Total Maximum Daily Loads for the Mohican River Watershed

Draft Report for Public Review
Division of Surface Water
December 2, 2014

Photo caption: Clear Fork of the Mohican River at Benedict Road bridge outside of the Village of Butler.

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Acronyms and Abbreviations

ALU	aquatic life use
AU	assessment unit
AWS	agricultural water supply
BMP	best management practices
BNA	base neutral and acid extractable compounds
BW	bathing water
CAFO	confined animal feeding operation
CFR	Code of Federal Regulations
cfs	cubic feet per second
Corps	United States Army Corps of Engineers
CREP	Conservation Reserve Enhancement Program (USDA program)
CRP	Conservation Reserve Program (USDA program)
CSO	combined sewer overflow
CSP	Conservation Security Program (USDA program)
CWA	Clean Water Act
CWH	coldwater habitat
D.O.	dissolved oxygen
DNAP	Division of Natural Areas and Preserves (part of ODNR)
DOW	Division of Wildlife (part of ODNR)
DSW	Division of Surface Water (part of Ohio EPA)
DSWC	Division of Soil and Water Conservation (part of ODNR)
ECBP	Eastern Corn Belt Plains (ecoregion)
EPA	Environmental Protection Agency, see U.S. EPA
EQIP	Environmental Quality Incentive Plan (USDA program)
EWH	exceptional warmwater habitat
FCA	fish consumption advisory
FFY	federal fiscal year (October 1 to September 30)
FSA	Farm Service Agency
FWPCA	Federal Water Pollution Control Act
gpd	gallons per day
GRP	Grassland Reserve Program (USDA program)
HELP	Huron Erie Lake Plain (ecoregion)
HU	hydrologic unit
HUC	hydrologic unit code
I/I	infiltration and inflow
IBI	Index of Biotic Integrity
ICI	Invertebrate Community Index
IR	Integrated Report
IWS	industrial water supply
kg	kilogram
L	liter
LA	load allocation
LaMP	Lakewide Management Plan
LEC	(Ohio) Lake Erie Commission
LEL	lowest effect level

LEPF	Lake Erie Protection Fund (LEC program)
LRAU	large river assessment unit
LRW	limited resource water
LTCP	long-term control plan
mg	milligram
MGD	million gallons per day
MHP	mobile home park
MIwb	Modified Index of well being
mi^2	square miles
ml	milliliter
MOR	monthly operating report
MPN	most probable number
MS4	municipal separate storm sewer system
MWH	modified warmwater habitat
n	number (of data points in a grouping)
NHD	National Hydrography Dataset
NOI	notice of intent
NPDES	National Pollutant Discharge Elimination System
NPS	nonpoint source
NRCS	Natural Resource Conservation Service
OAC	Ohio Administrative Code
ODA	Ohio Department of Agriculture
ODH	Ohio Department of Health
ODNR	Ohio Department of Natural Resources
ODOT	Ohio Department of Transportation
OEPA	Ohio Environmental Protection Agency
Ohio EPA	Ohio Environmental Protection Agency (preferred nomenclature)
ORC	Ohio Revised Code
ORSANCO	Ohio River Valley Water Sanitation Commission
OSC	on-site coordinator
OSUE	Ohio State University Extension
OWDA	Ohio Water Development Authority
OWRC	Ohio Water Resources Council
PAHs	polyaromatic hydrocarbons
PCBs	polychlorinated biphenyls
PCR	primary contact recreation
PEC	probable effect concentration
PDWS	public drinking water supply
PEC	probable effect concentration
ppb	parts per billion
PS	point source
PTI	permit to install
PTO	permit to operate
PWS	public water supply
QA	quality assurance
QC	quality control
QHEI	qualitative habitat evaluation index

RM	river mile
SCR	secondary contact recreation
SDWA	Safe Drinking Water Act
SEL	severe effect level
SFY	state fiscal year (July 1 to June 30)
SMP	sludge management plan
sq mi	square miles
SRW	state resource water
SSH	seasonal salmonid habitat
SSM	single-sample maximum
SSO	sanitary sewer overflow
STORET	STOrage and RETrieval (a U.S. EPA water quality database)
SWIMS	Surface Water Information Management System
SWCD	Soil and Water Conservation District
TEC	threshold effect concentration
TKN	total kjeldahl nitrogen
TMDL	total maximum daily load
TOC	total organic carbon
TSS	total suspended solids
ug	microgram
µg	microgram
U.S. EPA	United States Environmental Protection Agency
UAA	use attainability analysis
USACOE	United States Army Corps of Engineers
USC	United States Code
USDA	United States Department of Agriculture
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
VOC	volatile organic compound
WAU	watershed assessment unit
WHIP	Wildlife Habitat Incentives Program (USDA program)
WLA	wasteload allocation
WPCLF	Water Pollution Control Loan Fund
WQ	water quality
WQS	water quality standards
WRP	Wetland Reserve Program (USDA program)
WRRSP	Water Resource Restoration Sponsor Program (Ohio EPA program)
WTP	water treatment plant
WWH	warmwater habitat
WWTP	wastewater treatment plant

Acknowledgements

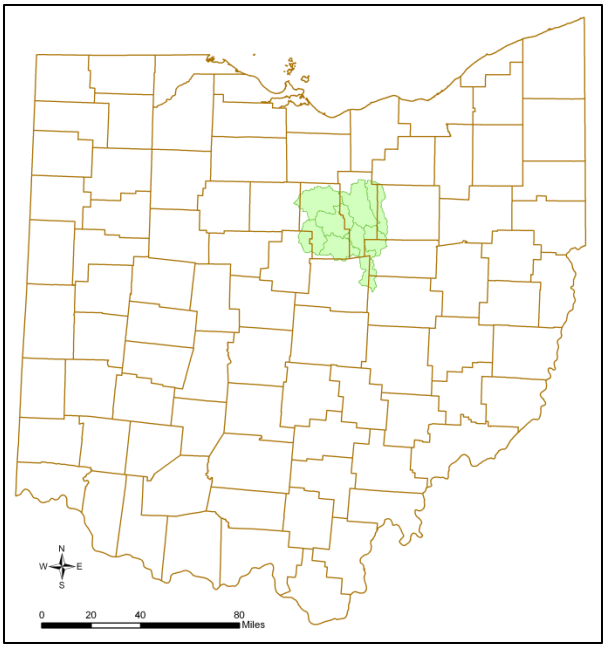
The following Ohio EPA staff provided technical expertise for this project:

Project leader and point source issues	Walter Ariss
Biological monitoring	Chuck McKnight, Brian Alsdorf
Point source issues	Eric Nygaard
Water quality issues	Dan Glomski, Brent Kuenzli, Joann Montgomery, Dan Imhoff
Nonpoint source issues	Katie McKibben
Storm water issues	Lynette Hablitzel
Public drinking water supply consultation	Amy Jo Klei
Enforcement consultation	Elizabeth Wick
Human health use consultation	Mylynda Shaskus
TMDL coordination	Beth Risley, Angela Defenbaugh

The Ohio EPA appreciates the cooperation of the property owners who allowed Ohio EPA personnel access to the project area.

Executive Summary

The Mohican River watershed is located in north-central Ohio, extending from northern Richland County to northwest Coshocton County. This 1,004.6 square mile watershed area is home to more than 190,000 people and encompasses all or part of eighteen municipalities in Richland, Ashland, Wayne, Crawford, Morrow, Knox, Medina, Holmes and Coshocton counties. The watershed is primarily agricultural and forested with 11 percent being developed.



Ohio map with the Mohican River watershed highlighted.

In 2007, Ohio EPA sampled 81 sites on streams in this watershed. Data collected related to water and sediment quality, aquatic biological communities, and habitat. Ohio's water quality standards were compared with these data to determine if quality criteria for various designated beneficial uses are being met.

Overall the watershed met criteria for recreation use at 13%, and 74% for aquatic life uses. Causes of impairments included bacteria, nutrients, sedimentation, direct habitat alterations, flow alterations, organic enrichment, dissolved oxygen, suspended algae, turbidity, biochemical oxygen demand, and natural conditions. Sources of these stressors include failing home sewage treatment systems (HSTS), agricultural practices (crop production, unrestricted cattle access, and manure runoff), dams or impoundments, channelization, urban runoff/storm sewers, municipal point source dischargers, and industrial point sources.

Total maximum daily loads (TMDLs) have been developed for pollutants and stressors that have impaired beneficial uses and precluded attainment of applicable water quality standards. Specific TMDLs that have been developed and are described in this report include:

- *Escherichia coli (E. coli)* (surrogate for organic enrichment)
- Total phosphorus (surrogate for dissolved oxygen, organic enrichment, and suspended algae)
- Nitrate-nitrite
- Total dissolved solids
- Sediment (surrogate for turbidity)
- Habitat (surrogate for dissolved oxygen, turbidity, and biological oxygen demand)

The needed load reductions ranged from 0.8 to 99.5% for *E. coli*, 2.3 to 92.1% for total phosphorus, 8.6% for nitrate-nitrite, and 15.6 to 41.9% for total dissolved solids. Sources of the pollutants that have been allocated the most significant reductions include municipal wastewater treatment plants, and nonpoint sources such as failing HSTSs and agriculture land.

Recommendations for regulatory action resulting from this TMDL analysis include lower effluent limits for *E. coli,* total phosphorus, nitrate-nitrite, and total dissolved solids. Sources of *E. coli* should be

addressed by home sewage planning and improvement, and education and outreach; for nutrient eutrophication by storm water best management practices; for sedimentation and direct habitat alterations by agricultural best management practices, bank or riparian restoration, stream restoration, education and outreach, and investigation into dam modification (for sedimentation purposes only).

1 INTRODUCTION

The Mohican River watershed is located in north-central Ohio and covers portions of Richland, Ashland, Wayne, Crawford, Morrow, Medina, Knox, Holmes and Coshocton counties. The Mohican River is formed by several major tributaries, including Clear Fork, Black Fork, Jerome Fork and Muddy Fork. The river mainstem drains from north to south, joining the Kokosing River in Coshocton County to form the Walhonding River. Ohio EPA sampled the Mohican River watershed in 2007 and 2008. The main causes of impairment were bacteria from failing home sewage treatment systems (HSTS) and agriculture; and nutrients, sediment and direct habitat alterations from agriculture, impoundments and urban land uses.

1.1 The Clean Water Act Requirement to Address Impaired Waters

The Clean Water Act (CWA) Section 303(d) requires States, Territories, and authorized Tribes to list and prioritize waters for which technology-based limits alone do not ensure attainment of water quality standards. Lists of these impaired waters (the Section 303(d) lists) are made available to the public for comment, then submitted to the U.S. Environmental Protection Agency (U.S. EPA) for approval in even-numbered years. Further, the CWA and U.S. EPA regulations require that total maximum daily loads (TMDLs) be developed for all waters on the Section 303(d) lists. The Ohio EPA identified the Mohican River watershed (assessment units 05040002 01 01 – 01 05; 02 01 – 02 05; 03 01 – 03 03; 04 01 – 04 05; 05 01 – 05 03; 06 01 – 06 06; 07 01 – 07 03; 08 01 – 08 06; and the large river) as impaired on the 2012 303(d) list (Ohio EPA 2012; available at http://www.epa.ohio.gov/dsw/tmdl/OhioIntegratedReport.aspx).

In the simplest terms, a TMDL can be thought of as a cleanup plan for a watershed that is not meeting water quality standards. A TMDL is defined as a calculation of the maximum amount of a pollutant that a waterbody can receive and still meet water quality standards and an allocation of that quantity among the sources of the pollutant. Ultimately, the goal of Ohio's TMDL process is full attainment of water quality standards (WQS), which would subsequently lead to the removal of the waterbodies from the 303(d) list. Figure 1-1 shows the phases of TMDL development in Ohio. Table 1-1 summarizes how the impairments identified in the Mohican River watershed are addressed in this TMDL report.

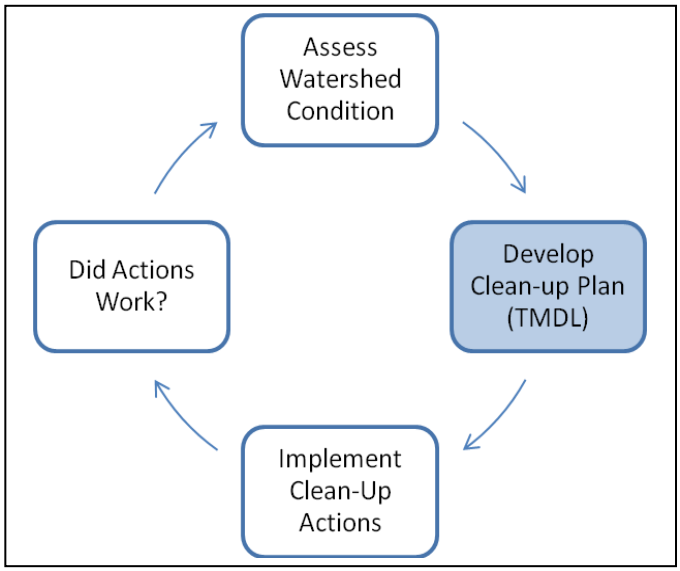


Figure 1-1. Overview of the TMDL project process.

Table 1-1. 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

1.2 Public Involvement

Public involvement is fundamental to the success of water restoration projects, including TMDL efforts. From the beginning, Ohio EPA has invited participation in all aspects of the TMDL program. The Ohio EPA convened an external advisory group in 1998 to assist the Agency with the development of the TMDL program in Ohio. The advisory group issued a report in July 2000 to the Director of Ohio EPA on their findings and recommendations. The Mohican River watershed TMDL project has been completed using the process endorsed by the advisory group.

On September 9, 2008, Ohio EPA employees met with several local campground and livery owners to discuss initial results of the watershed study. Ohio EPA shared both aquatic life and recreation use results and the meanings of each. Ohio EPA also engaged the operators of the major WWTPs in the watershed during routine inspections to make them aware of the TMDL process.

The draft TMDL report is available for public comment from December 2, 2014 through January 5, 2015. A copy of the draft report is posted on Ohio EPA's web page (http://www.epa.ohio.gov/dsw/tmdl/index.aspx).

Continued public involvement is essential to the success of any TMDL project. Ohio EPA will continue to support the implementation process and will facilitate, to the fullest extent possible, restoration actions that are acceptable to the communities and stakeholders in the study area and to Ohio EPA. Ohio EPA is reluctant to rely solely on regulatory actions and strongly upholds the need for voluntary actions facilitated by the local stakeholders, watershed organization, and agency partners to restore the Mohican River watershed.

1.3 Organization of Report

Chapter 2 gives an overview of water quality standards applicable in the watershed. Chapter 3 gives an overview of the water quality conditions in the watershed. Chapter 4 briefly discusses the methods used to calculate load reductions. Chapter 5 provides the load reduction results. Chapter 6 discusses suggested restoration methods to improve water quality.

More detailed information on selected topics is contained in appendices. Appendix A lists the permitted facilities in the watershed. Appendix B summarizes the findings of the watershed survey. Appendix C is a primer on Ohio's water quality standards. Appendix D contains details of the loading analysis. Appendix E discusses programs and actions available to improve water quality.

2 CHARACTERISTICS AND EXPECTATIONS OF THE WATERSHED

The Mohican River watershed is located in north-central Ohio and covers portions of Richland, Ashland, Medina, Wayne, Holmes, Coshocton, Knox, Morrow and Crawford counties. The watershed drains 1,004.6 square miles. Larger municipalities include Shelby, Mansfield, Ashland and Ontario.

2.1 Watershed Characteristics

The following subsections provide an overview of the characteristics of the Mohican River watershed.

2.1.1 Population and Distribution

Population in the Mohican River watershed is most concentrated in the vicinity of Mansfield, Shelby and Ashland. It is least concentrated near the mainstem in the southeastern portion of the watershed and in the less developed areas to the northern, eastern and southern edges of the watershed, as shown in Figure 2-1 (http://quickfacts.census.gov/).

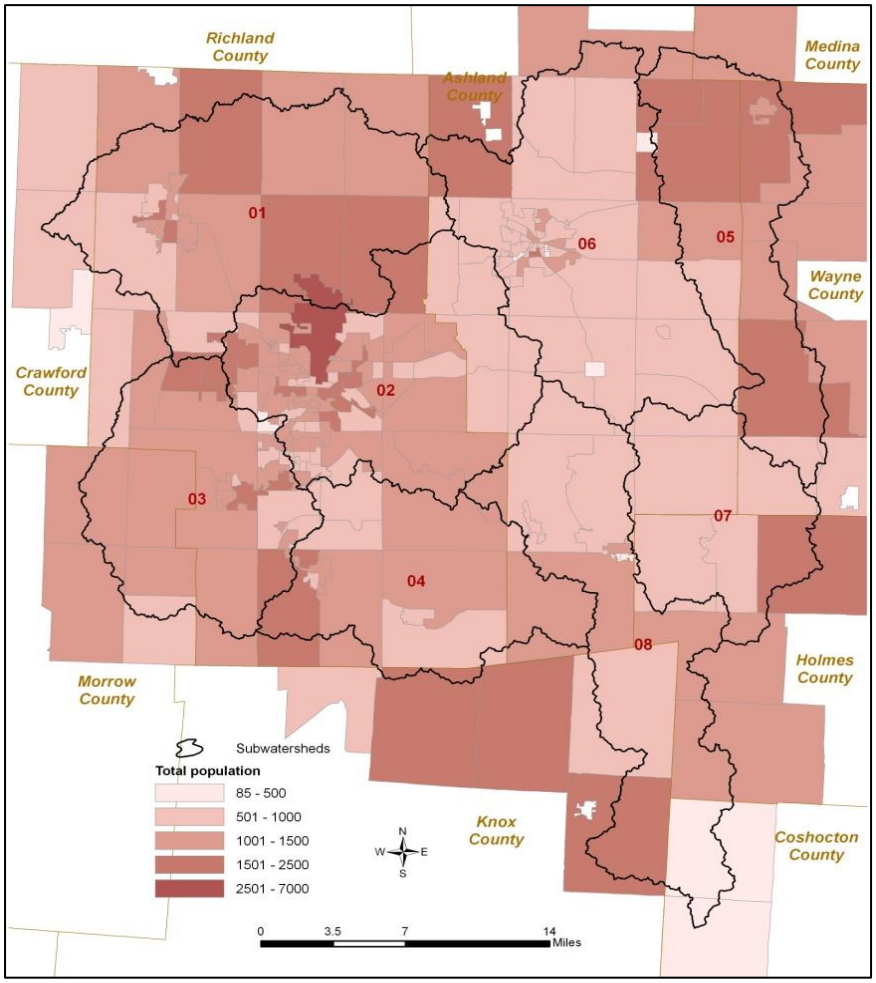


Figure 2-1. Population density in the Mohican River watershed according to the 2010 Census from the U.S. Census Bureau.

2.1.2 Land Use

The four dominant land uses in the Mohican River watershed are cultivated crops, forest, pasture and hay land and developed land. The agricultural land uses are concentrated in the northern and eastern portions of the watershed, while the forested land is concentrated in the southern and western portion of the watershed. The developed lands are concentrated in the larger municipalities (Mansfield, Ontario, Ashland and Shelby). The percentages of each land use type are show in Figure 2-2.

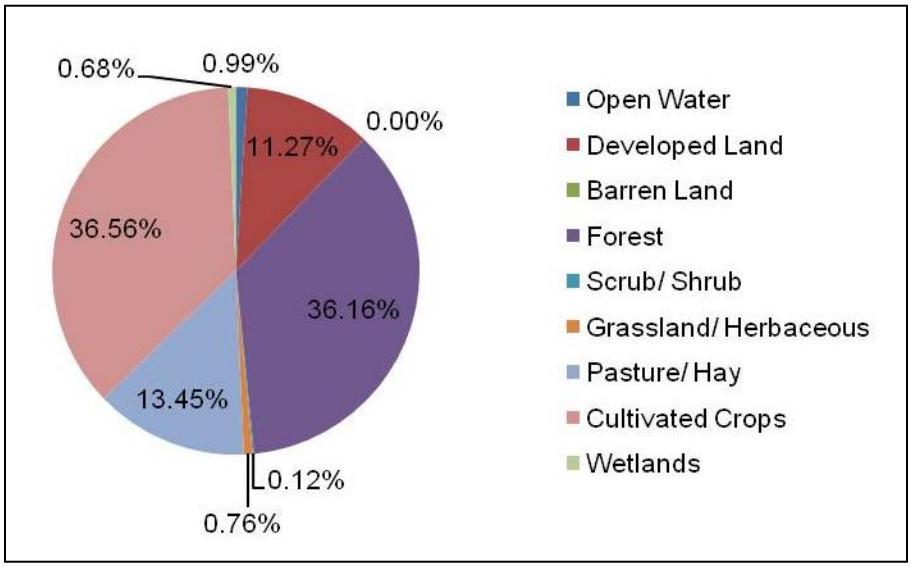


Figure 2-2. Distribution of land use types in the Mohican River watershed.

2.1.3 Point Source Discharges

Industrial and municipal point sources include wastewater treatment plants and factories. Wastewater treatment plants can contribute to bacteria, nutrient enrichment, siltation, and flow alteration problems. Industrial point sources, such as factories, sometimes discharge water that is excessively warm or cold, changing the temperature of the stream. Point sources may contain other pollutants such as chemicals, metals and silt.

NPDES dischargers are entities that possess a permit through the National Pollutant Discharge Elimination System (NPDES). NPDES permits limit the quantity of pollutants discharged and impose monitoring requirements. NPDES permits are designed to protect public health and the aquatic environment by helping to ensure compliance with state and federal regulations. NPDES entities generally discharge wastewater continuously. They primarily affect water quality under average- to low-flow conditions because the potential for dilution is lower. NPDES dischargers located near the origin of a stream or on a small tributary are more likely to cause water quality concerns because their effluent can dominate the natural stream flow. Appendix A lists the NPDES permittees in the Mohican River watershed.

The major municipal dischargers in the watershed are the City of Mansfield WWTP with a treatment design flow of 12.5 million gallons per day (MGD); the City of Ashland WWTP with a treatment design flow if 5.0 MGD; the City of Shelby WWTP with a design flow of 2.5 MGD; and the Village of Lexington

WWTP with a design flow of 1.5 MGD. There are a total of 78 individually permitted municipal and semi-public dischargers in the watershed.

The major industrial dischargers are Arcelor Mittal Tubular Products with average flow of approximately 0.200 MGD and AK Steel Mansfield Works with an average flow of approximately 0.800 MGD. There are 22 individually permitted facilities that discharge industrial process related wastewaters in the watershed.

Two major point source dischargers are located in close proximity to the headwaters of Black Fork Mohican River near Shelby. These are the Arcelor Mittal plant, which enters at RM 53.38 via Tuby Run, and the City of Shelby WWTP located at RM 50.07. Two other major dischargers, AK Steel at RM 14.95 and City of Mansfield WWTP at RM 11.18, are both located on Rocky Fork Mohican River.

In addition, there are ten permittees under various general permits (not including industrial storm water) in the watershed.

2.1.4 Public Drinking Water Supplies

Some communities supply public drinking water from ground water (underground aquifers). Other communities supply public drinking water by withdrawing water from surface waters, including lakes and streams. Surface water public drinking water supplies for the communities of Shelby and Mansfield are located in the Mohican River watershed. More details are available in Appendix B.

2.2 Water Quality Standards

TMDLs are required when a waterbody fails to meet water quality standards (WQS). Every state must adopt WQS to protect, maintain, and improve the quality of the nation's surface waters. WQS represent a level of water quality that will support the Clean Water Act goal of swimmable and fishable waters. Ohio's WQS, set forth in Chapter 3745-1 of the Ohio Administrative Code (OAC), include three major components: beneficial use designations, criteria and antidegradation provisions. Where criteria have not been developed, the State can develop water quality targets that are specific to individual TMDL projects.

Beneficial use designations describe the existing or potential uses of a waterbody, such as public water supply; protection and propagation of aquatic life; and recreation in and on the water. Ohio EPA assigns beneficial use designations to each waterbody in the state. Use designations are defined in paragraph (B) of rule 3745-1-07 of the OAC and are assigned in rules 3745-1-08 to 3745-1-32. Attainment of uses is based on specific numeric and narrative criteria.

Numeric criteria are estimations of chemical concentrations, degree of aquatic life toxicity, and physical conditions allowable in a waterbody without adversely impacting its beneficial uses. Narrative criteria, located in rule 3745-1-04 of the OAC, describe general water quality goals that apply to all surface waters. These criteria state that all waters shall be free from sludge, floating debris, oil, scum, color and odor-producing materials; substances that are harmful to human or animal health; and nutrients in concentrations that may cause excessive algal growth. Narrative “free froms,” also located in rule 3745-1-04 of the OAC, are general water quality criteria that apply to all surface waters. These criteria state

that all waters shall be free from sludge, floating debris, oil and scum, color and odor producing materials, substances that are harmful to human, animal or aquatic life, and nutrients in concentrations that may cause algal blooms. Much of Ohio EPA's present strategy regarding water quality based permitting is based upon the narrative free from of "no toxics in toxic amounts." Ohio EPA developed its strategy based on an evaluation of the potential for significant toxic impacts within the receiving waters. Very important components of this evaluation are the biological survey program and the biological criteria used to judge aquatic life use attainment.

Antidegradation provisions describe the conditions under which water quality may be lowered in surface waters. Under such conditions water quality may not be lowered below criteria protective of existing beneficial uses unless lower quality is deemed necessary to allow important economic or social development. Antidegradation provisions are in Sections 3745-1-05 and 3745-1-54 of the OAC.

The following sub-sections describe the applicable water quality standards for the Mohican River watershed. Further details can be found in Appendix C.

2.2.1 Aquatic Life Use

Ohio's WQS have seven subcategories of aquatic life uses (see http://www.epa.ohio.gov/portals/35/rules/01-07.pdf). The WQS rule contains a narrative for each aquatic life use and the three most commonly assigned aquatic life uses have quantitative, numeric biological criteria that express the minimum acceptable level of biological performance based on three separate biological indices. The indices measure the health of aquatic communities of both fish and insects.

Designated streams are shows in Figure **2-3**. Applicable aquatic life criteria are displayed in Table 2-1.

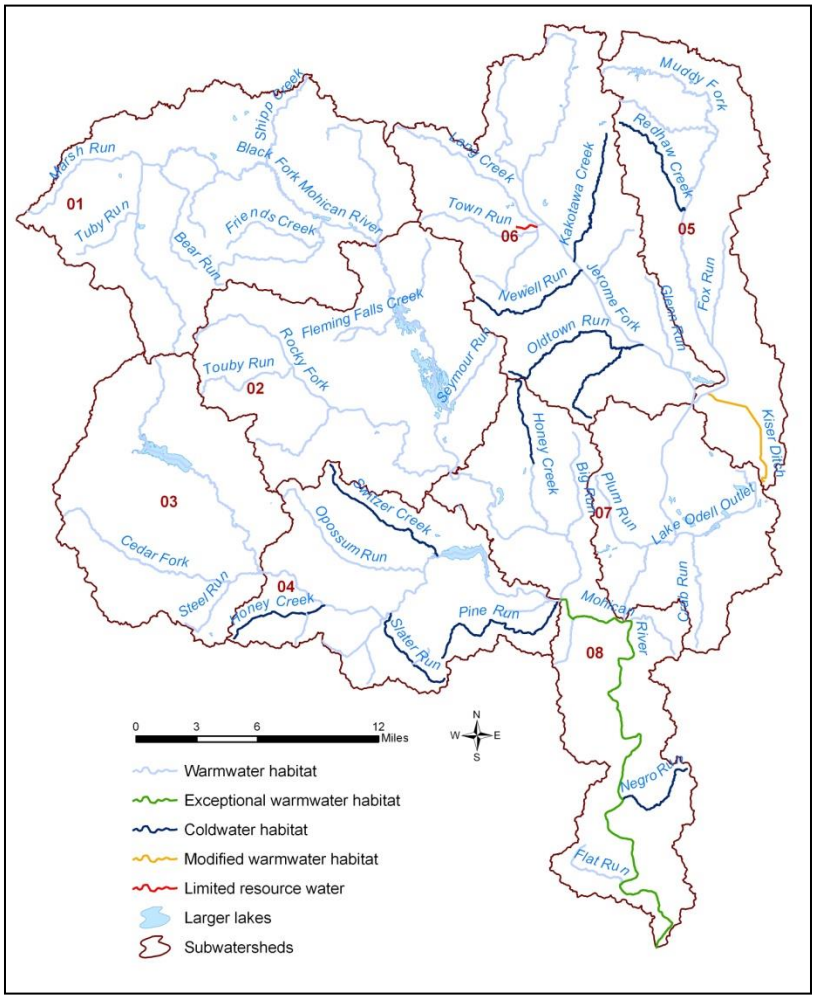


Figure 2-3. Aquatic life use designations in the Mohican River watershed.

Table 2-1. Aquatic life use criteria applicable to the Mohican River watershed.

Biological Index	Assessment Method[2, 3]	Biological Criteria for the Applicable Aquatic Life Use Designations[1]	
IBI	Headwater	40	50
	Wading	38	50
	Boat	40	48
MIwb	Wading	7.9	9.4
	Boat	8.7	9.6
ICI	All[5]	34	46

[1] Coldwater habitats (CWH), limited warmwater habitat (LWH), resource waters (LRW) and seasonal salmonid habitat (SSH) do not have associated biological criteria.

[2] The assessment method used at a site is determined by its drainage area (DA) according to the following: Headwater: DA ≤ 20 mi^2; wading: DA >20 mi^2 and ≤ 500 mi^2; boat: DA > 500 mi^2

[3] MIwb not applicable to drainage areas less than 20 mi^2.

2.2.2 Recreation Use

Ohio's WQS have three subcategories of recreation uses (bathing waters, primary contact and secondary contact). Within primary contact there are three classes of streams (A, B and C) that describe the general frequency with which the stream is used for recreation. The WQS rule contains a description of each recreation use and all primary contact recreation classes have numeric criteria that are associated with a statistically-based risk level. Use designations applicable in the Mohican River watershed are shown in Figure 2-4.

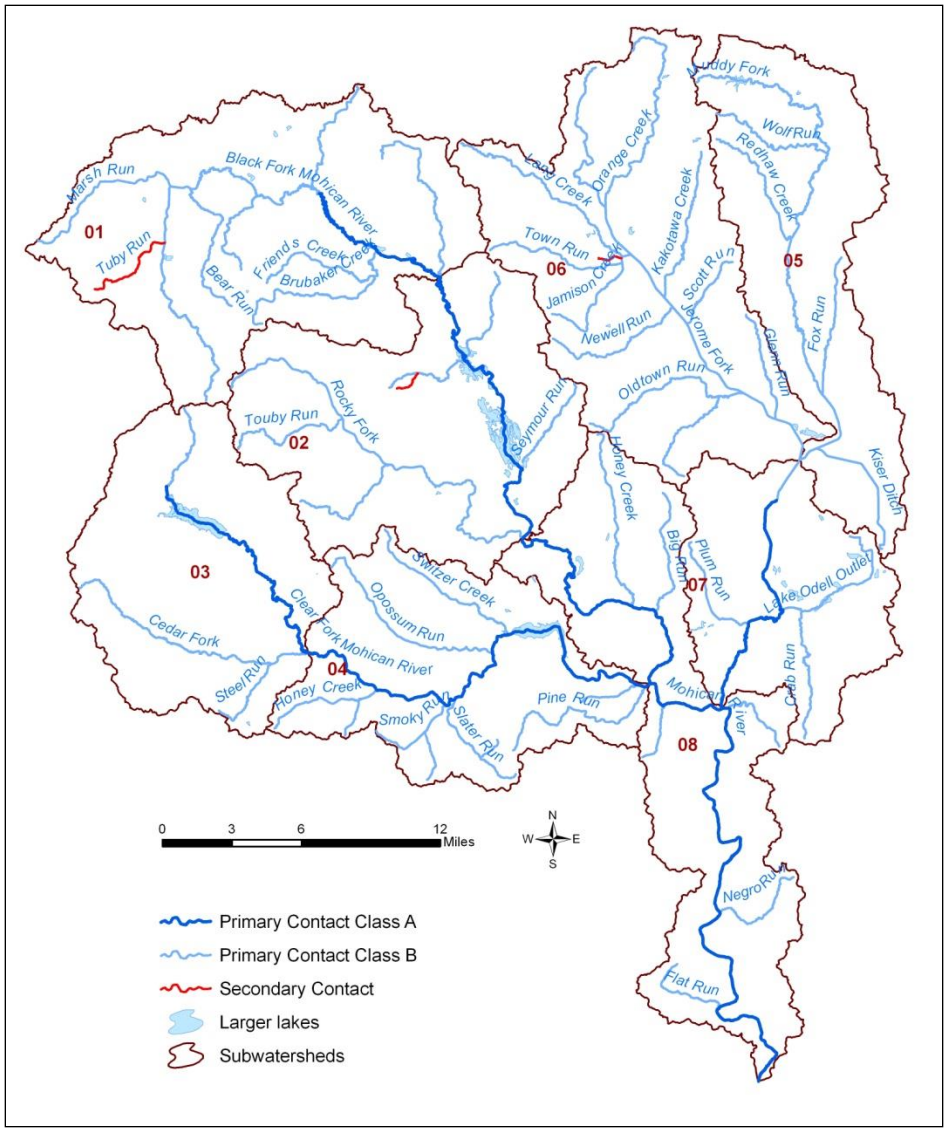


Figure 2-4. Recreation use designations in the Mohican River watershed.

Table 2-2 displays the criteria for the various recreation use designations (from Table 7-13 of OAC 3745-1-07).

Table 2-2. Recreation use criteria for Ohio.

Recreation Use	*E. coli* (colony counts per 100 ml)	
	Seasonal Geometric Mean	Single Sample Maximum[1]
Bathing water	126	235[2]
Class A primary contact recreation	126	298
Class B primary contact recreation	161	523
Class C primary contact recreation	206	940
Secondary contact recreation	1030	1030

[1] Except as noted in footnote 2, these criteria shall not be exceeded in more than ten per cent of the samples taken during any thirty-day period.

[2] This criterion shall be used for the issuance of beach and bathing water advisories.

2.2.3 Public Drinking Water Supply Use

The public drinking water supply use includes surface waters from which public drinking water is supplied. This beneficial use provides an opportunity to strengthen the connection between Clean Water Act and Safe Drinking Water Act (SDWA) activities by employing the authority of the CWA to meet SDWA objectives of source water protection and reduced risk to human health. Criteria associated with this use designation apply within five hundred yards of surface water intakes.

Figure 2-5 shows the locations of public drinking water supply surface water intakes. There are three nested subwatersheds in which intakes are located.

