0.06	0.06
Ashland Co West Holmes JVS 2PT00011	0.24	0.24	0.24	0.24	0.24

Values were adjusted for rounding.

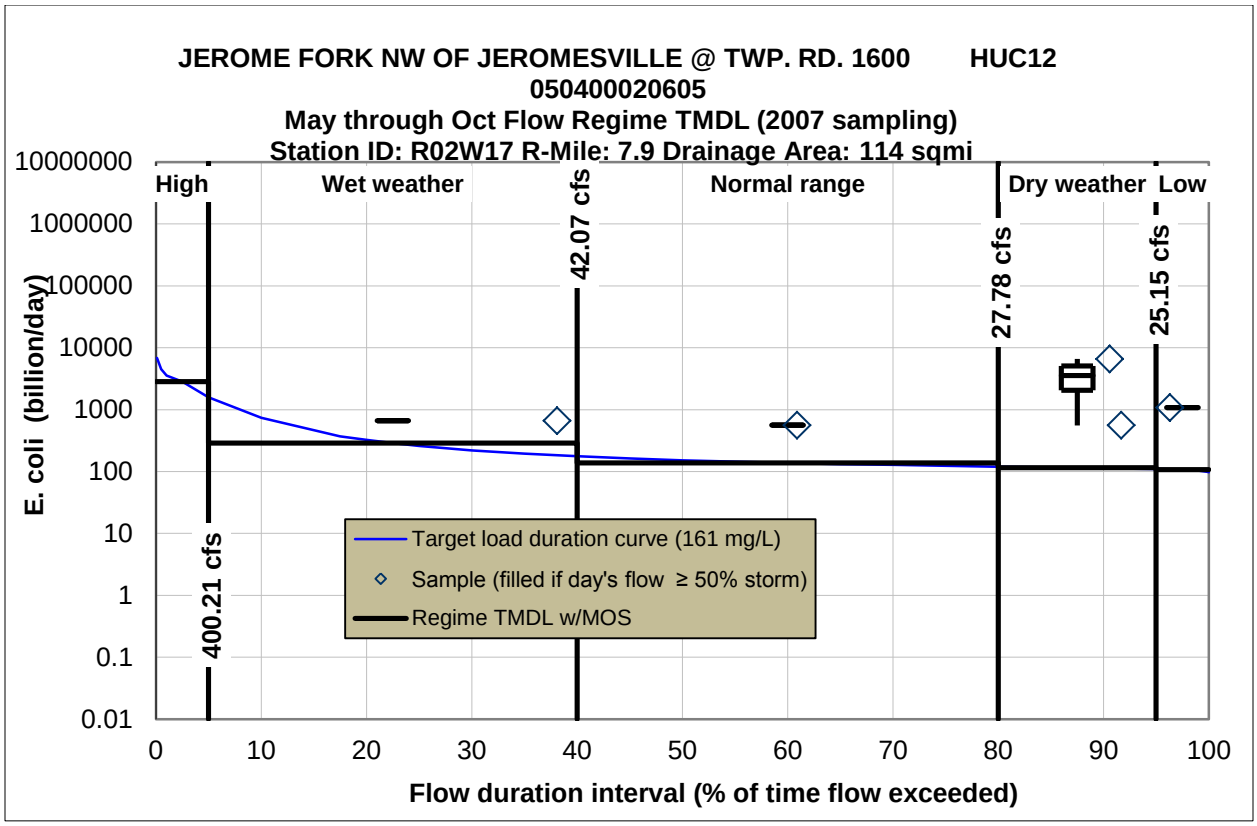

Figure D4-23. *E. coli* load duration curve for site on Jerome Fork NW of Jeromesville at Twp. Rd. 1600.

Table D4-23. *E. coli* TMDL for site on Jerome Fork NW of Jeromesville at Twp. Rd. 1600 (in billion cfu/day).

TMDL and Duration Intervals	High 0-5%	Wet weather 5-40%	Normal range 40-80%	Dry weather 80-95%	Low 95-100%
Samples Per Regime		1	1	2	1
Median Sample load		623	517.30	3229.74	971.51
Total Load Reduction Required	No Data	**66.9%**	**81.7%**	**97.6%**	**92.6%**
Total Maximum Daily Load	2835.28	277.23	126.91	104.42	96.27
Margin of Safety: 20%	567.06	55.45	25.38	20.88	19.25
Allowance for future growth: 5.6%	158.78	15.52	7.11	5.85	5.39
Load Allocation	2062.37	172.12	61.05	44.43	38.40
Wasteload Allocation Total	47.08	34.14	33.38	33.26	33.22
MS4 (0.68% of total area)	14.12	1.18	0.42	0.30	0.26
Maverick Innovative Solutions LLC 2PR00217	0.01	0.01	0.01	0.01	0.01
Green Acres MHP 2PY00058	0.11	0.11	0.11	0.11	0.11
C&R Enterprises C&DD 2IN00231	0.00	0.00	0.00	0.00	0.00
Agape Acres Inc 2PY00037	0.12	0.12	0.12	0.12	0.12
Mapleton Jr & Sr HS 2PT00040	0.13	0.13	0.13	0.13	0.13
Southwood Estates Homeowners Assoc Ltd 2GS00015	0.12	0.12	0.12	0.12	0.12
Ashland WTP 2IW00002	1.84	1.84	1.84	1.84	1.84
Ashland WWTP 2PD00010	30.47	30.47	30.47	30.47	30.47
Fin Feather and Fur Outfitters Mini-Mall 2PR00145	0.03	0.03	0.03	0.03	0.03
Unique Ventures Group LLC DBA Perkins Restaurant 2PR00221	0.12	0.12	0.12	0.12	0.12

Values were adjusted for rounding.

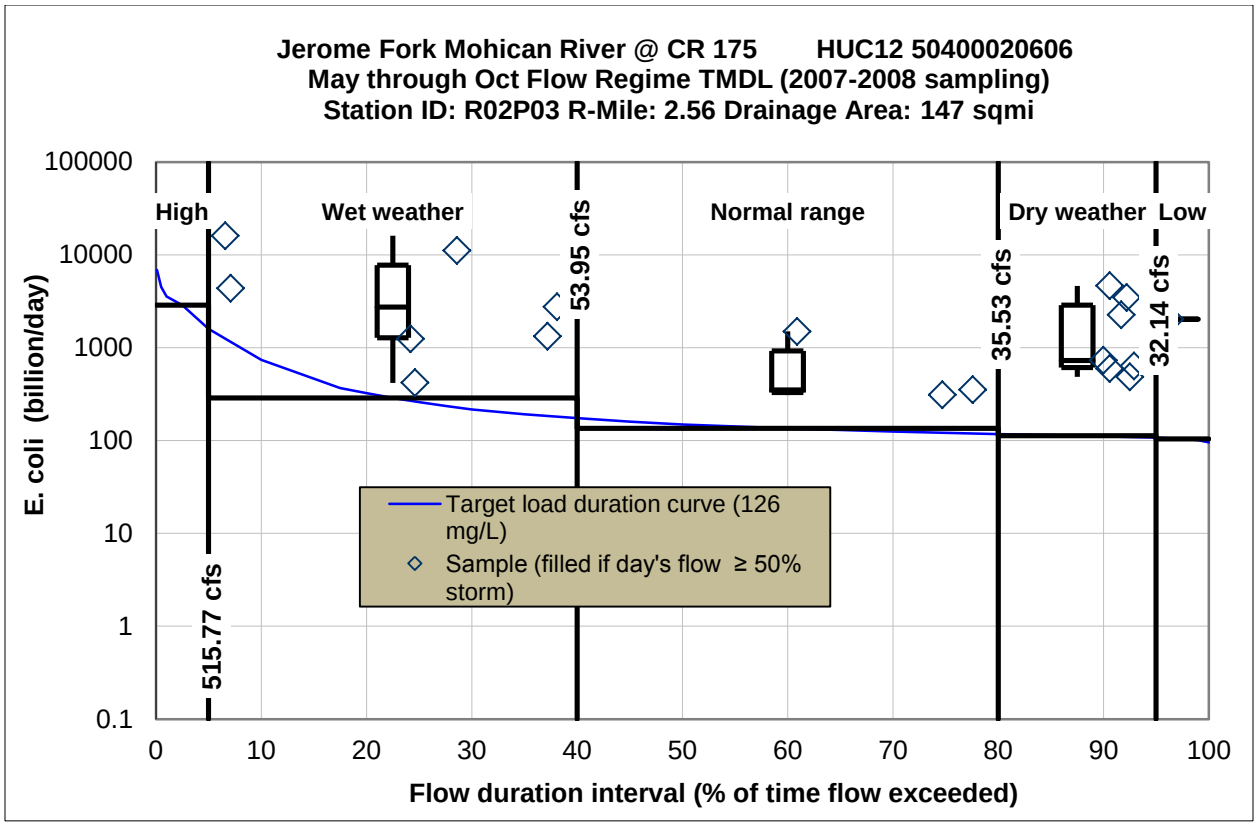

Figure D4-24. *E. coli* load duration curve for site on Jerome Fork Mohican R. at CR 175.

Table D4-24. *E. coli* TMDL for site on Jerome Fork Mohican R. at CR 175 (in billion cfu/day).

TMDL and Duration Intervals	High 0-5%	Wet weather 5-40%	Normal range 40-80%	Dry weather 80-95%	Low 95-100%
Samples Per Regime		7	3	7	1
Median Sample load		2619	327.35	674.84	1861.91
Total Load Reduction Required	No Data	**92.1%**	**71.1%**	**88.5%**	**96.2%**
Total Maximum Daily Load	2860.33	278.89	127.16	104.47	96.24
Margin of Safety: 20%	572.07	55.78	25.43	20.89	19.25
Allowance for future growth: 5.6%	160.18	15.62	7.12	5.85	5.39
Load Allocation	2095.13	174.54	61.55	44.77	38.65
Wasteload Allocation Total	32.96	32.96	32.96	32.96	32.96
MS4	0.00	0.00	0.00	0.00	0.00
Maverick Innovative Solutions LLC 2PR00217	0.01	0.01	0.01	0.01	0.01
Green Acres MHP 2PY00058	0.11	0.11	0.11	0.11	0.11
C&R Enterprises C&DD 2IN00231	0.00	0.00	0.00	0.00	0.00
Agape Acres Inc 2PY00037	0.12	0.12	0.12	0.12	0.12
Mapleton Jr & Sr HS 2PT00040	0.13	0.13	0.13	0.13	0.13
Southwood Estates Homeowners Assoc Ltd 2GS00015	0.12	0.12	0.12	0.12	0.12
Ashland WTP 2IW00002	1.84	1.84	1.84	1.84	1.84
Ashland WWTP 2PD00010	30.47	30.47	30.47	30.47	30.47
Fin Feather and Fur Outfitters Mini-Mall 2PR00145	0.03	0.03	0.03	0.03	0.03
Unique Ventures Group LLC DBA Perkins Restaurant 2PR00221	0.12	0.12	0.12	0.12	0.12

Values were adjusted for rounding

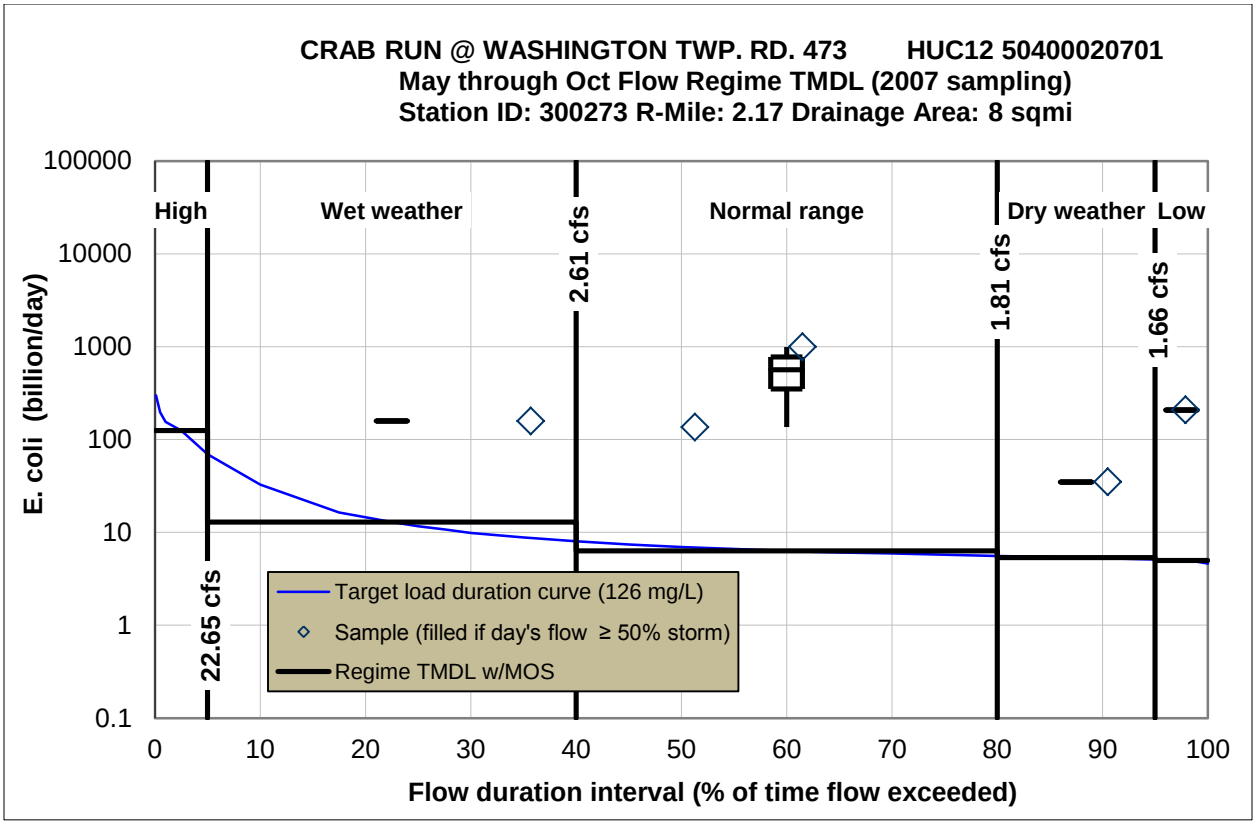

Figure D4-25. *E. coli* load duration curve for site on Crab Run at Washington Twp. Rd. 473.

Table D4-25. *E. coli* TMDL for site on Crab Run at Washington Twp. Rd. 473 (in billion cfu/day).

TMDL and Duration Intervals	High 0-5%	Wet weather 5-40%	Normal range 40-80%	Dry weather 80-95%	Low 95-100%
Samples Per Regime		1	2	1	1
Median Sample load		159	565.16	35.00	208.72
Total Load Reduction Required	No Data	**93.9%**	**99.2%**	**88.6%**	**98.2%**
Total Maximum Daily Load	124.94	12.95	6.35	5.36	5.02
Margin of Safety: 20%	24.99	2.59	1.27	1.07	1.00
Allowance for future growth: 5.6%	7.00	0.73	0.36	0.30	0.28
Load Allocation	92.89	9.56	4.65	3.92	3.67
Wasteload Allocation Total	0.07	0.07	0.07	0.07	0.07
MS4	0.00	0.00	0.00	0.00	0.00
Nashville WWTP 3IX00002	0.03	0.03	0.03	0.03	0.03
Nashville Elem Sch 3PT00063	0.03	0.03	0.03	0.03	0.03
Buckeye Deli 3PR00447	0.01	0.01	0.01	0.01	0.01

Values were adjusted for rounding.

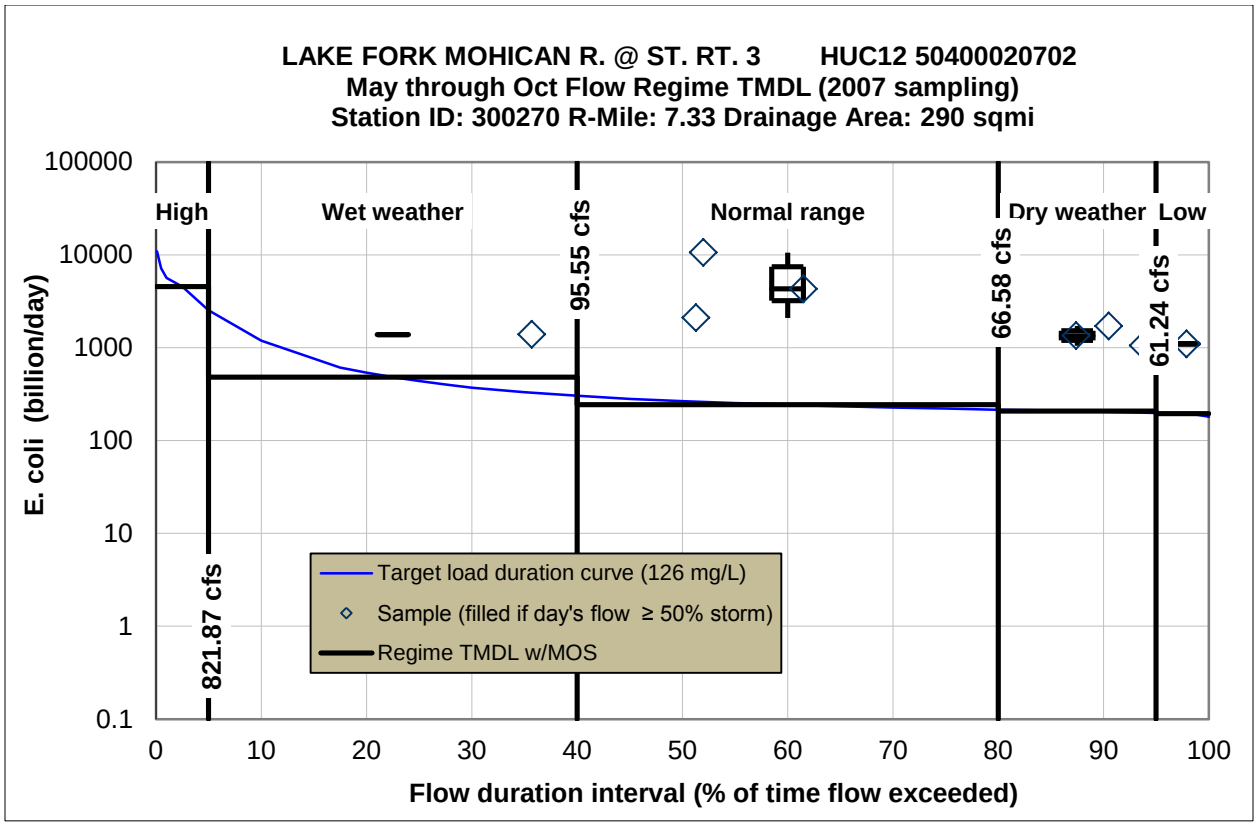

Figure D4-26. *E. coli* load duration curve for site on Lake Fork Mohican R. at St. Rt. 3.