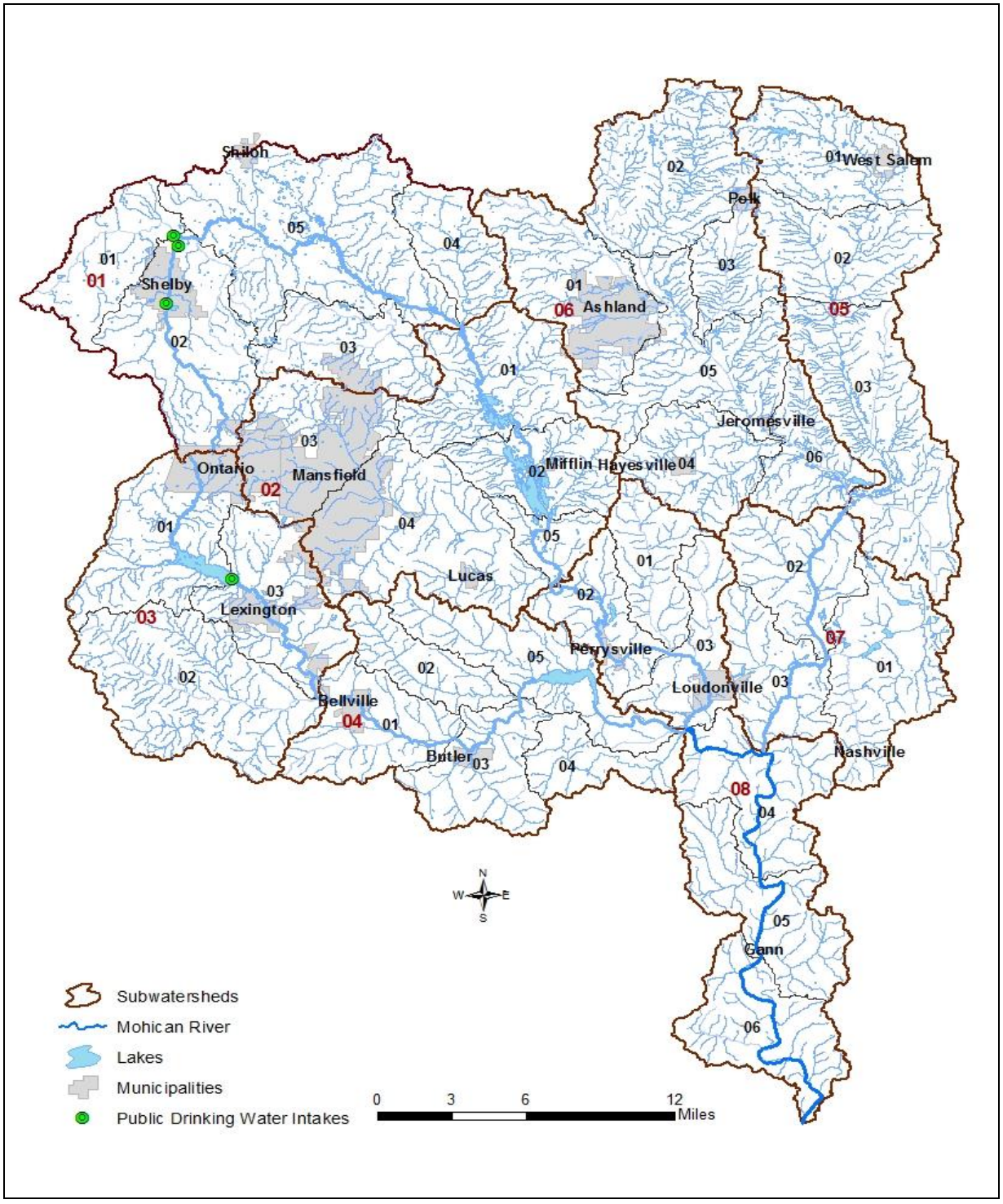


Figure 2-5. Public drinking water supply surface water intakes in the Mohican River watershed.

There were insufficient data to determine support of the public drinking water supply use at most intake locations in the watershed as discussed in the Integrated Report (Ohio EPA 2012). However, the headwaters of Clear Fork intake for Mansfield did have sufficient data for use support analysis. The use is supported fully at that location. In addition, some data from the intake at Marsh Run (also a Shelby water supply) indicated that the water supply should be placed on the watch list for nitrate.

2.2.4 Human Health (Fish Contaminants) Use

Ohio has adopted human health WQS criteria to protect the public from adverse impacts, both carcinogenic and non-carcinogenic, caused by exposure via drinking water (applicable at public water supply intakes) and by exposure in the contaminated flesh of sport fish (applicable in all surface waters). The latter criterion, called the non-drinking water human health criterion, ensures that levels of a chemical in water do not bioaccumulate in fish to levels harmful to people who catch and eat the fish. Ohio measures contaminants in fish tissue and uses the data in two comparisons: (1) to determine if the human health criteria are being violated, thus identifying the water for restoration through a TMDL or other action, or (2) to determine the quantity of sport fish that may be safely consumed. The first comparison can result in the water being identified as impaired on the 303(d) list; the second can result in the issuance of a sport fish consumption advisory.

The Integrated Report (Ohio EPA 2010) lists three watershed assessment units and the large river assessment unit as not supporting the human health use. In each case, polychlorinated biphenyls are the cause of impairment. In addition, three watershed assessment units are listed as impaired with historical data (older than ten years) that was not re-analyzed for the 2010 Integrated Report, so the cause of impairment is not specified.

Two common contaminants in fish tissue are polychlorinated biphenyls (PCBs) and mercury. PCBs are currently banned from use in the U.S. and are expected to decrease in streams over time. Therefore, no further action other than continued monitoring for PCBs in fish in Mohican River watershed will be taken.

The Mohican River watershed is included in the statewide fish advisory for mercury. Additional advisories specific to the Mohican River watershed do exist. Information regarding fish consumption advisories can be found at: http://www.epa.ohio.gov/dsw/fishadvisory/index.aspx.

3 WATER QUALITY CONDITIONS IN THE WATERSHED

Ohio uses the fish and aquatic insects that live in streams to assess the health of Ohio's flowing waters. Aquatic animals are generally the most sensitive indicators of pollution because they inhabit the water all of the time. A healthy stream community is also associated with high quality recreational opportunities (e.g., fishing and boating).

In addition to biological data, Ohio EPA collects information on the chemical quality of the water, sediment, and wastewater discharges; data on the contaminants in fish flesh; and physical information about streams. Taken together, this information identifies the factors that limit the health of aquatic life and that constitute threats to human health.

Ohio EPA completed a comprehensive water quality study in the Mohican River watershed in 2007. Eighty-one sites were studied for biological health, one hundred fifteen sites for water chemistry, eighty-six sites for recreation use, and sites in seventeen nested subwatersheds for human health (fish contaminants) use. Sites were scattered throughout the watershed. Please refer to Appendix B for more detail.

The 2007 dataset is more than five years old, so it is considered to be historical data. Ohio EPA has no reason to believe that the data are not still representative. Because Ohio EPA is required to prepare TMDL analyses for all waters on the impaired waters (303(d)) list and the Mohican watershed is identified as impaired, this historical level three credible data will be used in the development of this TMDL.

Biological partial and non-attainment were primarily located in the northern half of the watershed and non-attaining sites were concentrated in the northwestern and central areas. Of the sites sampled for aquatic life use support, 74% were fully attaining goals, 14% were attaining some but not all of the goals (partial attainment) and 12% were not attaining any of the goals. The more common causes of impairment were nutrients, direct habitat alterations and flow regime alterations. The most common sources were channelization, dams or impoundments and urban runoff / storm sewers. Only 13% of the sites assessed for support of the recreation use supported the use. Probable common sources were agricultural land uses and failing home sewage treatment systems.

The Mohican River watershed TMDL includes eight subwatersheds (Figure 3-1). Within each of the eight subwatersheds, smaller watersheds are nested. This chapter discusses conditions in each of the subwatersheds with detail added in unique nested subwatersheds. Overall, impairment of aquatic life uses was more common in the northern portion of the watershed, while impairment of recreation uses was scattered throughout the watershed. Sources of impairment tended to be related to agricultural land uses, urban storm water and municipal point sources.

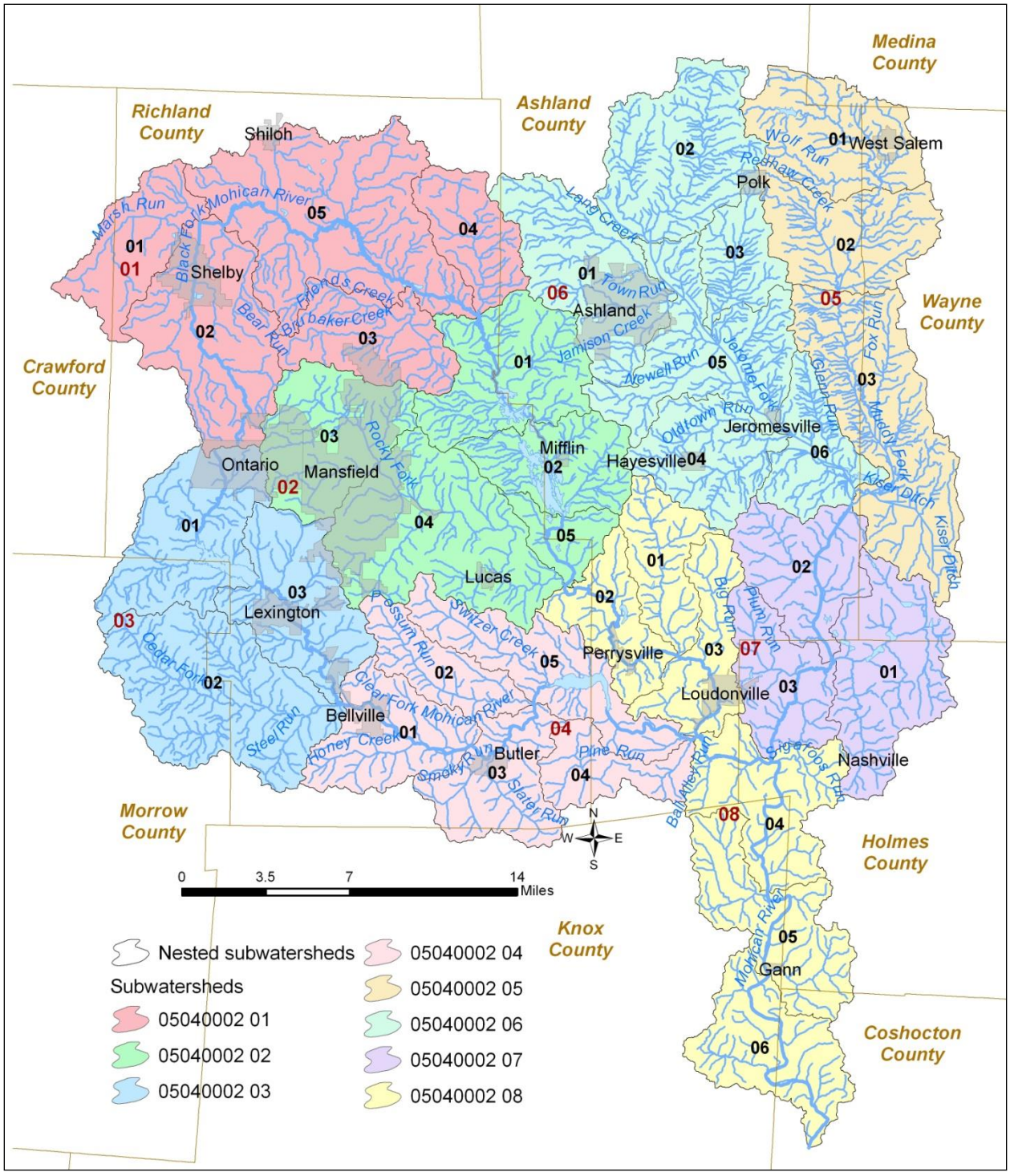


Figure 3-1. Map of the Mohican River watershed.

3.1 Headwaters Black Fork Mohican River (05040002 01)

The Headwaters Black Fork Mohican River subwatershed drains 162 square miles in the northwestern portion of the watershed (see Figure 3-2). It consists of five nested subwatersheds (12-digit watershed

assessment units). The main tributaries to Headwaters Black Fork Mohican River include Marsh Run, Whetstone Creek, Brubaker Creek and Bear Run. Major causes of impairment include direct habitat alterations and other flow regime alterations. Those causes are primarily associated with channelization and non-irrigated crop production.

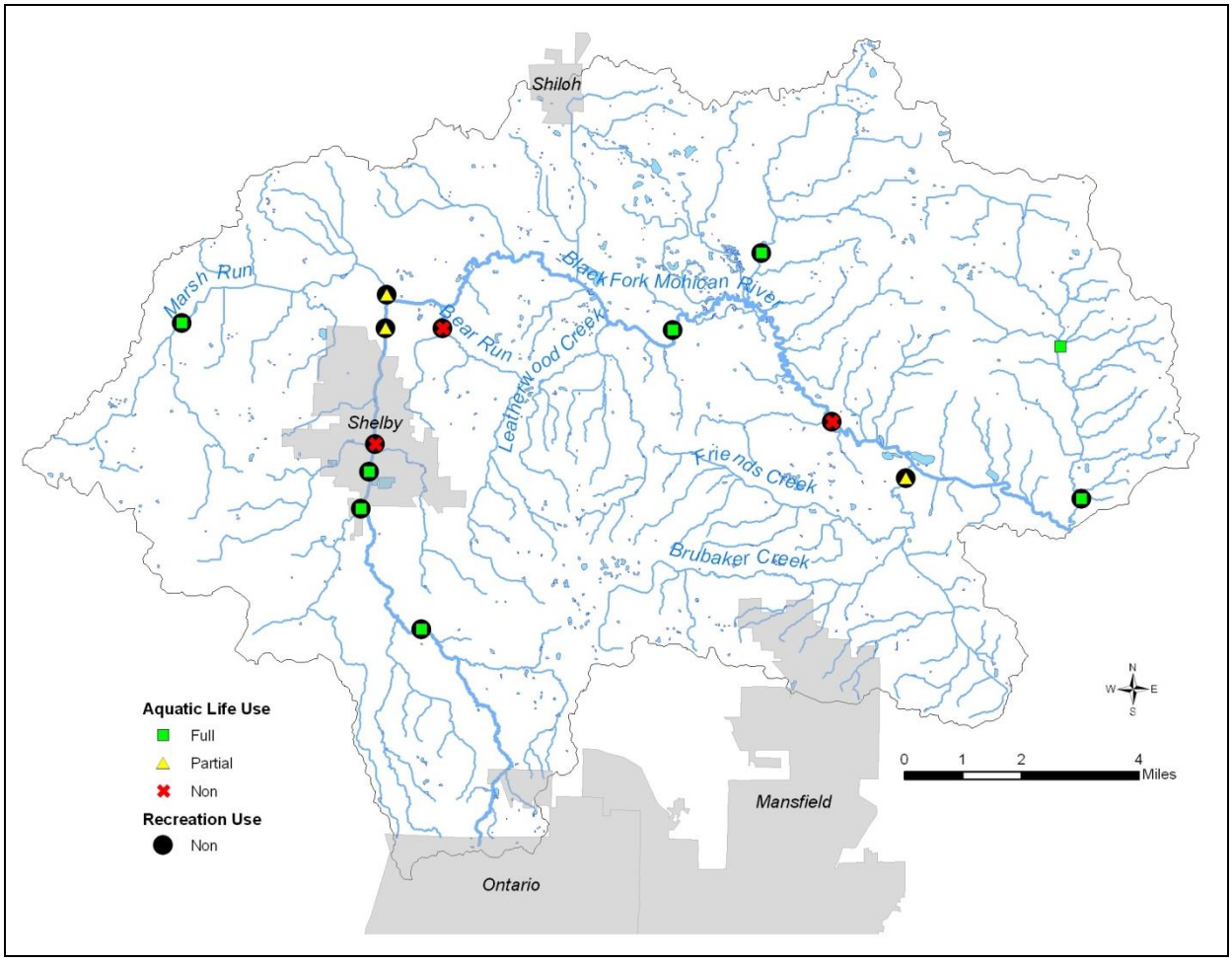


Figure 3-2. Attainment results for the Headwaters Black Fork Mohican River subwatershed.

In most cases, these causes are associated with land uses in the subwatershed (see Appendix B for further information). Figure 3-3 shows land use within the Headwaters Black Fork Mohican River subwatershed.

Aquatic life use was supported at eight sites in the watershed; partial attainment was identified at three sites and non-attainment at three sites. Biological communities in the subwatershed were impacted, largely, by a combination of factors related to agricultural practices, channelization, and storm water runoff. Recreation use was not supported at any assessed sites. Failing home sewage treatment systems, agricultural land uses and minor wastewater treatment plants (WWTPs) are possible sources of bacteria in the watershed.

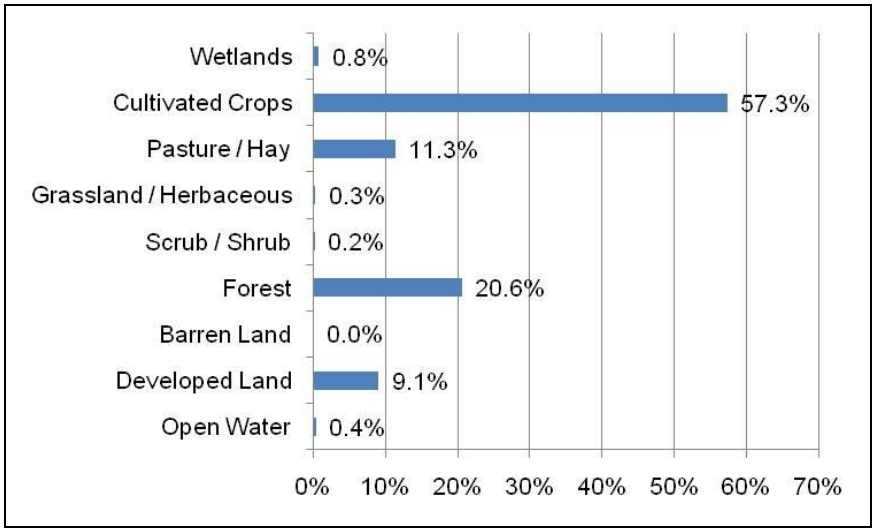


Figure 3-3. Land use in the Headwaters Black Fork Mohican River subwatershed.

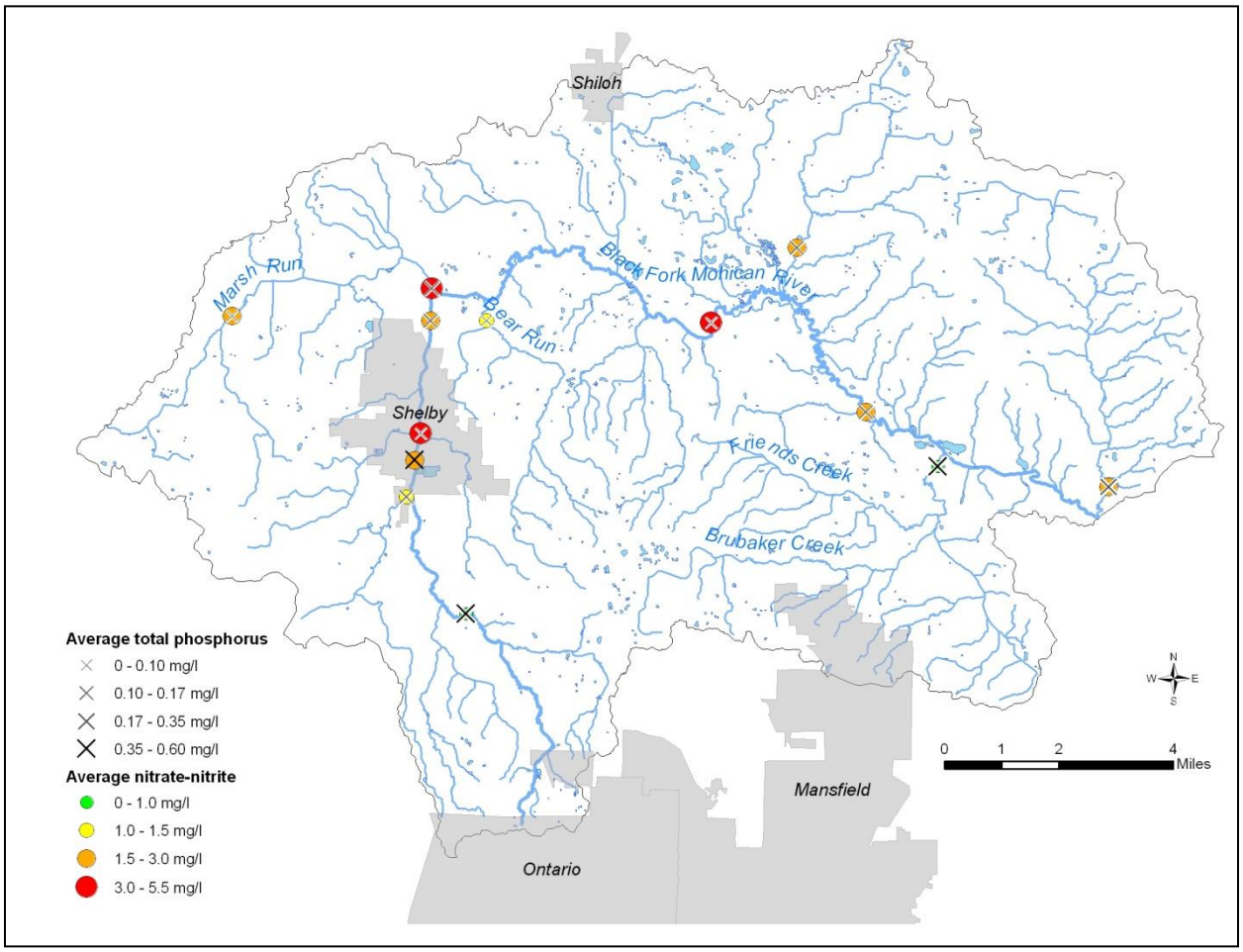


Figure 3-4. Water chemistry results for the Headwaters Black Fork Mohican River subwatershed.

Figure 3-4 shows some water chemistry results in the subwatershed. Some of these results aided in identifying causes of aquatic life use impairment. Figure 3-5 shows relative occurrence of causes of

aquatic life use impairment in the Headwaters Black Fork Mohican River subwatershed. Figure 3-6 shows the relative occurrence of sources of aquatic life use impairment in the Headwaters Black Fork Mohican River subwatershed.

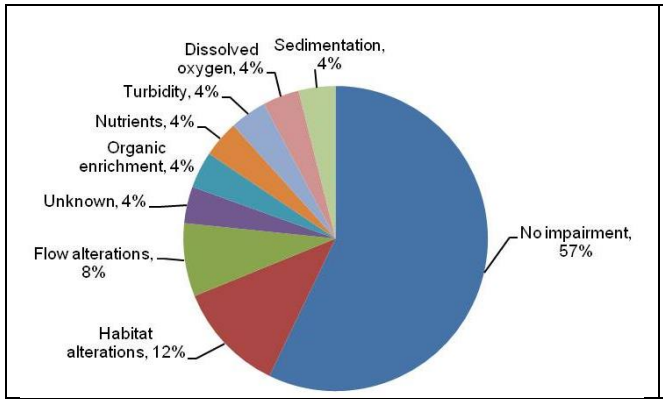


Figure 3-5. Causes of aquatic life use impairment in the Headwaters Black Fork Mohican River subwatershed.

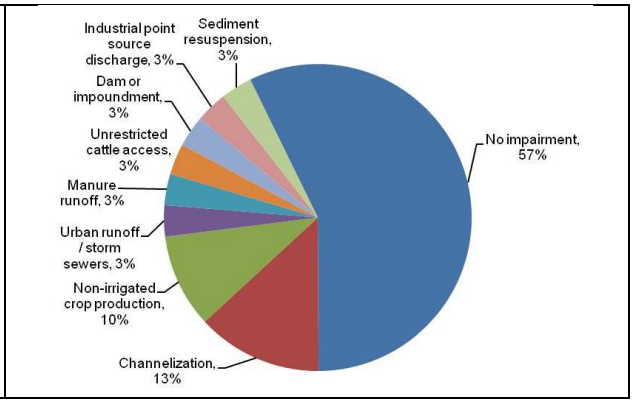


Figure 3-6. Sources of aquatic life use impairment in the Headwaters Black Fork Mohican River subwatershed.

Impairment was mostly located in the western and northern portions of the subwatershed. Figure 3-7 shows the locations of nested subwatersheds within the Headwaters Black Fork Mohican River subwatershed.

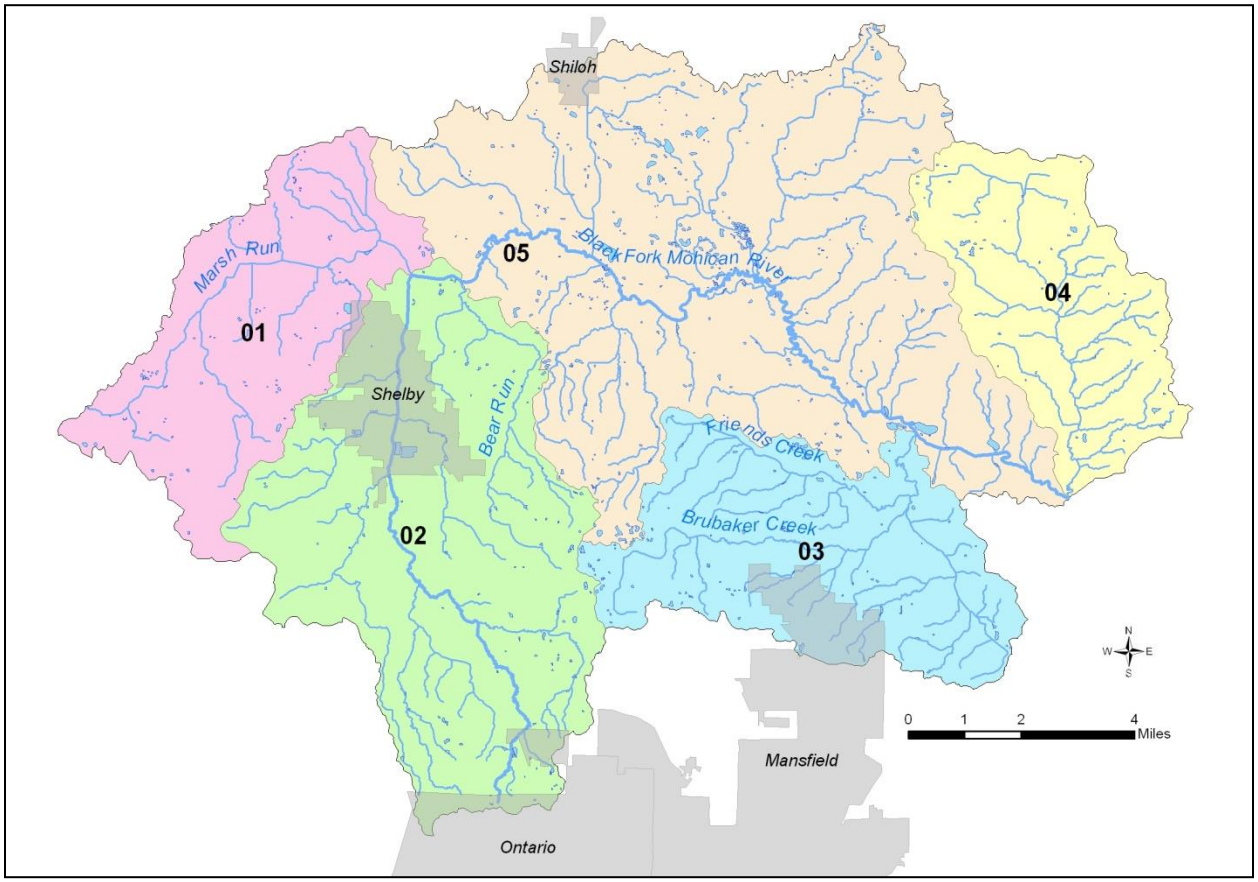


Figure 3-7. Locations of nested subwatersheds within the Headwaters Black Fork Mohican River subwatershed.

Table 3-1 shows the site-by-site results for each designated beneficial use organized by nested subwatersheds. For more specific information regarding individual site assessment results and supporting chemistry results, please see Appendix B.

Table 3-1. Number of impaired sites, organized by use and nested subwatershed, in the Headwaters Black Fork Mohican River subwatershed.

Nested Subwatershed (05040002 01)		Aquatic Life Use	Recreation Use	Public Drinking Water Supply Use	Human Health Use[1]
01 01	# impaired sites (non/partial)	0/1	2	0[3]	3
	Index score[2]	50	38	N/A	N/A
01 02	# impaired sites (non/partial)	2/1	6	0	3i
	Index score	50	20	N/A	N/A
01 03	# impaired sites (non/partial)	0/1	1	N/A	3
	Index score	N/A[4]	25	N/A	N/A
01 04	# impaired sites (non/partial)	0/0	1	N/A	3
	Index score	100	50	N/A	N/A
01 05	# impaired sites (non/partial)	1/0	3	N/A	3
	Index score	75	17	N/A	N/A

[1] Impairments to the human health use are reported based on the nested subwatershed, rather than the site, level. Numbers reported are 2010 Integrated Report categories. Impairments are not being addressed in this TMDL.

[2] The index score (between 0 and 100) indicates the relative support of the aquatic life or recreation use in the nested subwatershed. A score of 100 indicates full support of the use.

[3] While no sites in this nested subwatershed are impaired, one site had sufficient data to place the nested subwatershed on the watch list for nitrate in the 2010 Integrated Report.

[4] Only one site in this nested subwatershed was analyzed (partial attainment). There were insufficient sites to determine use support for the aquatic life use in this nested subwatershed.

Habitat tended to obtain lower scores on the qualitative habitat evaluation index (QHEI) on smaller streams in the subwatershed than on larger streams. Those streams that were highly urbanized or in intensive agricultural land use areas showed the greatest alteration from a natural state. The habitat showed an effect on biological communities in several instances where riparian vegetation had been removed, stream channels had been straightened, and stream channel substrates had been modified. Further details are available in Appendix B.

Tuby Run Total Dissolved Solids

Located, in the city of Shelby, the industry of ArcelorMittal, Inc. was identified as a source of some unique issues. Effluent from the industry dominated Tuby Run under dry weather conditions. The stream failed to meet WWH biocriteria due to the very poor condition of the macroinvertebrate community. A toxic response was evident in the limited types of macroinvertebrate taxa collected at RM 0.10. The toxicity suggested by the sampling results may have been episodic or specific to invertebrates because a relatively diverse fish assemblage was collected. It is possible that fish, under periodic chemical stress, are killed or migrate out the stream. Following the return of acceptable water quality, they would have the capacity to repopulate the reach from out of the Black Fork Mohican.

One particular chemical constituent that likely affected the macroinvertebrate community in Tuby Run was an elevated level of total dissolved solids (TDS). Grab sample concentrations ranged from 1540-2460 mg/l, with a median value of 2140 mg/l. Data reported by ArcelorMittal from the same June-August time period had an average dissolved solids concentration of 2501 mg/l. An Ohio EPA analysis of the relationship between total dissolved solids, mayfly sensitivity and invertebrate community index

(ICI) attainment suggests that a TDS concentration in excess of 1000 mg/l coincides with high likelihood for subpar ICI results and, in particular, a depressed mayfly fauna.

3.2 Rocky Fork – Black Fork Mohican River (05040002 02)

The Rocky Fork – Black Fork Mohican River subwatershed drains 139.7 square miles in the central portion of the watershed (see Figure 3-1). It consists of five nested subwatersheds. The main tributaries in Rocky Fork – Black Fork Mohican River include Rocky Fork, Touby Run and Black Fork. Major causes of impairment include nutrients, flow alteration and low dissolved oxygen. Those causes are primarily associated with urban runoff, dams or impoundments, crops with subsurface drains and channelization. The attainment statuses of individual sites are shown in Figure 3-8.

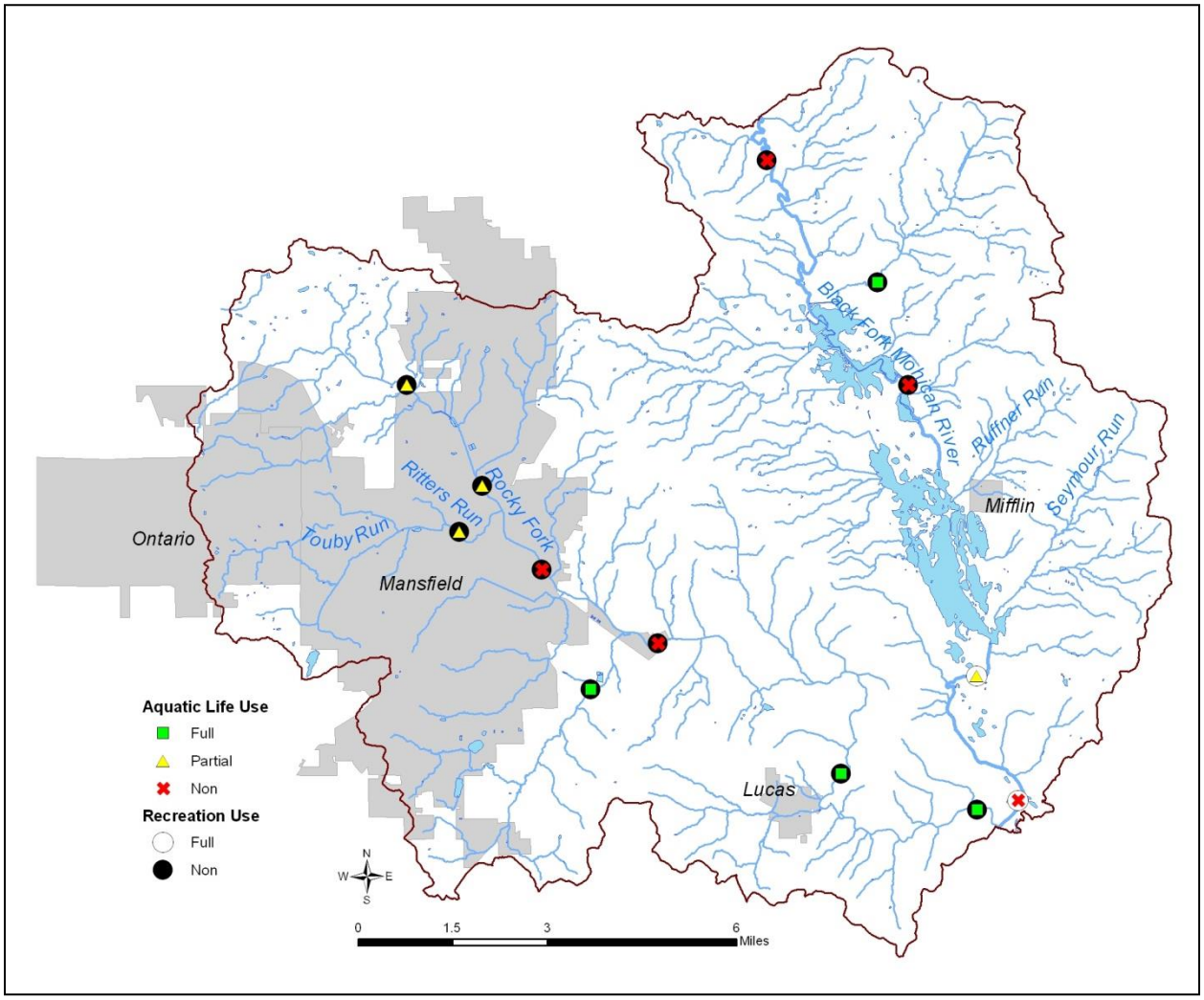


Figure 3-8. Attainment results for the Rocky Fork – Black Fork Mohican River subwatershed.