Table D4-26. *E. coli* TMDL for site on Lake Fork Mohican R. at St. Rt. 3 (in billion cfu/day).

TMDL and Duration Intervals	High 0-5%	Wet weather 5-40%	Normal range 40-80%	Dry weather 80-95%	Low 95-100%
Samples Per Regime		1	3	3	1
Median Sample load		1326	4112.46	1262.37	1024.64
Total Load Reduction Required	No Data	**73.5%**	**95.8%**	**88.4%**	**86.6%**
Total Maximum Daily Load	4531.55	471.59	232.99	197.29	184.31
Margin of Safety: 20%	906.31	94.32	46.60	39.46	36.86
Allowance for future growth: 5.6%	253.77	26.41	13.05	11.05	10.32
Load Allocation	3334.59	313.98	136.46	109.90	100.25
Wasteload Allocation Total	36.88	36.88	36.88	36.88	36.88
MS4	0.00	0.00	0.00	0.00	0.00
Iron Pony Saloon Well 0001 3PR00158	0.03	0.03	0.03	0.03	0.03
Hidden Acres MHP 2PR00239	0.09	0.09	0.09	0.09	0.09
ODOT Rest Area 3-36 3PP00029	0.12	0.12	0.12	0.12	0.12
West Salem WWTP 3PB00053	1.24	1.24	1.24	1.24	1.24
Cinnamon Lake Assn. WWTP 2PR00009	0.91	0.91	0.91	0.91	0.91
Northwestern Local Sch Dist WWTP 3PT00009	0.09	0.09	0.09	0.09	0.09
American Augers Inc 2PR00172	0.05	0.05	0.05	0.05	0.05
Hyponex Corp 3IN00166	0.00	0.00	0.00	0.00	0.00
Country Pointe Health Care Inc LLC, 001 3PR00488	0.11	0.11	0.11	0.11	0.11
Koenig's Korner 3PR00423	0.0034	0.0034	0.0034	0.0034	0.0034
Southwood Estates Homeowners Assoc Ltd 2GS00015	0.12	0.12	0.12	0.12	0.12
Ashland WTP 2IW00002	1.84	1.84	1.84	1.84	1.84
Ashland WWTP 2PD00010	30.47	30.47	30.47	30.47	30.47
Agape Acres Inc 2PY00037	0.12	0.12	0.12	0.12	0.12
Mapleton Jr & Sr HS 2PT00040	0.13	0.13	0.13	0.13	0.13
Fin Feather and Fur Outfitters Mini-Mall 2PR00145	0.03	0.03	0.03	0.03	0.03
Unique Ventures Group LLC (Perkins Restaurant) 2PR00221	0.12	0.12	0.12	0.12	0.12
Coburn Inc 2PR00140	0.03	0.03	0.03	0.03	0.03
Hayesville WWTP 2PA00089	0.37	0.37	0.37	0.37	0.37
Hillsdale High School 2PR00269	0.06	0.06	0.06	0.06	0.06
Ashland Co West Holmes JVS 2PT00011	0.24	0.24	0.24	0.24	0.24
Jeromesville WWTP 2PA00092	0.40	0.40	0.40	0.40	0.40
Maverick Innovative Solutions LLC 2PR00217	0.01	0.01	0.01	0.01	0.01
Green Acres MHP 2PY00058	0.11	0.11	0.11	0.11	0.11
C&R Enterprises C&DD 2IN00231	0.00	0.00	0.00	0.00	0.00
Country Pointe Health Care Inc LLC, 002 3PR00488	0.17	0.17	0.17	0.17	0.17

Values were adjusted for rounding.

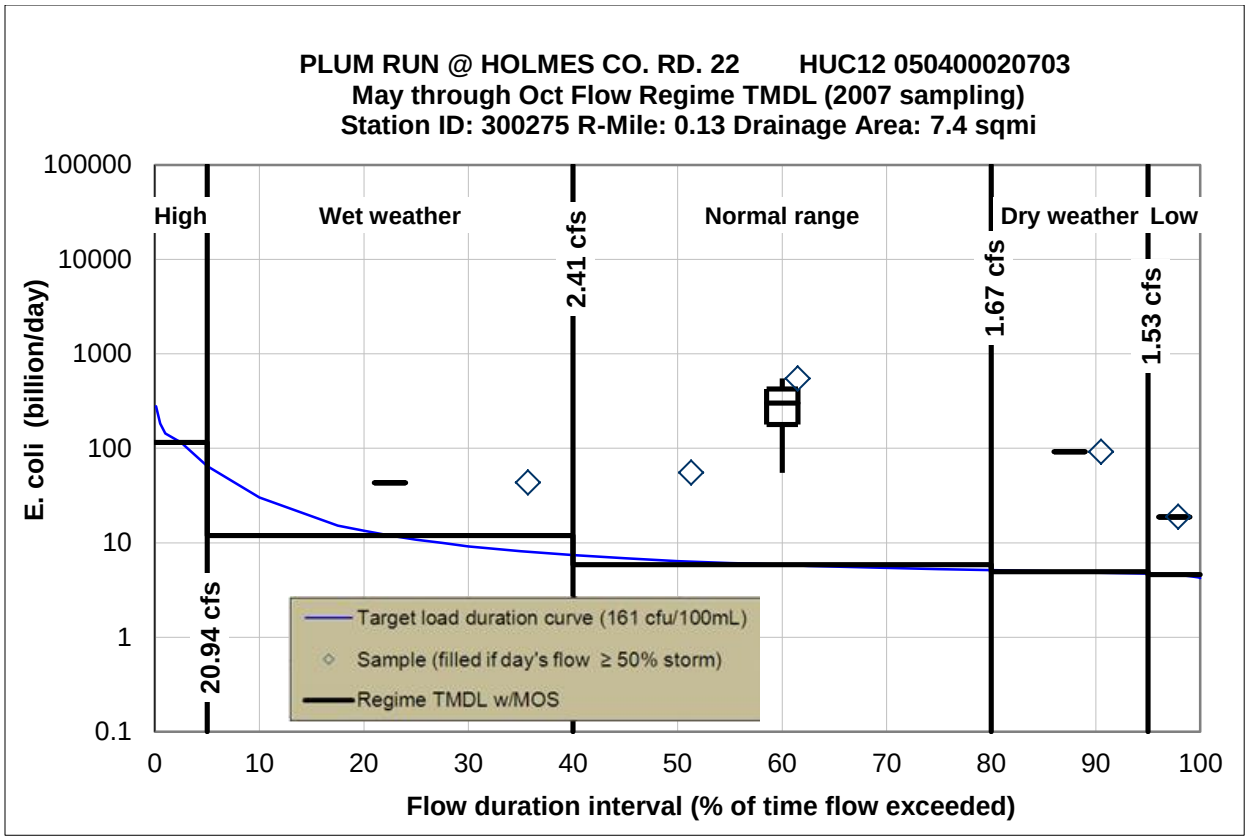

Figure D4-27. ***E. coli*** **load duration curve for site on Plum Run. at Holmes Co. Rd. 22.**

Table D4-27. ***E. coli*** **TMDL for site on Plum Run. at Holmes Co. Rd. 22 (in billion cfu/day).**

TMDL and Duration Intervals	High 0-5%	Wet weather 5-40%	Normal range 40-80%	Dry weather 80-95%	Low 95-100%
Samples Per Regime		1	2	1	1
Median Sample load		43	301.79	91.83	18.80
Total Load Reduction Required	No Data	**79.5%**	**98.6%**	**96.0%**	**81.8%**
Total Maximum Daily Load	115.54	11.93	5.86	4.93	4.59
Margin of Safety: 20%	23.11	2.39	1.17	0.99	0.92
Allowance for future growth: 5.6%	6.47	0.67	0.33	0.28	0.26
Load Allocation	85.96	8.88	4.36	3.67	3.42
Wasteload Allocation Total	0.00	0.00	0.00	0.00	0.00
MS4	0.00	0.00	0.00	0.00	0.00
No NPDES facilities	0.00	0.00	0.00	0.00	0.00

Values were adjusted for rounding.

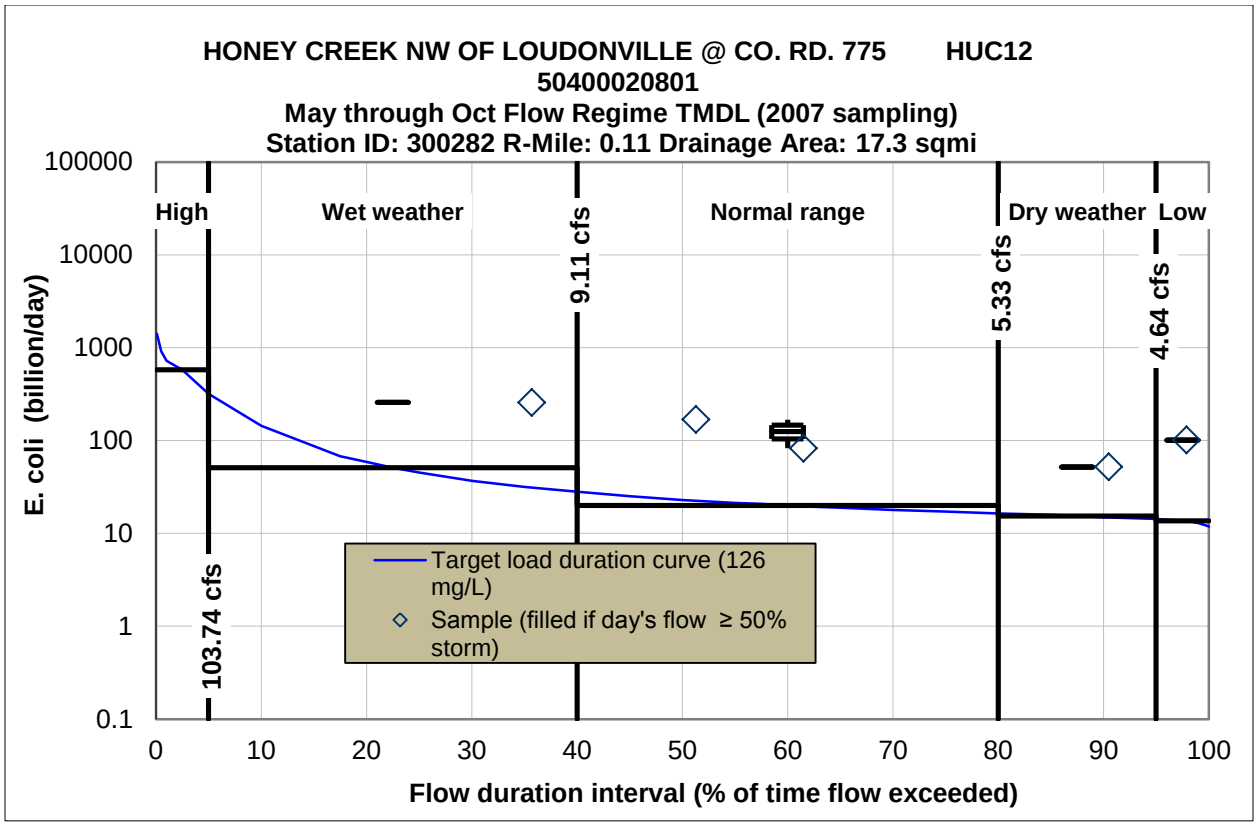

Figure D4-28. ***E. coli*** **load duration curve for site on Honey Ck. NW of Loudonville at Co. Rd. 775.**

Table D4-28. ***E. coli*** **TMDL for site on Honey Ck. NW of Loudonville at Co. Rd. 775 (in billion cfu/day).**

TMDL and Duration Intervals	High 0-5%	Wet weather 5-40%	Normal range 40-80%	Dry weather 80-95%	Low 95-100%
Samples Per Regime		1	2	1	1
Median Sample load		257	125.38	52.02	101.02
Total Load Reduction Required	No Data	**85.2%**	**88.1%**	**78.0%**	**89.9%**
Total Maximum Daily Load	580.13	51.14	20.04	15.41	13.72
Margin of Safety: 20%	116.03	10.23	4.01	3.08	2.74
Allowance for future growth: 5.6%	32.49	2.86	1.12	0.86	0.77
Load Allocation	431.62	38.05	14.91	11.47	10.21
Wasteload Allocation Total	0.00	0.00	0.00	0.00	0.00
MS4	0.00	0.00	0.00	0.00	0.00
No NPDES facilities	0.00	0.00	0.00	0.00	0.00

Values were adjusted for rounding.

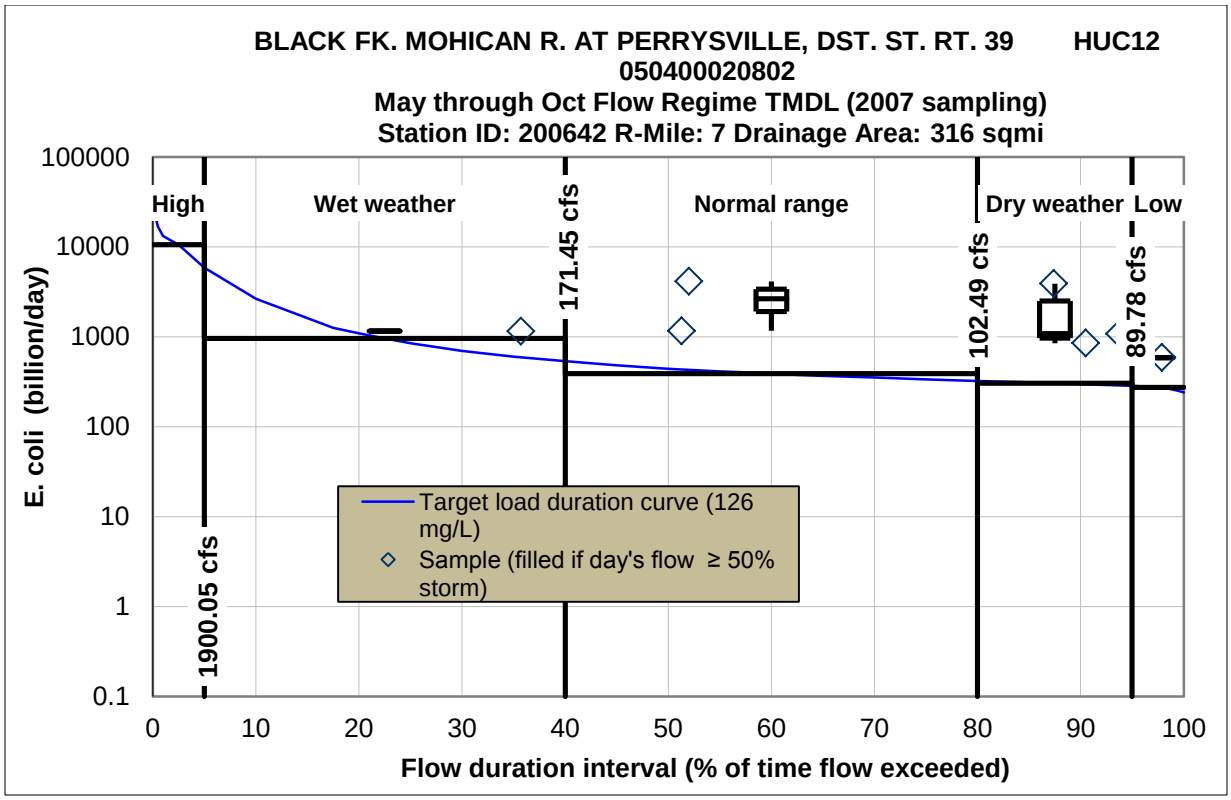

Figure D4-29. ***E. coli*** **load duration curve for site on Black Fork Mohican R. at Perrysville.**

Table D4-29. ***E. coli*** **TMDL for site on Black Fork Mohican R. at Perrysville (in billion cfu/day).**

TMDL and Duration Intervals	High 0-5%	Wet weather 5-40%	Normal range 40-80%	Dry weather 80-95%	Low 95-100%
Samples Per Regime		1	2	3	1
Median Sample load		1133	2599.42	1045.15	562.27
Total Load Reduction Required	No Data	**37.6%**	**89.1%**	**78.9%**	**64.8%**
Total Maximum Daily Load	10612.33	949.81	381.98	297.02	266.16
Margin of Safety: 20%	2122.47	189.96	76.40	59.40	53.23
Allowance for future growth: 5.6%	594.29	53.19	21.39	16.63	14.90
Load Allocation	7792.38	603.46	181.00	117.79	94.83
Wasteload Allocation Total	103.19	103.19	103.19	103.19	103.19
MS4	0.00	0.00	0.00	0.00	0.00
Perrysville WWTP 2PA00004	0.57	0.57	0.57	0.57	0.57
Mansfield Plumbing Products LLC 2IJ00062	0.64	0.64	0.64	0.64	0.64
Cornell Abraxas Ohio 2GS00002	0.12	0.12	0.12	0.12	0.12
Shelby Welded Tube 2GS00009	0.01	0.01	0.01	0.01	0.01
Northside MHP 2GS00019	0.01	0.01	0.01	0.01	0.01
Briarwood Estates MHP 2PY00018	0.18	0.18	0.18	0.18	0.18
Lust Subdiv WWTP 2PG00077	0.05	0.05	0.05	0.05	0.05
Voisard Mg Co. Inc. Pit No. 2 2PR00139	0.01	0.01	0.01	0.01	0.01

TMDL and Duration Intervals	High 0-5%	Wet weather 5-40%	Normal range 40-80%	Dry weather 80-95%	Low 95-100%
Shelby Municipal Light Plant 2IN00225	0.00	0.00	0.00	0.00	0.00
ArcelorMittal Tubular Products 2ID00002	1.39	1.39	1.39	1.39	1.39
Shelby WWTP 2PD00036	15.24	15.24	15.24	15.24	15.24
Dayspring Assisted Living and Care Facility 2PG00114	0.14	0.14	0.14	0.14	0.14
Crestview Local School 2GS00004	0.10	0.10	0.10	0.10	0.10
Pin Oak Estates MHP 2PR00072	0.14	0.14	0.14	0.14	0.14
Hillside MHP 2PV00700	0.08	0.08	0.08	0.08	0.08
Eastview WWTP 2PH00005	4.29	4.29	4.29	4.29	4.29
Johnny Appleseed Heritage Center 2PR00169	0.04	0.04	0.04	0.04	0.04
Oak Park Tavern 2PR00216	0.02	0.02	0.02	0.02	0.02
Econolodge 2PR00136	0.07	0.07	0.07	0.07	0.07
Ohio Hilltop - Mansfield Country 2PR00071	0.19	0.19	0.19	0.19	0.19
Charles Mill Sites Lake Cottage Area WWTP 2PP00049	0.21	0.21	0.21	0.21	0.21
Sensmeier & Sons Oil Co Inc 2GB00004	0.00	0.00	0.00	0.00	0.00
AK Steel Corporation 2ID00003	5.01	5.01	5.01	5.01	5.01
Tube City IMS, LLC 2IN00076	0.07	0.07	0.07	0.07	0.07
Ohio Air National Guard 179 Airlift Group 2IN00189	0.01	0.01	0.01	0.01	0.01
Lucas WWTP 2PB00038	0.46	0.46	0.46	0.46	0.46
Therm-O-Disc Inc 2IS00028	0.37	0.37	0.37	0.37	0.37
Mansfield WWTP 2PE00001	73.13	73.13	73.13	73.13	73.13
Hyundai Ideal Electric Co 2IN00058	0.08	0.08	0.08	0.08	0.08
Harp Subdiv WWTP 2PG00075	0.24	0.24	0.24	0.24	0.24
Joez Lounge 2PR00238	0.13	0.13	0.13	0.13	0.13
S & S Aggregate Plant No 14 2IJ00077	0.15	0.15	0.15	0.15	0.15

Values were adjusted for rounding.