In most cases, these causes are associated with land uses in the subwatershed (see Appendix B for further information). Figure 3-9 shows land use within the Rocky Fork – Black Fork Mohican River subwatershed.

Biological and habitat assessments were conducted at 13 sites in this subwatershed. Five sites met no biological goals and four sites met some, but not all, biological goals. Impaired sites were impacted by a combination of factors related to crop production, impoundment behind Charles Mill dam, storm water within the Mansfield urban area and effluent from the Mansfield WWTP. Recreation uses were supported at only two sites sampled in the subwatershed.

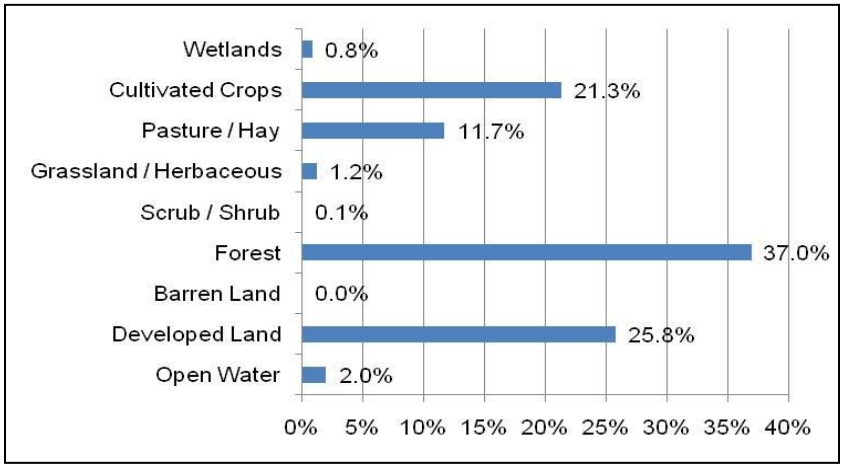


Figure 3-9. Land use in the Rocky Fork – Black Fork Mohican River subwatershed.

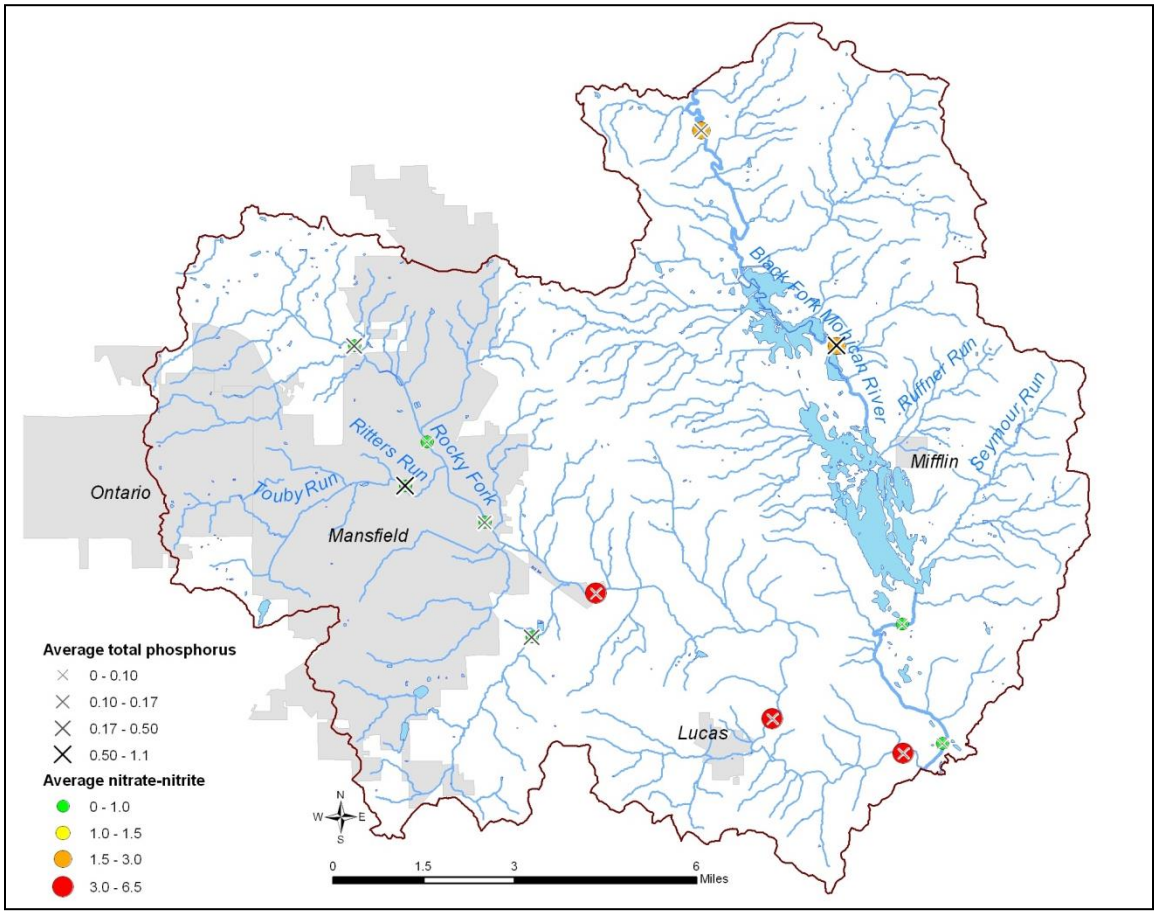


Figure 3-10. Water chemistry results for the Rocky Fork – Black Fork Mohican River subwatershed.

Figure 3-10 shows water chemistry results in the subwatershed. Some of these results aided in identifying causes of aquatic life use impairment. Figure 3-11 shows relative occurrence of causes of aquatic life use impairment in the Rocky Fork – Black Fork Mohican River subwatershed. Figure 3-12 shows the relative occurrence of sources of aquatic life use impairment in the Rocky Fork – Black Fork Mohican River subwatershed.

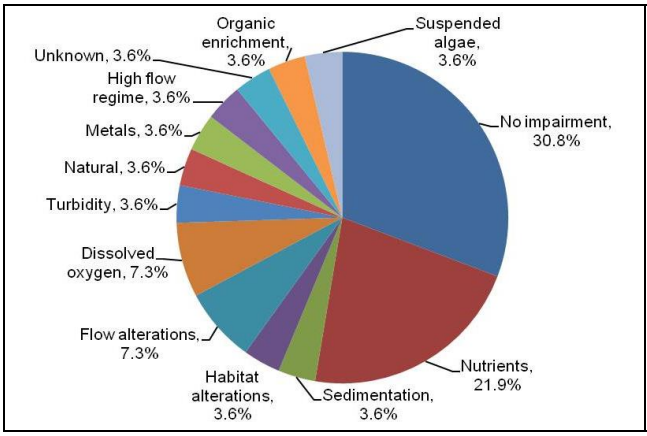


Figure 3-11. Causes of aquatic life use impairment in the Rocky Fork – Black Fork Mohican River subwatershed.

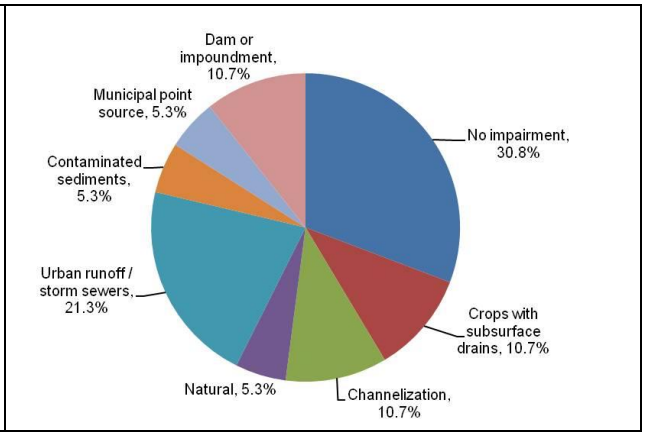


Figure 3-12. Sources of aquatic life use impairment in the Rocky Fork – Black Fork Mohican River subwatershed.

Impairment was scattered throughout the watershed. Figure 3-13 shows the locations of nested subwatersheds within the Rocky Fork – Black Fork Mohican River subwatershed.

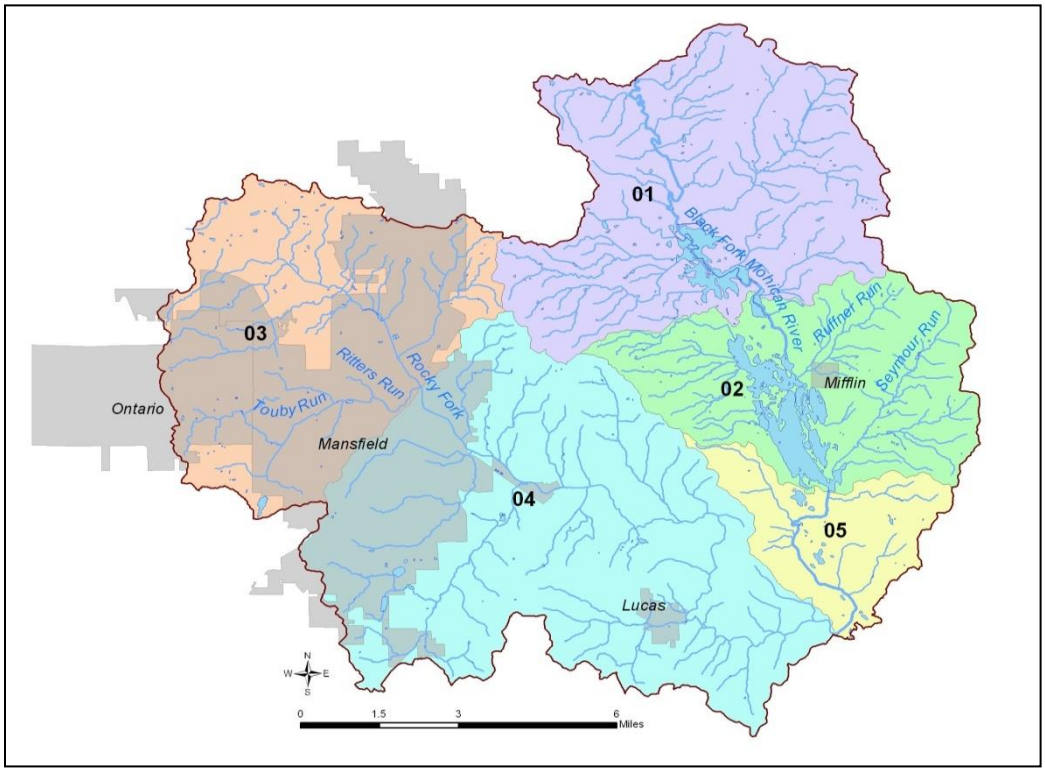


Figure 3-13. Locations of nested subwatersheds within the Rocky Fork – Black Fork Mohican River subwatershed.

Table 3-2 shows the site-by-site results for each designated beneficial use organized by nested subwatersheds. For more specific information regarding individual site assessment results and supporting chemistry results, please see Appendix B.

Table 3-2. Number of impaired sites, organized by use and nested subwatershed, in the Rocky Fork – Black Fork Mohican River subwatershed.

Nested Subwatershed (05040002 02)		Aquatic Life Use	Recreation Use	Public Drinking Water Supply Use	Human Health Use[1]
02 01	# impaired sites (non/partial)	2/0	3	N/A	5h
	Index score[2]	50.0	44	N/A	N/A
02 02	# impaired sites (non/partial)	N/A	N/A	N/A	1
	Index score	N/A	N/A	N/A	N/A
02 03	# impaired sites (non/partial)	0/3	3	N/A	5h
	Index score	0.0	25	N/A	N/A
02 04	# impaired sites (non/partial)	2/0	5	N/A	5h
	Index score	58.3	65	N/A	N/A
02 05	# impaired sites (non/partial)	1/1	0	N/A	5h
	Index score	0.0	100	N/A	N/A

[1] Impairments to the human health use are reported based on the nested subwatershed, rather than the site, level. Numbers reported are 2010 Integrated Report categories. Impairments are not being addressed in this TMDL.

[2] The index score (between 0 and 100) indicates the relative support of the aquatic life or recreation use in the nested subwatershed. A score of 100 indicates full support of the use.

Habitat scores recorded at four locations were generally consistent with the WWH use on the Black Fork Mohican River. Stream morphology exhibited recovery from past channelization both upstream and downstream from the reservoir but a heavy silt layer and significant substrate embeddedness were pervasive. Upstream from Mansfield, habitat in the Rocky Fork was reflective of the predominant agricultural land use within the subwatershed. Larger substrates were embedded by a heavy silt layer and limited in-stream cover was available to fish and other aquatic organisms. Downstream from Mansfield, the lower ten miles of the Rocky Fork contained some of the most diverse habitat to be found in the entire Mohican River watershed. The presence of larger substrates provided interstitial voids that are important for polishing water and act as niches for many aquatic species. The sinuous lower reach presented an abundance of woody debris, root wads, emergent vegetation and other types of cover less common in the upper reaches of the stream. These characteristics coupled with variable flow regimes and a good mix of riffle, run and pool habitats were conducive to very good QHEI scores and were sufficient to rank the lower Rocky Fork among the best aquatic environments in the 2007 study.

3.3 Headwaters Clear Fork Mohican River (05040002 03)

The Headwaters Clear Fork Mohican River subwatershed drains 112.1 square miles in the western portion of the watershed (see Figure 3-1Figure 3-2). It consists of three nested subwatersheds. The main tributaries to Headwaters Clear Fork Mohican River include Clear Fork Mohican River, Cedar Fork and Steel Run. Causes of impairment are direct habitat alteration and sedimentation, both of which stem from channelization. Figure 3-14 shows attainment statuses at sites sampled in the subwatershed.

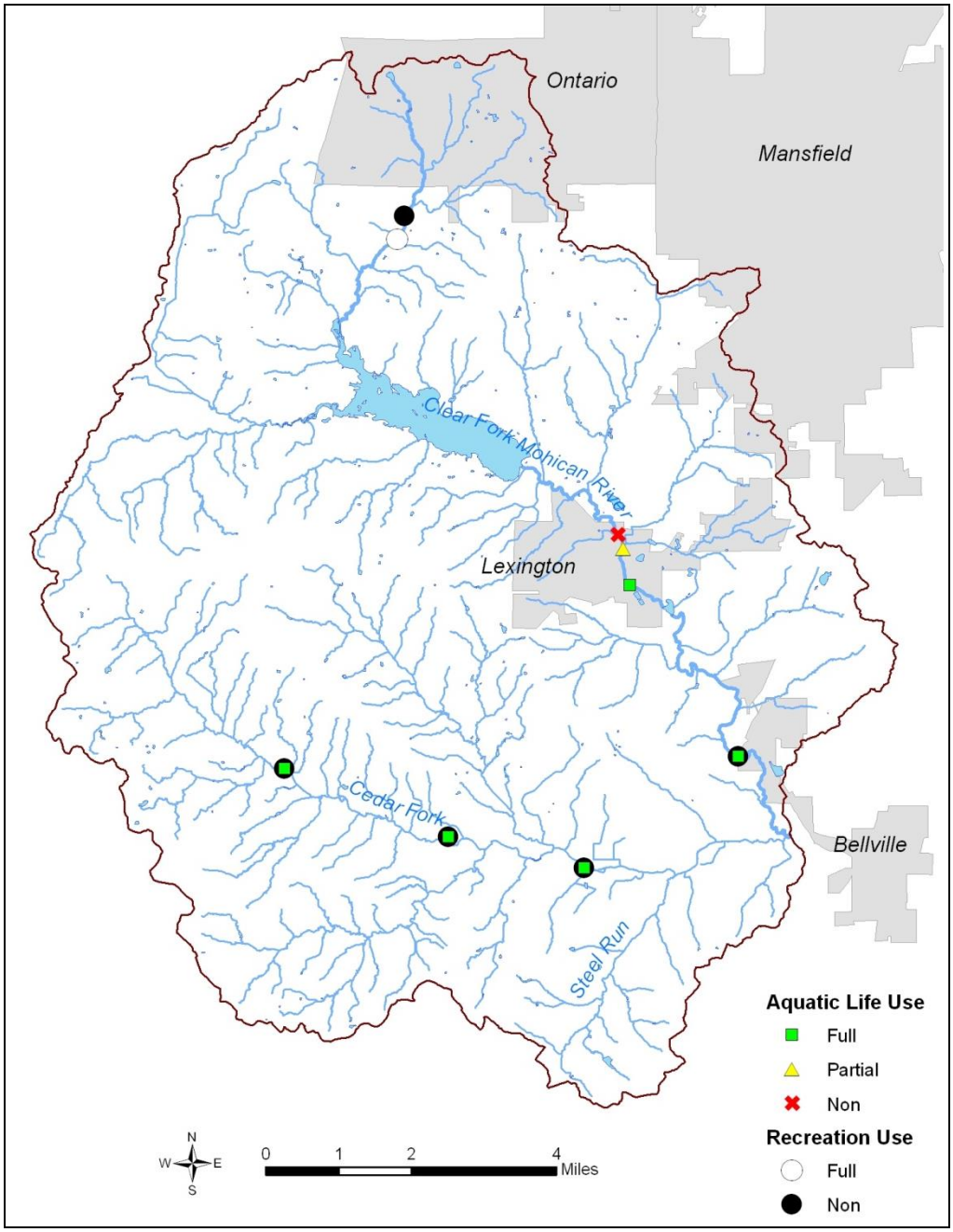


Figure 3-14. Attainment results for the Headwaters Clear Fork Mohican River subwatershed.

Two of three sites evaluated in 2007 in Lexington did not meet biological goals. One site fell short of goals for fish and macroinvertebrates; the other site fell short only in macroinvertebrate goals. Effects on the biology from the Clear Fork Reservoir and several other small, localized sources were noted, but the associated sites fully supported aquatic life uses. Cedar Fork in particular was observed to have more sensitive macroinvertebrate taxa than Clear Fork. Recreation use was not supported in the subwatershed; only one site attained criteria. In some cases, bacteria are associated with land uses in the subwatershed (see Appendix B for further information). Figure 3-15 shows land use within the Headwaters Clear Fork Mohican River subwatershed.

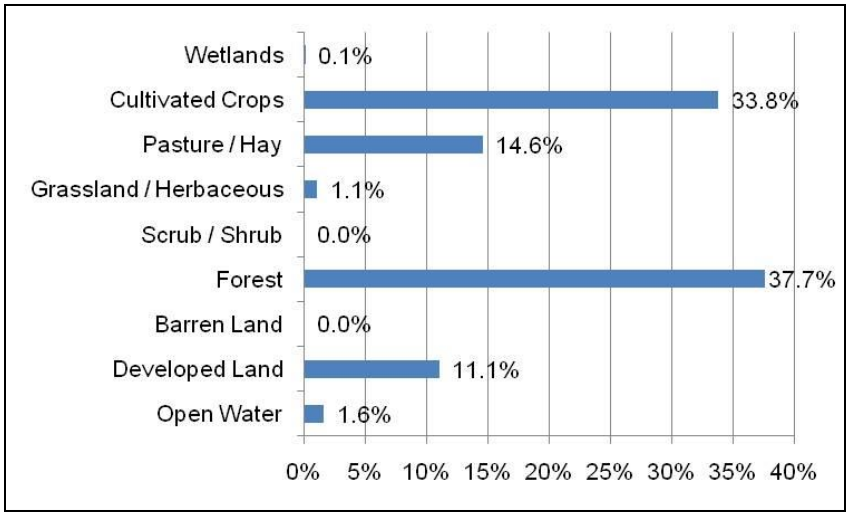


Figure 3-15. Land use in the Headwaters Clear Fork Mohican River subwatershed.

Figure 3-16 shows relative occurrence of causes of aquatic life use impairment in the Headwaters Clear Fork Mohican River subwatershed. Figure 3-17 shows the relative occurrence of sources of aquatic life use impairment in the subwatershed.

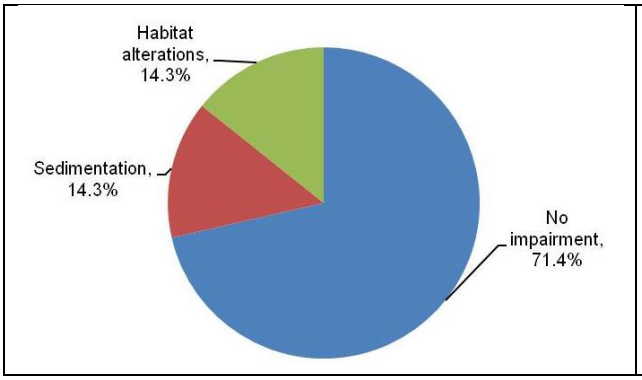


Figure 3-16. Causes of aquatic life use impairment in the Headwaters Clear Fork Mohican River subwatershed.

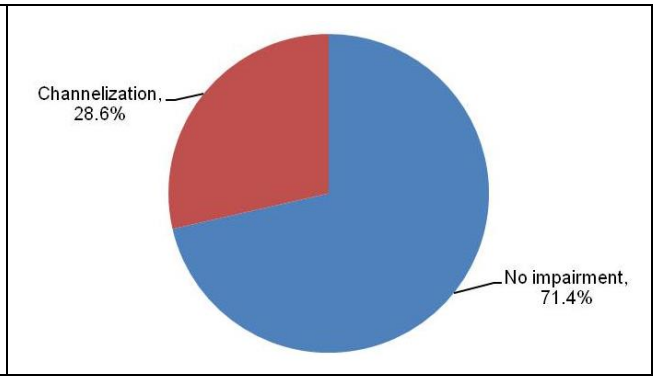


Figure 3-17. Sources of aquatic life use impairment in the Headwaters Clear Fork Mohican River subwatershed.

Aquatic life use impairment was associated with channel modifications in Lexington (located in the eastern nested subwatershed). Recreation use attainment was found only in the northeastern corner of the subwatershed. Otherwise, non-attainment was scattered throughout the area. Figure 3-18 shows the locations of nested subwatersheds within the Headwaters Clear Fork Mohican River subwatershed.

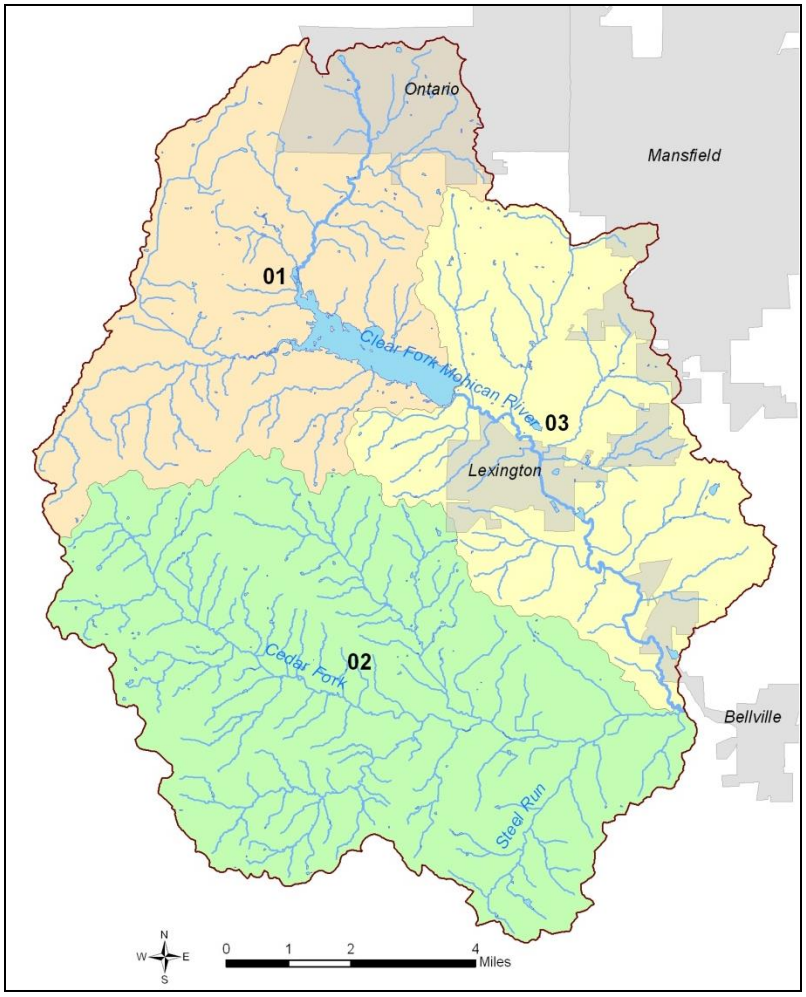


Figure 3-18. Locations of nested subwatersheds within the Headwaters Clear Fork Mohican River subwatershed.

Table 3-3 shows the site-by-site results for each designated beneficial use organized by nested subwatersheds. For more specific information regarding individual site assessment results and supporting chemistry results, please see Appendix B.

Table 3-3. Number of impaired sites, organized by use and nested subwatershed, in the Headwaters Clear Fork Mohican River subwatershed.

Nested Subwatershed (05040002 03)		Aquatic Life Use	Recreation Use	Public Drinking Water Supply Use	Human Health Use[1]
03 01	# impaired sites (non/partial)	0/0	0	0	5
	Index score[2]	N/A[3]	100	N/A	N/A
03 02	# impaired sites (non/partial)	0/0	3	N/A	3
	Index score	100.0	58	N/A	N/A
03 03	# impaired sites (non/partial)	1/1	2	N/A	3
	Index score	33.3	38	N/A	N/A

[1] Impairments to the human health use are reported based on the nested subwatershed, rather than the site, level. Numbers reported are 2010 Integrated Report categories. Impairments are not being addressed in this TMDL.

[2] The index score (between 0 and 100) indicates the relative support of the aquatic life or recreation use in the nested subwatershed. A score of 100 indicates full support of the use.

[3] There were insufficient data available to assess use support for this nested subwatershed in the 2010 Integrated Report. Therefore, no index score was calculated.

Within this subwatershed, the mainstem of Clear Fork has been extensively modified. It was impounded in 1949 by the construction of a dam to form the Clear Fork Reservoir. It is also in various stages of recovery from being channelized from roughly the Village of Lexington to Interstate 71. The impacts from this channelization are shown in the two sites that are not fully attaining biological goals in Lexington. Cedar Fork has generally retained natural in-stream conditions except in a few areas that have been modified for agricultural production. High habitat scores at three survey locations reflected the largely intact nature of the in-stream and riparian habitat. Further details are available in Appendix B and in the report *Biological and Water Quality Study of the Mohican River and Selected Tributaries* (Ohio EPA 2009).

3.4 Possum Run – Clear Fork Mohican River

The Possum Run – Clear Fork Mohican River subwatershed drains 105.3 square miles in the southern portion of the watershed (see Figure 3-1). It consists of five nested subwatersheds. The main tributaries to Possum Run – Clear Fork Mohican River include Possum Run, Slater Run and Clear Fork Mohican River. The subwatershed fully supports aquatic life uses (see Figure 3-19). Recreation uses were not supported in the majority of sites sampled.

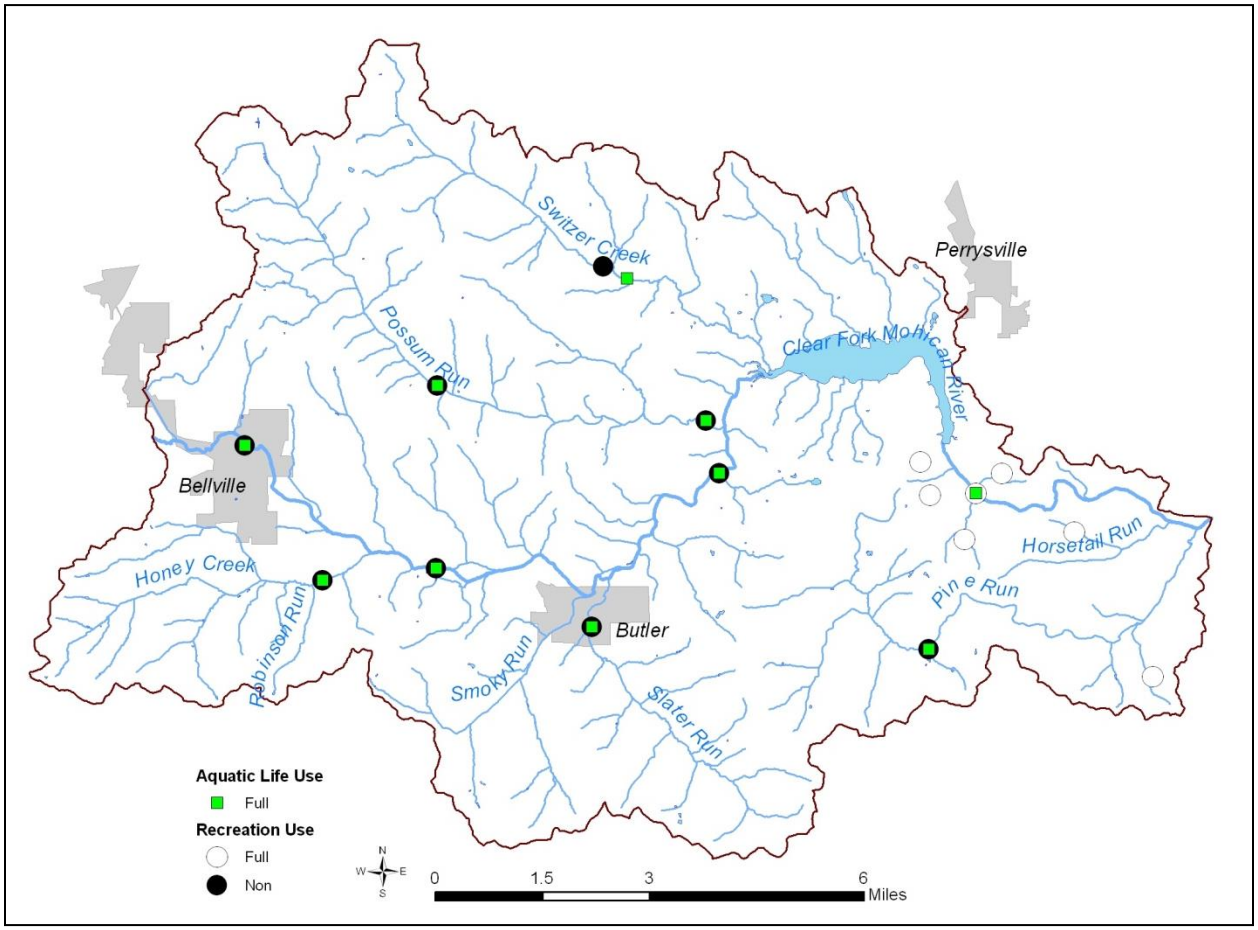


Figure 3-19. Attainment results for the Possum Run – Clear Fork Mohican River subwatershed.

In most cases, causes like bacteria are associated with land uses in the subwatershed (see Appendix B for further information). Figure 3-20 shows land use within the Possum Run – Clear Fork Mohican River subwatershed.

Clear Fork Mohican River was impounded in 1936, creating Pleasant Hill Lake. The dam is operated and maintained by the U.S. Army Corps of Engineers to provide flood control and recreation. Several tributaries to Clear Fork were recommended to be re-designated as coldwater habitat streams based on the presence of sufficient coldwater macroinvertebrate and fish taxa. The sampled streams within the subwatershed were notable because they supported reproducing populations of a number of declining fish species. Opossum Run supported least brook lampreys. Both least brook lampreys and redside dace were collected from Clear Creek, Pine Run, Slater Run, Honey Creek and Switzer Creek. Pine Run proved to be a candidate for preservation efforts, given the unique presence of both fish species in decline and rare macroinvertebrates.

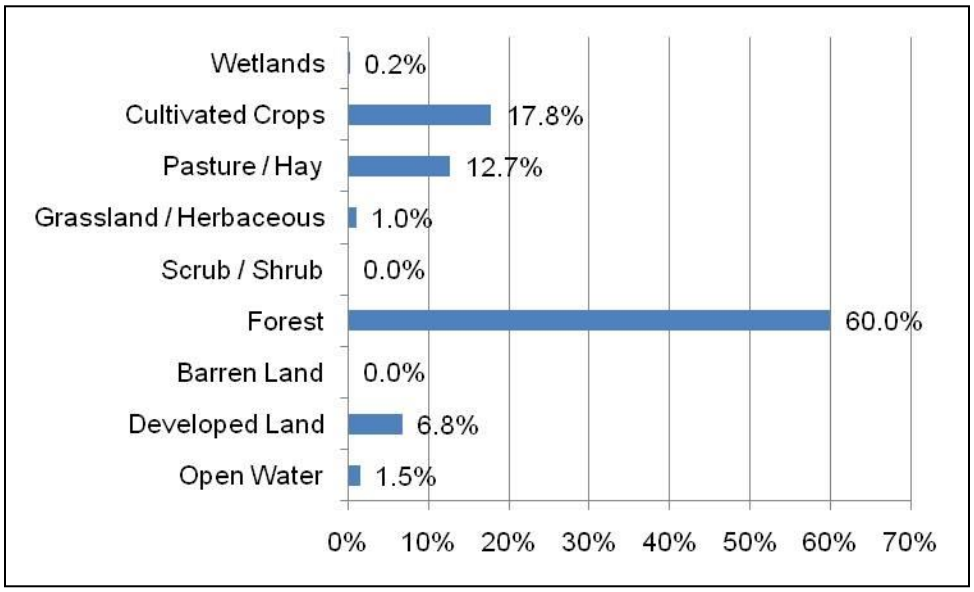


Figure 3-20. Land use in the Possum Run – Clear Fork Mohican River subwatershed.

Attainment of recreation uses was identified in the vicinity of Mohican State Park (in and around Horsetail and Pine runs). Figure 3-21 shows the locations of nested subwatersheds within the Possum Run – Clear Fork Mohican River subwatershed.

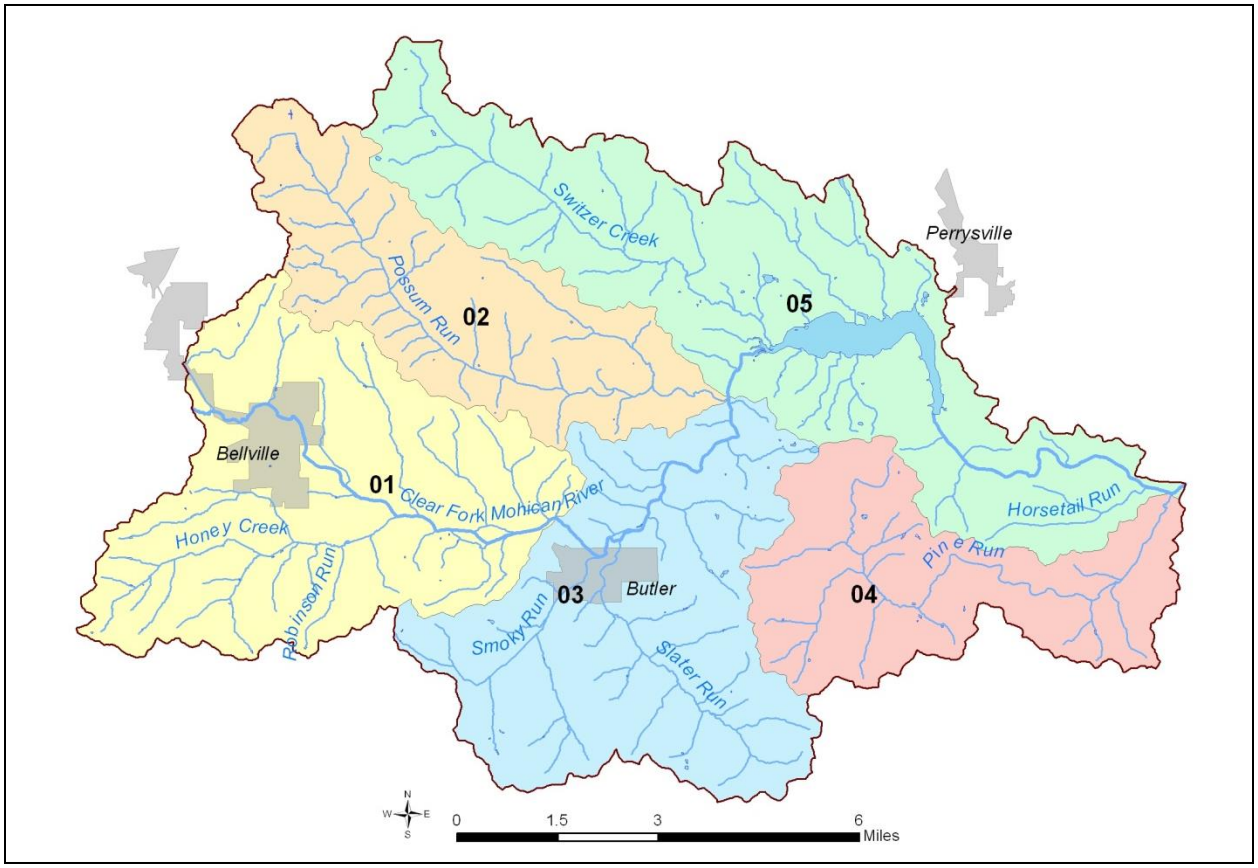


Figure 3-21. Locations of nested subwatersheds within the Possum Run – Clear Fork Mohican River subwatershed.

Table 3-4 shows the site-by-site results for each designated beneficial use organized by nested subwatersheds. For more specific information regarding individual site assessment results and supporting chemistry results, please see Appendix B.

Table 3-4. Number of impaired sites, organized by use and nested subwatershed, in the Possum Run – Clear Fork Mohican River subwatershed.

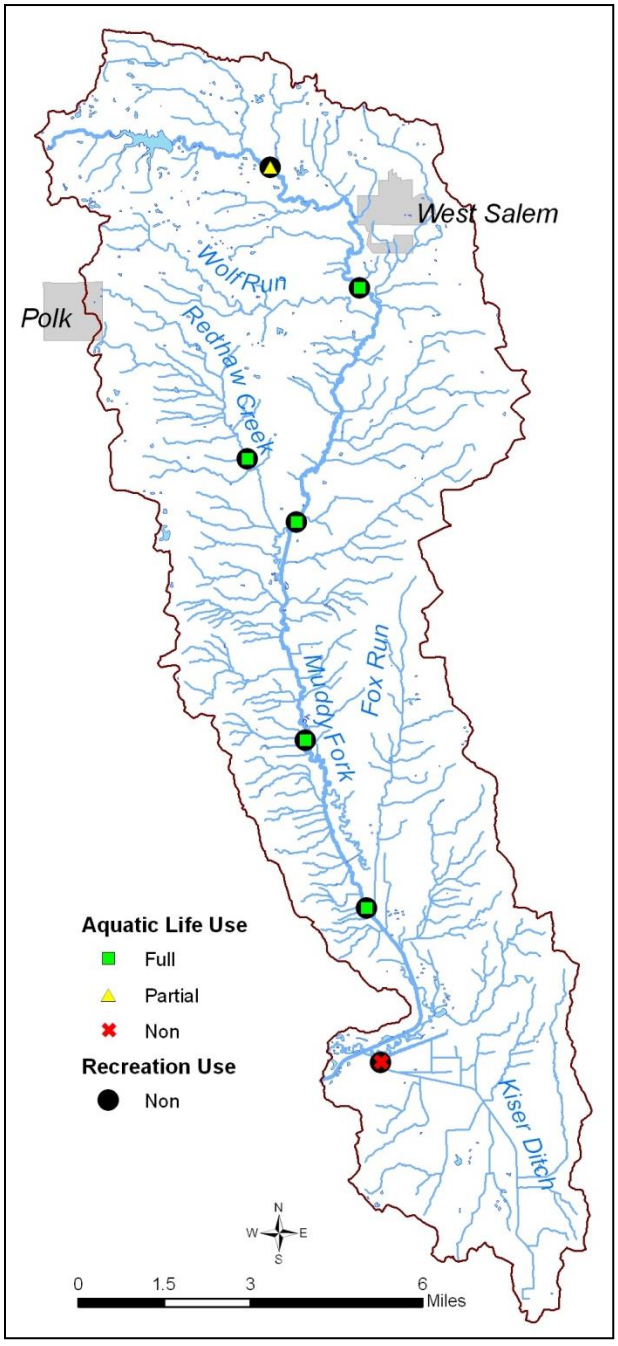
Nested Subwatershed (05040002 04)		Aquatic Life Use	Recreation Use	Public Drinking Water Supply Use	Human Health Use[1]
	# impaired sites (non/partial)	0/0	3	N/A	3
04 01	Index score[2]	100.0	63	N/A	N/A
	# impaired sites (non/partial)	0/0	2	N/A	3
04 02	Index score	100.0	75	N/A	N/A
	# impaired sites (non/partial)	0/0	2	N/A	3
04 03	Index score	100.0	50	N/A	N/A
	# impaired sites (non/partial)	0/0	1	N/A	3
04 04	Index score	100.0	63	N/A	N/A
	# impaired sites (non/partial)	0/0	1	N/A	5
04 05	Index score	100.0	94	N/A	N/A

[1] Impairments to the human health use are reported based on the nested subwatershed, rather than the site, level. Numbers reported are 2010 Integrated Report categories. Impairments are not being addressed in this TMDL.

[2] The index score (between 0 and 100) indicates the relative support of the aquatic life or recreation use in the nested subwatershed. A score of 100 indicates full support of the use.

In-stream and riparian habitats were consistently in good to very good condition throughout the subwatershed. The exception is the dam modifying Clear Fork Mohican River to create the lake (modifying natural habitats for some distance upstream of the dam). Further details are available in Appendix B.

3.5 Muddy Fork Mohican River (05040002 05)



The Muddy Fork Mohican River subwatershed drains 105.6 square miles in the northeastern portion of the watershed (see Figure 3-1). It consists of three nested subwatersheds. The main tributaries to Muddy Fork Mohican River include Muddy Fork, Kiser Ditch and Redhaw Creek. Major causes of impairment include low dissolved oxygen, biological oxygen demand, high flow regime, flow alteration and sedimentation. Those causes are primarily associated with dams or impoundments and channelization. See Figure 3-22 for sample locations.

In most cases, these causes are associated with land uses in the subwatershed (see Appendix B for further information). Figure 3-23 shows land use within the Muddy Fork Mohican River subwatershed.

The headwaters of the Muddy Fork of the Mohican River are impounded to form Cinnamon Lake. As a result, it appeared that water released from the reservoir was negligible except following periods of significant rainfall. Based on these circumstances, the stream is expected to be intermittent during low flow periods. Coldwater species were found in Redhaw Creek. Kiser Ditch suffers substantially from the Mohicanville Dam and the often anoxic conditions that follow heavy rains.

Figure 3-22. Attainment results for the Muddy Fork Mohican River subwatershed.

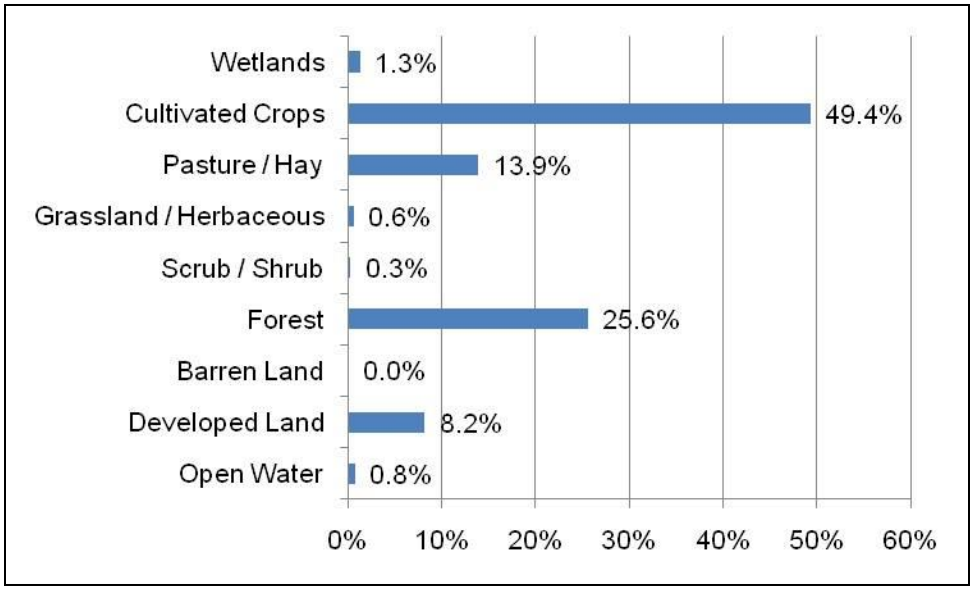


Figure 3-23. Land use in the Muddy Fork Mohican River subwatershed.

Results of chemistry sampling aided in identifying causes of aquatic life use impairment. Figure 3-24 shows relative occurrence of causes of aquatic life use impairment in the Muddy Fork Mohican River subwatershed. Figure 3-25 shows the relative occurrence of sources of aquatic life use impairment in the Muddy Fork Mohican River subwatershed.

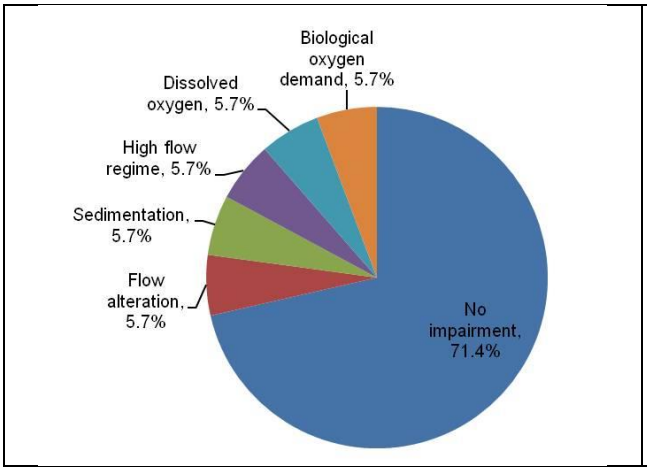


Figure 3-24. Causes of aquatic life use impairment in the Muddy Fork Mohican River subwatershed.

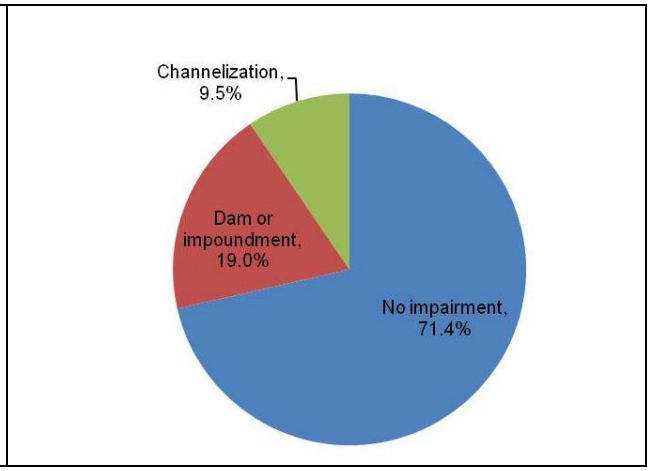


Figure 3-25. Sources of aquatic life use impairment in the Muddy Fork Mohican River subwatershed.

Aquatic life use impairment in Muddy Fork is located at the northern end of the subwatershed and impairment in Kiser Ditch is located in the southern end of the subwatershed. Recreation use impairment is spread throughout the watershed. Figure 3-26 shows the locations of nested subwatersheds within the Muddy Fork Mohican River subwatershed.

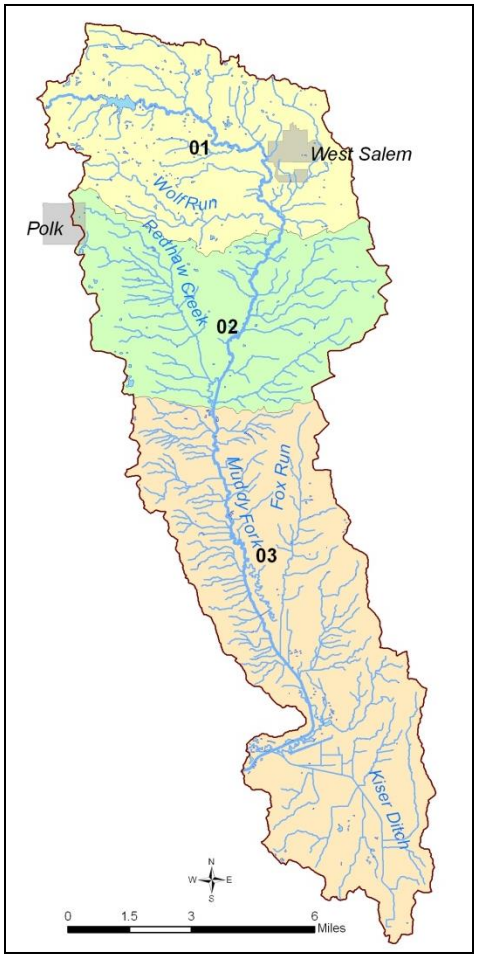


Figure 3-26. Locations of nested subwatersheds within the Muddy Fork Mohican River subwatershed.

Table 3-5 shows the site-by-site results for each designated beneficial use organized by nested subwatersheds. For more specific information regarding individual site assessment results and supporting chemistry results, please see Appendix B.

Table 3-5. Number of impaired sites, organized by use and nested subwatershed, in the Muddy Fork Mohican River subwatershed.

Nested Subwatershed (05040002 05)		Aquatic Life Use	Recreation Use	Public Drinking Water Supply Use	Human Health Use[1]
05 01	# impaired sites (non/partial)	0/1	2	0[3]	3
	Index score[2]	50.0	50	N/A	N/A
05 02	# impaired sites (non/partial)	0/0	2	N/A	3i
	Index score	100.0	25	N/A	N/A
05 03	# impaired sites (non/partial)	1/0	3	N/A	3i
	Index score	50.0	44	N/A	N/A

[1] Impairments to the human health use are reported based on the nested subwatershed, rather than the site, level. Numbers reported are 2010 Integrated Report categories. Impairments are not being addressed in this TMDL.

[2] The index score (between 0 and 100) indicates the relative support of the aquatic life or recreation use in the nested subwatershed. A score of 100 indicates full support of the use.

[3] Though some data were collected in this nested subwatershed, there were not enough data to assess support of the use.

In-stream and riparian habitats varied from poor to very good condition for the seven sites sampled in the Muddy Fork Mohican River subwatershed. Limited in-stream cover was a negative habitat attribute at all sampled locations. Various modifications of the channel and degrees of recovery were noted at the sampled locations on Muddy Fork. Kiser Ditch 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.

3.6 Jerome Fork – Mohican River (05040002 06)

The Jerome Fork – Mohican River subwatershed drains 161.5 square miles in the northeastern portion of the watershed (see Figure 3-1). It consists of six nested subwatersheds. The main tributaries to Jerome Fork – Mohican River include Lang Creek, Orange Creek, Katotawa Creek, Jamison Creek, Newell Run, Oldtown Run and Jerome Fork. Causes of impairment include nutrient enrichment and sedimentation/siltation. Those causes are associated with agricultural nonpoint sources, municipal point sources and channelization. Figure 3-27 shows attainment at sample sites.

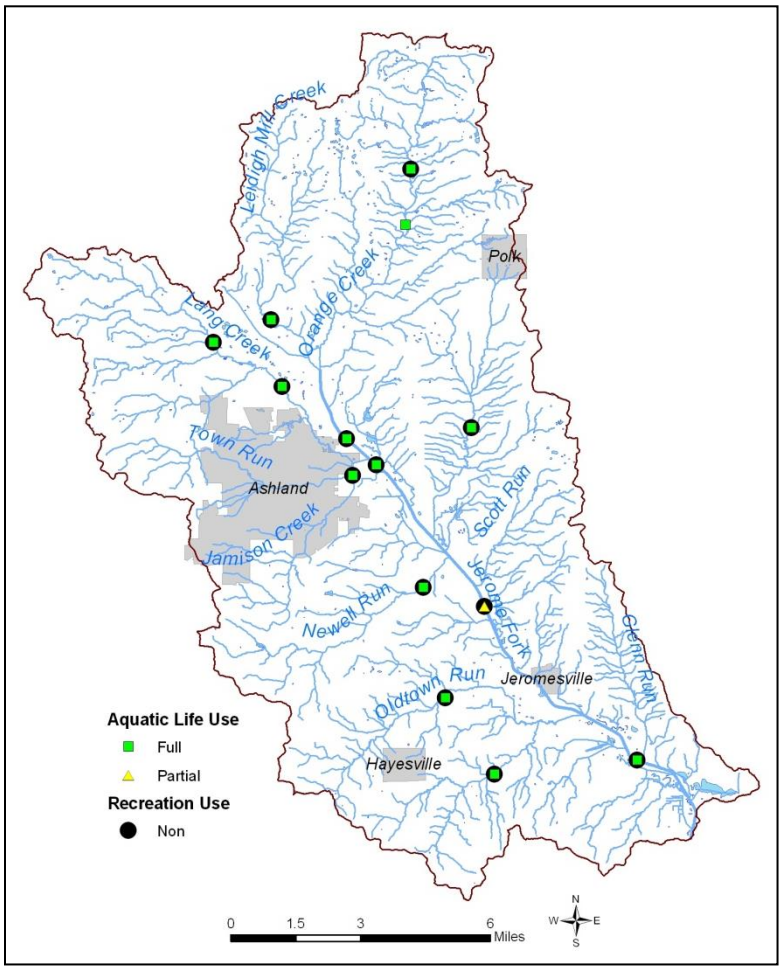


Figure 3-27. Attainment results for the Jerome Fork – Mohican River subwatershed.

In most cases, these causes are associated with land uses in the subwatershed (see Appendix B for further information). Figure 3-28 shows land use within the Jerome Fork – Mohican River subwatershed.

Agricultural nonpoint sources and municipal point sources both contribute to various degrees of nutrient enrichment along Lang Creek and Jerome Fork. The channelized nature of Jerome Fork upstream of Ashland combined with nutrient enrichment to prevent the fish community from attaining expectations for the aquatic life use designation. Recreation use impairment was widespread in the watershed. Sources likely included a combination of urban inputs from Ashland and agricultural inputs from the northern portion of the subwatershed.

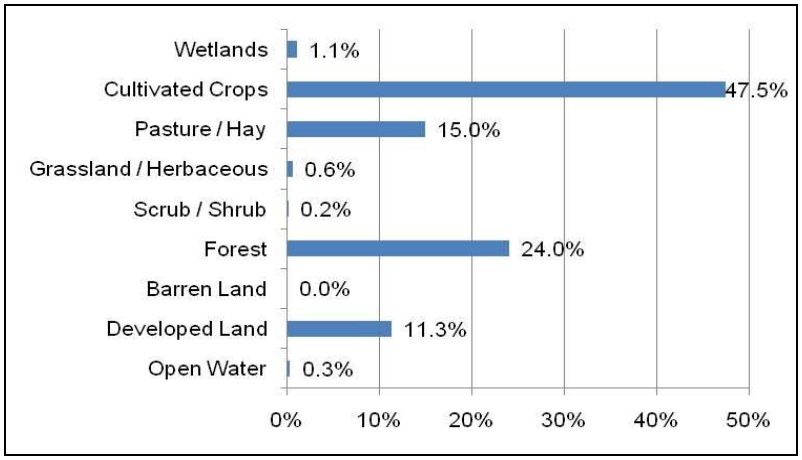


Figure 3-28. Land use in the Jerome Fork – Mohican River subwatershed.

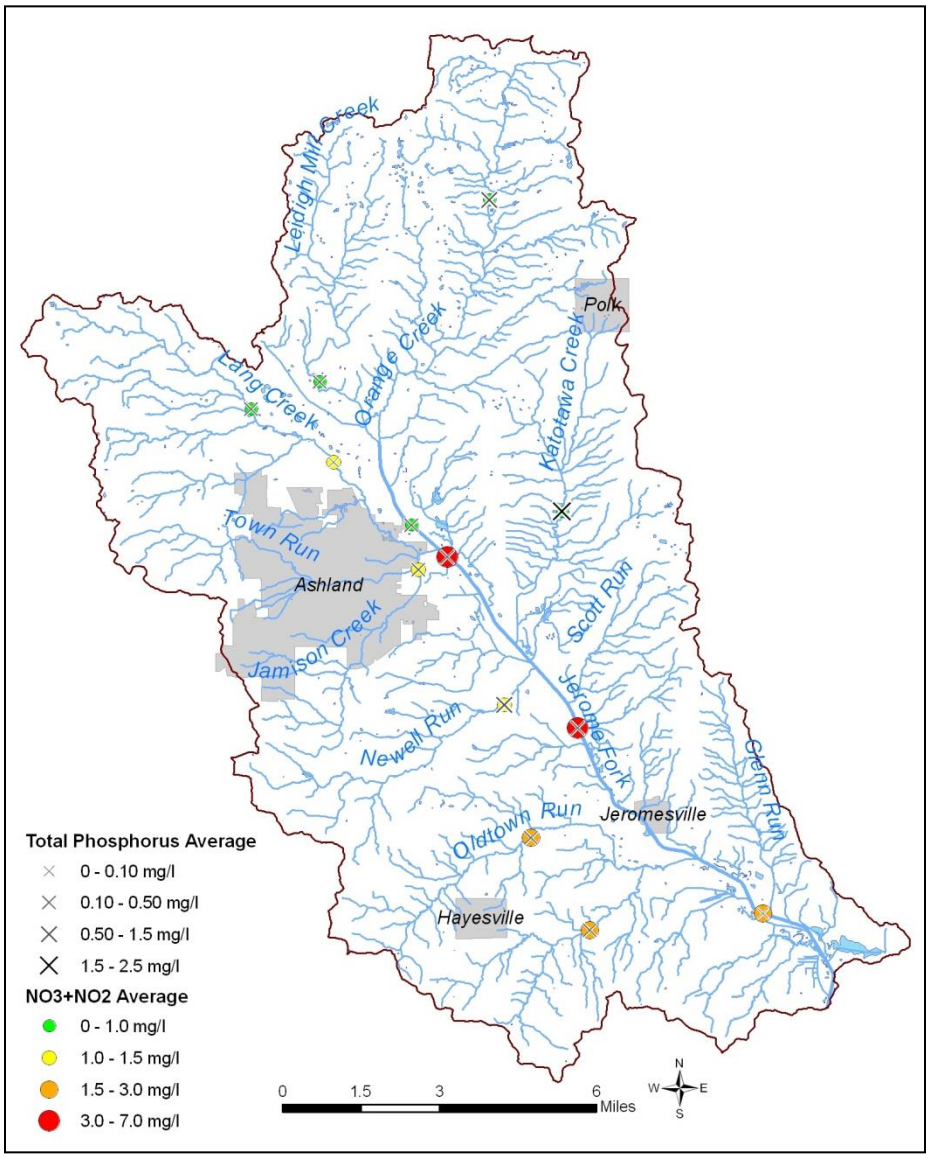


Figure 3-29. Water chemistry results for the Jerome Fork – Mohican River subwatershed.

Figure 3-29 shows water chemistry results in the subwatershed. Some of these results aided in identifying causes of aquatic life use impairment. Figure 3-30 shows relative occurrence of causes of aquatic life use impairment in the Jerome Fork – Mohican River subwatershed. Figure 3-31 shows the relative occurrence of sources of aquatic life use impairment in the Jerome Fork – Mohican River subwatershed.

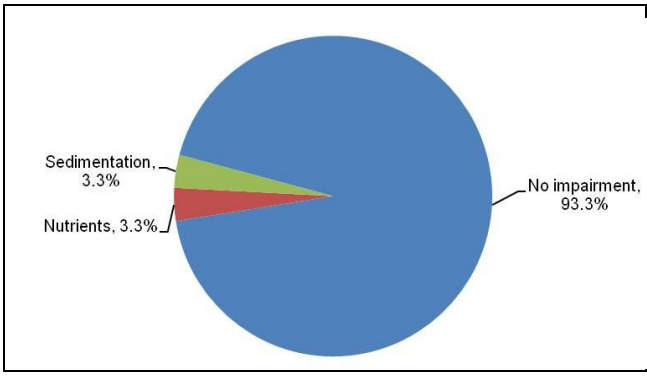


Figure 3-30. Causes of aquatic life use impairment in the Jerome Fork – Mohican River subwatershed.

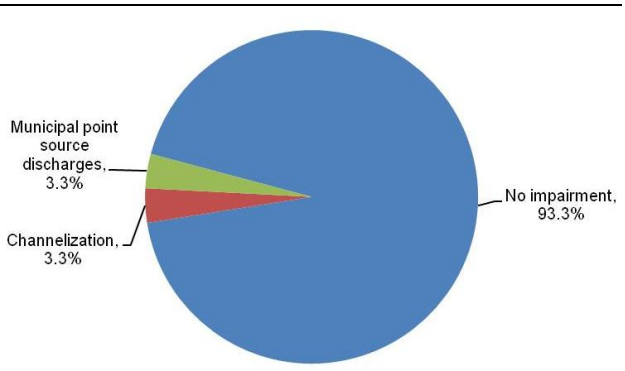
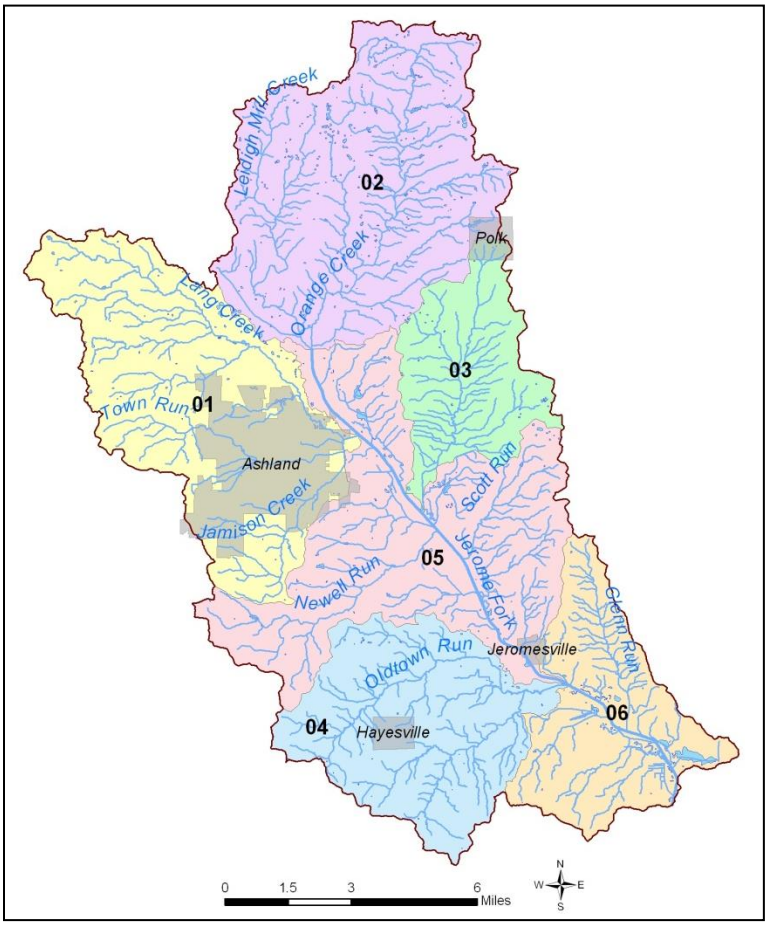


Figure 3-31. Sources of aquatic life use impairment in the Jerome Fork – Mohican River subwatershed.



The only aquatic life use impairment was located downstream of the confluence of Lang Creek and the Mohican River. Figure 3-32 shows the locations of nested subwatersheds within the Jerome Fork – Mohican River subwatershed.

Figure 3-32. Locations of nested subwatersheds within the Jerome Fork – Mohican River subwatershed.

Table 3-6 shows the site-by-site results for each designated beneficial use organized by nested subwatersheds. For more specific information regarding individual site assessment results and supporting chemistry results, please see Appendix B.

Table 3-6. Number of impaired sites, organized by use and nested subwatershed, in the Jerome Fork – Mohican River subwatershed.

Nested Subwatershed (05040002 06)		Aquatic Life Use	Recreation Use	Public Drinking Water Supply Use	Human Health Use[1]
06 01	# impaired sites (non/partial)	0/0	3	N/A	3
	Index score[2]	100.0	42	N/A	N/A
06 02	# impaired sites (non/partial)	0/0	2	N/A	3
	Index score	100.0	50	N/A	N/A
06 03	# impaired sites (non/partial)	0/0	1	N/A	3
	Index score	100.0	75	N/A	N/A
06 04	# impaired sites (non/partial)	0/0	2	N/A	3
	Index score	100.0	63	N/A	N/A
06 05	# impaired sites (non/partial)	0/1	4	N/A	3i
	Index score	75.0	31	N/A	N/A
06 06	# impaired sites (non/partial)	0/0	1	N/A	3
	Index score	100.0	25	N/A	N/A

[1] Impairments to the human health use are reported based on the nested subwatershed, rather than the site, level. Numbers reported are 2010 Integrated Report categories. Impairments are not being addressed in this TMDL.

[2] The index score (between 0 and 100) indicates the relative support of the aquatic life or recreation use in the nested subwatershed. A score of 100 indicates full support of the use.

In-stream and riparian habitats were in marginally good to very good condition throughout the Jerome Fork-Mohican River subwatershed. The effects of sedimentation and historical channelization were two of the more widespread negative habitat features observed in the study area, particularly along Jerome Fork. Much of Jerome Fork was confined within steep banks. Consequently, there was effectively no floodplain upon which fine substrates could be deposited. Larger substrates and interstitial spaces were buried by sediment and limited riffle/run/ pool development was present. The watercourse had been historically channelized and recent log removal was evident at one location. The removal of woody debris and trees from within and adjacent to the stream may temporarily allow for better drainage. However, increased erosion is likely and the cycle of stream bank destabilization and log jam creation is perpetuated. For further details, refer to Appendix B.

3.7 Lake Fork Mohican River (05040002 07)

The Lake Fork Mohican River subwatershed drains 79.8 square miles in the southeastern portion of the watershed (see Figure 3-1). It consists of three nested subwatersheds. The main tributaries to Lake Fork Mohican River include Odell Lake Outlet, Crab Run, Plum Run and Lake Fork. Causes of impairment include sedimentation/siltation, direct habitat alterations, dissolved oxygen, nutrient eutrophication, and other flow regime alterations (see Figure 3-33). Those causes are primarily associated with non-irrigated crop production, a dam or impoundment and channelization.

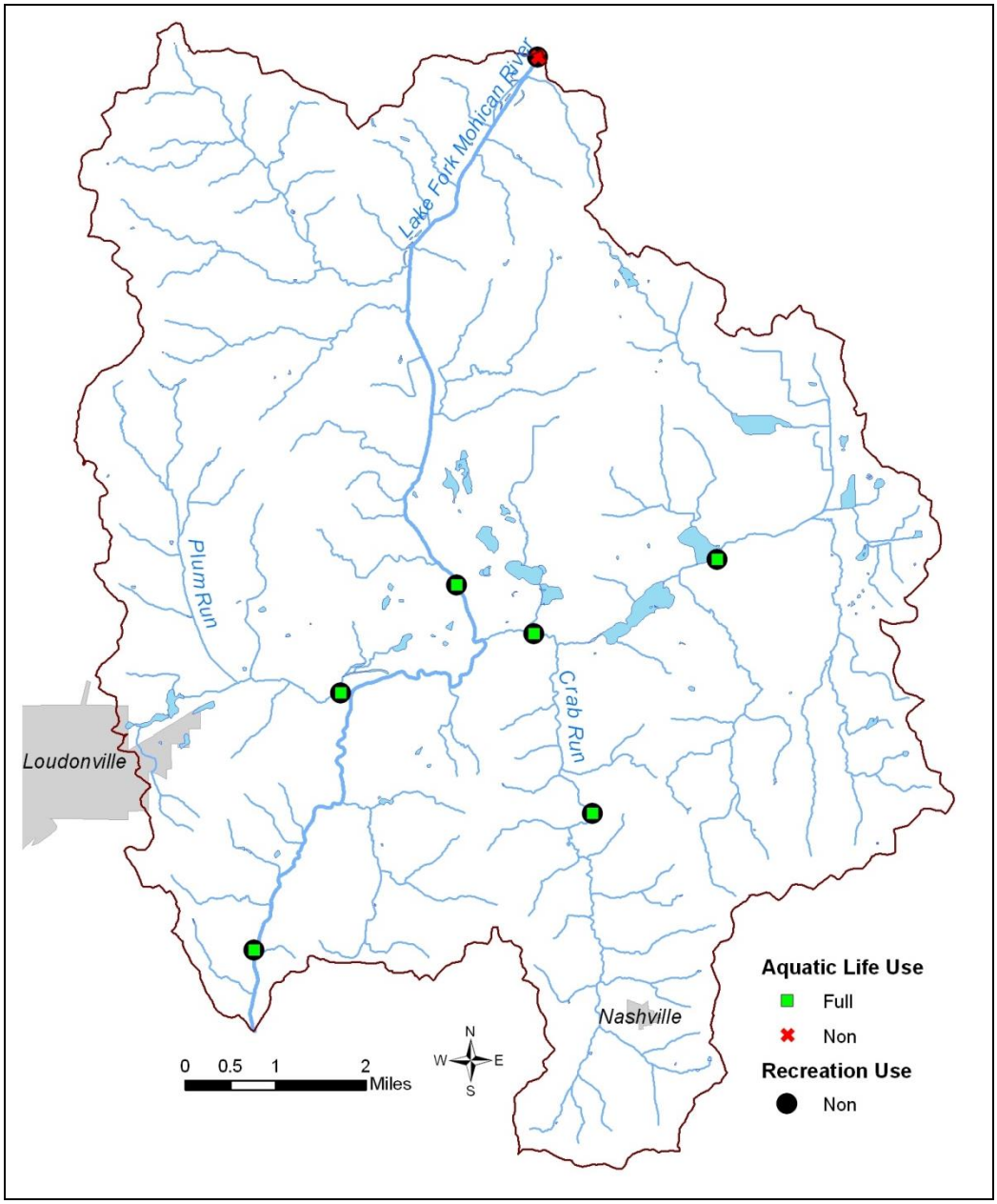


Figure 3-33. Attainment results for the Lake Fork Mohican River subwatershed.

In most cases, these causes are associated with land uses in the subwatershed (see Appendix B for further information). Figure 3-34 shows land use within the Lake Fork Mohican River subwatershed.