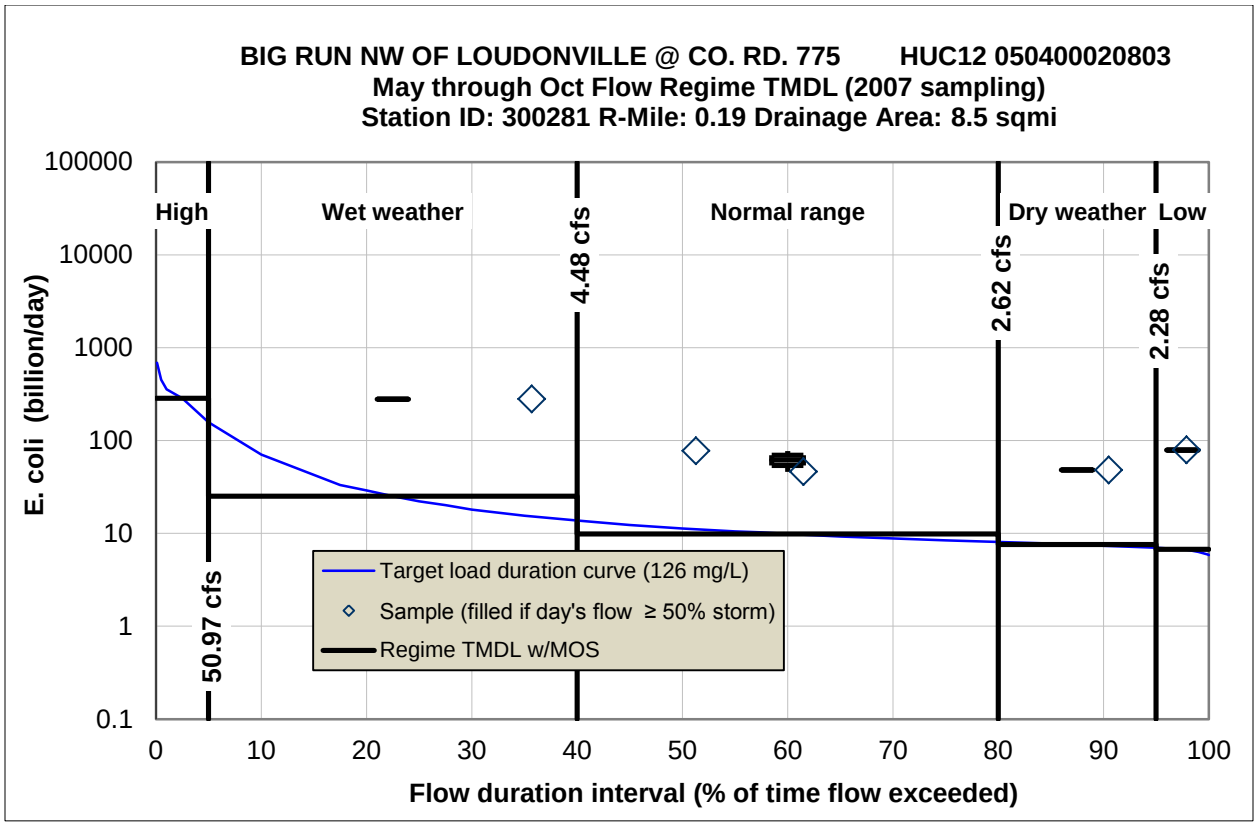

Figure D4-30. ***E. coli*** **load duration curve for site on Big Run NW of Loudonville @ C.R. 775.**

Table D4-30. ***E. coli*** **TMDL for site on Big Run NW of Loudonville @ C.R. 775 (in billion cfu/day).**

TMDL and Duration Intervals	High 0-5%	Wet weather 5-40%	Normal range 40-80%	Dry weather 80-95%	Low 95-100%
Samples Per Regime		1	2	1	1
Median Sample load		279	61.66	48.22	79.21
Total Load Reduction Required	No Data	**93.3%**	**88.1%**	**88.3%**	**93.7%**
Total Maximum Daily Load	285.06	25.12	9.86	7.58	6.75
Margin of Safety: 20%	57.01	5.02	1.97	1.52	1.35
Allowance for future growth: 5.6%	15.96	1.41	0.55	0.42	0.38
Load Allocation	212.08	18.69	7.34	5.64	5.02
Wasteload Allocation Total	0.00	0.00	0.00	0.00	0.00
MS4	0.00	0.00	0.00	0.00	0.00
No NPDES facilities	0.00	0.00	0.00	0.00	0.00

Values were adjusted for rounding.

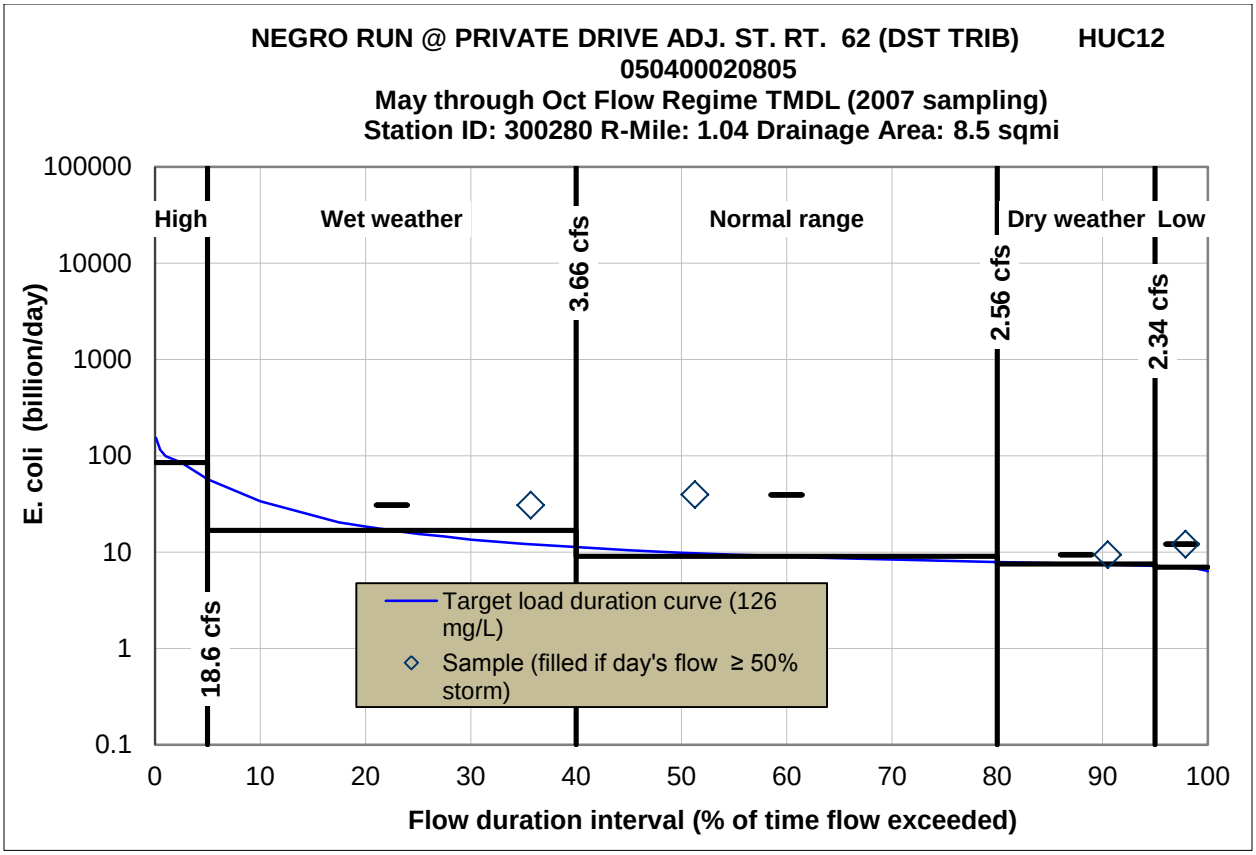

Figure D4-31. ***E. coli*** **load duration curve for site on Negro Run at Private Dr. Adj. St. Rt. 62 (DST TRIB).**

Table D4-31. ***E. coli*** **TMDL for site on Negro Run at Private Dr. Adj. St. Rt. 62 (DST TRIB) (in billion cfu/day).**

TMDL and Duration Intervals	High 0-5%	Wet weather 5-40%	Normal range 40-80%	Dry weather 80-95%	Low 95-100%
Samples Per Regime		1	1	1	1
Median Sample load		31	39.41	9.38	12.11
Total Load Reduction Required	No Data	**59.2%**	**82.9%**	**40.1%**	**57.0%**
Total Maximum Daily Load	85.36	16.86	9.03	7.55	7.00
Margin of Safety: 20%	17.07	3.37	1.81	1.51	1.40
Allowance for future growth: 5.6%	4.78	0.94	0.51	0.42	0.39
Load Allocation	63.51	12.55	6.72	5.62	5.21
Wasteload Allocation Total	0.00	0.00	0.00	0.00	0.00
MS4	0.00	0.00	0.00	0.00	0.00
No NPDES facilities	0.00	0.00	0.00	0.00	0.00

Values were adjusted for rounding.

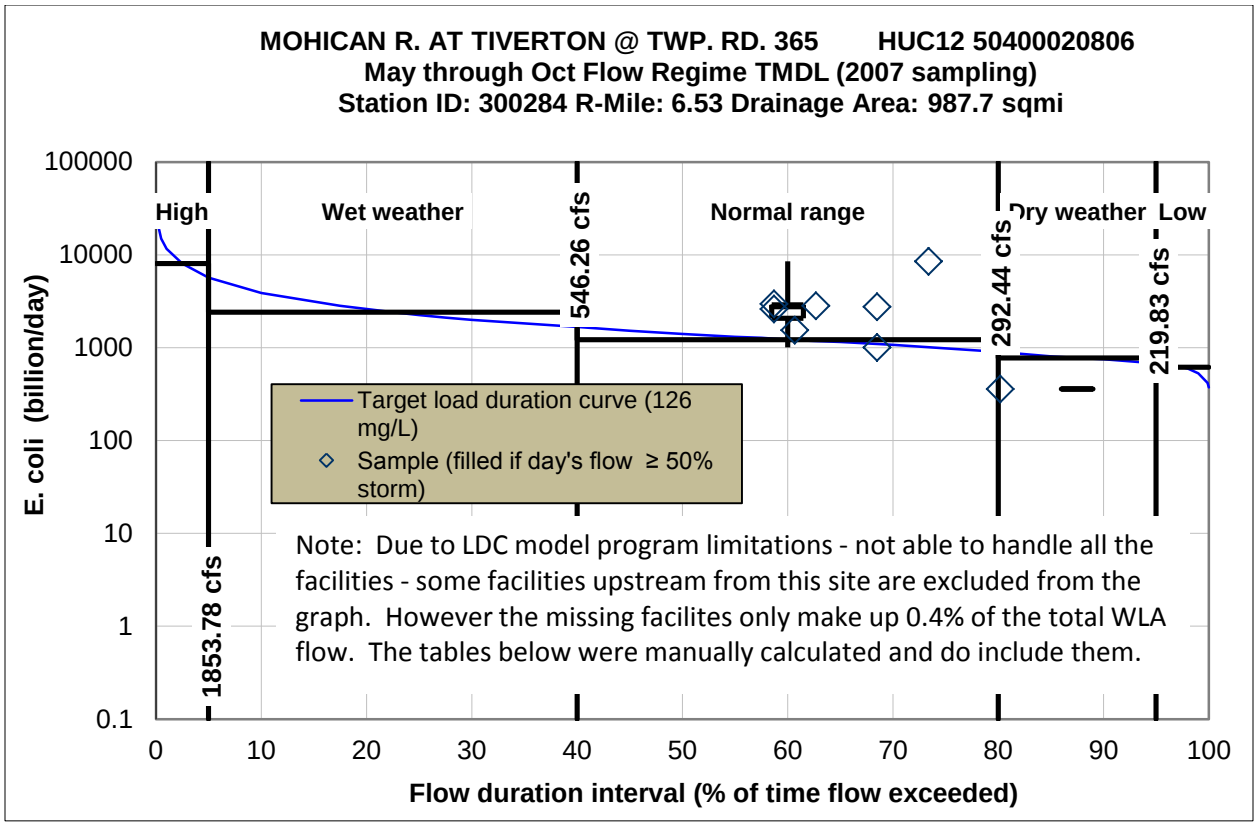

Figure D4-32. *E. coli* load duration curve for site on the Mohican River Mainstem at Tiverton Rd., RM 6.53.

Table D4-32. *E. coli* TMDL for site on the Mohican River Mainstem at Tiverton Rd., RM 6.53 (in billion cfu/day).

TMDL and Duration Intervals	High 0-5%	Wet weather 5-40%	Normal range 40-80%	Dry weather 80-95%	Low 95-100%
Samples Per Regime			7	1	
Median Sample load			2762	358	
Total Load Reduction Required	No Data	No Data	**67.74%**	**NA**	No Data
Total Maximum Daily Load	8065.06	2405.06	1198.06	756.06	599.06
Margin of Safety: 20%	1613	481	240	151	120
Allowance for future growth: 5.6%	452	135	67	42	34
Load Allocation	5439.87	1516.48	679.86	373.42	264.51
Wasteload Allocation Total	561.43	273.81	212.48	190.02	182.03
MS4 (6.83% of total area)	398.69	111.08	49.75	27.29	19.30
Cornell Abraxas Ohio 2GS00002	0.12	0.12	0.12	0.12	0.12
Shelby Welded Tube 2GS00009	0.01	0.01	0.01	0.01	0.01
Northside MHP 2GS00019	0.01	0.01	0.01	0.01	0.01
Briarwood Estates MHP 2PY00018	0.18	0.18	0.18	0.18	0.18
Lust Subdiv WWTP 2PG00077	0.05	0.05	0.05	0.05	0.05
Voisard Mg Co. Inc. Pit No. 2 2PR00139	0.01	0.01	0.01	0.01	0.01
Shelby Municipal Light Plant 2IN00225	0.0000	0.0000	0.0000	0.0000	0.0000
ArcelorMittal Tubular Products 2ID00002	1.39	1.39	1.39	1.39	1.39
Shelby WWTP 2PD00036	15.24	15.24	15.24	15.24	15.24
Dayspring Assisted Living and Care Facility 2PG00114	0.14	0.14	0.14	0.14	0.14
Crestview Local School 2GS00004	0.10	0.10	0.10	0.10	0.10
Country Meadows Subdiv WWTP 2PG00074	0.05	0.05	0.05	0.05	0.05
Pin Oak Estates MHP 2PR00072	0.14	0.14	0.14	0.14	0.14
Hillside MHP 2PV00700	0.08	0.08	0.08	0.08	0.08
Eastview WWTP 2PH00005	4.29	4.29	4.29	4.29	4.29
Johnny Appleseed Heritage Center 2PR00169	0.04	0.04	0.04	0.04	0.04
Oak Park Tavern 2PR00216	0.02	0.02	0.02	0.02	0.02
Econolodge 2PR00136	0.07	0.07	0.07	0.07	0.07
Ohio Hilltop - Mansfield Country 2PR00071	0.19	0.19	0.19	0.19	0.19
Charles Mill Sites Lake Cottage Area WWTP 2PP00049	0.21	0.21	0.21	0.21	0.21
Sensmeier & Sons Oil Co Inc 2GB00004	0.000	0.000	0.000	0.000	0.000
General Motors LLC 2IS00045	4.24	4.24	4.24	4.24	4.24
AK Steel Corporation 2ID00003	5.01	5.01	5.01	5.01	5.01
Tube City IMS, LLC 2IN00076	0.07	0.07	0.07	0.07	0.07
Ohio Air National Guard 179 Airlift Group 2IN00189	0.01	0.01	0.01	0.01	0.01
Lucas WWTP 2PB00038	0.46	0.46	0.46	0.46	0.46
Therm-O-Disc Inc 2IS00028	0.37	0.37	0.37	0.37	0.37