In general, sample locations were attaining goals for biology; high quality habitat was a major factor in that attainment. In several rural reaches upstream of sample sites, modified habitat was noted from agricultural land uses. Recreation use was not supported at any site in the subwatershed. Sources of bacteria include unsewered areas with failing home sewage treatment systems and agricultural land uses, particularly those that allow livestock free access to streams.

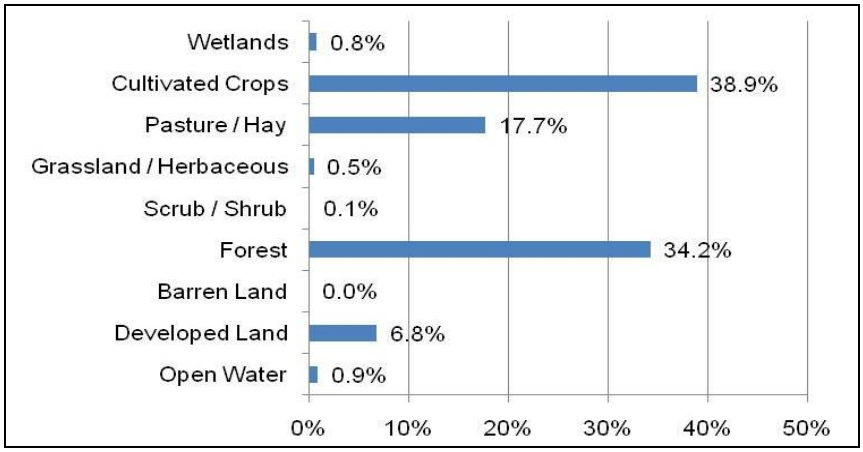


Figure 3-34. Land use in the Lake Fork Mohican River subwatershed.

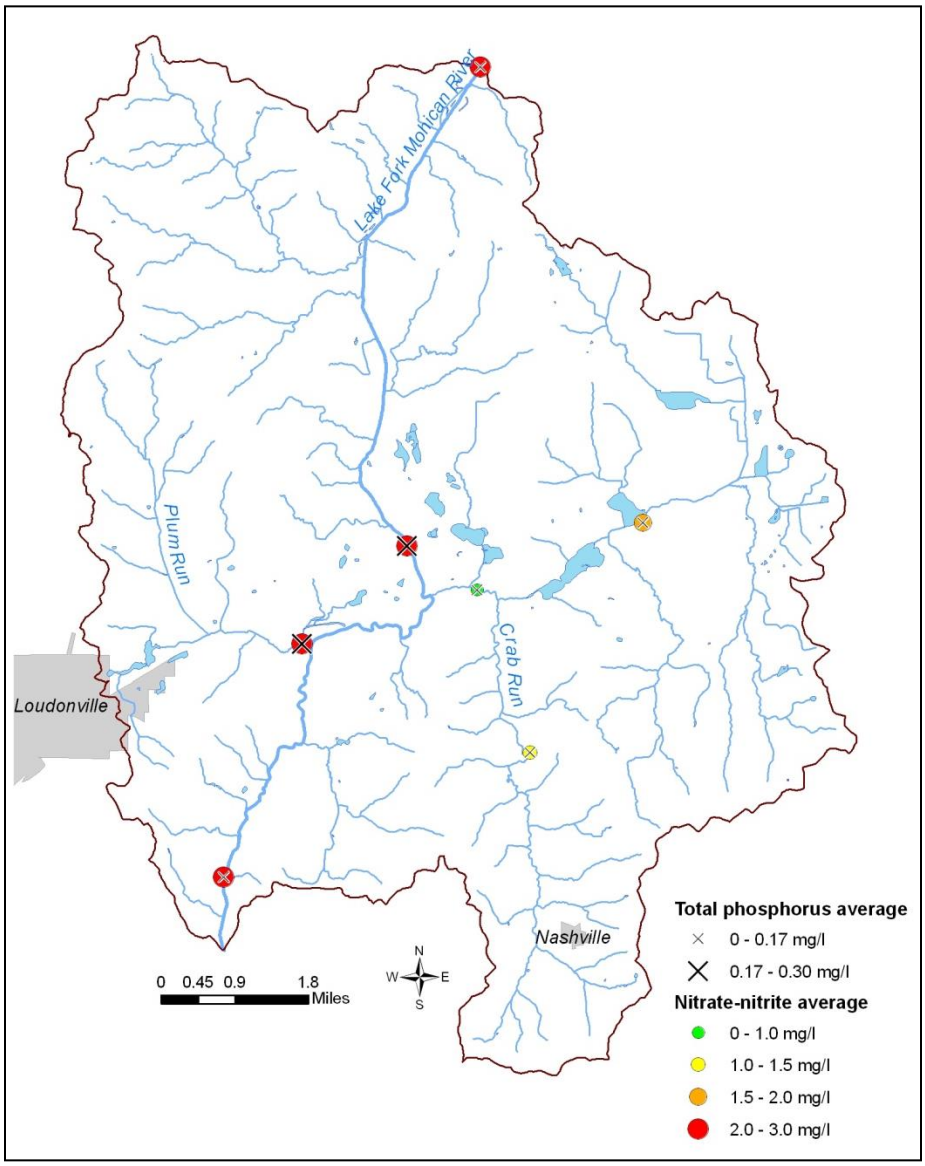


Figure 3-35. Water chemistry results for the Lake Fork Mohican River subwatershed.

Figure 3-35 shows water chemistry results in the subwatershed. Some of these results aided in identifying causes of aquatic life use impairment. Figure 3-36 shows relative occurrence of causes of aquatic life use impairment in the Lake Fork Mohican River subwatershed. Figure 3-37 shows the relative occurrence of sources of aquatic life use impairment in the Lake Fork Mohican River subwatershed.

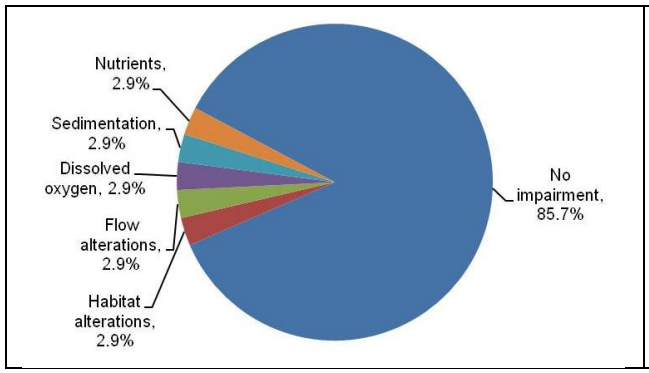


Figure 3-36. Causes of aquatic life use impairment in the Lake Fork Mohican River subwatershed.

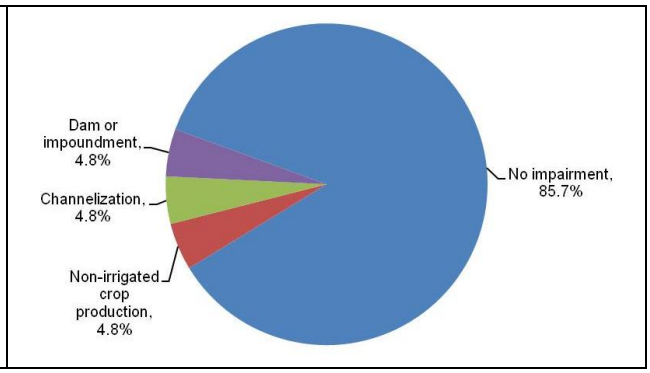
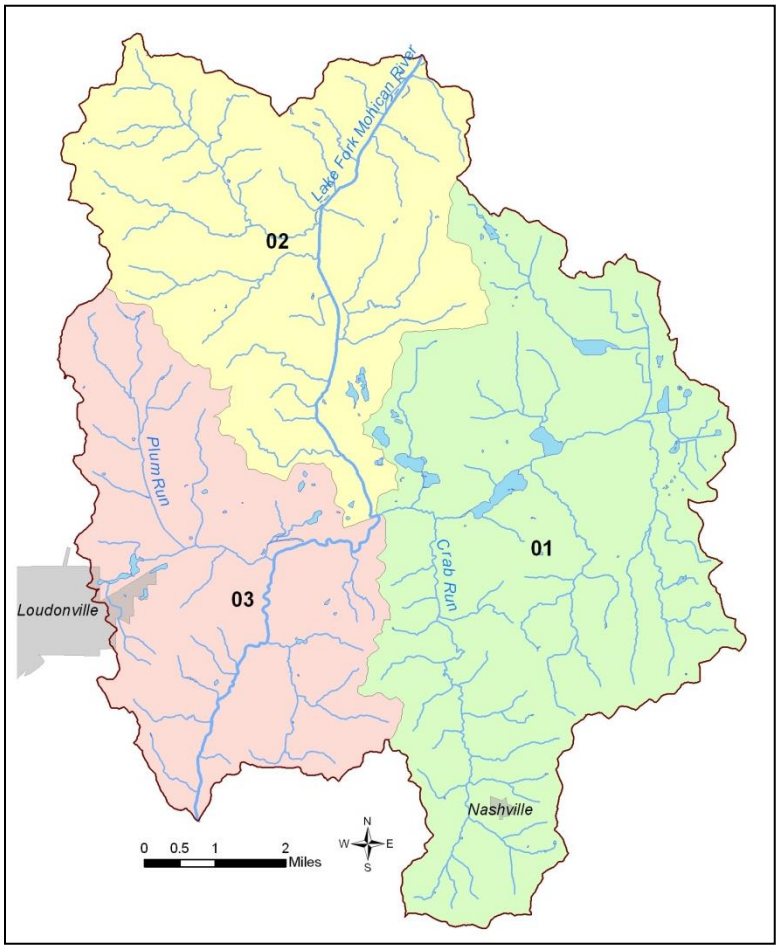


Figure 3-37. Sources of aquatic life use impairment in the Lake Fork Mohican River subwatershed.



Aquatic life use impairment is located only at the northeast corner of nested subwatershed 02. Recreation use impairment was scattered throughout the subwatershed. Figure 3-38 shows the locations of nested subwatersheds within the Lake Fork Mohican River subwatershed.

Figure 3-38. Locations of nested subwatersheds within the Lake Fork Mohican River subwatershed.

Table 3-7 shows the site-by-site results for each designated beneficial use organized by nested subwatersheds. For more specific information regarding individual site assessment results and supporting chemistry results, please see Appendix B.

Table 3-7. Number of impaired sites, organized by use and nested subwatershed, in the Lake Fork Mohican River subwatershed.

Nested Subwatershed (05040002 07)		Aquatic Life Use	Recreation Use	Public Drinking Water Supply Use	Human Health Use[1]
07 01	# impaired sites (non/partial)	0/0	3	N/A	3
	Index score[2]	100.0	17	N/A	N/A
07 02	# impaired sites (non/partial)	1/0	2	N/A	3
	Index score	50.0	38	N/A	N/A
07 03	# impaired sites (non/partial)	0/0	2	N/A	3
	Index score	100.0	33	N/A	N/A

[1] Impairments to the human health use are reported based on the nested subwatershed, rather than the site, level. Numbers reported are 2010 Integrated Report categories. Impairments are not being addressed in this TMDL.

[2] The index score (between 0 and 100) indicates the relative support of the aquatic life or recreation use in the nested subwatershed. A score of 100 indicates full support of the use.

The combination of channelization, a high sediment bedload and operation of the Mohicanville Dam produced a monotonous habitat in the reach of the Lake Fork that can be impounded. Downstream from the dam, natural recovery of typical stream habitat attributes was evident. Increasing heterogeneity of the habitat downstream of the dam was favorable to a wider range of fish and macroinvertebrates. Habitat scores were lower on Odell Lake Outlet and at the impaired Lake Fork Site. They tended to be higher at other sites sampled in the subwatershed. Further details are available in Appendix B.

3.8 Mohican River (05040002 08)

The Mohican River subwatershed drains 138.8 square miles in the southeastern portion of the watershed (see Figure 3-1). It consists of six nested subwatersheds. The main tributaries to Mohican River include Honey Creek, Black Fork Mohican River, Sigafoos Run, Negro Run, Flat Run and Big Run. Major causes of impairment include direct habitat alterations and high flow regime (see Figure 3-39). Those causes stem from major flooding or freshets.

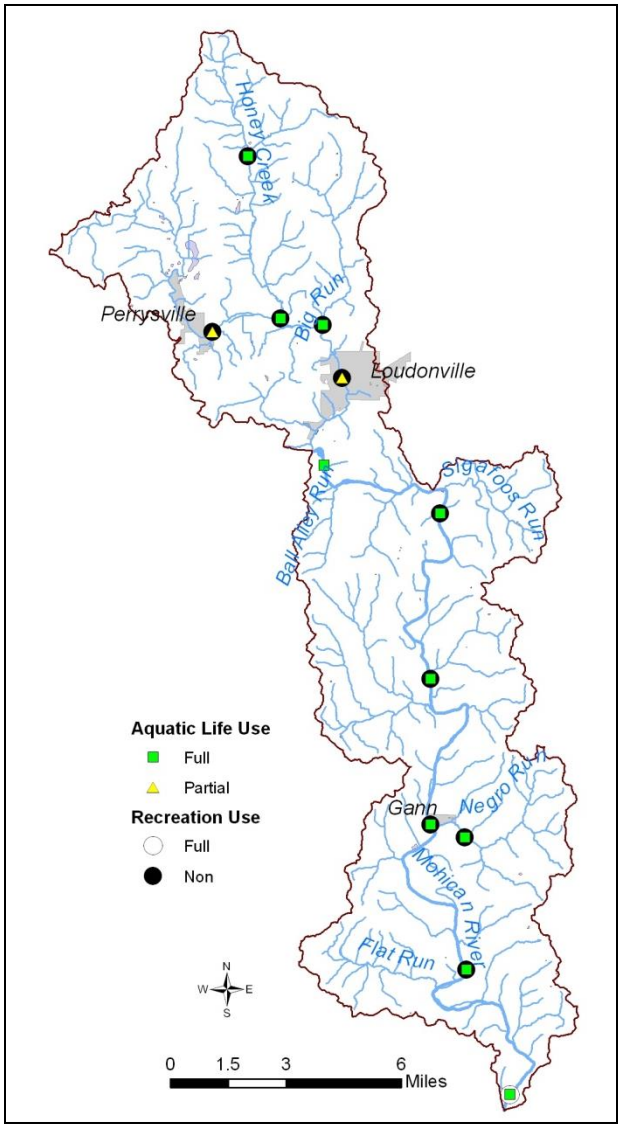


Figure 3-39. Attainment results for the Mohican River subwatershed.

In most cases, these causes are associated with land uses in the subwatershed (see Appendix B for further information). Figure 3-40 shows land use within the Mohican River subwatershed.

At the impaired locations, decimation of the community from high stream flow likely had a greater effect on the depressed macroinvertebrate index score than other possible sources. It appeared that elevated flow following summer flooding had redistributed and scoured the substrates. Reestablishment of a stable macroinvertebrate assemblage appeared to still be ongoing when sampling was conducted. The cycle of disruption and recolonization is likely repeated following similar high flow events. In most cases, other tributary sites were meeting biological expectations.

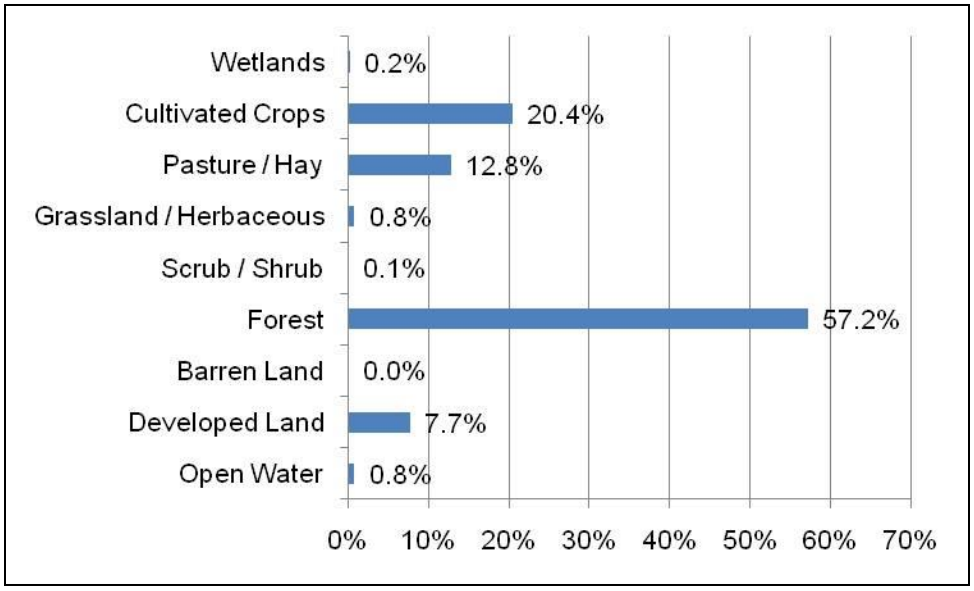


Figure 3-40. Land use in the Mohican River subwatershed.

Causes and sources were identified primarily through biological indicators and habitat. Figure 3-41 shows relative occurrence of causes of aquatic life use impairment in the Mohican River subwatershed. Figure 3-42 shows the relative occurrence of sources of aquatic life use impairment in the Mohican River subwatershed.

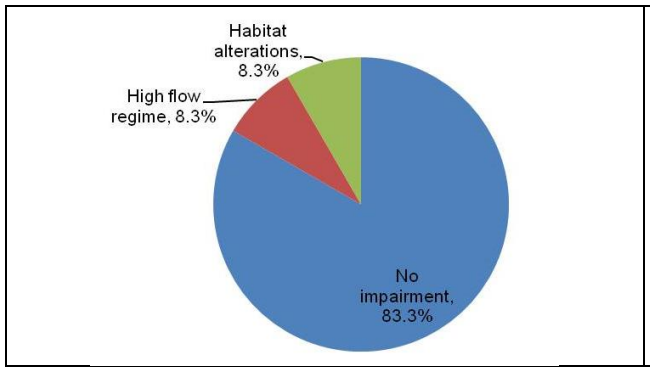


Figure 3-41. Causes of aquatic life use impairment in the Mohican River subwatershed.

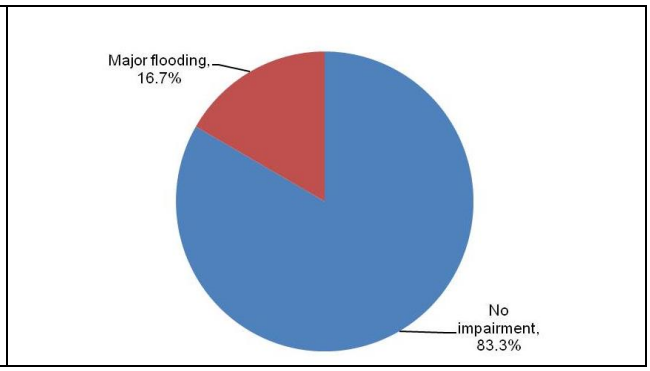


Figure 3-42. Sources of aquatic life use impairment in the Mohican River subwatershed.

Impairment was found in biology near the two more urbanized areas of the subwatershed, Perrysville and Loudonville, both located in the northern portion of the subwatershed. Figure 3-43 shows the locations of nested subwatersheds within the Mohican River subwatershed.

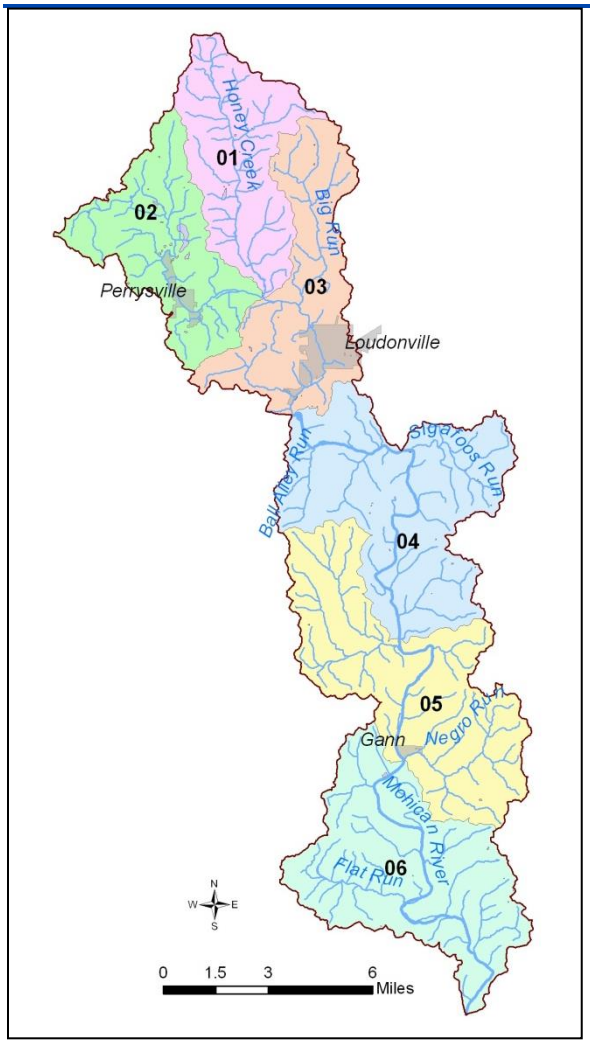


Table 3-8 shows the site-by-site results for each designated beneficial use organized by nested subwatersheds. For more specific information regarding individual site assessment results and supporting chemistry results, please see Appendix B.

Figure 3-43. Locations of nested subwatersheds within the Mohican River subwatershed.

Table 3-8. Number of impaired sites, organized by use and nested subwatershed, in the Mohican River subwatershed.

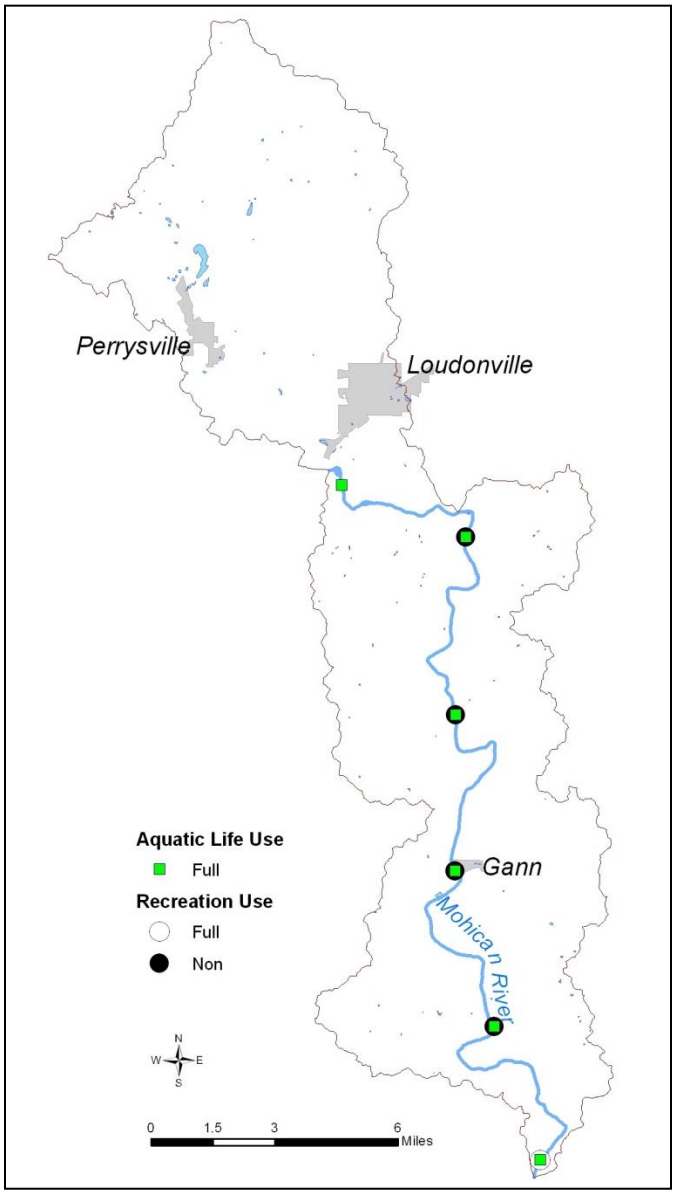
Nested Subwatershed (05040002 08)		Aquatic Life Use	Recreation Use	Public Drinking Water Supply Use	Human Health Use[1]
08 01	# impaired sites (non/partial)	0/0	2	N/A	3
	Index score[2]	100.0	38	N/A	N/A
08 02	# impaired sites (non/partial)	0/1	1	N/A	3i
	Index score	0.0	50	N/A	N/A
08 03	# impaired sites (non/partial)	0/1	2	N/A	3i
	Index score	50.0	42	N/A	N/A
08 04	# impaired sites (non/partial)	N/A	N/A	N/A	3i
	Index score	N/A	N/A	N/A	N/A
08 05	# impaired sites (non/partial)	0/0	1	N/A	3i
	Index score	100.0	75	N/A	N/A
08 06	# impaired sites (non/partial)	N/A	N/A	N/A	5
	Index score	N/A	N/A	N/A	N/A

[1] Impairments to the human health use are reported based on the nested subwatershed, rather than the site, level. Numbers reported are 2010 Integrated Report categories. Impairments are not being addressed in this TMDL.

[2] The index score (between 0 and 100) indicates the relative support of the aquatic life or recreation use in the nested subwatershed. A score of 100 indicates full support of the use.

In Black Fork Mohican River, in-stream and riparian habitats were in very good condition. It is classified as a State Scenic River downstream of Charles Mill Reservoir. Habitat in tributaries to Black Fork and Mohican River mainstem ranged widely, including agriculturally modified areas, areas recovering from modification and areas with natural and high quality habitat. Biology generally reflected this range; in more modified areas, biological assemblages were not as diverse as those areas where intact, high quality habitat existed. More details are available in Appendix B.

3.9 Mohican River Mainstem (Large River Assessment Unit)



The Mohican River mainstem drains 998.8 square miles (see Figure 3-1). The main tributaries to the Mohican River mainstem include Clear Fork, Black Fork, Lake Fork and Jerome Fork. There is no aquatic life use impairment along the large river assessment unit of the Mohican River mainstem (see Figure 3-44). Recreation use was supported only at the downstream site near the mouth of the river, though no exceedances of criteria were large enough to cause undue concern.

The Mohican River is a tributary of the Walhonding River and is about 27.58 miles in length. It is recognized as a state scenic river below Clear Fork to the confluence with the Walhonding River.

Biological index scores from the Mohican River were all in the exceptional range. The combination of good water quality and varied habitat with limited substrate embeddedness benefited the fish and macroinvertebrates communities. Diverse assemblages of both organism groups were collected and the river supported a number of declining fish species as well as blue breast darters, a threatened species in Ohio especially sensitive to perturbations in habitat and water quality.

Figure 3-44. Attainment results for the Mohican River mainstem.

Table 3-9 shows the site-by-site results for each designated beneficial use organized by nested subwatersheds. For more specific information regarding individual site assessment results and supporting chemistry results, please see Appendix B.

Table 3-9. Number of impaired sites, organized by use, in the Mohican River mainstem.

Large River Assessment Unit	Aquatic Life Use	Recreation Use	Public Drinking Water Supply Use	Human Health Use[1]
# impaired sites (non/partial)	0/0	4	N/A	5
Index score[2]	100.0	75	N/A	N/A

[1] Impairments to the human health use are reported based on the whole large river level, rather than by site. Numbers reported are 2010 Integrated Report categories. Impairments are not being addressed in this TMDL.

[2] The index score (between 0 and 100) indicates the relative support of the aquatic life or recreation use in the nested subwatershed. A score of 100 indicates full support of the use.

Habitat along the entire reach was in excellent condition. QHEI scores ranged from 82.0 to 91.0. Unimpeded riffle/run/pool development and an intact wooded riparian corridor were major factors benefiting the Mohican River. A variety of cover and current conditions were present. Habitat heterogeneity afforded potential for commensurate high diversity of fish and macroinvertebrates assemblages.

4 METHODS TO CALCULATE LOAD REDUCTIONS

The Mohican River watershed TMDL does not support three beneficial uses—aquatic life, recreation and human health (not addressed in this TMDL report). The causes of impairment to aquatic life uses consist of sedimentation/siltation, organic enrichment (sewage) biological indicators, direct habitat alterations, total dissolved solids, nutrient/eutrophication biological indicators, other flow regime alterations, turbidity, dissolved oxygen, metals, unknown toxicity, natural causes (flow or habitat), high flow regime (natural), suspended algae, flow alteration, biological oxygen demand. The cause of recreation use impairment is excessive concentrations of an indicator bacterium, *E. coli*. The linkage analysis examines the cause and effect relationships between watershed characteristics and pollutant sources and the effect on the stream biology and evaluates the use of surrogate measures to address the pollutant sources that would result in supporting beneficial uses.

How the Identified Stressors Lead to Impaired Uses

Nutrients rarely approach concentrations in the ambient environment that are toxic to aquatic life, and the 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 of water quality standards 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.

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 TP target concentrations based on observed concentrations associated with acceptable ranges of expected biological communities. The TP and nitrogen targets used in this report are shown in Table D-6. 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.

Justification for Using Nitrate and Nitrite Instead of Total Phosphorus for the Brubaker Creek 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 river mile (RM) 0.3, nuisance algae were observed, indicating enrichment from TP.

Brubaker Creek at RM 0.3 was sampled eight times for TP; 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 4-1 shows that concentrations increase with flow but since flow levels did not increase significantly, neither did TP concentrations. Assuming that there is a linear relationship between in-stream phosphorus concentration and flow then based on Figure 4-1, 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 TP 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.

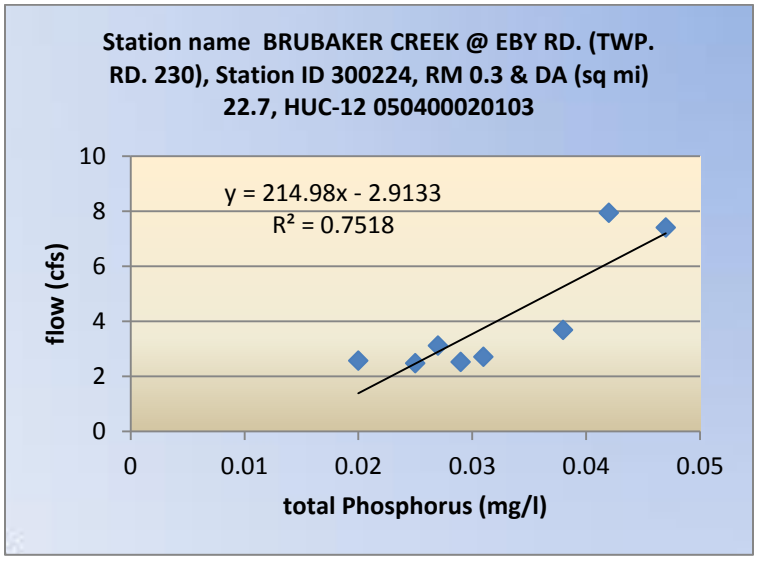


Figure 4-1. Comparison of total phosphorus to flow.

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 TP, in-stream nitrate and nitrite concentrations increase with flow. Also like TP, nitrate and nitrite typically enters streams via surface runoff and field tiles. However unlike TP, 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 TP 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 TP.

Justification for the Use of Surrogates

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 4-2)."

"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 an *E. coli* 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 4-2). 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 4-2. 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 4-1 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,

diligent work has been conducted with Voisard Manufacturing to address non-compliance. The Lust and Country Meadows subdivisions are abandoned; compliance schedules have been included in both NPDES permits to either upgrade or abandon the plants to address the non-compliance. As identified in the table, Shelby WWTP did not have any violations so non-compliance action is not necessary.

Because the potential sources of impairments are straightforward, TP and *E. coli* load duration curve (LDC) TMDLs, respectively, are used as surrogates for organic enrichment. In order to meet TP 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 4-1. 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
Country Meadows Subdivision	2PG00074*CD	14
Lust Subdivision WWTP	2PG00077*DD	3

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 4-8.

An analysis of QHEI habitat was performed, the results of which are shown in Section 5 of the report. 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."

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.

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. TP is used as a surrogate for suspended algae and D.O and directly for nutrients/eutrophication. For information on nutrient TMDLs see Section 4.1. Other flow alterations is addressed using a QHEI habitat TMDL, see section 4.2. 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 TP is the limiting nutrient for algae in the Charles Mill dam reservoir and serves well as a surrogate for suspended algae. The LDC (see Figure D4-41 in Appendix D) shows that TP 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 TP 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 4-3), 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 TP will result in lower concentrations of algae, TP can serve as a good surrogate for algae. In addition, reductions of algae via TP reductions will aid in addressing dissolved oxygen issues, as discussed below.

Figure 4-3. 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 (in Appendix D) for details on how algae affect in-stream DO. Unlike the typical situation where TP 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.

<u>Lower Muddy Fork Mohican River (05040002 05 03)</u>

QHEI is used as a surrogate for DO and biological oxygen demand (BOD) because the measurement of habitat reveals the problem inherent in Kiser Ditch. 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 Section 5.35 show that Kiser Ditch 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 Ditch 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.

<u>Mohicanville Dam-Lake Fork Mohican River (05040002 07 02)</u>

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 TP TMDL.

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

Tables 4-2 through 4-5 indicate how the applicable causes of impairment are addressed in each of the assessment units.

Table 4-2. Summary of causes of impairment and actions taken to address them in assessment units within the 05040002 01 and 05040002 02 ten-digit hydrologic units.

	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	

D – direct	Means that TMDLs are calculated for this parameter
S – surrogate	Means that TMDLs are calculated for a closely related cause and actions to reduce the impact of that cause should be sufficient to address this cause. There is substantial overlap in the sources of the loading of both parameters
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.

Table 4-3. Summary of causes of impairment and actions taken to address them in assessment units within the 05040002 03 and 05040002 04 ten-digit hydrologic units.

	Watershed Assessment Units							
	05040002 03			05040002 04				
Causes of Impairment	**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

D – direct	Means that TMDLs are calculated for this parameter
S – surrogate	Means that TMDLs are calculated for a closely related cause and actions to reduce the impact of that cause should be sufficient to address this cause. There is substantial overlap in the sources of the loading of both parameters
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.

Table 4-4. Summary of causes of impairment and actions taken to address them in assessment units within the 05040002 05 and 05040002 06 ten-digit hydrologic units.

	Watershed Assessment Units								
	05040002 05			05040002 06					
Causes of Impairment	**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

D – direct	Means that TMDLs are calculated for this parameter
S – surrogate	Means that TMDLs are calculated for a closely related cause and actions to reduce the impact of that cause should be sufficient to address this cause. There is substantial overlap in the sources of the loading of both parameters
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.

Table 4-5. Summary of causes of impairment and actions taken to address them in assessment units within the 05040002 07 and 05040002 08 ten-digit hydrologic units and the large river assessment unit.

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

D – direct	Means that TMDLs are calculated for this parameter
S – surrogate	Means that TMDLs are calculated for a closely related cause and actions to reduce the impact of that cause should be sufficient to address this cause. There is substantial overlap in the sources of the loading of both parameters
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.

Further details on modeling methods and analyses are available in Appendix D.