TMDL and Duration Intervals	High 0-5%	Wet weather 5-40%	Normal range 40-80%	Dry weather 80-95%	Low 95-100%
Mansfield WWTP 2PE00001	73.13	73.13	73.13	73.13	73.13
Hyundai Ideal Electric Co 2IN00058	0.08	0.08	0.08	0.08	0.08
Harp Subdiv WWTP 2PG00075	0.24	0.24	0.24	0.24	0.24
Joez Lounge 2PR00238	0.13	0.13	0.13	0.13	0.13
S & S Aggregate Plant No 14 2IJ00077	0.15	0.15	0.15	0.15	0.15
Brown Derby Roadhouse Restaurant 2PR00049	0.03	0.03	0.03	0.03	0.03
Greenball Corp 2PR00243	0.01	0.01	0.01	0.01	0.01
BP Amoco Oil Corp Bulk Plant Ontario 2IN00179	0.0046	0.0046	0.0046	0.0046	0.0046
Lake Timberlin Camp Resort 2GV00004	0.06	0.06	0.06	0.06	0.06
Johnsville Elem Sch 4GS00002	0.0000	0.0000	0.0000	0.0000	0.0000
Hickory Grove MHP 4PY00005	0.12	0.12	0.12	0.12	0.12
Johnsville WWTP - Morrow Co 4PG00052	0.24	0.24	0.24	0.24	0.24
Cedar Creek Court MHP 2PY00068	0.10	0.10	0.10	0.10	0.10
BRAMARJAC Inc DBA Pebble Creek Golf Club 2PR00255	0.03	0.03	0.03	0.03	0.03
Lexington WWTP 2PB00019	7.15	7.15	7.15	7.15	7.15
Hamilton Standard Controls United Technologies 2IN00107	0.0000	0.0000	0.0000	0.0000	0.0000
Mid-Ohio Sports Car Course 4PX00053	0.14	0.14	0.14	0.14	0.14
42 Motel 2PR00219	0.01	0.01	0.01	0.01	0.01
Mansfield WTP 2IV00052	0.14	0.14	0.14	0.14	0.14
SDD Holdings II LLC 2GS00016	0.01	0.01	0.01	0.01	0.01
Clear Fork High School 2GS00017	0.10	0.10	0.10	0.10	0.10
Ashford-Mansfield LLC dba Clear Fork MHP 2PY00024	0.14	0.14	0.14	0.14	0.14
Bellville WWTP 2PB00057	1.57	1.57	1.57	1.57	1.57
DH Bowman & Sons Inc 2IJ00101	0.00	0.00	0.00	0.00	0.00
BP Amoco Oil Corp Bulk Plant Bellville 2IN00175	0.0024	0.0024	0.0024	0.0024	0.0024
Ohio Ski Slopes Inc DBA Snow Trails 2PR00220	0.07	0.07	0.07	0.07	0.07
Butler WWTP 2PA00044	0.57	0.57	0.57	0.57	0.57
Camp Otyokwah 2PR00226	0.05	0.05	0.05	0.05	0.05
Butler Mohican KOA 2PR00266	0.05	0.05	0.05	0.05	0.05
ODYS Mohican Juvenile Correctional Facility 2PP00005	0.15	0.15	0.15	0.15	0.15
Wooster Outdoor Center 2PR00173	0.05	0.05	0.05	0.05	0.05
Camp Nuhop 2PR00131	0.04	0.04	0.04	0.04	0.04
ODNR Mohican State Park Lodge 2PP00033	0.38	0.38	0.38	0.38	0.38
Malabar Farm State Park Restaurant 2PP00050	0.02	0.02	0.02	0.02	0.02
Columbia Gas Transmission Corp Weaver Compressor Sta 2IN00066	0.0006	0.0006	0.0006	0.0006	0.0006

TMDL and Duration Intervals	High 0-5%	Wet weather 5-40%	Normal range 40-80%	Dry weather 80-95%	Low 95-100%
Hidden Acres MHP 2PR00239	0.09	0.09	0.09	0.09	0.09
ODOT Rest Area 3-36 3PP00029	0.12	0.12	0.12	0.12	0.12
West Salem WWTP 3PB00053	1.24	1.24	1.24	1.24	1.24
Cinnamon Lake Association WWTP 2PR00009	0.91	0.91	0.91	0.91	0.91
Northwestern Local Sch Dist WWTP 3PT00009	0.09	0.09	0.09	0.09	0.09
American Augers Inc 2PR00172	0.05	0.05	0.05	0.05	0.05
Hyponex Corp 3IN00166	0.00	0.00	0.00	0.00	0.00
Country Pointe Health Care Inc LLC 3PR00488	0.11	0.11	0.11	0.11	0.11
Koenig's Korner 3PR00423	0.0034	0.0034	0.0034	0.0034	0.0034
Southwood Estates Homeowners Assoc Ltd 2GS00015	0.12	0.12	0.12	0.12	0.12
Ashland WTP 2IW00002	1.84	1.84	1.84	1.84	1.84
Ashland WWTP 2PD00010	30.47	30.47	30.47	30.47	30.47
Agape Acres Inc 2PY00037	0.12	0.12	0.12	0.12	0.12
Mapleton Jr & Sr HS 2PT00040	0.13	0.13	0.13	0.13	0.13
Fin Feather and Fur Outfitters Mini-Mall 2PR00145	0.03	0.03	0.03	0.03	0.03
Unique Ventures Group LLC DBA Perkins Restaurant 2PR00221	0.12	0.12	0.12	0.12	0.12
Coburn Inc 2PR00140	0.03	0.03	0.03	0.03	0.03
Hayesville WWTP 2PA00089	0.37	0.37	0.37	0.37	0.37
Hillsdale High School 2PR00269	0.06	0.06	0.06	0.06	0.06
Ashland Co West Holmes JVS 2PT00011	0.24	0.24	0.24	0.24	0.24
Jeromesville WWTP 2PA00092	0.40	0.40	0.40	0.40	0.40
Maverick Innovative Solutions LLC 2PR00217	0.01	0.01	0.01	0.01	0.01
Green Acres MHP 2PY00058	0.11	0.11	0.11	0.11	0.11
C&R Enterprises C&DD 2IN00231	0.0000	0.0000	0.0000	0.0000	0.0000
Nashville WWTP 3IX00002	0.03	0.03	0.03	0.03	0.03
Buckeye Deli 3PR00447	0.01	0.01	0.01	0.01	0.01
Nashville Elem Sch 3PT00063	0.03	0.03	0.03	0.03	0.03
Whispering Hills Recreation Inc 3PR00172	0.15	0.15	0.15	0.15	0.15
Lakeville Elem Sch 3PT00062	0.02	0.02	0.02	0.02	0.02
Prairie House Apartments 3PW00035	0.01	0.01	0.01	0.01	0.01
Mansfield Plumbing Products - Big Prairie Facility 3IQ00103	0.95	0.95	0.95	0.95	0.95
Woodland Inn 3PR00327	0.01	0.01	0.01	0.01	0.01
Long Lake Park & Campground E 2PR00227	0.04	0.04	0.04	0.04	0.04
Round Lake Christian Assembly Lodge 2PR00196	0.06	0.06	0.06	0.06	0.06
Iron Pony Saloon Well 0001 3PR00158	0.03	0.03	0.03	0.03	0.03
Kaufman Trailer Park 3PV00127	0.03	0.03	0.03	0.03	0.03

TMDL and Duration Intervals	High 0-5%	Wet weather 5-40%	Normal range 40-80%	Dry weather 80-95%	Low 95-100%
Perrysville WWTP 2PA00004	0.57	0.57	0.57	0.57	0.57
Mansfield Plumbing Products LLC 2IJ00062	0.64	0.64	0.64	0.64	0.64
Mohican River Estates WWTP 2PY00028	0.10	0.10	0.10	0.10	0.10
Loudonville WWTP 2PD00023	2.86	2.86	2.86	2.86	2.86
Loudonville WTP 2IW00122	1.02	1.02	1.02	1.02	1.02
Mohican Wilderness Campground 4PX00048	0.04	0.04	0.04	0.04	0.04
Landoll's Mohican Castle 2PR00171	0.06	0.06	0.06	0.06	0.06
Warren-Veverka Co No 2 LLC 2PR00200	0.07	0.07	0.07	0.07	0.07
October Hills WWTP 3PG00134	0.14	0.14	0.14	0.14	0.14
Smiths Pleasant Valley Camp STU 1 3PR00271	0.02	0.02	0.02	0.02	0.02
Camp Mohaven 4PX00033	0.04	0.04	0.04	0.04	0.04
Malabar Farm State Park 2GU00072	0.14	0.14	0.14	0.14	0.14
Clear Fork Resort 2PR00285	0.06	0.06	0.06	0.06	0.06

Values were adjusted for rounding.

D4.2 LDCs: Aquatic Life Use Results

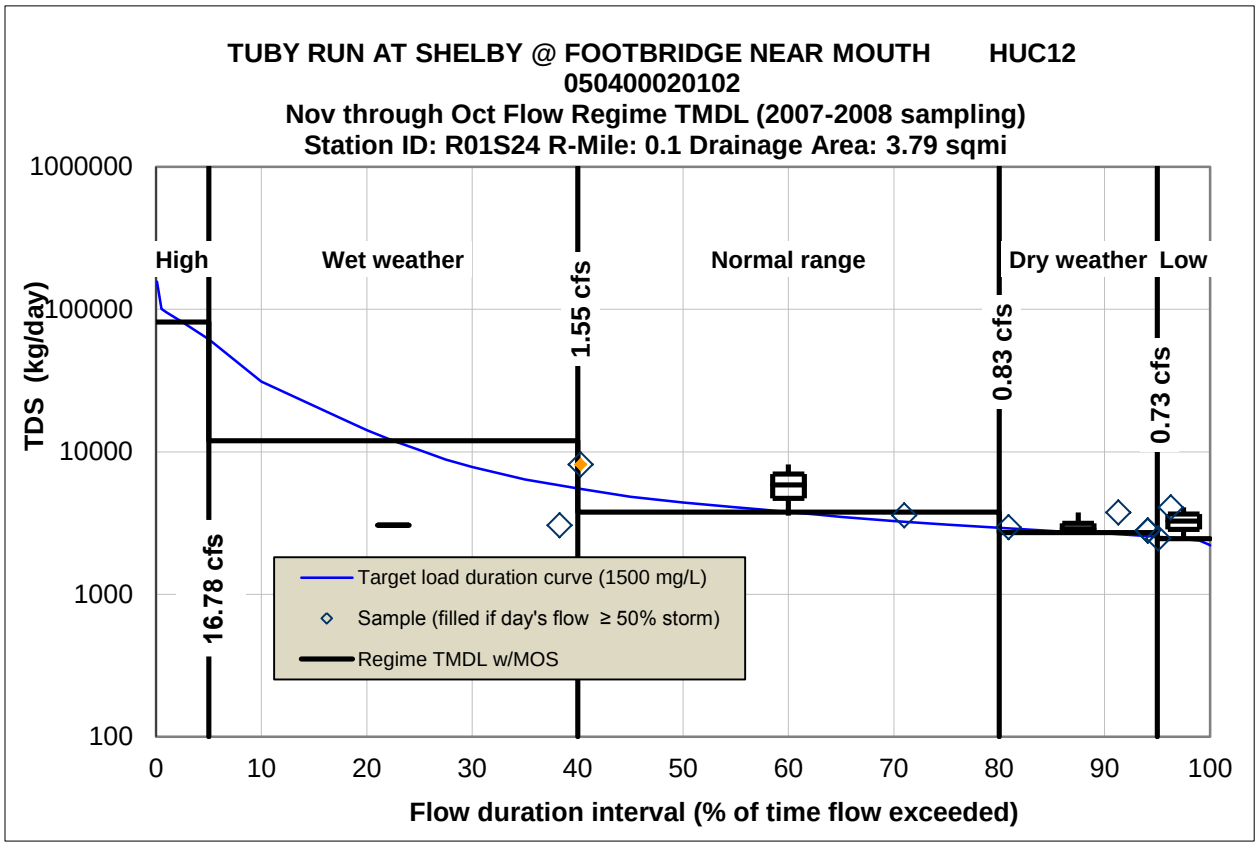

Figure D4-33. Total dissolved solids load duration curve for site on Tuby Run at Shelby at Footbridge near mouth.

Table D4-33. Total dissolved solids TMDL for site on Tuby Run at Shelby at Footbridge near mouth (in kg/day).

TMDL and Duration Intervals	High 0-5%	Wet weather 5-40%	Normal range 40-80%	Dry weather 80-95%	Low 95-100%
Samples Per Regime		1	2	4	2
Median Sample load		3127	6038.49	3031.31	3449.83
Total Load Reduction Required	No Data	**NA**	**41.9%**	**15.6%**	**32.5%**
Total Maximum Daily Load	81434.28	12073.85	3926.75	2862.49	2605.60
Margin of Safety: 5%	4071.71	603.69	196.34	143.12	130.28
Allowance for future growth: 5.6%	4560.32	676.14	219.90	160.30	145.91
Load Allocation	71507	9499	2216	1264	1035
Wasteload Allocation Total	1295	1295	1295	1295	1295
MS4	0.00	0.00	0.00	0.00	0.00
ArcelorMittal Tubular Products Shelby Inc. 2ID00002	1295	1295	1295	1295	1295

Values were adjusted for rounding.

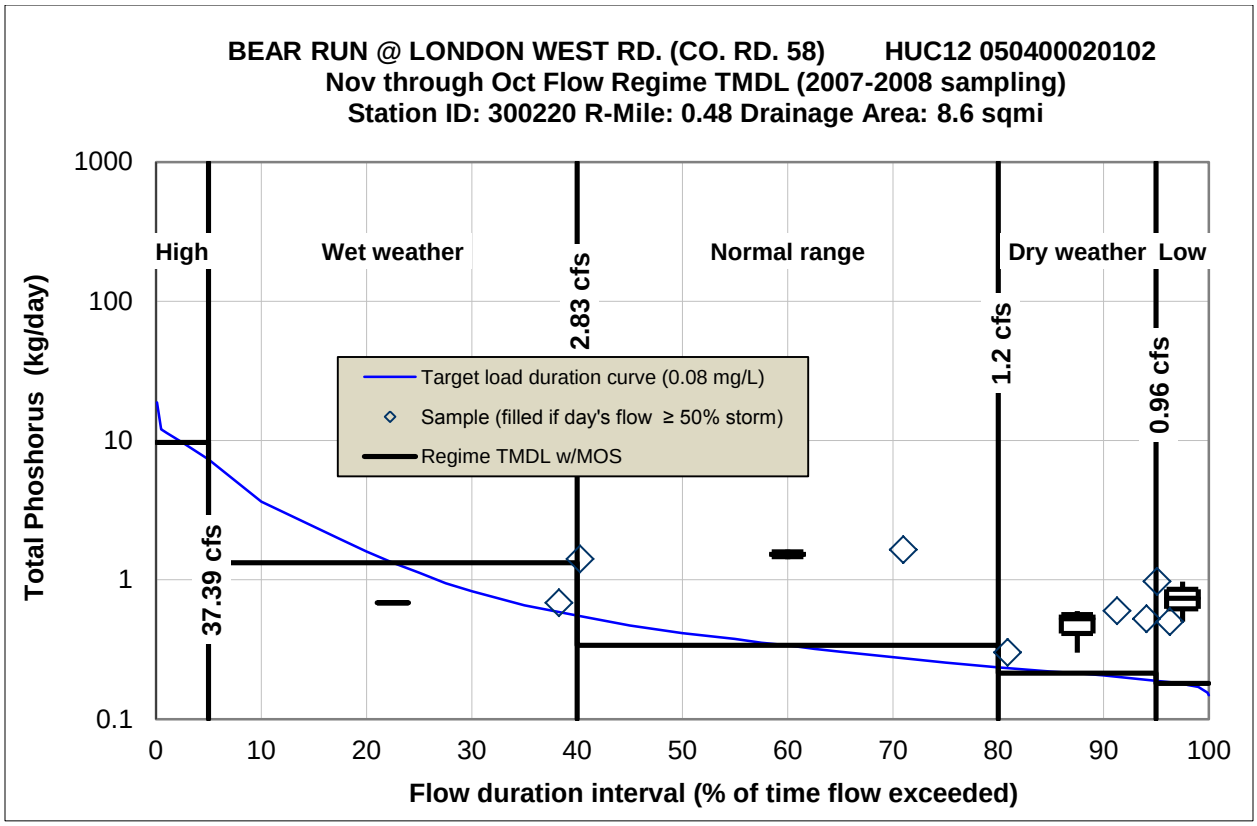

Figure D4-34. Total phosphorus load duration curve for site on Bear Run at London West Rd. (Co. Rd. 58).

Table D4-34. Total phosphorus TMDL for site on Bear Run at London West Rd. (Co. Rd. 58).

TMDL and Duration Intervals	High 0-5%	Wet weather 5-40%	Normal range 40-80%	Dry weather 80-95%	Low 95-100%
Samples Per Regime		1	2	3	2
Median Sample load		1	1.53	0.53	0.74
Total Load Reduction Required	No Data	**NA**	**80.2%**	**63.7%**	**78.1%**
Total Maximum Daily Load	9.72	1.33	0.34	0.21	0.18
Margin of Safety: 5%	0.49	0.07	0.02	0.01	0.01
Allowance for future growth: 5.6%	0.54	0.07	0.02	0.01	0.01
Load Allocation	8.67	1.17	0.29	0.17	0.14
Wasteload Allocation Total	0.02	0.02	0.02	0.02	0.02
MS4	0.00	0.00	0.00	0.00	0.00
Voisard Mfg Co. Inc. Pit no. 2 2PR00139	0.02	0.02	0.02	0.02	0.02

Values were adjusted for rounding.