4.1 Load Duration Curves

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.

4.1.1 Justification

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. 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 and wastewater treatment plants.

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.

4.1.2 Sources of Data

Water quality data used in the TMDL were collected in 2007 and 2008 by Ohio EPA. Flow data and stages were collected at that time at certain sites throughout the basin as well (called sentinel sites).

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.

4.1.3 Target(s)

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 TP 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 4-6. 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 4-6. 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 $\geq$20 mi^2 <200 mi^2)	0.1	1.0
Small rivers (drainage area $\geq$ 200 mi^2 <1000 mi^2)	0.17	1.5

4.1.4 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.

4.1.5 Seasonality and Critical Conditions

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 4-7.

Table 4-7. Load duration curve flow zones and typical contributing sources.

Contributing Source Area	Duration Curve Zone				
	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 in Appendix D 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.

4.2 Habitat and Sediment Method (QHEI)

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.

4.2.1 Justification

The 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.

4.2.2 Sources of Data

Habitat data using the QHEI were collected at sites where fish assemblages were sampled during survey work in 2007. QHEI metric scores were then used to calculate sediment TMDLs.

4.2.3 Target(s)

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 4-8 lists modified and high influence modified attributes and provides the QHEI targets used for this habitat TMDL.

Table 4-8. 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 4-9 summarizes the sediment TMDL targets that are used to address sedimentation.

Table 4-9. 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.

4.2.4 Allowance for Future Growth

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

4.2.5 Seasonality and 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.

4.3 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 (TP, 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 5.

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.

The assimilative capacity is determined by multiplying the stream flow by the target concentration and a conversion factor. In the case of Rocky Fork at RM 10.13 the TP target concentration (0.1 mg/L) is much lower than the Mansfield WWTP discharge concentration (1.84 mg/L), so the WWTP is reliant on upstream dilution to bolster the stream's assimilative capacity. At this site, however, there is not enough flow during low flow conditions to do that. Therefore, discharge overwhelms the assimilative capacity by so much that the usual first go to practice of reducing the MOS and/or the AFG had minimal impact on freeing up assimilative capacity. In order to protect for instream TP concentrations during low flow conditions, the discharge concentration must be lowered 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 10.13 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.

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.

5 LOAD REDUCTION RESULTS

Several analyses were completed to address the causes of impairment. Results are summarized in this chapter and organized by assessment unit. Further details are available in Appendix D.

5.1 Marsh Run (05040002 01 01)

Required reductions in this assessment unit ranged from 67.7 to 89.4 percent for *E. coli*.

Table 5-1. *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%
		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.

5.2 Headwaters Black Fork Mohican River (05040002 01 02)

Required reductions in this assessment unit ranged from 0 to 41.9 percent for TDS and 0 to 80.2 percent for TP.

Table 5-2. 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.

Table 5-3. Total phosphorus TMDL for site on Bear Run at London West Rd. (Co. Rd. 58) (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	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.

5.3 Brubaker Creek (05040002 01 03)

Required reductions in this assessment unit ranged from 70.3 to 96.0 percent for *E. coli* and 0 to 8.6 percent for nitrate and nitrite.

Table 5-4. *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.

Table 5-5. Nitrate and nitrite TMDL for site on Brubaker Cr. @ Eby Rd (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	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.

5.4 Whetstone Creek (05040002 01 04)

Required reductions in this assessment unit ranged from 87.6 to 97.0 percent for *E. coli*.

Table 5-6. *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.

5.5 Shipp Creek-Black Fork Mohican River (05040002 01 05)

Required reductions in this assessment unit ranged from 66.7 to 99.5 percent for *E. coli*.

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.

Table 5-7. *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.

Table 5-8. *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.

5.6 Village of Pavonia-Black Fork Mohican River (05040002 02 01)

Required reductions in this assessment unit ranged from 69.7 to 95.6 percent for *E. coli* and 0 to 70.0 percent for TP.

Table 5-9. *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.

For Table 5-10, in order to allow for a load allocation in the lowest flow category, the permit limit concentration would need to be reduced from the existing 2.32 mg/l to 1.3 mg/l. The MOS and AFG were both reduced to 1% in the lowest flow category only because there is more certainty at low flows about the relationship between load and wasteload allocations and water quality.

Table 5-10. 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.

Regarding Table 5-11, the discharge flows from the Shelby Municipal Light Plant, ArcelorMittal Tubular, and Shelby WWTP are such a large percentage of the total downstream flow that in order to retain assimilative capacity for the TP load allocation, the discharge concentrations for the facilities would need to be reduced from their existing concentrations of 0, 0, and 1.58 mg/l to 2, 2, and 0.1 mg/l, respectively. Shelby Light and ArcelorMittal were given a wasteload allocation in order for them to have the potential to be able to discharge TP. Implementation of the WLAs will be discussed in Section 6 of the report.

Table 5-11. 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.

5.7 Headwaters Rocky Fork (05040002 02 03)

Required reductions in this assessment unit ranged from 79.4 to 98.9 percent for *E. coli* and 0 to 73.3 percent for TP.

Table 5-12. *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.

Table 5-13. 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.

5.8 Outlet Rocky Fork (05040002 02 04)

Required reductions in this assessment unit ranged from 7.7 to 59.0 percent for *E. coli* and 87.2 to 92.1 percent for TP.

Table 5-14. *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.

Regarding

Table 5-15, 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 TP 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 report.

Table 5-15. 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.

5.9 Charles Mill-Black Fork Mohican River (05040002 02 05)

Required reductions in this assessment unit ranged from 0 to 12.0 percent for TP.

Regarding Table 5-16, 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 TP 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 0.2 kg/d. Implementation of the WLAs will be discussed in Section 6 of the report.

Table 5-16. 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.

Regarding Table 5-17, the discharge flows from the Shelby and Eastview WWTPs are such a large percentage of the total downstream flow that in order to retain assimilative capacity for the TP load allocation, the discharge concentration for the WWTPs would need to be reduced from their existing concentrations of 1.58 and 2.32 mg/l respectively, to 0.25 mg/l each. Also, to increase the amount of allowable 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. Implementation of the WLA will be discussed in Section 6 of the main report.

Table 5-17. 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.

5.10 Cedar Fork (05040002 03 02)

Required reductions in this assessment unit ranged from 61.9 to 74.2 percent for *E. coli*.

Table 5-18. *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.

5.11 Town of Lexington-Clear Fork Mohican River (05040002 03 03)

Required reductions in this assessment unit ranged from 79.9 to 96.4 percent for *E. coli*.

Table 5-19. *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.

5.12 Honey Creek-Clear Fork Mohican River (05040002 04 01)

Required reductions in this assessment unit ranged from 0 to 77.1 percent for *E. coli*.

Table 5-20. *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.

5.13 Opossum Run (05040002 04 02)

Required reductions in this assessment unit ranged from 54.1 to 78.7 percent for *E. coli*.

Table 5-21. 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.

5.14 Slater Run-Clear Fork Mohican River (05040002 04 03)

Required reductions in this assessment unit ranged from 0.8 to 52.8 percent for *E. coli*.

Table 5-22. *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.

5.15 Pine Run (05040002 04 04)

Required reductions in this assessment unit ranged from 78.1 to 92.8 percent for *E. coli*.

Table 5-23. *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.

5.16 Switzer Creek-Clear Fork Mohican River (05040002 04 05)

Required reductions in this assessment unit ranged from 76.6 to 94.9 percent for *E. coli*.

Table 5-24. *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.

5.17 Upper Muddy Fork Mohican River (05040002 05 01)

Required reductions in this assessment unit ranged from 22.0 to 88.0 percent for *E. coli*.

Table 5-25. *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.

5.18 Middle Muddy Fork Mohican River (05040002 05 02)

Required reductions in this assessment unit ranged from 18.8 to 97.4 percent for *E. coli*.

Table 5-26. *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.

5.19 Lower Muddy Fork Mohican River (05040002 05 03)

Required reductions in this assessment unit ranged from 58.8 to 89.4 percent for *E. coli*.

Table 5-27. *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.

5.20 Lang Creek (05040002 06 01)

Required reductions in this assessment unit ranged from 71.8 to 91.2 percent for *E. coli*.

Table 5-28. *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.

5.21 Orange Creek (05040002 06 02)

Required reductions in this assessment unit ranged from 56.0 to 66.5 percent for *E. coli*.

Table 5-29. *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.

5.22 Katotawa Creek (05040002 06 03)

Required reductions in this assessment unit ranged from 0 to 73.2 percent for *E. coli*.

Table 5-30. *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.

5.23 Oldtown Run (05040002 06 04)

Required reductions in this assessment unit ranged from 32.0 to 85.4 percent for *E. coli*.

Table 5-31. *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.

5.24 Jerome Fork-Mohican River (05040002 06 05)

Required reductions in this assessment unit ranged from 67.6 to 97.6 percent for *E. coli* and 90.4 to 90.5 percent for TP.

Table 5-32. *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.

Regarding Table 5-33, 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 TP load allocation, the discharge concentration for the WWTP would need to be reduced from its existing concentration of 3.84 mg/l to 0.2 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 5-33. 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.

5.25 Glenn Run-Jerome Fork Mohican River (05040002 06 06)

Required reductions in this assessment unit ranged from 71.1 to 96.2 percent for *E. coli*.

Table 5-34. *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

5.26 Crab Run (05040002 07 01)

Required reductions in this assessment unit ranged from 88.6 to 99.2 percent for *E. coli*.

Table 5-35. *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.

5.27 Mohicanville Dam-Lake Fork Mohican River (05040002 07 02)

Required reductions in this assessment unit ranged from 73.5 to 95.8 percent for *E. coli* and 0 to 35.7 percent for TP.

Table 5-36. *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.

Regarding

Table 5-37, 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 TP load allocation, the discharge concentration for the WWTP would need to be reduced from its existing concentration 3.84 mg/l to 0.8 mg/l. Also, to increase the amount of allowable 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 5-37. 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.

5.28 Plum Run-Lake Fork Mohican River (05040002 07 03)

Required reductions in this assessment unit ranged from 79.5 to 98.6 percent for *E. coli*.

Table 5-38. *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.

5.29 Honey Creek (05040002 08 01)

Required reductions in this assessment unit ranged from 78.0 to 89.9 percent for *E. coli*.

Table 5-39. *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.

5.30 Town of Perrysville-Black Fork Mohican River (05040002 08 02)

Required reductions in this assessment unit ranged from 37.6 to 89.1 percent for *E. coli*.

Table 5-40. *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
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

TMDL and Duration Intervals	High 0-5%	Wet weather 5-40%	Normal range 40-80%	Dry weather 80-95%	Low 95-100%
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.

5.31 Big Run-Black Fork Mohican River (05040002 08 03)

Required reductions in this assessment unit ranged from 88.1 to 93.7 percent for *E. coli*.

Table 5-41. *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.

5.32 Negro Run-Mohican River (05040002 08 05)

Required reductions in this assessment unit ranged from 40.1 to 82.9 percent for *E. coli*.

Table 5-42. *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.

5.33 Mohican River Mainstem (05040002 90 01)

Required reductions in this assessment unit ranged from 0 to 67.7 percent for *E. coli*.

Table 5-43. *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

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	0.0000	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
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

TMDL and Duration Intervals	High 0-5%	Wet weather 5-40%	Normal range 40-80%	Dry weather 80-95%	Low 95-100%
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
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

TMDL and Duration Intervals	High 0-5%	Wet weather 5-40%	Normal range 40-80%	Dry weather 80-95%	Low 95-100%
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
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.

5.34 Summary of Nutrient Wasteload Allocations

Table 5-44 summarizes the TP and nitrate and nitrite wasteload allocations for the nutrient TMDLs.

Table 5-44. Summary of the 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

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	Mansfield WWTP 2PE00001	4.54	0.1	12.
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	0.0008	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.	17.80	Northside MHP 2GS00019	0.03	3	0.0024

Sampling Site HUC 05040002	Sampling Site Description	River Mile	Facility Name	WLA (kg/d)	Conc. (mg/l)	Design Flow (MGD)
	1265					
02 05	Black Fork Mohican R. @ Twp. Rd. 1265	17.80	Briarwood Estates MHP 2PY00018	0.34	3	0.030
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	0.23	3	0.02

Sampling Site HUC 05040002	Sampling Site Description	River Mile	Facility Name	WLA (kg/d)	Conc. (mg/l)	Design Flow (MGD)
			3PP00029			
07 02	Lake Fork Mohican R. @ St. Rt. 95	14.04	West Salem WWTP 3PB00053	2.32	3	0.204
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

5.35 Sediment and Habitat TMDL Results

Table 5-45. 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 R. (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**		

Table 5-46. 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**

6 WATER QUALITY IMPROVEMENT STRATEGY

Biological partial and non-attainment were primarily located in the northern half of the watershed and non-attaining sites were concentrated in the northwestern and central areas. Of the sites sampled for aquatic life use support, 74% were fully attaining goals, 14% were attaining some but not all of the goals (partial attainment) and 12% were not attaining any of the goals. The more common causes of impairment were nutrients, direct habitat alterations and flow regime alterations. The most common sources were channelization, dams or impoundments and urban runoff / storm sewers. Only 13% of the sites assessed for support of the recreation use supported the use. Probable common sources were agricultural land uses and failing home sewage treatment systems.

Table 6-1 shows an overview of all of the nested subwatersheds that contain sites with partial and non-attainment of aquatic life and recreation uses. Causes of impairment are shown within parentheses following each source that might contribute to that cause. Table 6-2 and

Table 6-3 each represent a separate subwatershed (see Figure 3-1 for a map). A series of tables list actions appropriate for addressing the water quality stressors for each nested subwatershed in the basin. The recommended actions are well-established practices with demonstrated effectiveness. Details regarding these practices are included in Appendix E of this report. Additionally, Appendix E discusses various programs and organizations that can be sources for assistance in carrying out the recommended actions.

The actions indicate the universe of possibilities for resolving the water quality impairment. The recommendations are not intended to be rigid, and any number or combination should contribute to improvement, whether applied at sites where actual impairment was noted or other locations where sources contribute indirectly to impairment. However, restoring the quality of the water may require a concerted and sustained effort by several willing participants.

Table 6-1. Categories of implementation actions recommended in the Mohican River watershed.

Location Description (10-digit HUC) Location Description (12-digit HUC) Sources (Causes)	Restoration Categories											
	Bank & Riparian Restoration	Stream Restoration	Wetland Restoration	Conservation Easements	Dam Modification or Removal	Levee or Dike Modification or Removal	Abandoned Mine Land Reclamation	Home Sewage Planning and Improvement	Education and Outreach	Agricultural Best Management Practices	Storm Water Best Management Practices	Regulatory Point Source Controls
Headwaters Black Fork Mohican River (05040002 01)												
Marsh Run (01 01)												
Channelization (sedimentation/ siltation)									x	x		
Dam or impoundment (sedimentation/ siltation)					Modify							
Non-irrigated crop production (sedimentation/ siltation)									x	x		
Failing HSTS (bacteria)								x	x			
Headwaters Black Fork Mohican River (01 02)												
Channelization (direct habitat alterations)		x										
Urban runoff/storm sewers (other flow regime alterations)											x	
Industrial point source discharge (total dissolved solids)												x
Non-irrigated crop production (dissolved oxygen, organic enrichment)									x	x		
Unrestricted livestock access (dissolved oxygen, organic enrichment, bacteria)									x	x		
Manure runoff (dissolved oxygen, organic enrichment, bacteria)									x	x		
Failing HSTS (bacteria)								x	x			
Brubaker Creek (01 03)												
Non-irrigated crop production (nutrient eutrophication)									x	x		
Failing HSTS (bacteria)								x	x			

Location Description (10-digit HUC) Location Description (12-digit HUC) Sources (Causes)	Restoration Categories											
	Bank & Riparian Restoration	Stream Restoration	Wetland Restoration	Conservation Easements	Dam Modification or Removal	Levee or Dike Modification or Removal	Abandoned Mine Land Reclamation	Home Sewage Planning and Improvement	Education and Outreach	Agricultural Best Management Practices	Storm Water Best Management Practices	Regulatory Point Source Controls
Whetstone Creek (01 04)												
Failing HSTS (bacteria)								x	x			
Shipp Creek-Black Fork Mohican River (01 05)												
Sediment resuspension (turbidity)	x	x								x		
Channelization (direct habitat alterations, other flow regime alterations)		x							x	x		
Manure runoff (bacteria)									x	x		
Rocky Fork-Black Fork Mohican River (05040002 02)												
Village of Pavonia-Black Fork Mohican River (02 01)												
Channelization (direct habitat alterations, sedimentation/ siltation)		x							x			
Crop production with subsurface drainage (nutrient eutrophication)									x	x		
Dam or impoundment (dissolved oxygen, direct habitat alterations, turbidity)	No action recommended (dam cannot be changed)											
Non-irrigated crop production (other flow regime alterations)									x	x		
Failing HSTS (bacteria)								x	x			
Seymour Run-Black Fork (02 02)												
No data - no action necessary												
Headwaters Rocky Fork (02 03)												
Natural causes and sources - no action necessary												
Unspecified urban storm water (nutrient eutrophication)											x	

Location Description (10-digit HUC) Location Description (12-digit HUC) Sources (Causes)	Restoration Categories											
	Bank & Riparian Restoration	Stream Restoration	Wetland Restoration	Conservation Easements	Dam Modification or Removal	Levee or Dike Modification or Removal	Abandoned Mine Land Reclamation	Home Sewage Planning and Improvement	Education and Outreach	Agricultural Best Management Practices	Storm Water Best Management Practices	Regulatory Point Source Controls
Unspecified urban storm water (high flow regime, unknown)	Not addressed											
Contaminated sediments (metals)	Not addressed											
Failing HSTS (bacteria)								x	x			
Outlet Rocky Fork (02 04)												
Unspecified urban storm water (nutrient eutrophication)											x	
Municipal point source discharges (nutrient eutrophication, organic enrichment)												x
Failing HSTS (bacteria)								x	x			
Charles Mill-Black Fork Mohican River (02 05)												
Dam or impoundment (nutrient eutrophication, suspended algae, other flow regime alterations, dissolved oxygen)	No action recommended (dam cannot be changed)											
Headwaters Clear Fork Mohican River (05040002 03)												
Headwaters Clear Fork Mohican River (03 01)												
Insufficient data to assess - no action necessary												
Cedar Fork (03 02)												
Manure runoff (bacteria)									x	x		
Package plant (bacteria)												x
Failing HSTS (bacteria)								x	x			
Unrestricted livestock access (bacteria)									x	x		
Town of Lexington-Clear Fork Mohican River (03 03)												
Channelization (sedimentation/ siltation, direct habitat alterations)		x										
Manure runoff (bacteria)									x	x		

Location Description (10-digit HUC) Location Description (12-digit HUC) Sources (Causes)	Restoration Categories											
	Bank & Riparian Restoration	Stream Restoration	Wetland Restoration	Conservation Easements	Dam Modification or Removal	Levee or Dike Modification or Removal	Abandoned Mine Land Reclamation	Home Sewage Planning and Improvement	Education and Outreach	Agricultural Best Management Practices	Storm Water Best Management Practices	Regulatory Point Source Controls
Failing HSTS (bacteria)								x	x			
Municipal point source discharge (bacteria)												Done
Possum Run-Clear Fork Mohican River (05040002 04)												
Honey Creek-Clear Fork Mohican River (04 01)												
Manure runoff (bacteria)									x	x		
Package plant (bacteria)												x
Failing HSTS (bacteria)								x	x			
Possum Run (04 02)												
Natural - wildlife (bacteria)	No action recommended (wildlife cannot be removed)											
Slater Run-Clear Fork Mohican River (04 03)												
Manure runoff (bacteria)									x	x		
Pine Run (04 04)												
Natural - wildlife (bacteria)	No action recommended (wildlife cannot be removed)											
Switzer Creek-Clear Fork Mohican River (04 05)												
Failing HSTS (bacteria)								x	x			
Muddy Fork Mohican River (05040002 05)												
Upper Muddy Fork Mohican River (05 01)												
Dam or impoundment (other flow regime alterations)	No action recommended (dam cannot be changed)											
West Salem bypasses (bacteria)												x
Middle Muddy Fork Mohican River (05 02)												
Failing HSTS (bacteria)												x
West Salem bypasses (bacteria)												x
Lower Muddy Fork Mohican River (05 03)												
Channelization (sedimentation/ siltation)		x	x									

Location Description (10-digit HUC) Location Description (12-digit HUC) Sources (Causes)	Restoration Categories											
	Bank & Riparian Restoration	Stream Restoration	Wetland Restoration	Conservation Easements	Dam Modification or Removal	Levee or Dike Modification or Removal	Abandoned Mine Land Reclamation	Home Sewage Planning and Improvement	Education and Outreach	Agricultural Best Management Practices	Storm Water Best Management Practices	Regulatory Point Source Controls
Dam or impoundment (dissolved oxygen, high flow regime, biochemical oxygen demand)	No action recommended (dam cannot be changed)											
Failing HSTS (bacteria)								x	x			
West Salem bypasses (bacteria)												x
Jerome Fork-Mohican River (05040002 06)												
Lang Creek (06 01)												
Plant bypasses (bacteria)												x
Orange Creek (06 02)												
Failing HSTS (bacteria)								x	x			
Package plant (bacteria)												x
Manure runoff (bacteria)									x	x		
Unrestricted livestock access (bacteria)									x	x		
Katotawa Creek (06 03)												
Failing HSTS (bacteria)								x	x			
Manure runoff (bacteria)									x	x		
Unrestricted livestock access (bacteria)									x	x		
Oldtown Run (06 04)												
Package plant (bacteria)												Done
Manure runoff (bacteria)									x	x		
Unrestricted livestock access (bacteria)									x	x		
Jerome Fork-Mohican River (06 05)												
Channelization (sedimentation/ siltation)	x	x										
Municipal point source discharges (nutrient eutrophication)												x
Unsewered community (bacteria)												x
Plant bypasses (bacteria)												x

Location Description (10-digit HUC) Location Description (12-digit HUC) Sources (Causes)	Restoration Categories											
	Bank & Riparian Restoration	Stream Restoration	Wetland Restoration	Conservation Easements	Dam Modification or Removal	Levee or Dike Modification or Removal	Abandoned Mine Land Reclamation	Home Sewage Planning and Improvement	Education and Outreach	Agricultural Best Management Practices	Storm Water Best Management Practices	Regulatory Point Source Controls
Glenn Run-Jerome Fork Mohican River (06 06)												
Manure runoff (bacteria)									x	x		
Unsewered community (bacteria)												Done
Lake Fork Mohican River (05040002 07)												
Crab Run (07 01)												
Failing HSTS (bacteria)								x	x			
Manure runoff (bacteria)									x	x		
Unrestricted livestock access (bacteria)									x	x		
Mohicanville Dam-Lake Fork Mohican River (07 02)												
Channelization (direct habitat alterations, sedimentation/ siltation)	x	x										
Non-irrigated crop production (nutrient eutrophication)									x	x		
Dam or impoundment (other flow regime alterations, dissolved oxygen)	No action recommended (dam cannot be changed)											
Failing HSTS (bacteria)								x	x			
Manure runoff (bacteria)									x	x		
Unrestricted livestock access (bacteria)									x	x		
Plum Run-Lake Fork Mohican River (07 03)												
Manure runoff (bacteria)									x	x		
Unrestricted livestock access (bacteria)									x	x		
Mohican River (05040002 08)												
Honey Creek (08 01)												
Failing HSTS (bacteria)								x	x			
Manure runoff (bacteria)									x	x		

Location Description (10-digit HUC) Location Description (12-digit HUC) Sources (Causes)	Restoration Categories											
	Bank & Riparian Restoration	Stream Restoration	Wetland Restoration	Conservation Easements	Dam Modification or Removal	Levee or Dike Modification or Removal	Abandoned Mine Land Reclamation	Home Sewage Planning and Improvement	Education and Outreach	Agricultural Best Management Practices	Storm Water Best Management Practices	Regulatory Point Source Controls
Town of Perrysville-Black Fork Mohican River (08 02)												
Natural causes and sources - no action necessary												
Municipal point source discharges (bacteria)												Done
Big Run-Black Fork Mohican River (08 03)												
Natural causes and sources - no action necessary												
Manure runoff (bacteria)									x	x		
Unrestricted cattle access (bacteria)									x	x		
Sigafoos Run-Mohican River (08 04)												
No data - no action necessary												
Negro Run-Mohican River (08 05)												
Natural - wildlife (bacteria)	No action recommended (wildlife cannot be removed)											
Flat Run-Mohican River (08 06)												
No data - no action necessary												
Mohican River Main Stem: Large River Assessment Unit												
Natural - wildlife (bacteria)	No action recommended (wildlife cannot be removed)											
Package plants (bacteria)												Done

6.1 Regulatory Recommendations

Recommendations for NPDES permits are summarized by discharger and nested subwatershed in Tables 6-2 through 6-5. Any suggestions in permit limits reflect calculated TMDLs. Ohio EPA will work with permit holders to accomplish any needed reductions in loadings.

Table 6-2. Recommended implementation actions through the NPDES program for total phosphorus.
Note: Any specific permit condition noted in the table indicates a recommended change from current permit conditions. "No change" means that no change is recommended.

Nested Sub-watershed (05040002)	Entity	Ohio EPA Permit #	Receiving Stream	Design Flow (million gallons per day)	Wasteload Allocation (load in kg/day)	Wasteload Allocation (concen-tration in mg/L)	Recommended Permit Conditions		Explanation for difference
							First Phase	Second Phase	
01 02	ArcelorMittal Tubular Products	2ID00002	Tuby Run, Black Fork Mohican River	0.203	0.08	0.1	Monitor 1x per month	Average monthly limit of 1.0 mg/L	Currently there is no monitoring in the permit for the facility. At the next permit renewal, evaluate reasonable potential relative to monitoring data to determine if limit needed.
01 02	Briarwood Estates MHP	2PY00018	Unnamed trib. to Black Fork Mohican River	0.03	0.34	3	Monitor 1x per month	Average monthly limit of 3.0 mg/L	No current data exist to determine existing effluent load.
01 02	Cornell Abraxas Ohio	2GS00002	Unnamed trib. to Black Fork Mohican River	0.02	0.23	3	Monitor 1x per month	Average monthly limit of 3.0 mg/L	No current data exist to determine existing effluent load.
01 02	Lust Subdiv WWTP	2PG00077	Unnamed trib. to Black Fork Mohican River	0.008	0.09	3	Monitor 1x per month	Average monthly limit of 3.0 mg/L	No current data exist to determine existing effluent load.
01 02	Northside MHP	2GS00019	Black Fork Mohican River	0.0024	0.03	3	Monitor 1x per month	Average monthly limit of 3.0 mg/L	No current data exist to determine existing effluent load.
01 02	Shelby Municipal Light Plant	2IN00225	Unnamed trib. to Black Fork Mohican River	0	0	0.1	Monitor 1x per month	Average monthly limit of 1.0 mg/L	Currently there is no monitoring in the permit for the facility. At the next permit renewal, evaluate reasonable potential relative to monitoring data to determine if limit needed.

Nested Sub-watershed (05040002)	Entity	Ohio EPA Permit #	Receiving Stream	Design Flow (million gallons per day)	Wasteload Allocation (load in kg/day)	Wasteload Allocation (concen-tration in mg/L)	Recommended Permit Conditions		Explanation for difference
							First Phase	Second Phase	
01 02	Shelby Welded Tube	2GS00009	Black Fork Mohican River	0.002	0.02	3	Monitor 1x per month	Average monthly limit of 3.0 mg/L	No current data exist to determine existing effluent load.
01 02	Shelby WWTP	2PD00036	Black Fork Mohican River	2.5	2.74	0.25	Average monthly limit of 1.0 mg/L	Average monthly limit of 0.6 mg/L	Currently there is weekly monitoring and no limit in the permit for the facility. After implementing phase 1, evaluate reasonable potential relative to monitoring data to determine if further limits needed.
01 02	Voisard Mfg Co. Inc. Pit no. 2	2PR00139	Unnamed trib. to Bear Run	0.0015	0.02	3	Monitor 1x per month	Average monthly limit of 3.0 mg/L	No current data exist to determine existing effluent load.
01 03	Dayspring Assisted Living and Care Facility	2PG00114	Unnamed trib. to Brubaker Creek	0.009	0.1	3	Monitor 1x per month	Average monthly limit of 3.0 mg/L	No current data exist to determine existing effluent load.
01 05	Crestview Local School	2GS00004	Unnamed trib. to Black Fork Mohican River	0.013	0.15	3	Monitor 1x per month	Average monthly limit of 3.0 mg/L	No current data exist to determine existing effluent load.
01 05	Pin Oak Estates MHP	2PR00072	Unnamed trib. to Black Fork Mohican River	0.03	0.34	3	Monitor 1x per month	Average monthly limit of 3.0 mg/L	No current data exist to determine existing effluent load.
02 01	Eastview WWTP	2PH00005	Unnamed trib. to Fleming Falls Creek	0.932	0.64	0.18	Average monthly limit of 1.0 mg/L	Average monthly limit of 0.6 mg/L	Currently there is monthly monitoring and no limit in the permit for the facility. After implementing phase 1, evaluate reasonable potential relative to monitoring data to determine if further limits needed.

Nested Sub-watershed (05040002)	Entity	Ohio EPA Permit #	Receiving Stream	Design Flow (million gallons per day)	Wasteload Allocation (load in kg/day)	Wasteload Allocation (concen-tration in mg/L)	Recommended Permit Conditions		Explanation for difference
							First Phase	Second Phase	
02 01	Hillside MHP	2PV00700	Unnamed trib. to Fleming Falls Creek	0.017	0.19	3	Monitor 1x per month	Average monthly limit of 3.0 mg/L	No current data exist to determine existing effluent load.
02 03	AK Steel Corporation	2ID00003	Rocky Fork Mohican R.	1.735	0.31	0.1	Monitor 1x per month	Average monthly limit of 1.0 mg/L	Currently there is no monitoring in the permit for the facility. At the next permit renewal, evaluate reasonable potential relative to monitoring data to determine if limit needed.
02 03	Ohio Air National Guard 179 Airlift Group	2IN00189	Unnamed trib. to Rocky Fork Mohican River	0.15	0.0008	0.1	Monitor 1x per month	Average monthly limit of 1.0 mg/L	Currently there is no monitoring in the permit for the facility. At the next permit renewal, evaluate reasonable potential relative to monitoring data to determine if limit needed.
02 03	Tube City IMS, LLC	2IN00076	Rocky Fork Mohican River	0.77	0.0004	0.1	Monitor 1x per month	Average monthly limit of 1.0 mg/L	Currently there is no monitoring in the permit for the facility. At the next permit renewal, evaluate reasonable potential relative to monitoring data to determine if limit needed.
02 04	Harp Subdiv WWTP	2PG00075	Unnamed trib. to Rocky Fork Mohican River	0.04	0.45	3	Monitor 1x per month	Average monthly limit of 3.0 mg/L	No current data exist to determine existing effluent load.
02 04	Hyundai Ideal Electric Co	2IN00058	Rocky Fork Mohican River	0.0135	0	3	Monitor 1x per month	Average monthly limit of 3.0 mg/L	No current data exist to determine existing effluent load.

Nested Sub-watershed (05040002)	Entity	Ohio EPA Permit #	Receiving Stream	Design Flow (million gallons per day)	Wasteload Allocation (load in kg/day)	Wasteload Allocation (concen-tration in mg/L)	Recommended Permit Conditions		Explanation for difference
							First Phase	Second Phase	
02 04	Joez Lounge	2PR00238	Unnamed trib. to Rocky Fork Mohican River	0.021	0.24	3	Monitor 1x per month	Average monthly limit of 3.0 mg/L	No current data exist to determine existing effluent load.
02 04	Mansfield WWTP	2PE00001	Rocky Fork Mohican River	12	4.54	0.1	Average monthly limit of 1.0 mg/L	Average monthly limit of 0.6 mg/L	Currently there is biweekly monitoring and no limit in the permit for the facility. After implementing phase 1, evaluate reasonable potential relative to monitoring data to determine if further limits needed.
02 04	Therm-O-Disc Inc	2IS00028	Unnamed trib. to Rocky Fork Mohican River	0.078	0.02	3	Monitor 1x per month	Average monthly limit of 3.0 mg/L	No current data exist to determine existing effluent load.
03 01	General Motors LLC (Ontario Business Park)	2IS00045	Unnamed trib. to Clear Fork Mohican River	0.8	0	0.2	Monitor 1x per month	Average monthly limit of 1.0 mg/L	Currently there is no monitoring in the permit for the facility. At the next permit renewal, evaluate reasonable potential relative to monitoring data to determine if limit needed.
05 01	Cinnamon Lake Association WWTP	2PR00009	Muddy Fork Mohican River	0.15	1.7	3	Monitor 1x per month	Average monthly limit of 3.0 mg/L	No current data exist to determine existing effluent load.
05 01	Hidden Acres MHP	2PR00239	Unnamed trib. to Wolf Run	0.015	0.17	3	Monitor 1x per month	Average monthly limit of 3.0 mg/L	No current data exist to determine existing effluent load.
05 01	ODOT Rest Area 3-36	3PP00029	Unnamed trib. to Muddy Fork	0.02	0.23	3	Monitor 1x per month	Average monthly limit of 3.0 mg/L	No current data exist to determine existing effluent load.

Nested Sub-watershed (05040002)	Entity	Ohio EPA Permit #	Receiving Stream	Design Flow (million gallons per day)	Wasteload Allocation (load in kg/day)	Wasteload Allocation (concen-tration in mg/L)	Recommended Permit Conditions		Explanation for difference
							First Phase	Second Phase	
05 01	West Salem WWTP	3PB00053	Muddy Fork Mohican River	0.204	2.32	3	Monitor 1x per month	Average monthly limit of 3.0 mg/L	No current data exist to determine existing effluent load.
05 02	American Augers Inc	2PR00172	Unnamed trib. to Wolf Run	0.0075	0.09	3	Monitor 1x per month	Average monthly limit of 3.0 mg/L	No current data exist to determine existing effluent load.
05 02	Northwestern Local Sch Dist WWTP	3PT00009	Unnamed trib. to Muddy Fork	0.015	0.17	3	Monitor 1x per month	Average monthly limit of 3.0 mg/L	No current data exist to determine existing effluent load.
05 03	Country Pointe Health Care Inc LLC	3PR00488	Fox Run (trib. to Muddy Fork)	0.0275	0.31	3	Monitor 1x per month	Average monthly limit of 3.0 mg/L	No current data exist to determine existing effluent load.
05 03	Hyponex Corp	3IN00166	Kiser Ditch	0.4	4.54	3	Monitor 1x per month	Average monthly limit of 3.0 mg/L	No current data exist to determine existing effluent load.
05 03	Koenig's Korner	3PR00423	Unnamed trib. to Muddy Fork	0.00055	0.01	3	Monitor 1x per month	Average monthly limit of 3.0 mg/L	No current data exist to determine existing effluent load.
06 01	Ashland WTP	2IW00002	Lang Creek	2.056	0.78	0.1	Monitor 1x per month	Average monthly limit of 1.0 mg/L	Currently there is no monitoring in the permit for the facility. At the next permit renewal, evaluate reasonable potential relative to monitoring data to determine if limit needed.