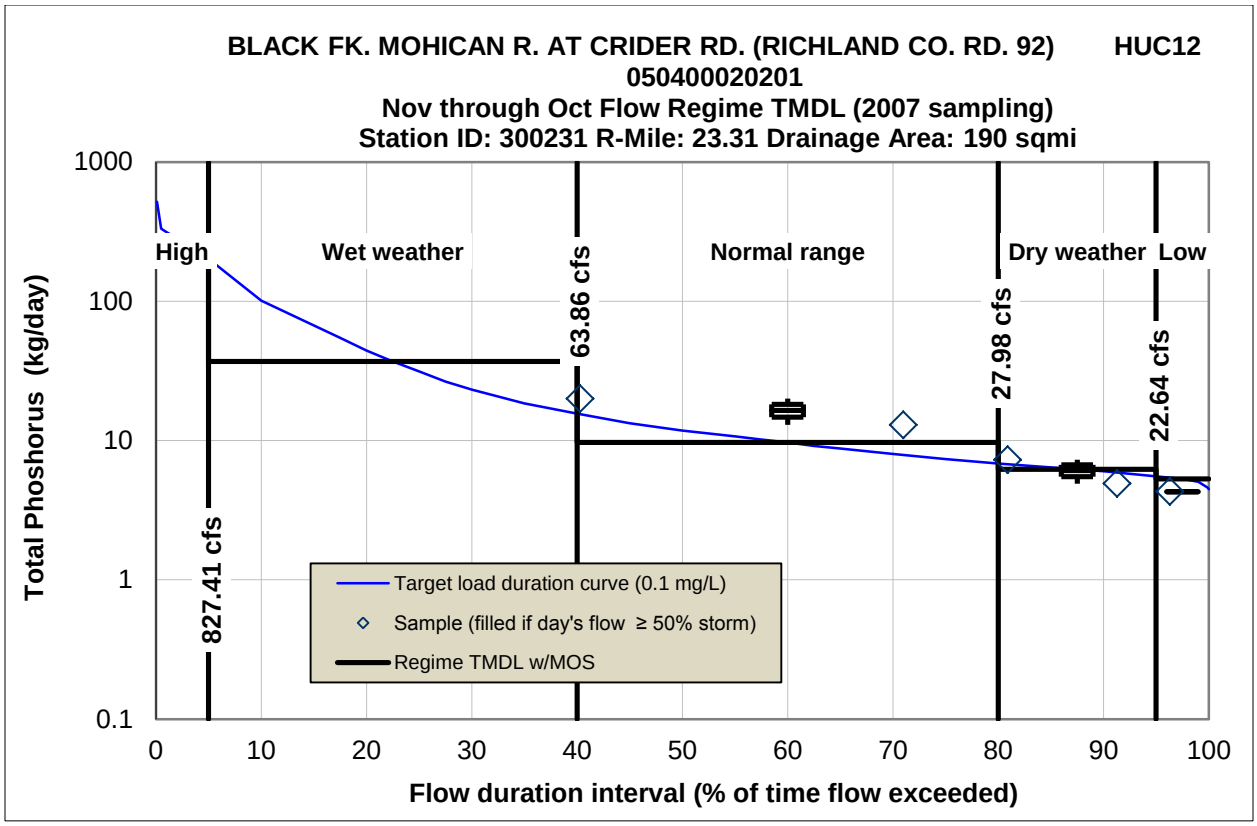

Figure D4-35. Total phosphorus load duration curve for site on Black Fk. Mohican R. at Crider Rd. (Richland Co. Rd. 92).

The discharge flows from the Shelby Municipal Light Plant, ArcelorMittal Tubular, Shelby WWTP and Eastview WWTP are a large percentage of the total downstream flow and thus the load and wasteload allocations are sensitive to the concentrations allocated to each. Since Shelby Muncipal Light and ArcelorMittal Tubular show little evidence of discharging significant total phosphorus each were assigned a small concentration in the wasteload allocation in order for the other facilities upstream of the site to have more assimilative capacity.

The concentrations allocated to Shelby WWTP and Eastview WWTP, 0.29 mg/l and 0.18 mg/l respectively, are based on the maximum it can discharge while considering the other upstream and downstream facility discharges while still maintaining a minimum load allocation of at least 0.2 kg/d.

Implementation of the WLAs will be discussed in Section 6 of the main report.

Table D4-35. Total phosphorus TMDL for site on Black Fk. Mohican R. at Crider Rd. (Richland Co. Rd. 92).

TMDL and Duration Intervals	High 0-5%	Wet weather 5-40%	Normal range 40-80%	Dry weather 80-95%	Low 95-100%
Samples Per Regime			2	2	1
Median Sample load			16.48	6.10	4.31
Total Load Reduction Required	No Data	No Data	**47.4%**	**8.9%**	**NA**
Total Maximum Daily Load	268.80	36.97	9.70	6.22	5.31
Margin of Safety: 5%	13.44	1.85	0.48	0.31	0.00
Allowance for future growth: 5.6%	15.05	2.07	0.54	0.35	0.00
Load Allocation	212.33	25.08	3.05	0.24	0.01
Wasteload Allocation Total	27.97	7.97	5.62	5.32	4.99
MS4 (9.65% of total area)	22.68	2.68	0.33	0.03	0.00
Hillside MHP 2PV00700	0.19	0.19	0.19	0.19	0.19
Eastview WWTP 2PH00005	0.64	0.64	0.64	0.64	0.64
Cornell Abraxas Ohio 2GS00002	0.23	0.23	0.23	0.23	0.23
Shelby Welded Tube 2GS00009	0.02	0.02	0.02	0.02	0.02
Northside MHP 2GS00019	0.03	0.03	0.03	0.03	0.03
Briarwood Estates MHP 2PY00018	0.34	0.34	0.34	0.34	0.34
Lust Subdiv WWTP 2PG00077	0.09	0.09	0.09	0.09	0.09
Voisard Mg Co. Inc. Pit No. 2 2PR00139	0.02	0.02	0.02	0.02	0.02
Shelby Municiple Light Plant 2IN00225	0	0	0	0	0
ArcelorMittal Tubular Products 2ID00002	0.09	0.09	0.09	0.09	0.09
Shelby WWTP 2PD00036	2.74	2.74	2.74	2.74	2.74
Dayspring Assisted Living and Care Facility 2PG00114	0.34	0.34	0.34	0.34	0.34
Crestview Local School 2GS00004	0.25	0.25	0.25	0.25	0.25
Pin Oak Estates MHP 2PR00072	0.34	0.34	0.34	0.34	0.34

Values were adjusted for rounding.

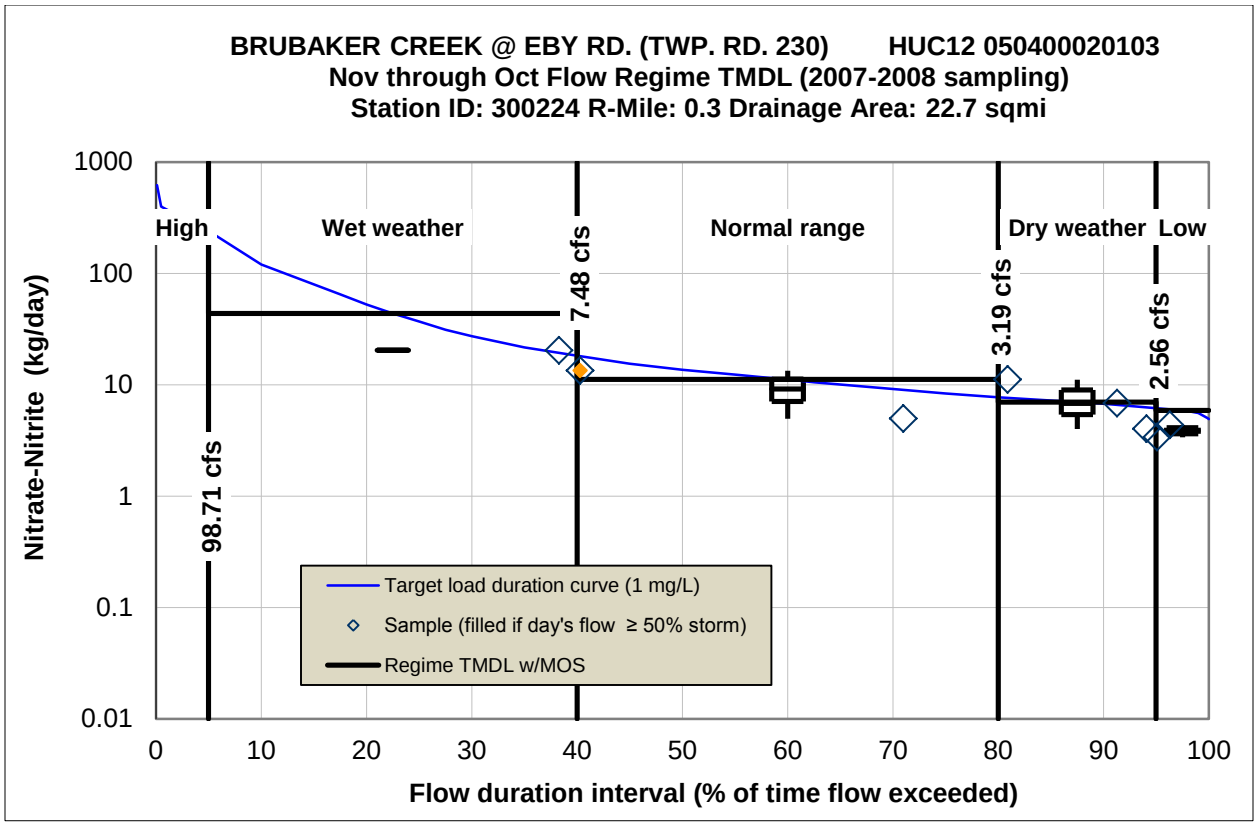

Figure D4-36. Nitrate and nitrite load duration curve for site on Brubaker Cr. @ Eby Rd.

Table D4-36. Nitrate and nitrite TMDL for site on Brubaker Cr. @ Eby Rd.

TMDL and Duration Intervals	High 0-5%	Wet weather 5-40%	Normal range 40-80%	Dry weather 80-95%	Low 95-100%
Samples Per Regime		1	2	3	2
Median Sample load		20	9.23	6.91	3.92
Total Load Reduction Required	No Data	**NA**	**NA**	**8.6%**	**NA**
Total Maximum Daily Load	320.77	43.82	11.23	7.07	5.97
Margin of Safety: 5%	16.04	2.19	0.56	0.35	0.30
Allowance for future growth: 5.6%	17.96	2.45	0.63	0.35	0.33
Load Allocation	286.66	39.06	9.93	6.21	5.22
Wasteload Allocation Total	0.11	0.11	0.11	0.11	0.11
MS4	0.00	0.00	0.00	0.00	0.00
Dayspring Assisted Living and Care Facility 2PG00114	0.11	0.11	0.11	0.11	0.11

Values were adjusted for rounding.

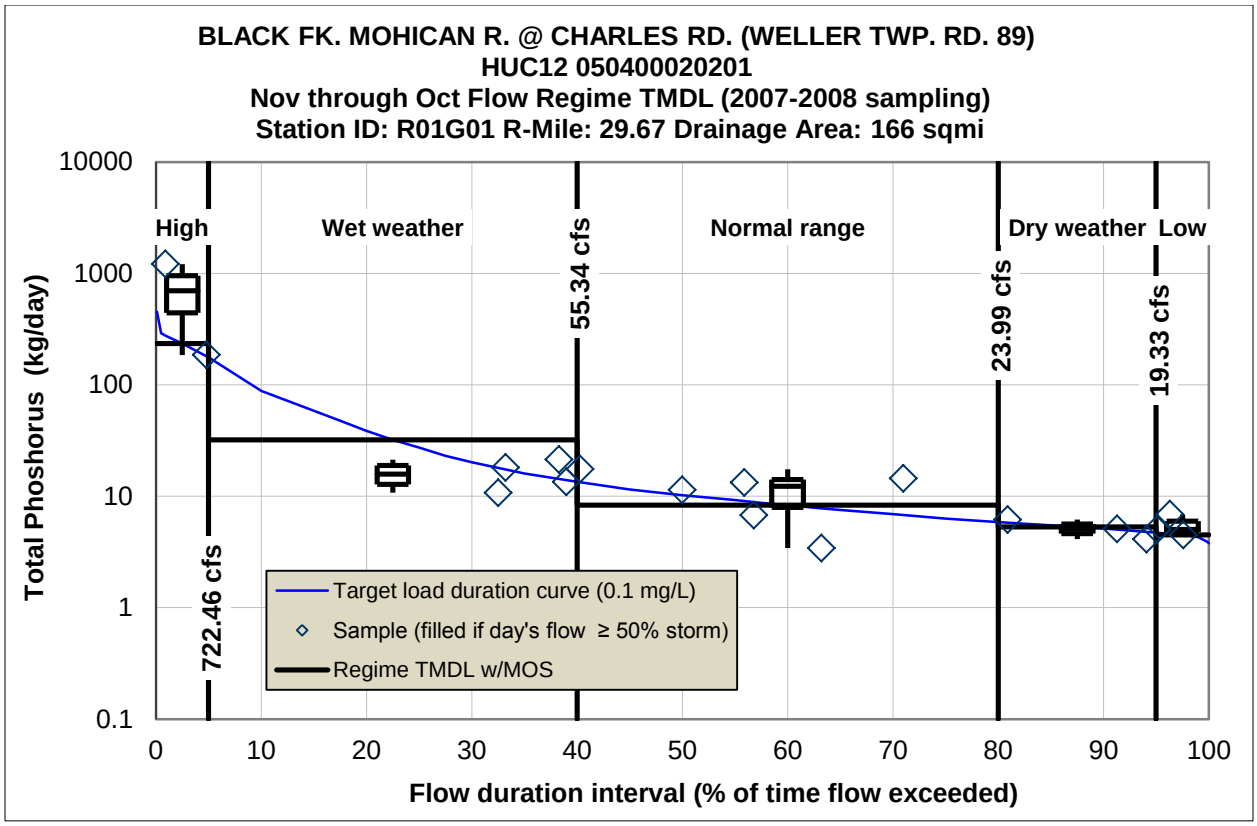

Figure D4-37. Total phosphorus load duration curve for site on Black Fk. Mohican R. at Charles Rd. (Weller Twp. Rd. 89).

The discharge flows from the Shelby Municipal Light Plant, ArcelorMittal Tubular, and Shelby WWTP are a large percentage of the total downstream flow and thus the load and wasteload allocations are sensitive to the concentrations allocated to each. Since Shelby Municipal Light and ArcelorMittal Tubular show no evidence of discharging total phosphorus each were assigned a small concentration in the wasteload allocation in order for the other facilities upstream of the site to have more assimilative capacity.

The concentration allocated to Shelby WWTP, 0.29 mg/l, is based on the maximum it can discharge while considering the other upstream and downstream facility discharges while still maintaining a minimum load allocation of at least 0.2 kg/d.

Implementation of the WLAs will be discussed in Section 6 of the main report.

Table D4-37. Total phosphorus TMDL for site on Black Fk. Mohican R. at Charles Rd. (Weller Twp. Rd. 89).

TMDL and Duration Intervals	High 0-5%	Wet weather 5-40%	Normal range 40-80%	Dry weather 80-95%	Low 95-100%
Samples Per Regime	2	4	6	3	3
Median Sample load	700	16	12.33	5.10	5.04
Total Load Reduction Required	**70.0%**	**NA**	**39.5%**	**7.1%**	**10.9%**
Total Maximum Daily Load	234.74	32.19	8.36	5.32	4.53
Margin of Safety: 5%	11.74	1.61	0.42	0.27	0.01
Allowance for future growth: 5.6%	13.14	1.80	0.47	0.30	0.01
Load Allocation	185.55	21.95	2.70	0.25	0.02
Wasteload Allocation Total	24.31	6.83	4.78	4.52	4.49
MS4 (9.65% of total area)	19.82	2.34	0.29	0.03	0.00
Cornell Abraxas Ohio 2GS00002	0.23	0.23	0.23	0.23	0.23
Shelby Welded Tube 2GS00009	0.02	0.02	0.02	0.02	0.02
Northside MHP 2GS00019	0.03	0.03	0.03	0.03	0.03
Briarwood Estates MHP 2PY00018	0.34	0.34	0.34	0.34	0.34
Lust Subdiv WWTP 2PG00077	0.09	0.09	0.09	0.09	0.09
Voisard Mg Co. Inc. Pit No. 2 2PR00139	0.02	0.02	0.02	0.02	0.02
Shelby Municipal Light Plant 2IN00225	0.00	0.00	0.00	0.00	0.00
ArcelorMittal Tubular Products 2ID00002	0.09	0.09	0.09	0.09	0.09
Shelby WWTP 2PD00036	2.74	2.74	2.74	2.74	2.74
Dayspring Assisted Living and Care Facility 2PG00114	0.34	0.34	0.34	0.34	0.34
Crestview Local School 2GS00004	0.25	0.25	0.25	0.25	0.25
Pin Oak Estates MHP 2PR00072	0.34	0.34	0.34	0.34	0.34

Values were adjusted for rounding.