Nested Sub-watershed (05040002)	Entity	Ohio EPA Permit #	Receiving Stream	Design Flow (million gallons per day)	Wasteload Allocation (load in kg/day)	Wasteload Allocation (concen-tration in mg/L)	Recommended Permit Conditions		Explanation for difference
							First Phase	Second Phase	
06 01	Ashland WWTP	2PD00010	Lang Creek	5	4.35	0.23	Average monthly limit of 1.0 mg/L	Average monthly limit of 0.6 mg/L	Currently there is weekly monitoring and no limit in the permit for the facility. After implementing phase 1, evaluate reasonable potential relative to monitoring data to determine if further limits needed.
06 01	Southwood Estates Homeowners Assoc Ltd	2GS00015	Unnamed trib. to Jamison Creek	0.02	0.23	3	Monitor 1x per month	Average monthly limit of 3.0 mg/L	No current data exist to determine existing effluent load.
06 02	Agape Acres Inc	2PY00037	Leidigh Mill Creek	0.02	0.23	3	Monitor 1x per month	Average monthly limit of 3.0 mg/L	No current data exist to determine existing effluent load.
06 02	Mapleton Jr & Sr HS	2PT00040	Unnamed trib. to Orange Creek (trib. to Jerome Fork Mohican River)	0.0221	0.25	3	Monitor 1x per month	Average monthly limit of 3.0 mg/L	No current data exist to determine existing effluent load.
06 03	Fin Feather and Fur Outfitters Mini-Mall	2PR00145	Katotawa Creek	0.005	0.06	3	Monitor 1x per month	Average monthly limit of 3.0 mg/L	No current data exist to determine existing effluent load.
06 03	Unique Ventures Group LLC DBA Perkins Restaurant	2PR00221	Unnamed trib. to Jerome Fork Mohican River	0.023	0.23	3	Monitor 1x per month	Average monthly limit of 3.0 mg/L	No current data exist to determine existing effluent load.
06 04	Ashland Co West Holmes JVS	2PT00011	Unnamed trib. to Oldtown Run	0.04	0.45	3	Monitor 1x per month	Average monthly limit of 3.0 mg/L	No current data exist to determine existing effluent load.

Nested Sub-watershed (05040002)	Entity	Ohio EPA Permit #	Receiving Stream	Design Flow (million gallons per day)	Wasteload Allocation (load in kg/day)	Wasteload Allocation (concen-tration in mg/L)	Recommended Permit Conditions		Explanation for difference
							First Phase	Second Phase	
06 04	Coburn Inc	2PR00140	Unnamed trib. to Quaker Springs Run	0.0005	0.05	3	Monitor 1x per month	Average monthly limit of 3.0 mg/L	No current data exist to determine existing effluent load.
06 04	Hayesville WWTP	2PA00089	Unnamed trib. to Oldtown Run	0.06	0.68	3	Monitor 1x per month	Average monthly limit of 3.0 mg/L	No current data exist to determine existing effluent load.
06 04	Hillsdale High School	2PR00269	Unnamed trib. to Quaker Springs Run	0.01	0.11	3	Monitor 1x per month	Average monthly limit of 3.0 mg/L	No current data exist to determine existing effluent load.
06 05	C&R Enterprises C&DD	2IN00231	Jerome Fork	0	0	3	Monitor 1x per month	Average monthly limit of 3.0 mg/L	No current data exist to determine existing effluent load.
06 05	Green Acres MHP	2PY00058	Unnamed trib. to Jerome Fork Mohican River	0.018	0.2	3	Monitor 1x per month	Average monthly limit of 3.0 mg/L	No current data exist to determine existing effluent load.
06 05	Jeromesville WWTP	2PA00092	Unnamed trib. to Jerome Fork Mohican River	0.066	0.75	3	Monitor 1x per month	Average monthly limit of 3.0 mg/L	No current data exist to determine existing effluent load.
06 05	Maverick Innovative Solutions LLC	2PR00217	Jerome Fork	0.0015	0.02	3	Monitor 1x per month	Average monthly limit of 3.0 mg/L	No current data exist to determine existing effluent load.

Table 6-3. Recommended implementation actions through the NPDES program for nitrate-nitrite.
Note: Any specific permit condition noted in the table indicates a recommended change from current permit conditions. "No change" means that no change is recommended.

Nested Subwatershed (05040002)	Entity	Ohio EPA Permit #	Receiving Stream	Design Flow (million gallons per day)	Wasteload Allocation (load in kg/day)	Wasteload Allocation (concentration in mg/L)	Recommended Permit Conditions
01 03	Dayspring Assisted Living and Care Facility	2PG00114	Brubaker Creek	0.009	0.03	1.0 mg/L	No change

Table 6-4. Recommended implementation actions through the NPDES program for total dissolved solids.
Note: Any specific permit condition noted in the table indicates a recommended change from current permit conditions. "No change" means that no change is recommended.

Nested Subwatershed (05040002)	Entity	Ohio EPA Permit #	Receiving Stream	Design Flow (million gallons per day)	Wasteload Allocation (load in kg/day)	Wasteload Allocation (concentration in mg/L)	Recommended Permit Conditions
01 02	ArcelorMittal Tubular Products Shelby Inc	2ID00002	Tuby Run	0.228	1152.66 kg/day	1,500 mg/L	Average monthly limit of 1, 500 mg/L

Table 6-5. Recommended implementation actions through the NPDES program for *E. coli*.
Note: Any specific permit condition noted in the table indicates a recommended change from current permit conditions. "No change" means that no change is recommended.

Nested Subwatershed (05040002)	Entity	Ohio EPA Permit #	Receiving Stream	Design Flow (million gallons per day)	Wasteload Allocation (load in billion cfu / day)	Wasteload Allocation (concentration in cfu / 100 mL)	Recommended Permit Conditions
01 02	ArcelorMittal Tubular Products	2ID00002	Tuby Run, Black Fork Mohican River	0.228	1.24	161	Average monthly limit of 161 cfu/100 mL
01 02	Briarwood Estates MHP	2PY00018	Unnamed trib. to Black Fork Mohican River	0.03	0.18	161	Average monthly limit of 161 cfu/100 mL

01 02	Cornell Abraxas Ohio	2GS00002	Unnamed trib. to Black Fork Mohican River	0.02	0.12	161	Average monthly limit of 161 cfu/100 mL
01 02	Lust Subdiv WWTP	2PG00077	Unnamed trib. to Black Fork Mohican River	0.008	0.05	161	Average monthly limit of 161 cfu/100 mL
01 02	Northside MHP	2GS00019	Black Fork Mohican River	0.0024	0.01	161	Average monthly limit of 161 cfu/100 mL
01 02	Shelby Municipal Light Plant	2IN00225	Unnamed trib. to Black Fork Mohican River	Storm water	0	161	Average monthly limit of 161 cfu/100 mL
01 02	Shelby Welded Tube	2GS00009	Black Fork Mohican River	0.002	0.01	161	Average monthly limit of 161 cfu/100 mL
01 02	Shelby WWTP	2PD00036	Black Fork Mohican River	2.5	15.24	161	Average monthly limit of 161 cfu/100 mL
01 02	Voisard Mg Co. Inc. Pit No. 2	2PR00139	Unnamed trib. to Bear Run	0.0015	0.01	161	Average monthly limit of 161 cfu/100 mL
01 03	Dayspring Assisted Living and Care Facility	2PG00114	Unnamed trib. to Brubaker Creek	0.03	0.04	126	Average monthly limit of 126 cfu/100 mL
01 05	Country Meadows Subdiv WWTP	2PG00074	Leatherwood Creek	0.009	0.05	161	Average monthly limit of 161 cfu/100 mL
01 05	Crestview Local School	2GS00004	Unnamed trib. to Black Fork Mohican River	0.022	0.06	126	Average monthly limit of 126 cfu/100 mL
01 05	Pin Oak Estates MHP	2PR00072	Unnamed trib. to Black Fork Mohican River	0.03	0.14	126	Average monthly limit of 126 cfu/100 mL
02 01	Eastview WWTP	2PH00005	Unnamed trib. to Fleming Falls Creek	0.9	4.45	126	Average monthly limit of 126 cfu/100 mL
02 01	Hillside MHP	2PV00700	Unnamed trib. to Fleming Falls Creek	0.017	0.08	126	Average monthly limit of 126 cfu/100 mL
02 02	Charles Mill Sites Lake Cottage Area WWTP	2PP00049	Charles Mill Lake	0.045	0.21	126	Average monthly limit of 126 cfu/100 mL
02 02	Econolodge	2PR00136	Unnamed trib. to Charles Mill Lake	0.015	0.07	126	Average monthly limit of 126 cfu/100 mL

02 02	Johnny Appleseed Heritage Center	2PR00169	Unnamed trib. to Charles Mill Lake	0.008	0.04	126	Average monthly limit of 126 cfu/100 mL
02 02	Oak Park Tavern	2PR00216	Unnamed trib. to Charles Mill Lake	0.004	0.02	126	Average monthly limit of 126 cfu/100 mL
02 02	Ohio Hilltop - Mansfield Country	2PR00071	Unnamed trib. to Charles Mill Lake	0.04	0.19	126	Average monthly limit of 126 cfu/100 mL
02 03	AK Steel Corporation	2ID00003	Rocky Fork Mohican R.	0.822	5.01	161	Average monthly limit of 161 cfu/100 mL
02 03	Ohio Air National Guard 179 Airlift Group	2IN00189	Unnamed trib. to Rocky Fork Mohican River	Storm water	0.01	161	Average monthly limit of 161 cfu/100 mL
02 03	Sensmeier & Sons Oil Co Inc	2GB00004	Touby Run	Storm water	0	161	Average monthly limit of 161 cfu/100 mL
02 03	Tube City IMS, LLC	2IN00076	Rocky Fork Mohican River	Storm water	0.07	161	Average monthly limit of 161 cfu/100 mL
02 04	Harp Subdiv WWTP	2PG00075	Unnamed trib. to Rocky Fork Mohican River	0.04	0.24	161	Average monthly limit of 161 cfu/100 mL
02 04	Hyundai Ideal Electric Co	2IN00058	Rocky Fork Mohican River	Contact cooling water	0.08	161	Average monthly limit of 161 cfu/100 mL
02 04	Joez Lounge	2PR00238	Unnamed trib. to Rocky Fork Mohican River	0.021	0.13	161	Average monthly limit of 161 cfu/100 mL
02 04	Lucas WWTP	2PB00038	Rocky Fork Mohican River	0.096	0.46	126	Average monthly limit of 126 cfu/100 mL
02 04	Mansfield WWTP	2PE00001	Rocky Fork Mohican River	12	73.13	161	Average monthly limit of 161 cfu/100 mL
02 04	Therm-O-Disc Inc	2IS00028	Unnamed trib. to Rocky Fork Mohican River	Contact cooling water	0.48	161	Average monthly limit of 161 cfu/100 mL
02 05	S & S Aggregate Plant No 14	2IJ00077	Black Fork Mohican River	Storm water	0.15	126	Average monthly limit of 126 cfu/100 mL
03 01	BP Amoco Oil Corp Bulk Plant Ontario	2IN00179	Unnamed trib. to Black Fork Mohican River	Storm water	0.0046	161	Average monthly limit of 161 cfu/100 mL

03 01	Brown Derby Roadhouse Restaurant	2PR00049	Unnamed trib. to Clear Fork Mohican River	0.005	0.03	126	Average monthly limit of 126 cfu/100 mL
03 01	General Motors LLC	2IS00045	Unnamed trib. to Clear Fork Mohican River	Storm water	4.24	161	Average monthly limit of 161 cfu/100 mL
03 01	Greenball Corp	2PR00243	Unnamed trib. to Clear Fork Mohican River	0.002	0.01	126	Average monthly limit of 126 cfu/100 mL
03 02	BRAMARJAC Inc DBA Pebble Creek Golf Club	2PR00255	Unnamed trib. to Cedar Fork Mohican River	0.005	0.03	161	Average monthly limit of 161 cfu/100 mL
03 02	Cedar Creek Court MHP	2PY00068	Unnamed trib. to Cedar Fork Mohican River	0.017	0.1	161	Average monthly limit of 161 cfu/100 mL
03 02	Hickory Grove MHP	4PY00005	Unnamed trib. to Cedar Fork	0.02	0.12	161	Average monthly limit of 161 cfu/100 mL
03 02	Johnsville WWTP - Morrow Co	4PG00052	Cedar Fork	0.04	0.24	161	Average monthly limit of 161 cfu/100 mL
03 02	Lake Timberlin Camp Resort	2GV00004	Unnamed trib. to Steel Run	0.013	0.08	161	Average monthly limit of 161 cfu/100 mL
03 02	Johnsville Elem Sch	4GS00002	Cedar Fork	0.005	0	161	Average monthly limit of 161 cfu/100 mL
03 03	42 Motel	2PR00219	Unnamed trib. to Clear Fork Mohican River	0.0025	0.01	126	Average monthly limit of 126 cfu/100 mL
03 03	Hamilton Standard Controls United Technologies	2IN00107	Unnamed trib. to Clear Fork Mohican River	N/A - intermittent	0	126	Average monthly limit of 126 cfu/100 mL
03 03	Lexington WWTP	2PB00019	Clear Fork Mohican River	1.5	7.15	126	Average monthly limit of 126 cfu/100 mL
03 03	Mansfield WTP	2IV00052	Unnamed trib. to Clear Fork Mohican River	N/A - intermittent	0.14	126	Average monthly limit of 126 cfu/100 mL
03 03	Mid-Ohio Sports Car Course	4PX00053	Unnamed trib. to Clear Fork Mohican River	0.03	0.14	126	Average monthly limit of 126 cfu/100 mL

04 01	Ashford-Mansfield LLC dba Clear Fork MHP	2PY00024	Clear Fork Mohican River	0.03	0.14	126	Average monthly limit of 126 cfu/100 mL
04 01	Bellville WWTP	2PB00057	Clear Fork Mohican River	0.33	1.57	126	Average monthly limit of 126 cfu/100 mL
04 01	BP Amoco Oil Corp Bulk Plant Bellville	2IN00175	Clear Fork Mohican River	Storm water	0.0024	126	Average monthly limit of 126 cfu/100 mL
04 01	Clear Fork High School	2GS00017	Unnamed trib. to Clear Fork Mohican River	0.02	0.1	126	Average monthly limit of 126 cfu/100 mL
04 01	DH Bowman & Sons Inc	2IJ00101	Unnamed trib. to Clear Fork Mohican River	N/A - intermittent	0	126	Average monthly limit of 126 cfu/100 mL
04 01	SDD Holdings II LLC	2GS00016	Unnamed trib. to Honey Creek	0.0015	0.01	126	Average monthly limit of 126 cfu/100 mL
04 02	Ohio Ski Slopes Inc DBA Snow Trails	2PR00220	Possum Run	0.012	0.07	161	Average monthly limit of 161 cfu/100 mL
04 03	Butler WWTP	2PA00044	Clear Fork Mohican River	0.12	0.57	126	Average monthly limit of 126 cfu/100 mL
04 03	Camp Otyokwah	2PR00226	Unnamed trib. to Clear Fork Mohican River	0.0096	0.05	126	Average monthly limit of 126 cfu/100 mL
04 03	Clear Fork Resort	2PR00285	Slater Run	0.013	0.06	126	Average monthly limit of 126 cfu/100 mL
04 04	Butler Mohican KOA	2PR00266	Unnamed trib. to Pine Run	0.0075	0.05	161	Average monthly limit of 161 cfu/100 mL
04 05	Camp Nuhop	2PR00131	Pleasant Hill Lake	0.009	0.04	126	Average monthly limit of 126 cfu/100 mL
04 05	Columbia Gas Transmission Corp Weaver Compressor Sta	2IN00066	Switzer Creek	N/A - intermittent	0	126	Average monthly limit of 126 cfu/100 mL
04 05	Malabar Farm State Park	2GU00072	Switzer Creek	0.004	0.14	126	Average monthly limit of 126 cfu/100 mL
04 05	Malabar Farm State Park Restaurant	2PP00050	Switzer Creek	0.004	0.02	126	Average monthly limit of 126 cfu/100 mL
04 05	ODNR Mohican State Park Lodge	2PP00033	Pleasant Hill Lake	0.08	0.38	126	Average monthly limit of 126 cfu/100 mL

04 05	ODYS Mohican Juvenile Correctional Facility	2PP00005	Unnamed trib. to Clear Fork Mohican River	0.032	0.15	126	Average monthly limit of 126 cfu/100 mL
04 05	Wooster Outdoor Center	2PR00173	Pleasant Hill Lake	0.01	0.05	126	Average monthly limit of 126 cfu/100 mL
05 01	Cinnamon Lake Association WWTP	2PR00009	Muddy Fork Mohican River	0.15	0.91	161	Average monthly limit of 161 cfu/100 mL
05 01	Hidden Acres MHP	2PR00239	Unnamed trib. to Wolf Run	0.015	0.09	161	Average monthly limit of 161 cfu/100 mL
05 01	ODOT Rest Area 3-36	3PP00029	Unnamed trib. to Muddy Fork	0.02	0.12	161	Average monthly limit of 161 cfu/100 mL
05 01	West Salem WWTP	3PB00053	Muddy Fork Mohican River	0.204	1.24	161	Average monthly limit of 161 cfu/100 mL
05 02	American Augers Inc	2PR00172	Unnamed trib. to Wolf Run	0.0075	0.05	161	Average monthly limit of 161 cfu/100 mL
05 02	Northwestern Local Sch Dist WWTP	3PT00009	Unnamed trib. to Muddy Fork	0.015	0.09	161	Average monthly limit of 161 cfu/100 mL
05 03	Country Pointe Health Care Inc LLC, 001	3PR00488	Fox Run (trib. to Muddy Fork)	0.01825	0.11	161	Average monthly limit of 161 cfu/100 mL
05 03	Country Pointe Health Care Inc LLC, 002	3PR00488	Fox Run (trib. to Muddy Fork)	0.0275	0.17	161	Average monthly limit of 161 cfu/100 mL
05 03	Hyponex Corp	3IN00166	Kiser Ditch	0.0015	2.44	161	Average monthly limit of 161 cfu/100 mL
05 03	Koenig's Korner	3PR00423	Unnamed trib. to Muddy Fork	0.00055	0.0034	161	Average monthly limit of 161 cfu/100 mL
06 01	Ashland WTP	2IW00002	Lang Creek	N/A - intermittent	12.53	161	Average monthly limit of 161 cfu/100 mL
06 01	Ashland WWTP	2PD00010	Lang Creek	5	30.47	161	Average monthly limit of 161 cfu/100 mL
06 01	Southwood Estates Homeowners Assoc Ltd	2GS00015	Unnamed trib. to Jamison Creek	0.02	0.12	161	Average monthly limit of 161 cfu/100 mL
06 02	Agape Acres Inc	2PY00037	Leidigh Mill Creek	0.02	0.12	161	Average monthly limit of 161 cfu/100 mL
06 02	Mapleton Jr & Sr HS	2PT00040	Unnamed trib. to Orange Creek (trib. to Jerome Fork Mohican R.)	0.0221	0.13	161	Average monthly limit of 161 cfu/100 mL

06 03	Fin Feather and Fur Outfitters Mini-Mall	2PR00145	Katotawa Creek	0.005	0.03	161	Average monthly limit of 161 cfu/100 mL
06 03	Unique Ventures Group LLC DBA Perkins Restaurant	2PR00221	Unnamed trib. to Jerome Fork Mohican River	0.02	0.12	161	Average monthly limit of 161 cfu/100 mL
06 04	Ashland Co West Holmes JVS	2PT00011	Unnamed trib. to Oldtown Run	0.04	0.24	161	Average monthly limit of 161 cfu/100 mL
06 04	Coburn Inc	2PR00140	Unnamed trib. to Quaker Springs Run	0.0045	0.03	161	Average monthly limit of 161 cfu/100 mL
06 04	Hayesville WWTP	2PA00089	Unnamed trib. to Oldtown Run	0.06	0.37	161	Average monthly limit of 161 cfu/100 mL
06 04	Hillsdale High School	2PR00269	Unnamed trib. to Quaker Springs Run	0.01	0.06	161	Average monthly limit of 161 cfu/100 mL
06 05	C&R Enterprises C&DD	2IN00231	Jerome Fork	Storm water	0	161	Average monthly limit of 161 cfu/100 mL
06 05	Green Acres MHP	2PY00058	Unnamed trib. to Jerome Fork Mohican River	0.018	0.11	161	Average monthly limit of 161 cfu/100 mL
06 05	Jeromesville WWTP	2PA00092	Unnamed trib. to Jerome Fork Mohican River	0.066	0.4	161	Average monthly limit of 161 cfu/100 mL
06 05	Maverick Innovative Solutions LLC	2PR00217	Jerome Fork	0.0015	0.01	161	Average monthly limit of 161 cfu/100 mL
07 01	Buckeye Deli	3PR00447	Unnamed trib. to Crab Run	0.0015	0.01	161	Average monthly limit of 161 cfu/100 mL
07 01	Lakeville Elem Sch	3PT00062	Unnamed trib. to Crab Run	0.005	0.02	126	Average monthly limit of 126 cfu/100 mL
07 01	Long Lake Park & Campground E	2PR00227	Unnamed trib. to Bonnet Lake	0.008	0.04	126	Average monthly limit of 126 cfu/100 mL
07 01	Mansfield Plumbing Products - Big Prairie Facility	3IQ00103	Unnamed trib. to Odell Lake	N/A - industrial	0.95	126	Average monthly limit of 126 cfu/100 mL
07 01	Nashville Elem Sch	3PT00063	Unnamed trib. to Crab Run	0.005	0.03	126	Average monthly limit of 126 cfu/100 mL

07 01	Nashville WWTP	3IX00002	Unnamed trib. to Crab Run	0.00495	0.03	161	Average monthly limit of 161 cfu/100 mL
07 01	Prairie House Apartments	3PW00035	Odell Lake	0.003	0.01	126	Average monthly limit of 126 cfu/100 mL
07 01	Round Lake Christian Assembly Lodge	2PR00196	Round Lake	0.01225	0.06	126	Average monthly limit of 126 cfu/100 mL
07 01	Whispering Hills Recreation Inc	3PR00172	Unnamed trib. to Odell Lake	0.025	0.15	126	Average monthly limit of 126 cfu/100 mL
07 01	Woodland Inn	3PR00327	Unnamed trib. to Odell Lake	0.0016	0.01	126	Average monthly limit of 126 cfu/100 mL
07 02	Iron Pony Saloon Well 0001	3PR00158	Lake Fork Mohican River	0.007	0.03	126	Average monthly limit of 126 cfu/100 mL
07 03	Kaufman Trailer Park	3PV00127	Unnamed trib. to Lake Fork Mohican River	0.006	0.03	126	Average monthly limit of 126 cfu/100 mL
08 02	Mansfield Plumbing Products LLC	2IJ00062	Black Fork Mohican River	N/A - industrial	0.64	126	Average monthly limit of 126 cfu/100 mL
08 02	Perrysville WWTP	2PA00004	Black Fork Mohican River	0.12	0.57	126	Average monthly limit of 126 cfu/100 mL
08 03	Loudonville WTP	2IW00122	Black Fork Mohican River	N/A - industrial	1.02	126	Average monthly limit of 126 cfu/100 mL
08 03	Loudonville WWTP	2PD00023	Black Fork Mohican River	0.6	2.86	126	Average monthly limit of 126 cfu/100 mL
08 03	Mohican River Estates WWTP	2PY00028	Black Fork Mohican River	0.02	0.1	126	Average monthly limit of 126 cfu/100 mL
08 04	Landoll's Mohican Castle	2PR00171	Unnamed trib. to Mohican River	0.013	0.06	126	Average monthly limit of 126 cfu/100 mL
08 04	Mohican Wilderness Campground	4PX00048	Mohican River	0.009, 0.00625	0.04	126	Average monthly limit of 126 cfu/100 mL
08 04	October Hills WWTP	3PG00134	Mohican River	0.06	0.14	126	Average monthly limit of 126 cfu/100 mL
08 04	Smiths Pleasant Valley Camp STU 1	3PR00271	Mohican River	0.005	0.02	126	Average monthly limit of 126 cfu/100 mL
08 04	Warren-Veverka Co No 2 LLC	2PR00200	Ball Alley Run	0.015	0.07	126	Average monthly limit of 126 cfu/100 mL
08 05	Camp Mohaven	4PX00033	Unnamed trib. to Mohican River	0.009	0.04	126	Average monthly limit of 126 cfu/100 mL

6.2 Headwaters Black Fork Mohican River (05040002 01)

The Shelby public drinking water supply intake requires use of a dam in the Marsh Run nested subwatershed. The city could consider ways to modify dam to allow greater water flow when the intake is not being used. Greater flow generally allows for less build-up of sediment behind dams.

In the Shipp Creek-Black Fork Mohican River nested subwatershed, low gradient exacerbates other habitat issues. Restoring some velocity may alleviate some of the other issues, so it should be prioritized over other habitat options.

Table 6-6. Recommended implementation actions in the Headwaters Black Fork Mohican River subwatershed.

Restoration Categories		Specific Restoration Actions	Headwaters Black Fork Mohican River (05040002 01)				
			Marsh Run (01 01)	Headwaters Black Fork Mohican River (01 02)	Brubaker Creek (01 03)	Whetstone Creek (01 04)	Shipp Creek-Black Fork Mohican River (01 05)
Bank & Riparian Restoration	constructed	Restore streambank using bio-engineering					
		Restore streambank by recontouring or regrading					
	planted	Plant grasses in riparian areas					
		Plant prairie grasses in riparian areas					
		Remove/treat invasive species					
		Plant trees or shrubs in riparian areas					x
Stream Restoration		Restore flood plain		x			x
		Restore stream channel		x			x
		Install in-stream habitat structures		x			x
		Install grade structures		x			H
		Construct 2-stage channel					
		Restore natural flow					
Wetland Restoration		Reconnect wetland to stream					
		Reconstruct & restore wetlands					
		Plant wetland species					
Conservation Easements		Acquire conservation easements					
Dam Modification or Removal		Remove dams					
		Modify dams	x				
		Remove associated dam support structures					
		Install fish passage and/or habitat structures					
		Restore natural flow					
Levee or Dike Modification or Removal		Remove levees					
		Breach or modify levees					

Restoration Categories		Specific Restoration Actions	Headwaters Black Fork Mohican River (05040002 01)				
			Marsh Run (01 01)	Headwaters Black Fork Mohican River (01 02)	Brubaker Creek (01 03)	Whetstone Creek (01 04)	Shipp Creek-Black Fork Mohican River (01 05)
		Remove dikes					
		Modify dikes					
		Restore natural flood plain function					
Abandoned Mine Land Reclamation	treatment	Construct lime dosers					
		Install slag leach beds					
		Install limestone leach beds					
		Install limestone channels					
		Install successive alkalinity producing systems					
		Install settling ponds					
		Install vertical flow ponds					
		Install limestone drains (anoxic and/or oxic)					
		Construct acid mine drainage wetland					
	flow diversion	Repair subsidence sites					
		Reclaim pit impoundments					
		Reclaim abandoned mine land					
		Eliminate stream captures					
		Eliminate mine drainage discharges					
		Restore positive drainage					
		Cover toxic mine spoils					
Home Sewage Planning and Improvement		Develop HSTS plan	x	x	x	x	
		Inspect HSTS	x	x	x	x	
		Repair or replace traditional HSTS	x	x	x	x	
		Repair or replace alternative HSTS	x	x	x	x	
Education and Outreach		Host meetings, workshops, and/or other events	x	x	x	x	x
		Distribute educational materials	x	x	x	x	x
Agricultural Best Management Practices	farmland	Plant cover/manure crops		x	x		x
		Implement conservation tillage practices	x				x
		Implement grass/legume rotations	x				
		Convert to permanent hayland					
		Install grassed waterways	x				x
		Install vegetated buffer areas/strips	x	x	x		x
		Install location-specific conservation buffer					
		Install / restore wetlands					

Restoration Categories		Specific Restoration Actions	Headwaters Black Fork Mohican River (05040002 01)				
			Marsh Run (01 01)	Headwaters Black Fork Mohican River (01 02)	Brubaker Creek (01 03)	Whetstone Creek (01 04)	Shipp Creek-Black Fork Mohican River (01 05)
	nutrients / agro-chemicals	Conduct soil testing		x	x		
		Install nitrogen reduction practices		x	x		
		Develop nutrient management plans		x	x		
	drainage	Install sinkhole stabilization structures					
		Install controlled drainage system			x		x
		Implement drainage water management					
		Construct overwide ditch					
		Construct 2-stage channel					x
	livestock	Implement prescribed & conservation grazing practices		x			
		Install livestock exclusion fencing		x			
		Install livestock crossings		x			
		Install alternative water supplies		x			
		Install livestock access lanes		x			
	manure	Implement manure management practices		x			x
		Construct animal waste storage structures		x			x
		Implement manure transfer practices		x			x
		Install grass manure spreading strips		x			x
	misc. infrastructure and mgt	Install chemical mixing pads			x		
		Install heavy use feeding pads					
		Install erosion & sediment control structures	x				
		Install roof water management practices					
		Install milkhouse waste treatment practices					
		Develop whole farm management plans		x	x		x
Storm Water Best Management Practices	planning	Develop/implement local ordinances/resolutions					
		Develop local comprehensive land use plans					
	construction practices	Implement erosion controls					
		Implement sediment controls					
		Implement non-sediment controls					
	post construction practices	Reduce pollutant(s) through treatment					
		Reduce pollutant(s) through flow/volume management					
	post development/	Implement erosion controls					
		Implement sediment controls					

Restoration Categories		Specific Restoration Actions	Headwaters Black Fork Mohican River (05040002 01)				
			Marsh Run (01 01)	Headwaters Black Fork Mohican River (01 02)	Brubaker Creek (01 03)	Whetstone Creek (01 04)	Shipp Creek-Black Fork Mohican River (01 05)
	storm water retrofit	Implement non-sediment controls					
		Reduce pollutant(s) through treatment					
		Reduce pollutant(s) through flow/volume management		x			
Regulatory Point Source Controls (includes Storm Water, Sanitary, and Industrial)	planning	Develop long-term control plan (CSOs)					
		Develop/implement local ordinances/resolutions					
		Develop water quality management/208 plans					
	collection and new treatment	Install sewer systems in communities					
		Implement long-term control plan (CSOs)					
		Eliminate SSOs/CSOs/by-passes					
	enhanced treatment	Issue permit(s) and/or modify permit limit(s)		x			
		Improve quality of effluent		x			
	monitoring	Establish ambient monitoring program					
		Increase effluent monitoring					
	alternatives	Establish water quality trading					
	construction practices	Issue permit(s) and/or modify permit limit(s)					
		Implement erosion controls					
		Implement sediment controls					
		Implement non-sediment controls					
	post construction practices	Issue permit(s) and/or modify permit limit(s)					
		Reduce pollutant(s) through treatment					
		Reduce pollutant(s) through flow/volume management					
	post development/ storm water retrofit	Issue permit(s) and/or modify permit limit(s)					
		Implement erosion controls					
		Implement sediment controls					
		Implement non-sediment controls					
		Reduce pollutant(s) through treatment					
		Reduce pollutant(s) through flow/volume management		x			
		Reduce volume to CSOs					

6.3 Rocky Fork-Black Fork Mohican River (05040002 02)

Home sewage treatment system investigation and repair or replacement should be focused first on homes in the unincorporated areas surrounding Mansfield and Ontario. Many homes in these areas

were built on small lots and at the time of installation utilized discharging HSTS or have since failed and been modified to discharging systems.

Table 6-7. Recommended implementation actions in the Rocky Fork-Black Fork Mohican River subwatershed.

Restoration Categories		Specific Restoration Actions	Rocky Fork-Black Fork Mohican River (05040002 02)				
			Village of Pavonia-Black Fork Mohican River (02 01)	Seymour Run-Black Fork (02 02)	Headwaters Rocky Fork (02 03)	Outlet Rocky Fork (02 04)	Charles Mill-Black Fork Mohican River (02 05)
Bank & Riparian Restoration	constructed	Restore streambank using bio-engineering					
		Restore streambank by recontouring or regrading					
	planted	Plant grasses in riparian areas					
		Plant prairie grasses in riparian areas					
		Remove/treat invasive species					
		Plant trees or shrubs in riparian areas					
Stream Restoration		Restore flood plain	x				
		Restore stream channel	x				
		Install in-stream habitat structures					
		Install grade structures					
		Construct 2-stage channel					
		Restore natural flow					
Wetland Restoration		Reconnect wetland to stream					
		Reconstruct & restore wetlands					
		Plant wetland species					
Conservation Easements		Acquire conservation easements					
Dam Modification or Removal		Remove dams					
		Modify dams					
		Remove associated dam support structures					
		Install fish passage and/or habitat structures					
		Restore natural flow					
Levee or Dike Modification or Removal		Remove levees					
		Breach or modify levees					
		Remove dikes					
		Modify dikes					
		Restore natural flood plain function					
Abandoned	treatment	Construct lime dosers					

Restoration Categories		Specific Restoration Actions	Rocky Fork-Black Fork Mohican River (05040002 02)				
			Village of Pavonia-Black Fork Mohican River (02 01)	Seymour Run-Black Fork (02 02)	Headwaters Rocky Fork (02 03)	Outlet Rocky Fork (02 04)	Charles Mill-Black Fork Mohican River (02 05)
Mine Land Reclamation		Install slag leach beds					
		Install limestone leach beds					
		Install limestone channels					
		Install successive alkalinity producing systems					
		Install settling ponds					
		Install vertical flow ponds					
		Install limestone drains (anoxic and/or oxic)					
		Construct acid mine drainage wetland					
	flow diversion	Repair subsidence sites					
		Reclaim pit impoundments					
		Reclaim abandoned mine land					
		Eliminate stream captures					
		Eliminate mine drainage discharges					
		Restore positive drainage					
		Cover toxic mine spoils					
Home Sewage Planning and Improvement		Develop HSTS plan	x		x	x	
		Inspect HSTS	x		x	x	
		Repair or replace traditional HSTS	x		x	x	
		Repair or replace alternative HSTS	x		x	x	
Education and Outreach		Host meetings, workshops, and/or other events	x		x	x	
		Distribute educational materials	x		x	x	
Agricultural Best Management Practices	farmland	Plant cover/manure crops	x				
		Implement conservation tillage practices	x				
		Implement grass/legume rotations	x				
		Convert to permanent hayland					
		Install grassed waterways					
		Install vegetated buffer areas/strips	x				
		Install location-specific conservation buffer					
		Install / restore wetlands					
	nutrients / agro-	Conduct soil testing	x				
		Install nitrogen reduction practices	x				

Restoration Categories		Specific Restoration Actions	Rocky Fork-Black Fork Mohican River (05040002 02)				
			Village of Pavonia-Black Fork Mohican River (02 01)	Seymour Run-Black Fork (02 02)	Headwaters Rocky Fork (02 03)	Outlet Rocky Fork (02 04)	Charles Mill-Black Fork Mohican River (02 05)
	chemicals	Develop nutrient management plans	x				
	drainage	Install sinkhole stabilization structures					
		Install controlled drainage system	x				
		Implement drainage water management					
		Construct overwide ditch					
		Construct 2-stage channel	x				
	livestock	Implement prescribed & conservation grazing practices					
		Install livestock exclusion fencing					
		Install livestock crossings					
		Install alternative water supplies					
		Install livestock access lanes					
	manure	Implement manure management practices					
		Construct animal waste storage structures					
		Implement manure transfer practices					
		Install grass manure spreading strips					
	misc. infrastructure and mgt	Install chemical mixing pads					
		Install heavy use feeding pads					
		Install erosion & sediment control structures	x				
		Install roof water management practices					
		Install milkhouse waste treatment practices					
		Develop whole farm management plans	x				
Storm Water Best Management Practices	planning	Develop/implement local ordinances/resolutions					
		Develop local comprehensive land use plans					
	construction practices	Implement erosion controls					
		Implement sediment controls					
		Implement non-sediment controls					
	post construction practices	Reduce pollutant(s) through treatment					
		Reduce pollutant(s) through flow/volume management			x	x	
	post development/	Implement erosion controls					
		Implement sediment controls					

Restoration Categories		Specific Restoration Actions	Rocky Fork-Black Fork Mohican River (05040002 02)				
			Village of Pavonia-Black Fork Mohican River (02 01)	Seymour Run-Black Fork (02 02)	Headwaters Rocky Fork (02 03)	Outlet Rocky Fork (02 04)	Charles Mill-Black Fork Mohican River (02 05)
	storm water retrofit	Implement non-sediment controls					
		Reduce pollutant(s) through treatment			x	x	
		Reduce pollutant(s) through flow/volume management			x	x	
Regulatory Point Source Controls (includes Storm Water, Sanitary, and Industrial)	planning	Develop long-term control plan (CSOs)					
		Develop/implement local ordinances/resolutions					
		Develop water quality management/208 plans					
	collection and new treatment	Install sewer systems in communities					
		Implement long-term control plan (CSOs)					
		Eliminate SSOs/CSOs/by-passes					
	enhanced treatment	Issue permit(s) and/or modify permit limit(s)				x	
		Improve quality of effluent				x	
	monitoring	Establish ambient monitoring program					
		Increase effluent monitoring					
	alternatives	Establish water quality trading					
	construction practices	Issue permit(s) and/or modify permit limit(s)					
		Implement erosion controls					
		Implement sediment controls					
		Implement non-sediment controls					
	post construction practices	Issue permit(s) and/or modify permit limit(s)					
		Reduce pollutant(s) through treatment					
		Reduce pollutant(s) through flow/volume management					
	post development/ storm water retrofit	Issue permit(s) and/or modify permit limit(s)					
		Implement erosion controls					
		Implement sediment controls					
		Implement non-sediment controls					
		Reduce pollutant(s) through treatment					
		Reduce pollutant(s) through flow/volume management					
		Reduce volume to CSOs					

6.4 Headwaters Clear Fork Mohican River (05040002 03)

Lake Timberline Campground is located in the Cedar Fork nested subwatershed. While the campground operates under the small sanitary general permit, it has no disinfection. Adding a disinfection process would likely improve bacteria concentrations in the stream.