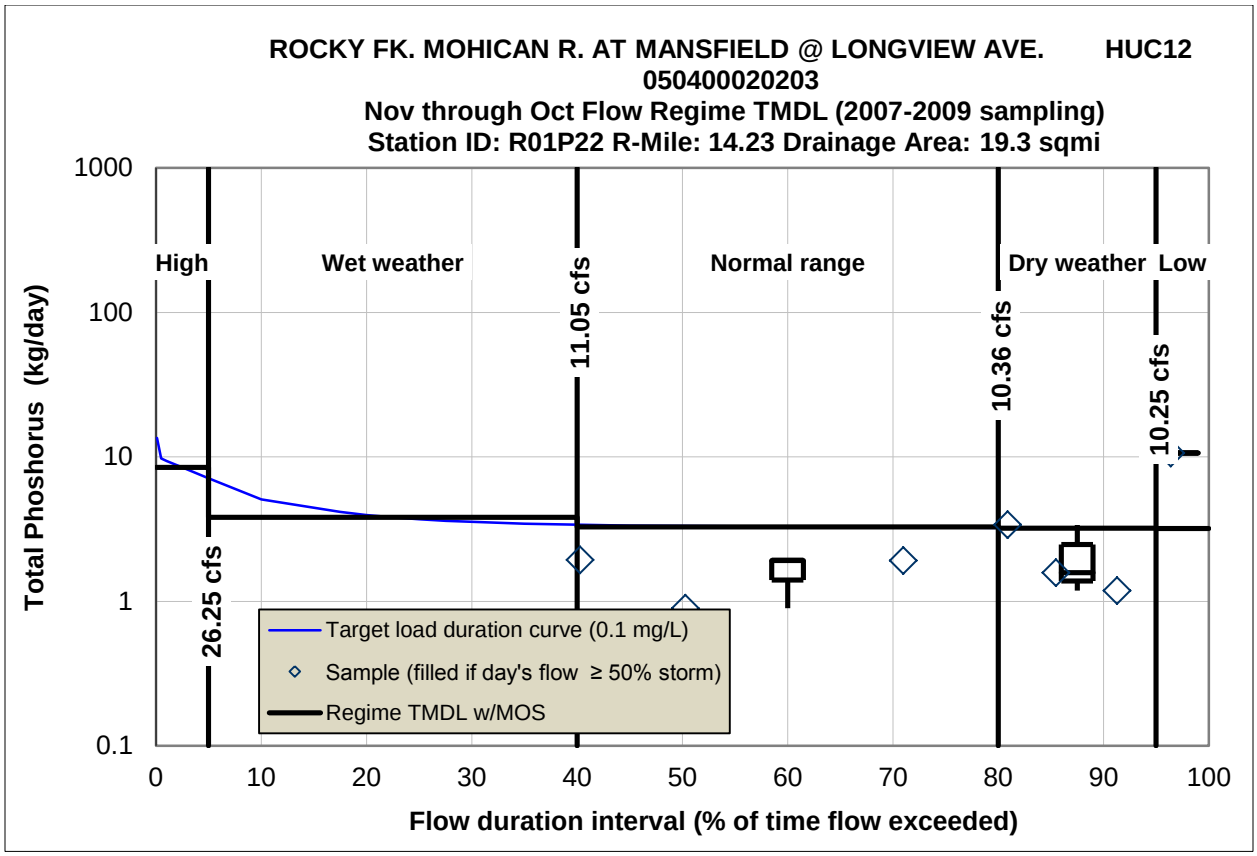

Figure D4-38. Total phosphorus load duration curve for site on Rocky Fk. Mohican R. at Mansfield at Longview Ave.

Table D4-38. Total phosphorus TMDL for site on Rocky Fk. Mohican R. at Mansfield at Longview Ave.

TMDL and Duration Intervals	High 0-5%	Wet weather 5-40%	Normal range 40-80%	Dry weather 80-95%	Low 95-100%
Samples Per Regime			3	3	1
Median Sample load			1.58	1.31	8.39
Total Load Reduction Required	No Data	No Data	**NA**	**NA**	**73.3%**
Total Maximum Daily Load	7.76	3.12	2.59	2.52	2.50
Margin of Safety: 5%	0.39	0.16	0.13	0.13	0.13
Allowance for future growth: 5.6%	0.43	0.17	0.14	0.14	0.14
Load Allocation	3.17	1.19	0.96	0.93	0.92
Wasteload Allocation Total	3.76	1.06	1.35	1.32	1.31
MS4 (52.14% of total area)	3.45	1.29	1.04	1.01	1.00
General Motors LLC 2IS00045	0.00	0.00	0.00	0.00	0.00
AK Steel Corporation 2ID00003	0.31	0.31	0.31	0.31	0.31
Tube City IMS, LLC 2IN00076	0.0004	0.0004	0.0004	0.0004	0.0004
Ohio Air National Guard 179 Airlift Group 2IN00189	0.0008	0.0008	0.0008	0.0008	0.0008
Sensmeier (2GB00004)	0	0	0	0	0

Values were adjusted for rounding.

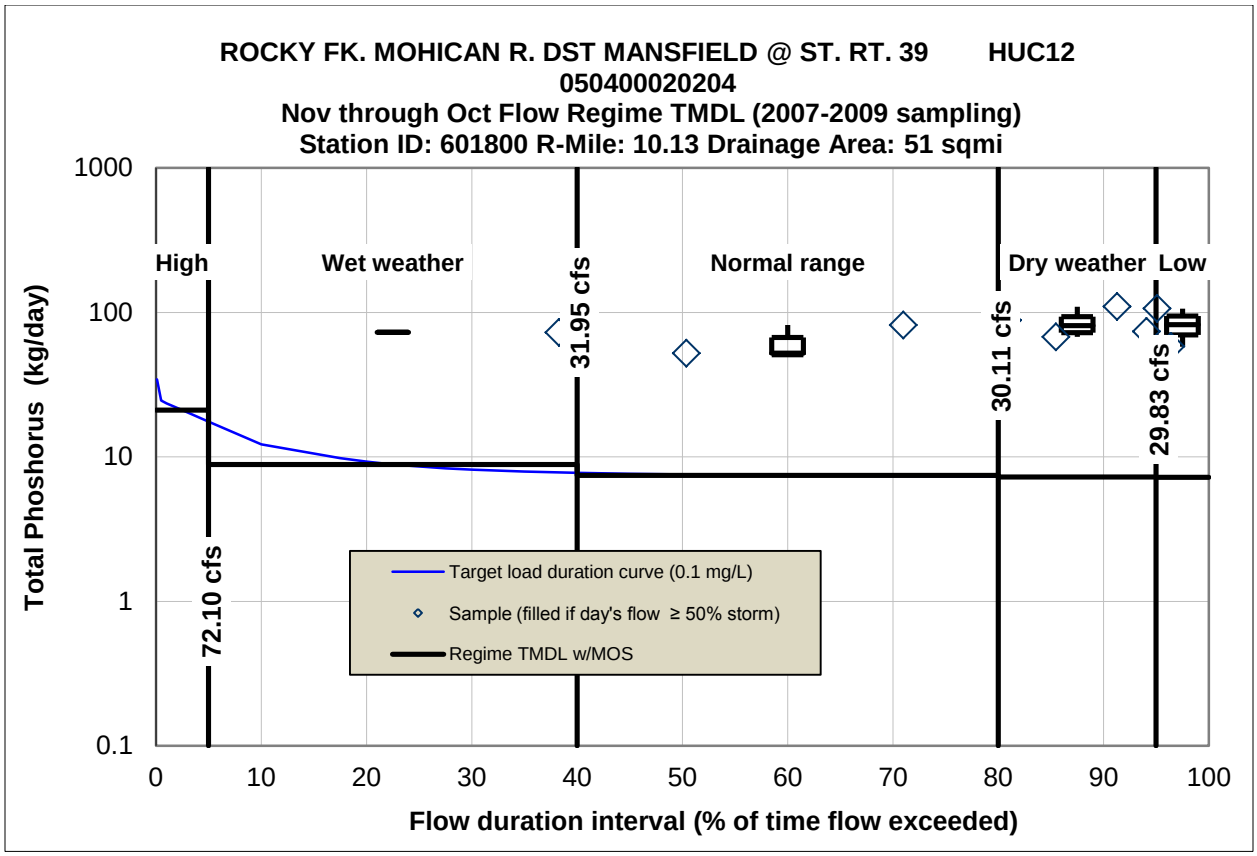

Figure D4-39. Total phosphorus load duration curve for site on Rocky Fk. Mohican R. at St. Rt. 39.

The discharge flows from the Mansfield WWTP are such a large percentage of the total downstream flow that in order to retain assimilative capacity for the total phosphorus load allocation, the discharge concentration for the WWTP would need to be reduced from its existing concentration of 1.84 mg/l to 0.1 mg/l. Implementation of the WLA will be discussed in Section 6 of the main report.

Table D4-39. Total phosphorus TMDL for site on Rocky Fk. Mohican R. at St. Rt. 39.

TMDL and Duration Intervals	High 0-5%	Wet weather 5-40%	Normal range 40-80%	Dry weather 80-95%	Low 95-100%
Samples Per Regime		1	3	4	2
Median Sample load		73	52.63	81.77	82.81
Total Load Reduction Required	No Data	**89.1%**	**87.2%**	**92.0%**	**92.1%**
Total Maximum Daily Load	21.16	7.93	7.51	7.33	7.29
Margin of Safety: 5%	1.06	0.45	0.38	0.37	0.36
Allowance for future growth: 5.6%	1.19	0.50	0.42	0.41	0.41
Load Allocation	3.58	0.65	0.31	0.26	0.25
Wasteload Allocation Total	15.34	6.33	6.41	6.29	6.26
MS4 (73.2% of total area)	9.77	1.76	0.84	0.72	0.69
Therm-O-Disc Inc 2IS00028	0.02	0.02	0.02	0.02	0.02
Mansfield WWTP 2PE00001	4.54	4.54	4.54	4.54	4.54
Hyundai Ideal Electric Co 2IN00058	0.000	0.000	0.000	0.000	0.000
Harp Subdiv WWTP 2PG00075	0.45	0.45	0.45	0.45	0.45
Joez Lounge 2PR00238	0.24	0.24	0.24	0.24	0.24
AK Steel Corporation 2ID00003	0.31	0.31	0.31	0.31	0.31
Tube City IMS, LLC 2IN00076	0.0004	0.0004	0.0004	0.0004	0.0004
Ohio Air National Guard 179 Airlift Group 2IN00189	0.0008	0.0008	0.0008	0.0008	0.0008
Sensmeier (2GB00004)	0.00	0.00	0.00	0.00	0.00

Values were adjusted for rounding.

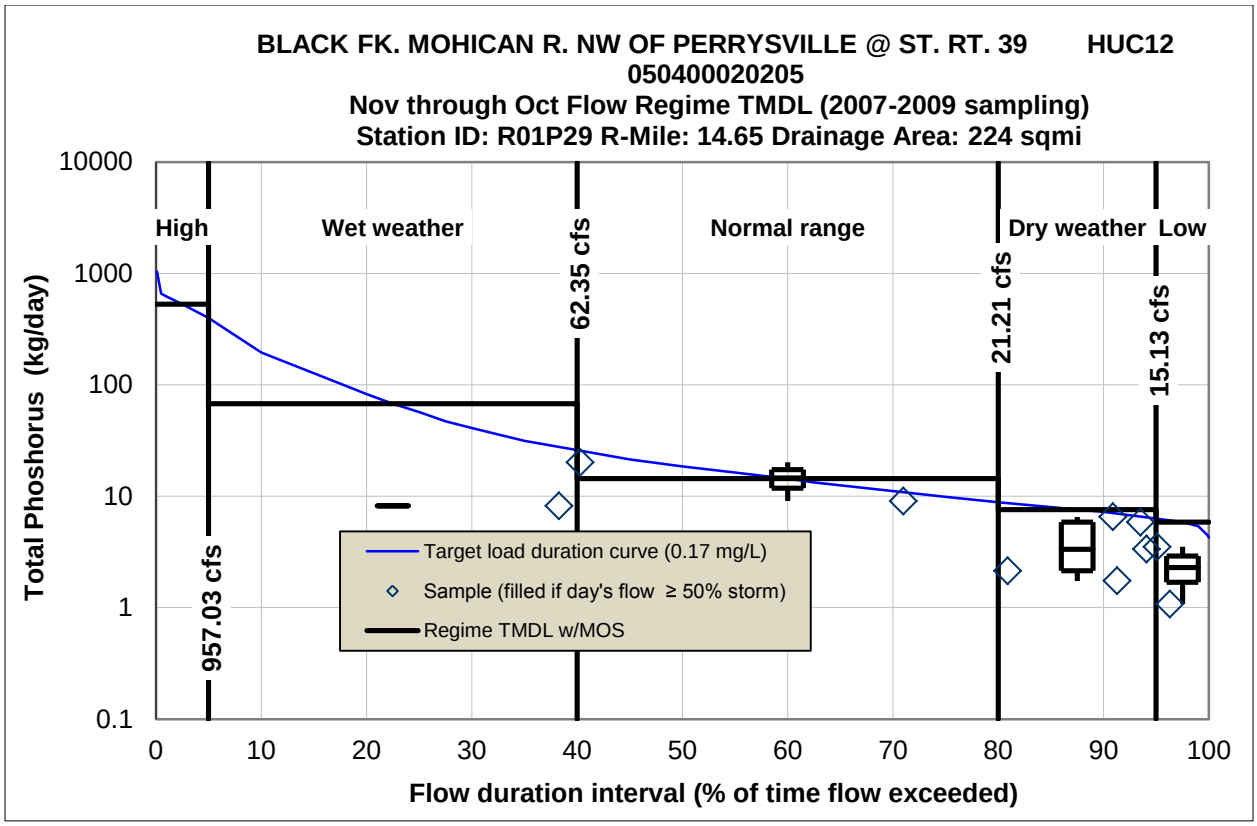

Figure D4-40. Total phosphorus load duration curve for site on Black Fk. Mohican R. NW of Perrysville at St. Rt. 39.

The discharge flows from the Shelby Municipal Light Plant, ArcelorMittal Tubular, Shelby WWTP and Eastview WWTP are a large percentage of the total downstream flow and thus the load and wasteload allocations are sensitive to the concentrations allocated to each. Since Shelby Muncipal Light and ArcelorMittal Tubular show no evidence of discharging total phosphorus each were assigned a small concentration in the wasteload allocation in order for the other facilities upstream of the site to have more assimilative capacity.

The concentrations allocated to Shelby WWTP and Eastview WWTP, 0.29 mg/l and 0.18 mg/l respectively, are based on the maximum each facility can discharge while considering the other upstream and downstream facility discharges while still maintaining a minimum load allocation of at least 0.2 kg/d. Implementation of the WLAs will be discussed in Section 6 of the main report.

Table D4-40. Total phosphorus TMDL for site on Black Fk. Mohican R. NW of Perrysville at St. Rt. 39.

TMDL and Duration Intervals	High 0-5%	Wet weather 5-40%	Normal range 40-80%	Dry weather 80-95%	Low 95-100%
Samples Per Regime		1	2	5	2
Median Sample load		8	14.61	3.35	2.30
Total Load Reduction Required	No Data	**NA**	**12.0%**	**NA**	**NA**
Total Maximum Daily Load	531.48	67.91	14.37	7.61	5.84
Margin of Safety: 5%	26.57	3.40	0.72	0.38	0.29
Allowance for future growth: 5.6%	29.76	3.80	0.80	0.43	0.33
Load Allocation	470.16	55.72	7.86	1.82	0.24
Wasteload Allocation Total	4.99	4.99	4.99	4.99	4.99
MS4	0.00	0.00	0.00	0.00	0.00
Cornell Abraxas Ohio 2GS00002	0.23	0.23	0.23	0.23	0.23
Shelby Welded Tube 2GS00009	0.02	0.02	0.02	0.02	0.02
Northside MHP 2GS00019	0.03	0.03	0.03	0.03	0.03
Briarwood Estates MHP 2PY00018	0.34	0.34	0.34	0.34	0.34
Lust Subdiv WWTP 2PG00077	0.09	0.09	0.09	0.09	0.09
Voisard Mg Co. Inc. Pit No. 2 2PR00139	0.02	0.02	0.02	0.02	0.02
Shelby Municiple Light Plant 2IN00225	0.00	0.00	0.00	0.00	0.00
ArcelorMittal Tubular Products 2ID00002	0.09	0.09	0.09	0.09	0.09
Shelby WWTP 2PD00036	2.74	2.74	2.74	2.74	2.74
Dayspring Assisted Living and Care Facility 2PG00114	0.03	0.03	0.03	0.03	0.03
Crestview Local School 2GS00004	0.25	0.25	0.25	0.25	0.25
Pin Oak Estates MHP 2PR00072	0.34	0.34	0.34	0.34	0.34
Hillside MHP 2PV00700	0.19	0.19	0.19	0.19	0.19
Eastview WWTP 2PH00005	0.61	0.61	0.61	0.61	0.61

Values were adjusted for rounding.

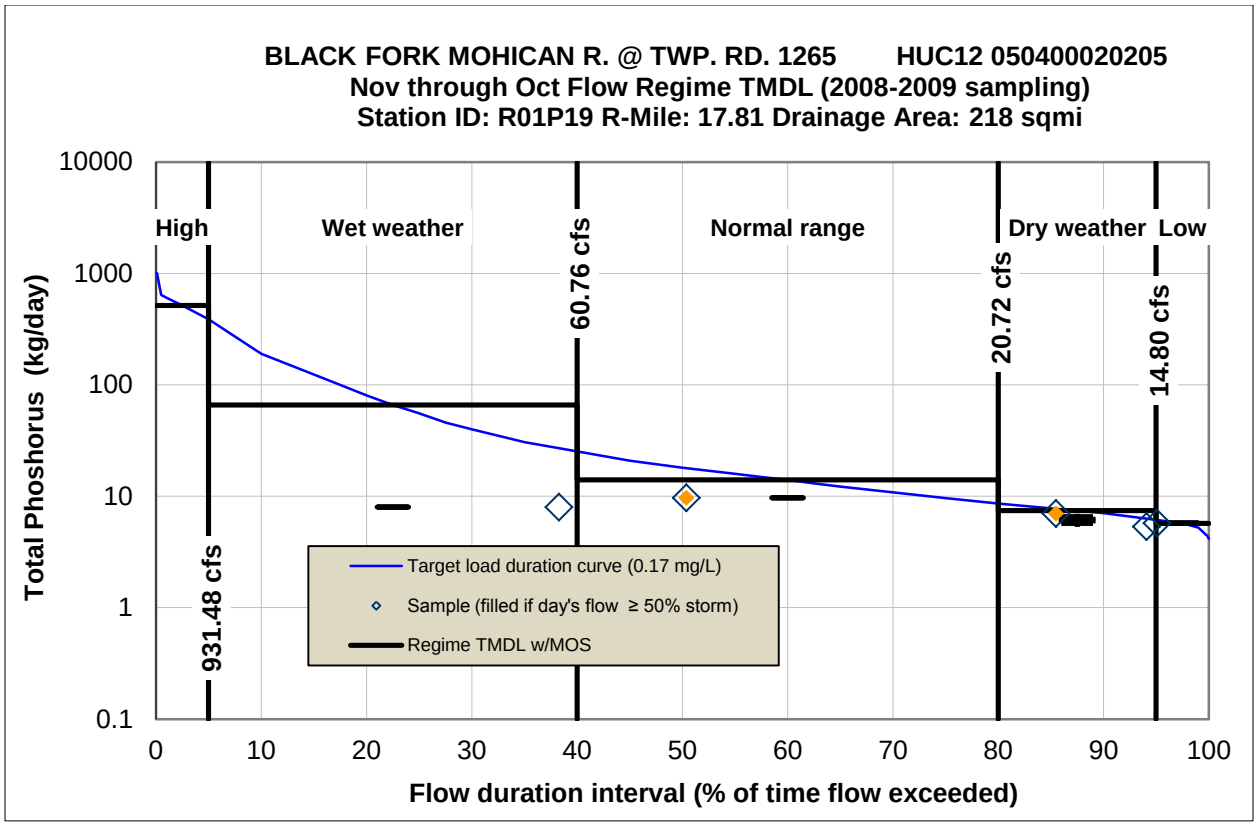

Figure D4-41. Total phosphorus load duration curve for site on Black Fk. Mohican R. at Twp. Rd. 1265.

The discharge flows from the Shelby Municipal Light Plant, ArcelorMittal Tubular, Shelby WWTP and Eastview WWTP are a large percentage of the total downstream flow and thus the load and wasteload allocations are sensitive to the concentrations allocated to each. Since Shelby Muncipal Light and ArcelorMittal Tubular show no evidence of discharging total phosphorus each were assigned a small concentration in the wasteload allocation in order for the other facilities upstream of the site to have more assimilative capacity.

The concentrations allocated to Shelby WWTP and Eastview WWTP, 0.29 mg/l and 0.18 mg/l respectively, are based on the maximum it can discharge while considering the other upstream and downstream facility discharges while still maintaining a minimum load allocation of at least 0.2 kg/d.

Implementation of the WLAs will be discussed in Section 6 of the main report.

Table D4-41. Total phosphorus TMDL for site on Black Fk. Mohican R. at Twp. Rd. 1265.

TMDL and Duration Intervals	High 0-5%	Wet weather 5-40%	Normal range 40-80%	Dry weather 80-95%	Low 95-100%
Samples Per Regime		1	1	2	1
Median Sample load		8	9.69	6.15	5.74
Total Load Reduction Required	No Data	**NA**	**NA**	**NA**	**3.2%**
Total Maximum Daily Load	517.28	66.12	14.02	7.44	5.72
Margin of Safety: 5%	25.86	3.31	0.70	0.37	0.06
Allowance for future growth: 5.6%	28.97	3.70	0.78	0.42	0.09
Load Allocation	457.25	53.91	7.34	1.46	0.37
Wasteload Allocation Total	5.19	5.19	5.19	5.19	5.19
MS4	0.00	0.00	0.00	0.00	0.00
Cornell Abraxas Ohio 2GS00002	0.23	0.23	0.23	0.23	0.23
Shelby Welded Tube 2GS00009	0.02	0.02	0.02	0.02	0.02
Northside MHP 2GS00019	0.03	0.03	0.03	0.03	0.03
Briarwood Estates MHP 2PY00018	0.34	0.34	0.34	0.34	0.34
Lust Subdiv WWTP 2PG00077	0.09	0.09	0.09	0.09	0.09
Voisard Mg Co. Inc. Pit No. 2 2PR00139	0.02	0.02	0.02	0.02	0.02
Shelby Municiple Light Plant 2IN00225	0.00	0.00	0.00	0.00	0.00
ArcelorMittal Tubular Products 2ID00002	0.09	0.09	0.09	0.09	0.09
Shelby WWTP 2PD00036	2.74	2.74	2.74	2.74	2.74
Dayspring Assisted Living and Care Facility 2PG00114	0.34	0.34	0.34	0.34	0.34
Crestview Local School 2GS00004	0.25	0.25	0.25	0.25	0.25
Pin Oak Estates MHP 2PR00072	0.34	0.34	0.34	0.34	0.34
Hillside MHP 2PV00700	0.19	0.19	0.19	0.19	0.19
Eastview WWTP 2PH00005	0.01	0.01	0.01	0.01	0.01

Values were adjusted for rounding.

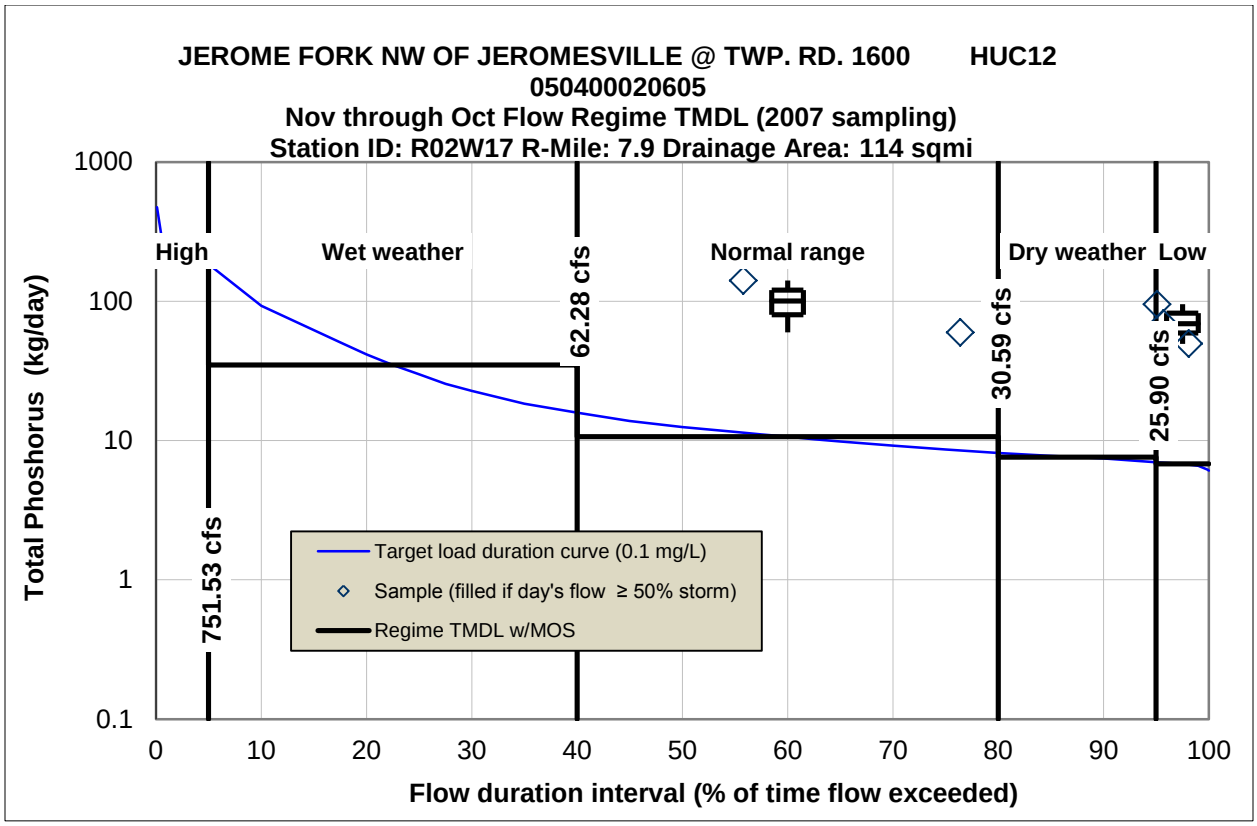

Figure D4-42. Total phosphorus load duration curve for site on Jerome Fork NW of Jeromesville at Twp. Rd. 1600.

The discharge flows from the Ashland WWTP are such a large percentage of the total downstream flow that in order to retain assimilative capacity for the total phosphorus load allocation, the discharge concentration for the WWTP would need to be reduced from its existing concentration of 3.84 mg/l to 0.23 mg/l. Also, to increase the WLA, the MOS and AFG were changed in the lowest flow segment only from 5.0% and 5.6% to 1.0% and 1.6%, respectively. During the lowest flows, sources are primarily point sources, so there is more certainty about the relationship between LA, WLA and water quality. Implementation of the WLA will be discussed in Section 6 of the main report.

Table D4-42. Total phosphorus TMDL for site on Jerome Fork NW of Jeromesville at Twp. Rd. 1600.

TMDL and Duration Intervals	High 0-5%	Wet weather 5-40%	Normal range 40-80%	Dry weather 80-95%	Low 95-100%
Samples Per Regime			2		3
Median Sample load			94.07		62.78
Total Load Reduction Required	No Data	No Data	**90.5%**	No Data	**90.4%**
Total Maximum Daily Load	244.33	34.26	10.00	6.93	6.13
Margin of Safety: 5%	12.22	1.71	0.50	0.35	0.06
Allowance for future growth: 5.6%	13.68	1.92	0.50	0.39	0.10
Load Allocation	211.31	24.95	3.26	0.52	0.30
Wasteload Allocation Total	7.13	5.85	5.70	5.68	5.68
MS4 (0.68% of total area)	1.45	0.17	0.02	0.00	0.00
Maverick Innovative Solutions LLC 2PR00217	0.02	0.02	0.02	0.02	0.02
Green Acres MHP 2PY00058	0.20	0.20	0.20	0.20	0.20
C&R Enterprises C&DD 2IN00231	0.00	0.00	0.00	0.00	0.00
Agape Acres Inc 2PY00037	0.23	0.23	0.23	0.23	0.23
Mapleton Jr & Sr HS 2PT00040	0.25	0.25	0.25	0.25	0.25
Southwood Estates Homeowners Assoc Ltd 2GS00015	0.23	0.23	0.23	0.23	0.23
Ashland WTP 2IW00002	0.11	0.11	0.11	0.11	0.11
Ashland WWTP 2PD00010	4.35	4.35	4.35	4.35	4.35
Fin Feather and Fur Outfitters Mini-Mall 2PR00145	0.06	0.06	0.06	0.06	0.06
Unique Ventures Group LLC DBA Perkins Restaurant 2PR00221	0.23	0.23	0.23	0.23	0.23

Values were adjusted for rounding.

Note: The Jeromesville WWTP is located in this nested subwatershed but is downstream from the site, so it is not included in this TMDL.

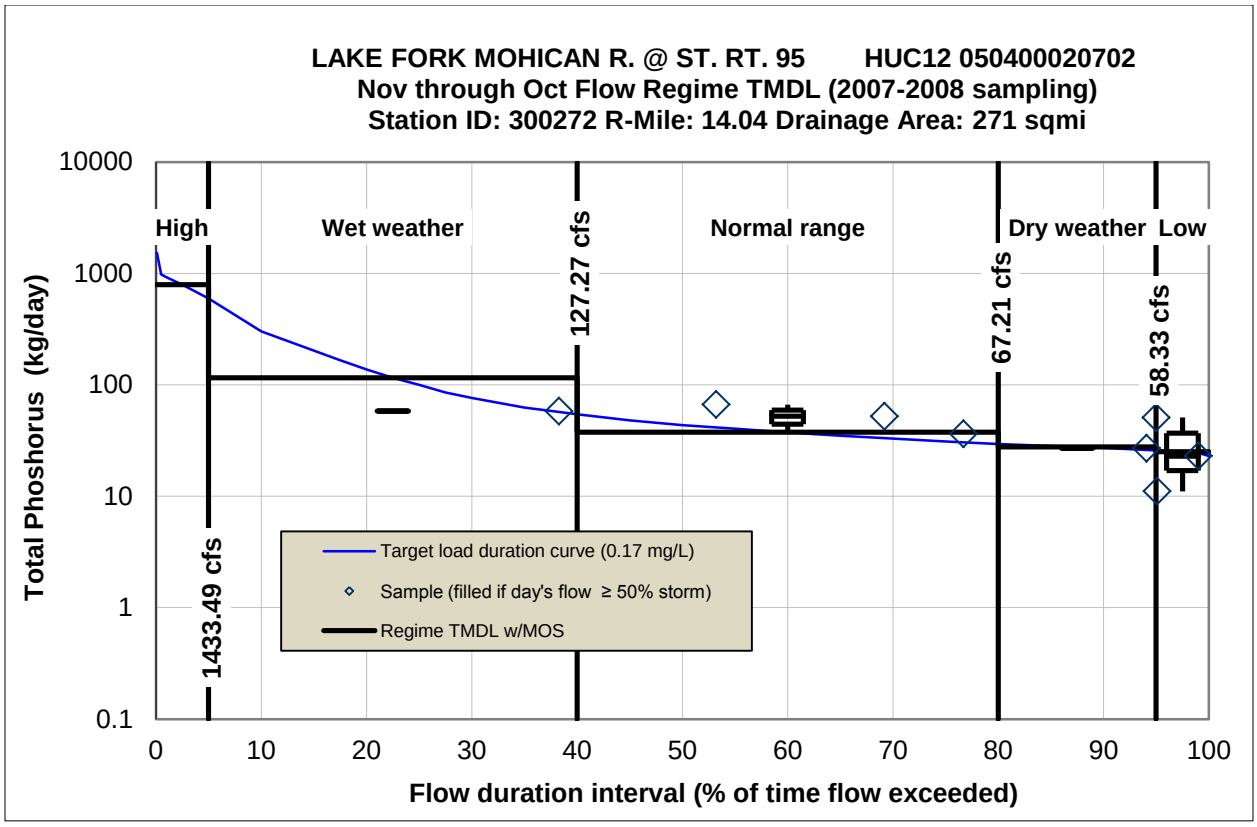

Figure D4-43. Total phosphorus load duration curve for site on Lake Fork Mohican R. at St. Rt. 95.

The discharge flows from the Ashland WWTP are such a large percentage of the total downstream flow that in order to retain assimilative capacity for the total phosphorus load allocation, the discharge concentration for the WWTP would need to be reduced from its existing concentration 3.84 mg/l to 0.23 mg/l. During the lowest flows, sources are primarily point sources, so there is more certainty about the relationship between LA, WLA and water quality. Implementation of the WLA will be discussed in Section 6 of the main report.

Table D4-43. Total phosphorus TMDL for site on Lake Fork Mohican R. at St. Rt. 95.

TMDL and Duration Intervals	High 0-5%	Wet weather 5-40%	Normal range 40-80%	Dry weather 80-95%	Low 95-100%
Samples Per Regime		1	3	1	3
Median Sample load		57	50.01	25.52	21.61
Total Load Reduction Required	No Data	**NA**	**35.5%**	**8.3%**	**2.3%**
Total Maximum Daily Load	791.03	114.22	36.06	26.18	23.61
Margin of Safety: 5%	39.55	5.71	1.80	1.31	1.18
Allowance for future growth: 5.6%	44.30	6.40	2.02	1.47	1.32
Load Allocation	694.35	89.28	19.41	10.58	8.28
Wasteload Allocation Total	12.82	12.82	12.82	12.82	12.82
MS4	0.00	0.00	0.00	0.00	0.00
Hidden Acres MHP 2PR00239	0.17	0.17	0.17	0.17	0.17
ODOT Rest Area 3-36 3PP00029	0.23	0.23	0.23	0.23	0.23
West Salem WWTP 3PB00053	2.32	2.32	2.32	2.32	2.32
Cinnamon Lake Association WWTP 2PR00009	1.70	1.70	1.70	1.70	1.70
Northwestern Local Sch Dist WWTP 3PT00009	0.17	0.17	0.17	0.17	0.17
American Augers Inc 2PR00172	0.09	0.09	0.09	0.09	0.09
Hyponex Corp 3IN00166	0.00	0.00	0.00	0.00	0.00
Country Pointe Health Care Inc LLC, 001 3PR00488	0.31	0.31	0.31	0.31	0.31
Koenig's Korner 3PR00423	0.0034	0.0034	0.0034	0.0034	0.0034
Southwood Estates Homeowners Assoc Ltd 2GS00015	0.23	0.23	0.23	0.23	0.23
Ashland WTP 2IW00002	0.01	0.01	0.01	0.01	0.01
Ashland WWTP 2PD00010	4.35	4.35	4.35	4.35	4.35
Agape Acres Inc 2PY00037	0.23	0.23	0.23	0.23	0.23
Mapleton Jr & Sr HS 2PT00040	0.25	0.25	0.25	0.25	0.25
Fin Feather and Fur Outfitters Mini-Mall 2PR00145	0.06	0.06	0.06	0.06	0.06
Unique Ventures Group LLC DBA Perkins Restaurant 2PR00221	0.23	0.23	0.23	0.23	0.23
Coburn Inc 2PR00140	0.05	0.05	0.05	0.05	0.05
Hayesville WWTP 2PA00089	0.68	0.68	0.68	0.68	0.68
Hillsdale High School 2PR00269	0.11	0.11	0.11	0.11	0.11
Ashland Co West Holmes JVS 2PT00011	0.45	0.45	0.45	0.45	0.45
Jeromesville WWTP 2PA00092	0.75	0.75	0.75	0.75	0.75
Maverick Innovative Solutions LLC 2PR00217	0.02	0.02	0.02	0.02	0.02
Green Acres MHP 2PY00058	0.20	0.20	0.20	0.20	0.20
C&R Enterprises C&DD Landfill (no flow reported) 2IN00231	0	0	0	0	0
Country Pointe Health Care Inc LLC, 002 3PR00488	0.21	0.21	0.21	0.21	0.21

Values were adjusted for rounding.

Table D4-44 summarizes the total phosphorus and nitrate and nitrite wasteload allocations for the LDCs above.

Table D4-44. Summary of facilities' nutrient wasteload allocations.

Sampling Site HUC 05040002	Sampling Site Description	River Mile	Facility Name	WLA (kg/d)	Conc. (mg/l)	Design Flow (MGD)
Total Phosphorus Wasteload Allocations						
01 02	Bear Run @ London West Rd. (Co. Rd. 58)	0.48	Voisard Mfg Co. Inc. Pit no. 2 2PR00139	0.02	3	0.0015
02 01	Black Fk. Mohican R. at Crider Rd. (Richland Co. Rd. 92)	23.31	Hillside MHP 2PV00700	0.19	3	0.017
02 01	Black Fk. Mohican R. at Crider Rd. (Richland Co. Rd. 92)	23.31	Eastview WWTP 2PH00005	0.64	0.18	0.932
02 01	Black Fk. Mohican R. @ Charles Rd. (Weller Twp. Rd. 89)	29.67	Cornell Abraxas Ohio 2GS00002	0.23	3	0.02
02 01	Black Fk. Mohican R. @ Charles Rd. (Weller Twp. Rd. 89)	29.67	Shelby Welded Tube 2GS00009	0.02	3	0.002
02 01	Black Fk. Mohican R. @ Charles Rd. (Weller Twp. Rd. 89)	29.67	Northside MHP 2GS00019	0.03	3	0.0024
02 01	Black Fk. Mohican R. @ Charles Rd. (Weller Twp. Rd. 89)	29.67	Briarwood Estates MHP 2PY00018	0.34	3	0.030
02 01	Black Fk. Mohican R. @ Charles Rd. (Weller Twp. Rd. 89)	29.67	Lust Subdiv WWTP 2PG00077	0.09	3	0.008
02 01	Black Fk. Mohican R. @ Charles Rd. (Weller Twp. Rd. 89)	29.67	Voisard Mg Co. Inc. Pit No. 2 2PR00139	0.02	3	0.0015
02 01	Black Fk. Mohican R. @ Charles Rd. (Weller Twp. Rd. 89)	29.67	Shelby Municipal Light Plant 2IN00225	0.00	0.1	0
02 01	Black Fk. Mohican R. @ Charles Rd. (Weller Twp. Rd. 89)	29.67	ArcelorMittal Tubular Products 2ID00002	0.08	0.1	0.203
02 01	Black Fk. Mohican R. @ Charles Rd. (Weller Twp. Rd. 89)	29.67	Shelby WWTP 2PD00036	2.74	0.25	2.5
02 01	Black Fk. Mohican R. @ Charles Rd. (Weller Twp. Rd. 89)	29.67	Dayspring Assisted Living and Care Facility 2PG00114	0.10	3	0.009
02 01	Black Fk. Mohican R. @ Charles Rd. (Weller Twp. Rd. 89)	29.67	Crestview Local School 2GS00004	0.15	3	0.013
02 01	Black Fk. Mohican R. @ Charles Rd. (Weller Twp. Rd. 89)	29.67	Pin Oak Estates MHP 2PR00072	0.34	3	0.03
02 03	Rocky Fk. Mohican R. at Mansfield @ Longview Ave.	14.23	General Motors LLC 2IS00045	0.00	0.2	0.8
02 03	Rocky Fk. Mohican R. at Mansfield @ Longview Ave.	14.23	AK Steel Corporation 2ID00003	0.31	0.1	1.735
02 03	Rocky Fk. Mohican R. at Mansfield @ Longview Ave.	14.23	Tube City IMS, LLC 2IN00076	0.0004	0.1	0.77
02 03	Rocky Fk. Mohican R. at Mansfield @ Longview Ave.	14.23	Ohio Air National Guard 179 Airlift Group 2IN00189	0.0008	0.1	0.15
02 04	Rocky Fk. Mohican R. dst Mansfield @ St. Rt. 39	10.13	Therm-O-Disc Inc 2IS00028	0.02	3	0.078
02 04	Rocky Fk. Mohican R. dst Mansfield @ St. Rt. 39	10.13	Mansfield WWTP 2PE00001	4.54	0.1	12.

Sampling Site HUC 05040002	Sampling Site Description	River Mile	Facility Name	WLA (kg/d)	Conc. (mg/l)	Design Flow (MGD)
02 04	Rocky Fk. Mohican R. Dst Mansfield @ St. Rt. 39	10.13	Hyundai Ideal Electric Co 2IN00058	0.00	3	0.0135
02 04	Rocky Fk. Mohican R. Dst Mansfield @ St. Rt. 39	10.13	Harp Subdiv WWTP 2PG00075	0.45	3	0.04
02 04	Rocky Fk. Mohican R. Dst Mansfield @ St. Rt. 39	10.13	Joez Lounge 2PR00238	0.24	3	0.021
02 04	Rocky Fk. Mohican R. Dst Mansfield @ St. Rt. 39	10.13	AK Steel Corporation 2ID00003	0.31	0.1	1.735
02 04	Rocky Fk. Mohican R. Dst Mansfield @ St. Rt. 39	10.13	Tube City IMS, LLC 2IN00076	0.0004	0.1	0.77
02 04	Rocky Fk. Mohican R. Dst Mansfield @ St. Rt. 39	10.13	Ohio Air National Guard 179 Airlift Group 2IN00189	0.00	0.1	0.15
02 05	Black Fk. Mohican R. NW of Perrysville @ St. Rt. 39	14.65	Cornell Abraxas Ohio 2GS00002	0.23	3	0.02
02 05	Black Fk. Mohican R. NW of Perrysville @ St. Rt. 39	14.65	Shelby Welded Tube 2GS00009	0.02	3	0.002
02 05	Black Fk. Mohican R. NW of Perrysville @ St. Rt. 39	14.65	Northside MHP 2GS00019	0.03	3	0.0024
02 05	Black Fk. Mohican R. NW of Perrysville @ St. Rt. 39	14.65	Briarwood Estates MHP 2PY00018	0.34	3	0.030
02 05	Black Fk. Mohican R. NW of Perrysville @ St. Rt. 39	14.65	Lust Subdiv WWTP 2PG00077	0.09	3	0.008
02 05	Black Fk. Mohican R. NW of Perrysville @ St. Rt. 39	14.65	Voisard Mg Co. Inc. Pit No. 2 2PR00139	0.02	3	0.0015
02 05	Black Fk. Mohican R. NW of Perrysville @ St. Rt. 39	14.65	Shelby Municipal Light Plant 2IN00225	0.00	0.1	0
02 05	Black Fk. Mohican R. NW of Perrysville @ St. Rt. 39	14.65	ArcelorMittal Tubular Products 2ID00002	0.08	0.1	0.203
02 05	Black Fk. Mohican R. NW of Perrysville @ St. Rt. 39	14.65	Shelby WWTP 2PD00036	2.74	0.25	2.5
02 05	Black Fk. Mohican R. NW of Perrysville @ St. Rt. 39	14.65	Dayspring Assisted Living and Care Facility 2PG00114	0.10	3	0.009
02 05	Black Fk. Mohican R. NW of Perrysville @ St. Rt. 39	14.65	Crestview Local School 2GS00004	0.15	3	0.013
02 05	Black Fk. Mohican R. NW of Perrysville @ St. Rt. 39	14.65	Pin Oak Estates MHP 2PR00072	0.34	3	0.03
02 05	Black Fk. Mohican R. NW of Perrysville @ St. Rt. 39	14.65	Hillside MHP 2PV00700	0.19	3	0.017
02 05	Black Fk. Mohican R. NW of Perrysville @ St. Rt. 39	14.65	Eastview WWTP 2PH00005	0.64	0.18	0.932
02 05	Black Fork Mohican R. @ Twp. Rd. 1265	17.80	Cornell Abraxas Ohio 2GS00002	0.23	3	0.02
02 05	Black Fork Mohican R. @ Twp. Rd. 1265	17.80	Shelby Welded Tube 2GS00009	0.02	3	0.002
02 05	Black Fork Mohican R. @ Twp. Rd. 1265	17.80	Northside MHP 2GS00019	0.03	3	0.0024
02 05	Black Fork Mohican R. @ Twp. Rd.	17.80	Briarwood Estates MHP	0.34	3	0.030

Sampling Site HUC 05040002	Sampling Site Description	River Mile	Facility Name	WLA (kg/d)	Conc. (mg/l)	Design Flow (MGD)
	1265		2PY00018			
02 05	Black Fork Mohican R. @ Twp. Rd. 1265	17.80	Lust Subdiv WWTP 2PG00077	0.09	3	0.008
02 05	Black Fork Mohican R. @ Twp. Rd. 1265	17.80	Voisard Mg Co. Inc. Pit No. 2 2PR00139	0.02	3	0.0015
02 05	Black Fork Mohican R. @ Twp. Rd. 1265	17.80	Shelby Municipal Light Plant 2IN00225	0.00	0.1	0
02 05	Black Fork Mohican R. @ Twp. Rd. 1265	17.80	ArcelorMittal Tubular Products 2ID00002	0.08	0.1	0.203
02 05	Black Fork Mohican R. @ Twp. Rd. 1265	17.80	Shelby WWTP 2PD00036	2.74	0.25	2.5
02 05	Black Fork Mohican R. @ Twp. Rd. 1265	17.80	Dayspring Assisted Living and Care Facility 2PG00114	0.10	3	0.009
02 05	Black Fork Mohican R. @ Twp. Rd. 1265	17.80	Crestview Local School 2GS00004	0.15	3	0.013
02 05	Black Fork Mohican R. @ Twp. Rd. 1265	17.80	Pin Oak Estates MHP 2PR00072	0.34	3	0.03
02 05	Black Fork Mohican R. @ Twp. Rd. 1265	17.80	Hillside MHP 2PV00700	0.19	3	0.017
02 05	Black Fork Mohican R. @ Twp. Rd. 1265	17.80	Eastview WWTP 2PH00005	0.64	0.18	0.932
06 05	Jerome Fork NW of Jeromesville @ Twp. Rd. 1600	7.9	Maverick Innovative Solutions LLC 2PR00217	0.02	3	0.0015
06 05	Jerome Fork NW of Jeromesville @ Twp. Rd. 1600	7.9	Green Acres MHP 2PY00058	0.20	3	0.018
06 05	Jerome Fork NW of Jeromesville @ Twp. Rd. 1600	7.9	C&R Enterprises C&DD 2IN00231	0.00	3	0
06 05	Jerome Fork NW of Jeromesville @ Twp. Rd. 1600	7.9	Agape Acres Inc 2PY00037	0.23	3	0.02
06 05	Jerome Fork NW of Jeromesville @ Twp. Rd. 1600	7.9	Mapleton Jr & Sr HS 2PT00040	0.25	3	0.0221
06 05	Jerome Fork NW of Jeromesville @ Twp. Rd. 1600	7.9	Southwood Estates Homeowners Assoc Ltd 2GS00015	0.23	3	0.02
06 05	Jerome Fork NW of Jeromesville @ Twp. Rd. 1600	7.9	Ashland WTP 2IW00002	0.78	0.1	2.056
06 05	Jerome Fork NW of Jeromesville @ Twp. Rd. 1600	7.9	Ashland WWTP 2PD00010	4.35	0.23	5.0
06 05	Jerome Fork NW of Jeromesville @ Twp. Rd. 1600	7.9	Fin Feather and Fur Outfitters Mini-Mall 2PR00145	0.06	3	0.005
06 05	Jerome Fork NW of Jeromesville @ Twp. Rd. 1600	7.9	Unique Ventures Group LLC DBA Perkins Restaurant 2PR00221	0.23	3	0.023
07 02	Lake Fork Mohican R. @ St. Rt. 95	14.04	Hidden Acres MHP 2PR00239	0.17	3	0.015
07 02	Lake Fork Mohican R. @ St. Rt. 95	14.04	ODOT Rest Area 3-36 3PP00029	0.23	3	0.02
07 02	Lake Fork Mohican R. @ St. Rt. 95	14.04	West Salem WWTP 3PB00053	2.32	3	0.204

Sampling Site HUC 05040002	Sampling Site Description	River Mile	Facility Name	WLA (kg/d)	Conc. (mg/l)	Design Flow (MGD)
07 02	Lake Fork Mohican R. @ St. Rt. 95	14.04	Cinnamon Lake Association WWTP 2PR00009	1.70	3	0.15
07 02	Lake Fork Mohican R. @ St. Rt. 95	14.04	Northwestern Local Sch Dist WWTP 3PT00009	0.17	3	0.015
07 02	Lake Fork Mohican R. @ St. Rt. 95	14.04	American Augers Inc 2PR00172	0.09	3	0.0075
07 02	Lake Fork Mohican R. @ St. Rt. 95	14.04	Hyponex Corp 3IN00166	4.54	3	0.4
07 02	Lake Fork Mohican R. @ St. Rt. 95	14.04	Country Pointe Health Care Inc LLC 3PR00488	0.31	3	0.0275
07 02	Lake Fork Mohican R. @ St. Rt. 95	14.04	Koenig's Korner 3PR00423	0.0034	3	0.00055
07 02	Lake Fork Mohican R. @ St. Rt. 95	14.04	Southwood Estates Homeowners Assoc Ltd 2GS00015	0.23	3	0.02
07 02	Lake Fork Mohican R. @ St. Rt. 95	14.04	Ashland WTP 2IW00002	0.78	0.1	2.056
07 02	Lake Fork Mohican R. @ St. Rt. 95	14.04	Ashland WWTP 2PD00010	4.35	0.23	5.0
07 02	Lake Fork Mohican R. @ St. Rt. 95	14.04	Agape Acres Inc 2PY00037	0.23	3	0.02
07 02	Lake Fork Mohican R. @ St. Rt. 95	14.04	Mapleton Jr & Sr HS 2PT00040	0.25	3	0.0221
07 02	Lake Fork Mohican R. @ St. Rt. 95	14.04	Fin Feather and Fur Outfitters Mini-Mall 2PR00145	0.06	3	0.005
07 02	Lake Fork Mohican R. @ St. Rt. 95	14.04	Unique Ventures Group LLC DBA Perkins Restaurant 2PR00221	0.23	3	0.023
07 02	Lake Fork Mohican R. @ St. Rt. 95	14.04	Coburn Inc 2PR00140	0.05	3	0.0005
07 02	Lake Fork Mohican R. @ St. Rt. 95	14.04	Hayesville WWTP 2PA00089	0.68	3	0.06
07 02	Lake Fork Mohican R. @ St. Rt. 95	14.04	Hillsdale High School 2PR00269	0.11	3	0.01
07 02	Lake Fork Mohican R. @ St. Rt. 95	14.04	Ashland Co West Holmes JVS 2PT00011	0.45	3	0.04
07 02	Lake Fork Mohican R. @ St. Rt. 95	14.04	Jeromesville WWTP 2PA00092	0.75	3	0.066
07 02	Lake Fork Mohican R. @ St. Rt. 95	14.04	Maverick Innovative Solutions LLC 2PR00217	0.02	3	0.0015
07 02	Lake Fork Mohican R. @ St. Rt. 95	14.04	Green Acres MHP 2PY00058	0.20	3	0.018
07 02	Lake Fork Mohican R. @ St. Rt. 95	14.04	C&R Enterprises C&DD 2IN00231	0.00	3	0
Nitrate and Nitrite Wasteload Allocations						
01 03	Brubaker Creek @ Eby Rd. (Twp. Rd. 230)	0.3	Dayspring Assisted Living and Care Facility 2PG00114	0.03	1.0	0.009

D4.3 Sediment Analysis

Table D4-45. Characterization of the sediment TMDL using QHEI metrics for sites with impairment due to sedimentation/siltation and/or habitat alteration in the Mohican River TMDL study area.
Note: ALU designation in parentheses; if a second designation is listed the first entry is proposed. Und = previously undesignated ALU designation. Grouped by nested subwatershed; all sites are located within the 8-digit hydrologic unit 05040002.

Stream/River	River Mile	QHEI Categories			Total Sediment Score	Deviation from target (%)	Main impairment category
		Substrate	Channel	Riparian			
01 01 Marsh Run							
Marsh Run (WWH)	0.2	0.5	4	3.5	8	75.0	Substrate
01 05 Black Fork Mohican River							
Black Fork Mohican River (WWH)	36.6	2.5	7	3	12.5	60.9%	Substrate
02 01 Black Fork Mohican River							
Black Fork Mohican River (WWH)	29.6	5.5	9	7	21.5	32.8	Substrate
05 03 Kiser Ditch							
Kiser Ditch Und (MWH)	0.4	4.5	4	6	14.5	37.0	Channel
07 02 Lake Fork Mohican River							
Lake Fork Mohican River (WWH)	12.7	8.5	8	5	21.5	32.8	Substrate
Target (MWH-channel mod)		**≥9**	**≥10**	**≥4**	**≥23**		
Target (WWH)		**≥ 13**	**≥ 14**	**≥ 5**	**≥ 32**		
Target (EWH)		**≥ 15**	**≥ 15**	**≥ 5**	**≥ 35**		

D4.4 Habitat Alteration

Table D4-46. Characterization of the habitat TMDL using QHEI metrics for sites with impairment due to habitat alteration, sedimentation/siltation, turbidity, and/or flow alteration (non-natural) in the Mohican River TMDL study area.

Note: ALU designation in parentheses; if a second designation is listed the first entry is proposed. Und = previously undesignated ALU designation. Grouped by nested subwatershed; all sites are located within the 8-digit hydrologic unit 05040002.

Stream/River	River Mile	QHEI Score	# of High Influence Attributes	Total # of Modified Attributes	Subscore			Total Habitat Score
					QHEI	High Influence	Modified	
01 02 Black Fork Mohican River								
Black Fork Mohican R. (WWH)	50.9	64.5	1	6	1	1	0	2
01 05 Black Fork Mohican River								
Black Fork Mohican R. (WWH)	36.6	35.5	2	7	0	0	0	0
02 01 Black Fork Mohican River								
Black Fork Mohican R. (WWH)	23.3	56	1	5	0	1	0	1
07 02 Lake Fork Mohican River								
Lake Fork Mohican R. (WWH)	12.7	47.5	1	7	0	1	0	1
Target (WWH)		**≥ 60 = 1 pt**	**< 2 = 1 pt**	**< 5 = 1 pt**				**3 pts**
Target (EWH)		**≥ 75 = 1 pt**	**0 = 1 pt**	**< 3 = 1 pt**				**3 pts**

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