In the Town of Lexington-Clear Fork Mohican River nested subwatershed, channelization and direct habitat alterations are listed as causes of aquatic life use impairment. The stream in this region is urbanized on one bank and agricultural on the other bank. Restoration actions should focus on in-stream habitat improvements prior to riparian ones. In addition, upgrades to the Lexington wastewater treatment plant were completed in 2009, improving effluent quality.

Table 6-8. Recommended implementation actions in the Headwaters Clear Fork Mohican River subwatershed.

Restoration Categories		Specific Restoration Actions	Headwaters Clear Fork Mohican River (05040002 03)		
			Headwaters Clear Fork Mohican River (03 01)	Cedar Fork (03 02)	Town of Lexington-Clear Fork Mohican River (03 03)
Bank & Riparian Restoration	constructed	Restore streambank using bio-engineering			
		Restore streambank by recontouring or regrading			
	planted	Plant grasses in riparian areas			
		Plant prairie grasses in riparian areas			
		Remove/treat invasive species			
		Plant trees or shrubs in riparian areas			
Stream Restoration		Restore flood plain			x
		Restore stream channel			x
		Install in-stream habitat structures			x
		Install grade structures			x
		Construct 2-stage channel			x
		Restore natural flow			x
Wetland Restoration		Reconnect wetland to stream			
		Reconstruct & restore wetlands			
		Plant wetland species			
Conservation Easements		Acquire conservation easements			
Dam Modification or Removal		Remove dams			
		Modify dams			
		Remove associated dam support structures			
		Install fish passage and/or habitat structures			
		Restore natural flow			

Restoration Categories		Specific Restoration Actions	Headwaters Clear Fork Mohican River (05040002 03)		
			Headwaters Clear Fork Mohican River (03 01)	Cedar Fork (03 02)	Town of Lexington-Clear Fork Mohican River (03 03)
Levee or Dike Modification or Removal		Remove levees			
		Breach or modify levees			
		Remove dikes			
		Modify dikes			
		Restore natural flood plain function			
Abandoned Mine Land Reclamation	treatment	Construct lime dosers			
		Install slag leach beds			
		Install limestone leach beds			
		Install limestone channels			
		Install successive alkalinity producing systems			
		Install settling ponds			
		Install vertical flow ponds			
		Install limestone drains (anoxic and/or oxic)			
		Construct acid mine drainage wetland			
	flow diversion	Repair subsidence sites			
		Reclaim pit impoundments			
		Reclaim abandoned mine land			
		Eliminate stream captures			
		Eliminate mine drainage discharges			
		Restore positive drainage			
		Cover toxic mine spoils			
Home Sewage Planning and Improvement		Develop HSTS plan		x	x
		Inspect HSTS		x	x
		Repair or replace traditional HSTS		x	x
		Repair or replace alternative HSTS		x	x
Education and Outreach		Host meetings, workshops, and/or other events		x	x
		Distribute educational materials		x	x
Agricultural Best Management Practices	farmland	Plant cover/manure crops			
		Implement conservation tillage practices			
		Implement grass/legume rotations			
		Convert to permanent hayland			
		Install grassed waterways			

Restoration Categories		Specific Restoration Actions	Headwaters Clear Fork Mohican River (05040002 03)		
			Headwaters Clear Fork Mohican River (03 01)	Cedar Fork (03 02)	Town of Lexington-Clear Fork Mohican River (03 03)
		Install vegetated buffer areas/strips		x	x
		Install location-specific conservation buffer			
		Install / restore wetlands			
	nutrients / agro-chemicals	Conduct soil testing			
		Install nitrogen reduction practices			
		Develop nutrient management plans			
	drainage	Install sinkhole stabilization structures			
		Install controlled drainage system			
		Implement drainage water management			
		Construct overwide ditch			
		Construct 2-stage channel			
	livestock	Implement prescribed & conservation grazing practices		x	
		Install livestock exclusion fencing		x	
		Install livestock crossings		x	
		Install alternative water supplies		x	
		Install livestock access lanes		x	
	manure	Implement manure management practices		x	x
		Construct animal waste storage structures		x	x
		Implement manure transfer practices		x	x
		Install grass manure spreading strips		x	x
	misc. infrastructure and mgt	Install chemical mixing pads			
		Install heavy use feeding pads			
		Install erosion & sediment control structures			
		Install roof water management practices			
		Install milkhouse waste treatment practices			
		Develop whole farm management plans		x	x
Storm Water Best Management Practices	planning	Develop/implement local ordinances/resolutions			
		Develop local comprehensive land use plans			
	construction practices	Implement erosion controls			
		Implement sediment controls			
		Implement non-sediment controls			
	post	Reduce pollutant(s) through treatment			

Restoration Categories		Specific Restoration Actions	Headwaters Clear Fork Mohican River (05040002 03)		
			Headwaters Clear Fork Mohican River (03 01)	Cedar Fork (03 02)	Town of Lexington-Clear Fork Mohican River (03 03)
	construction practices	Reduce pollutant(s) through flow/volume management			
	post development/ storm water retrofit	Implement erosion controls			
		Implement sediment controls			
		Implement non-sediment controls			
		Reduce pollutant(s) through treatment			
		Reduce pollutant(s) through flow/volume management			
Regulatory Point Source Controls (includes Storm Water, Sanitary, and Industrial)	planning	Develop long-term control plan (CSOs)			
		Develop/implement local ordinances/resolutions			
		Develop water quality management/208 plans			
	collection and new treatment	Install sewer systems in communities			
		Implement long-term control plan (CSOs)			
		Eliminate SSOs/CSOs/by-passes			
	enhanced treatment	Issue permit(s) and/or modify permit limit(s)			
		Improve quality of effluent		x	x
	monitoring	Establish ambient monitoring program			
		Increase effluent monitoring			
	alternatives	Establish water quality trading			
	construction practices	Issue permit(s) and/or modify permit limit(s)			
		Implement erosion controls			
		Implement sediment controls			
		Implement non-sediment controls			
	post construction practices	Issue permit(s) and/or modify permit limit(s)			
		Reduce pollutant(s) through treatment			
		Reduce pollutant(s) through flow/volume management			
	post development/ storm water retrofit	Issue permit(s) and/or modify permit limit(s)			
		Implement erosion controls			
		Implement sediment controls			
		Implement non-sediment controls			
		Reduce pollutant(s) through treatment			
		Reduce pollutant(s) through flow/volume management			
		Reduce volume to CSOs			

6.5 Possum Run-Clear Fork Mohican River (05040002 04)

Honey Creek Campground, located in the Honey Creek-Clear Fork Mohican River nested subwatershed, is not currently permitted to discharge. A permit should be acquired to help reduce bacteria in streams.

In the Possum Run and Pine Run nested subwatersheds, there are not clear anthropogenic sources of bacteria. Hence, wildlife is the most likely source of bacteria and cannot easily be prohibited access to streams.

While failing home sewage treatment systems in the Switzer Creek-Clear Fork Mohican River subwatershed are the most likely source of bacteria in this area, the area is nonetheless sparsely populated. Addressing possible failing HSTS should therefore be a lower priority than other areas.

Table 6-9. Recommended implementation actions in the Possum Run-Clear Fork Mohican River subwatershed.

Restoration Categories		Specific Restoration Actions	Possum Run-Clear Fork Mohican River (05040002 04)				
			Honey Creek-Clear Fork Mohican River (04 01)	Possum Run (04 02)	Slater Run-Clear Fork Mohican River (04 03)	Pine Run (04 04)	Switzer Creek-Clear Fork Mohican River (04 05)
Bank & Riparian Restoration	constructed	Restore streambank using bio-engineering					
		Restore streambank by recontouring or regrading					
	planted	Plant grasses in riparian areas					
		Plant prairie grasses in riparian areas					
		Remove/treat invasive species					
		Plant trees or shrubs in riparian areas					
Stream Restoration		Restore flood plain					
		Restore stream channel					
		Install in-stream habitat structures					
		Install grade structures					
		Construct 2-stage channel					
		Restore natural flow					
Wetland Restoration		Reconnect wetland to stream					
		Reconstruct & restore wetlands					
		Plant wetland species					
Conservation Easements		Acquire conservation easements					
Dam Modification or Removal		Remove dams					
		Modify dams					
		Remove associated dam support structures					
		Install fish passage and/or habitat structures					

Restoration Categories		Specific Restoration Actions	Possum Run-Clear Fork Mohican River (05040002 04)				
			Honey Creek-Clear Fork Mohican River (04 01)	Possum Run (04 02)	Slater Run-Clear Fork Mohican River (04 03)	Pine Run (04 04)	Switzer Creek-Clear Fork Mohican River (04 05)
		Restore natural flow					
Levee or Dike Modification or Removal		Remove levees					
		Breach or modify levees					
		Remove dikes					
		Modify dikes					
		Restore natural flood plain function					
Abandoned Mine Land Reclamation	treatment	Construct lime dosers					
		Install slag leach beds					
		Install limestone leach beds					
		Install limestone channels					
		Install successive alkalinity producing systems					
		Install settling ponds					
		Install vertical flow ponds					
		Install limestone drains (anoxic and/or oxic)					
		Construct acid mine drainage wetland					
	flow diversion	Repair subsidence sites					
		Reclaim pit impoundments					
		Reclaim abandoned mine land					
		Eliminate stream captures					
		Eliminate mine drainage discharges					
		Restore positive drainage					
		Cover toxic mine spoils					
Home Sewage Planning and Improvement		Develop HSTS plan	x				L
		Inspect HSTS	x				L
		Repair or replace traditional HSTS	x				L
		Repair or replace alternative HSTS	x				L
Education and Outreach		Host meetings, workshops, and/or other events	x		x		L
		Distribute educational materials	x		x		L
Agricultural Best Management Practices	farmland	Plant cover/manure crops					
		Implement conservation tillage practices					
		Implement grass/legume rotations					
		Convert to permanent hayland					

Restoration Categories		Specific Restoration Actions	Possum Run-Clear Fork Mohican River (05040002 04)				
			Honey Creek-Clear Fork Mohican River (04 01)	Possum Run (04 02)	Slater Run-Clear Fork Mohican River (04 03)	Pine Run (04 04)	Switzer Creek-Clear Fork Mohican River (04 05)
		Install grassed waterways					
		Install vegetated buffer areas/strips	x		x		
		Install location-specific conservation buffer					
		Install / restore wetlands					
	nutrients / agro-chemicals	Conduct soil testing					
		Install nitrogen reduction practices					
		Develop nutrient management plans					
	drainage	Install sinkhole stabilization structures					
		Install controlled drainage system					
		Implement drainage water management					
		Construct overwide ditch					
		Construct 2-stage channel					
	livestock	Implement prescribed & conservation grazing practices					
		Install livestock exclusion fencing					
		Install livestock crossings					
		Install alternative water supplies					
		Install livestock access lanes					
	manure	Implement manure management practices	x		x		
		Construct animal waste storage structures	x		x		
		Implement manure transfer practices	x		x		
		Install grass manure spreading strips	x		x		
	misc. infrastructure and mgt	Install chemical mixing pads					
		Install heavy use feeding pads					
		Install erosion & sediment control structures					
		Install roof water management practices					
		Install milkhouse waste treatment practices					
		Develop whole farm management plans	x		x		
Storm Water Best Management Practices	planning	Develop/implement local ordinances/resolutions					
		Develop local comprehensive land use plans					
	construction practices	Implement erosion controls					
		Implement sediment controls					
		Implement non-sediment controls					

Restoration Categories		Specific Restoration Actions	Possum Run-Clear Fork Mohican River (05040002 04)				
			Honey Creek-Clear Fork Mohican River (04 01)	Possum Run (04 02)	Slater Run-Clear Fork Mohican River (04 03)	Pine Run (04 04)	Switzer Creek-Clear Fork Mohican River (04 05)
	post construction practices	Reduce pollutant(s) through treatment					
		Reduce pollutant(s) through flow/volume management					
	post development/ storm water retrofit	Implement erosion controls					
		Implement sediment controls					
		Implement non-sediment controls					
		Reduce pollutant(s) through treatment					
		Reduce pollutant(s) through flow/volume management					
Regulatory Point Source Controls (includes Storm Water, Sanitary, and Industrial)	planning	Develop long-term control plan (CSOs)					
		Develop/implement local ordinances/resolutions					
		Develop water quality management/208 plans					
	collection and new treatment	Install sewer systems in communities					
		Implement long-term control plan (CSOs)					
		Eliminate SSOs/CSOs/by-passes					
	enhanced treatment	Issue permit(s) and/or modify permit limit(s)	x				
		Improve quality of effluent	x				
	monitoring	Establish ambient monitoring program					
		Increase effluent monitoring					
	alternatives	Establish water quality trading					
	construction practices	Issue permit(s) and/or modify permit limit(s)					
		Implement erosion controls					
		Implement sediment controls					
		Implement non-sediment controls					
	post construction practices	Issue permit(s) and/or modify permit limit(s)					
		Reduce pollutant(s) through treatment					
		Reduce pollutant(s) through flow/volume management					
	post development/ storm water retrofit	Issue permit(s) and/or modify permit limit(s)					
		Implement erosion controls					
		Implement sediment controls					
		Implement non-sediment controls					
		Reduce pollutant(s) through treatment					
		Reduce pollutant(s) through flow/volume management					
		Reduce volume to CSOs					

6.6 Muddy Fork Mohican River (05040002 05)

Polk is an unsewered area in the Middle Muddy Fork Mohican River nested subwatershed that is likely contributing to bacteria issues in Muddy Fork. While Polk has submitted a permit-to-install application with Ohio EPA in order to build a sewer system and a wastewater treatment plant, funding is not currently available to do so. Polk would be a good candidate should external funding become available.

Kiser Ditch, located in the Lower Muddy Fork Mohican River nested subwatershed, does not support the modified warmwater habitat aquatic life use. The stream is naturally lower in gradient and has some features of a wetland, so wetland restoration would be a plausible implementation action. However, there is some agricultural use around the stream. If wetland restoration were infeasible, in-stream restoration to increase aeration might be feasible. Because of some of the challenges posed by the natural limitations of the stream and some of the land uses involved, stream and/or wetland restoration in this area should be a lower priority than other parts of the watershed.

Table 6-10. Recommended implementation actions in the Muddy Fork Mohican River subwatershed.

Restoration Categories		Specific Restoration Actions	Muddy Fork Mohican River (05040002 05)		
			Upper Muddy Fork Mohican River (05 01)	Middle Muddy Fork Mohican River (05 02)	Lower Muddy Fork Mohican River (05 03)
Bank & Riparian Restoration	constructed	Restore streambank using bio-engineering			
		Restore streambank by recontouring or regrading			
	planted	Plant grasses in riparian areas			
		Plant prairie grasses in riparian areas			
		Remove/treat invasive species			
		Plant trees or shrubs in riparian areas			
Stream Restoration		Restore flood plain			x
		Restore stream channel			x
		Install in-stream habitat structures			x
		Install grade structures			x
		Construct 2-stage channel			
		Restore natural flow			
Wetland Restoration		Reconnect wetland to stream			x
		Reconstruct & restore wetlands			x
		Plant wetland species			
Conservation Easements		Acquire conservation easements			
Dam Modification or Removal		Remove dams			
		Modify dams			
		Remove associated dam support structures			

Restoration Categories		Specific Restoration Actions	Muddy Fork Mohican River (05040002 05)		
			Upper Muddy Fork Mohican River (05 01)	Middle Muddy Fork Mohican River (05 02)	Lower Muddy Fork Mohican River (05 03)
		Install fish passage and/or habitat structures			
		Restore natural flow			
Levee or Dike Modification or Removal		Remove levees			
		Breach or modify levees			
		Remove dikes			
		Modify dikes			
		Restore natural flood plain function			
Abandoned Mine Land Reclamation	treatment	Construct lime dosers			
		Install slag leach beds			
		Install limestone leach beds			
		Install limestone channels			
		Install successive alkalinity producing systems			
		Install settling ponds			
		Install vertical flow ponds			
		Install limestone drains (anoxic and/or oxic)			
		Construct acid mine drainage wetland			
	flow diversion	Repair subsidence sites			
		Reclaim pit impoundments			
		Reclaim abandoned mine land			
		Eliminate stream captures			
		Eliminate mine drainage discharges			
		Restore positive drainage			
		Cover toxic mine spoils			
Home Sewage Planning and Improvement		Develop HSTS plan			x
		Inspect HSTS			x
		Repair or replace traditional HSTS			x
		Repair or replace alternative HSTS			x
Education and Outreach		Host meetings, workshops, and/or other events			x
		Distribute educational materials			x
Agricultural Best Management Practices	farmland	Plant cover/manure crops			
		Implement conservation tillage practices			
		Implement grass/legume rotations			
		Convert to permanent hayland			

Restoration Categories		Specific Restoration Actions	Muddy Fork Mohican River (05040002 05)		
			Upper Muddy Fork Mohican River (05 01)	Middle Muddy Fork Mohican River (05 02)	Lower Muddy Fork Mohican River (05 03)
		Install grassed waterways			
		Install vegetated buffer areas/strips			
		Install location-specific conservation buffer			
		Install / restore wetlands			
	nutrients / agro-chemicals	Conduct soil testing			
		Install nitrogen reduction practices			
		Develop nutrient management plans			
	drainage	Install sinkhole stabilization structures			
		Install controlled drainage system			
		Implement drainage water management			
		Construct overwide ditch			
		Construct 2-stage channel			
	livestock	Implement prescribed & conservation grazing practices			
		Install livestock exclusion fencing			
		Install livestock crossings			
		Install alternative water supplies			
		Install livestock access lanes			
	manure	Implement manure management practices			
		Construct animal waste storage structures			
		Implement manure transfer practices			
		Install grass manure spreading strips			
	misc. infrastructure and mgt	Install chemical mixing pads			
		Install heavy use feeding pads			
		Install erosion & sediment control structures			
		Install roof water management practices			
		Install milkhouse waste treatment practices			
		Develop whole farm management plans			
Storm Water Best Management Practices	planning	Develop/implement local ordinances/resolutions			
		Develop local comprehensive land use plans			
	construction practices	Implement erosion controls			
		Implement sediment controls			
		Implement non-sediment controls			
	post	Reduce pollutant(s) through treatment			

Restoration Categories		Specific Restoration Actions	Muddy Fork Mohican River (05040002 05)		
			Upper Muddy Fork Mohican River (05 01)	Middle Muddy Fork Mohican River (05 02)	Lower Muddy Fork Mohican River (05 03)
	construction practices	Reduce pollutant(s) through flow/volume management			
	post development/ storm water retrofit	Implement erosion controls			
		Implement sediment controls			
		Implement non-sediment controls			
		Reduce pollutant(s) through treatment			
		Reduce pollutant(s) through flow/volume management			
Regulatory Point Source Controls (includes Storm Water, Sanitary, and Industrial)	planning	Develop long-term control plan (CSOs)			
		Develop/implement local ordinances/resolutions			
		Develop water quality management/208 plans			
	collection and new treatment	Install sewer systems in communities		x	
		Implement long-term control plan (CSOs)			
		Eliminate SSOs/CSOs/by-passes	x	x	x
	enhanced treatment	Issue permit(s) and/or modify permit limit(s)		x	
		Improve quality of effluent	x	x	x
	monitoring	Establish ambient monitoring program			
		Increase effluent monitoring			
	alternatives	Establish water quality trading			
	construction practices	Issue permit(s) and/or modify permit limit(s)			
		Implement erosion controls			
		Implement sediment controls			
		Implement non-sediment controls			
	post construction practices	Issue permit(s) and/or modify permit limit(s)			
		Reduce pollutant(s) through treatment			
		Reduce pollutant(s) through flow/volume management			
	post development/ storm water retrofit	Issue permit(s) and/or modify permit limit(s)			
		Implement erosion controls			
		Implement sediment controls			
		Implement non-sediment controls			
		Reduce pollutant(s) through treatment			
		Reduce pollutant(s) through flow/volume management			
		Reduce volume to CSOs			

6.7 Jerome Fork-Mohican River (05040002 06)

In the Lang Creek nested subwatershed, an equalization basin was installed at the City of Ashland WWTP in 2006 to eliminate bypasses. The equalization basin generally addresses the identified water quality issues, but some effluent improvement could further improve water quality.

The unsewered community of Polk is contributing to recreation use impairment in the Orange Creek and Katotawa Creek nested subwatersheds. Recommendations regarding Polk were discussed in Section 6.6.

Hillsdale High School operates a small package plant in the Oldtown Run nested subwatershed. In 2011, the high school obtained a permit, completed a plant upgrade and improved operational issues, thus likely eliminating one source of impairment. Manure runoff is also likely in parts of this nested subwatershed. Good land application processes should be emphasized by local soil and water conservation organizations.

In the Jerome Fork-Mohican River nested subwatershed, Ashland has fixed its issues with bypasses, but infiltration and inflow issues are still being addressed. Nankin is a small unsewered community; installing sewers would improve water quality.

Jeromesville in the Glenn Run-Jerome Fork Mohican River nested subwatershed was a source of bacteria and nutrients. It installed sanitary sewers and a treatment plant in 2008. Also, several farms from Quaker Springs Run and Oldtown Run contribute runoff to this nested subwatershed; agricultural best management practices would help to improve runoff quality.

Table 6-11. Recommended implementation actions in the Jerome Fork-Mohican River subwatershed.

Restoration Categories		Specific Restoration Actions	Jerome Fork-Mohican River (05040002 06)					
			Lang Creek (06 01)	Orange Creek (06 02)	Katotawa Creek (06 03)	Oldtown Run (06 04)	Jerome Fork-Mohican River (06 05)	Glenn Run-Jerome Fork Mohican River (06 06)
Bank & Riparian Restoration	constructed	Restore streambank using bio-engineering						
		Restore streambank by recontouring or regrading					x	
	planted	Plant grasses in riparian areas					x	
		Plant prairie grasses in riparian areas					x	
		Remove/treat invasive species						
		Plant trees or shrubs in riparian areas					x	
Stream Restoration		Restore flood plain					x	
		Restore stream channel					x	
		Install in-stream habitat structures					x	
		Install grade structures					x	

Restoration Categories		Specific Restoration Actions	Jerome Fork-Mohican River (05040002 06)					
			Lang Creek (06 01)	Orange Creek (06 02)	Katotawa Creek (06 03)	Oldtown Run (06 04)	Jerome Fork-Mohican River (06 05)	Glenn Run-Jerome Fork Mohican River (06 06)
		Construct 2-stage channel					x	
		Restore natural flow						
Wetland Restoration		Reconnect wetland to stream						
		Reconstruct & restore wetlands						
		Plant wetland species						
Conservation Easements		Acquire conservation easements						
Dam Modification or Removal		Remove dams						
		Modify dams						
		Remove associated dam support structures						
		Install fish passage and/or habitat structures						
		Restore natural flow						
Levee or Dike Modification or Removal		Remove levees						
		Breach or modify levees						
		Remove dikes						
		Modify dikes						
		Restore natural flood plain function						
Abandoned Mine Land Reclamation	treatment	Construct lime dosers						
		Install slag leach beds						
		Install limestone leach beds						
		Install limestone channels						
		Install successive alkalinity producing systems						
		Install settling ponds						
		Install vertical flow ponds						
		Install limestone drains (anoxic and/or oxic)						
		Construct acid mine drainage wetland						
	flow diversion	Repair subsidence sites						
		Reclaim pit impoundments						
		Reclaim abandoned mine land						
		Eliminate stream captures						
		Eliminate mine drainage discharges						
		Restore positive drainage						
		Cover toxic mine spoils						
Home Sewage		Develop HSTS plan		x	x			

Restoration Categories		Specific Restoration Actions	Jerome Fork-Mohican River (05040002 06)					
			Lang Creek (06 01)	Orange Creek (06 02)	Katotawa Creek (06 03)	Oldtown Run (06 04)	Jerome Fork-Mohican River (06 05)	Glenn Run-Jerome Fork Mohican River (06 06)
Planning and Improvement		Inspect HSTS		x	x			
		Repair or replace traditional HSTS		x	x			
		Repair or replace alternative HSTS		x	x			
Education and Outreach		Host meetings, workshops, and/or other events		x	x	x		x
		Distribute educational materials		x	x	x		x
Agricultural Best Management Practices	farmland	Plant cover/manure crops						
		Implement conservation tillage practices						
		Implement grass/legume rotations						
		Convert to permanent hayland						
		Install grassed waterways						
		Install vegetated buffer areas/strips		x	x	x		x
		Install location-specific conservation buffer						
		Install / restore wetlands						
	nutrients / agro-chemicals	Conduct soil testing						
		Install nitrogen reduction practices						
		Develop nutrient management plans						
	drainage	Install sinkhole stabilization structures						
		Install controlled drainage system						
		Implement drainage water management						
		Construct overwide ditch						
		Construct 2-stage channel						
	livestock	Implement prescribed & conservation grazing practices		x	x	x		
		Install livestock exclusion fencing		x	x	x		
		Install livestock crossings		x	x	x		
		Install alternative water supplies		x	x	x		
		Install livestock access lanes		x	x	x		
	manure	Implement manure management practices		x	x	x		x
		Construct animal waste storage structures		x	x	x		x
		Implement manure transfer practices		x	x	x		x
		Install grass manure spreading strips		x	x	x		x
	misc. infrastructure	Install chemical mixing pads						
		Install heavy use feeding pads						

Restoration Categories		Specific Restoration Actions	Jerome Fork-Mohican River (05040002 06)					
			Lang Creek (06 01)	Orange Creek (06 02)	Katotawa Creek (06 03)	Oldtown Run (06 04)	Jerome Fork-Mohican River (06 05)	Glenn Run-Jerome Fork Mohican River (06 06)
	and mgt	Install erosion & sediment control structures						
		Install roof water management practices						
		Install milkhouse waste treatment practices						
		Develop whole farm management plans		x	x	x		x
Storm Water Best Management Practices	planning	Develop/implement local ordinances/resolutions						
		Develop local comprehensive land use plans						
	construction practices	Implement erosion controls						
		Implement sediment controls						
		Implement non-sediment controls						
	post construction practices	Reduce pollutant(s) through treatment						
		Reduce pollutant(s) through flow/volume management						
	post development/ storm water retrofit	Implement erosion controls						
		Implement sediment controls						
		Implement non-sediment controls						
		Reduce pollutant(s) through treatment						
		Reduce pollutant(s) through flow/volume management						
Regulatory Point Source Controls (includes Storm Water, Sanitary, and Industrial)	planning	Develop long-term control plan (CSOs)						
		Develop/implement local ordinances/resolutions						
		Develop water quality management/208 plans						
	collection and new treatment	Install sewer systems in communities					x	Done
		Implement long-term control plan (CSOs)						
		Eliminate SSOs/CSOs/by-passes	x				x	
	enhanced treatment	Issue permit(s) and/or modify permit limit(s)					x	Done
		Improve quality of effluent	x	x		Done	x	
	monitoring	Establish ambient monitoring program						
		Increase effluent monitoring						
	alternatives	Establish water quality trading						
	construction practices	Issue permit(s) and/or modify permit limit(s)						
		Implement erosion controls						
		Implement sediment controls						
		Implement non-sediment controls						
	post construction	Issue permit(s) and/or modify permit limit(s)						
		Reduce pollutant(s) through treatment						

Restoration Categories		Specific Restoration Actions	Jerome Fork-Mohican River (05040002 06)					
			Lang Creek (06 01)	Orange Creek (06 02)	Katotawa Creek (06 03)	Oldtown Run (06 04)	Jerome Fork-Mohican River (06 05)	Glenn Run-Jerome Fork Mohican River (06 06)
	practices	Reduce pollutant(s) through flow/volume management						
	post development/ storm water retrofit	Issue permit(s) and/or modify permit limit(s)						
		Implement erosion controls						
		Implement sediment controls						
		Implement non-sediment controls						
		Reduce pollutant(s) through treatment						
		Reduce pollutant(s) through flow/volume management						
		Reduce volume to CSOs						

6.8 Lake Fork Mohican River (05040002 07)

The draft watershed action plan identifies the Village of Big Prairie as a probable source of bacterial contamination in the Crab Run nested subwatershed. Home sewage treatment systems should be inspected and those that are failing should be fixed or replaced.

Similarly, Mohicanville Village is located in the Mohicanville Dam-Lake Fork Mohican River nested subwatershed and is probably a source of bacteria. Home sewage treatment systems should be inspected and those that are failing should be fixed or replaced.

Table 6-12. Recommended implementation actions in the Lake Fork Mohican River subwatershed.

Restoration Categories		Specific Restoration Actions	Lake Fork Mohican River (05040002 07)		
			Crab Run (07 01)	Mohicanville Dam-Lake Fork Mohican River (07 02)	Plum Run-Lake Fork Mohican River (07 03)
Bank & Riparian Restoration	constructed	Restore streambank using bio-engineering			
		Restore streambank by recontouring or regrading		x	
	planted	Plant grasses in riparian areas		x	

Restoration Categories		Specific Restoration Actions	Lake Fork Mohican River (05040002 07)		
			Crab Run (07 01)	Mohicanville Dam-Lake Fork Mohican River (07 02)	Plum Run-Lake Fork Mohican River (07 03)
		Plant prairie grasses in riparian areas		x	
		Remove/treat invasive species			
		Plant trees or shrubs in riparian areas		x	
Stream Restoration		Restore flood plain		x	
		Restore stream channel		x	
		Install in-stream habitat structures		x	
		Install grade structures		x	
		Construct 2-stage channel		x	
		Restore natural flow		x	
Wetland Restoration		Reconnect wetland to stream			
		Reconstruct & restore wetlands			
		Plant wetland species			
Conservation Easements		Acquire conservation easements			
Dam Modification or Removal		Remove dams			
		Modify dams			
		Remove associated dam support structures			
		Install fish passage and/or habitat structures			
		Restore natural flow			
Levee or Dike Modification or Removal		Remove levees			
		Breach or modify levees			
		Remove dikes			
		Modify dikes			
		Restore natural flood plain function			
Abandoned Mine Land Reclamation	treatment	Construct lime dosers			
		Install slag leach beds			
		Install limestone leach beds			
		Install limestone channels			
		Install successive alkalinity producing systems			
		Install settling ponds			
		Install vertical flow ponds			
		Install limestone drains (anoxic and/or oxic)			
		Construct acid mine drainage wetland			

Restoration Categories		Specific Restoration Actions	Lake Fork Mohican River (05040002 07)		
			Crab Run (07 01)	Mohicanville Dam-Lake Fork Mohican River (07 02)	Plum Run-Lake Fork Mohican River (07 03)
	flow diversion	Repair subsidence sites			
		Reclaim pit impoundments			
		Reclaim abandoned mine land			
		Eliminate stream captures			
		Eliminate mine drainage discharges			
		Restore positive drainage			
		Cover toxic mine spoils			
Home Sewage Planning and Improvement		Develop HSTS plan	x	x	
		Inspect HSTS	x	x	
		Repair or replace traditional HSTS	x	x	
		Repair or replace alternative HSTS	x	x	
Education and Outreach		Host meetings, workshops, and/or other events	x	x	x
		Distribute educational materials	x	x	x
Agricultural Best Management Practices	farmland	Plant cover/manure crops	x	x	
		Implement conservation tillage practices			
		Implement grass/legume rotations			
		Convert to permanent hayland			
		Install grassed waterways			
		Install vegetated buffer areas/strips	x	x	x
		Install location-specific conservation buffer			
		Install / restore wetlands			
	nutrients / agro-chemicals	Conduct soil testing		x	
		Install nitrogen reduction practices		x	
		Develop nutrient management plans		x	
	drainage	Install sinkhole stabilization structures			
		Install controlled drainage system			
		Implement drainage water management			
		Construct overwide ditch			
		Construct 2-stage channel		x	
	livestock	Implement prescribed & conservation grazing practices	x	x	x
		Install livestock exclusion fencing	x	x	x
		Install livestock crossings	x	x	x

Restoration Categories		Specific Restoration Actions	Lake Fork Mohican River (05040002 07)		
			Crab Run (07 01)	Mohicanville Dam-Lake Fork Mohican River (07 02)	Plum Run-Lake Fork Mohican River (07 03)
		Install alternative water supplies	x	x	x
		Install livestock access lanes	x	x	x
	manure	Implement manure management practices	x	x	x
		Construct animal waste storage structures	x	x	x
		Implement manure transfer practices	x	x	x
		Install grass manure spreading strips	x	x	x
	misc. infrastructure and mgt	Install chemical mixing pads		x	
		Install heavy use feeding pads			
		Install erosion & sediment control structures			
		Install roof water management practices			
		Install milkhouse waste treatment practices			
		Develop whole farm management plans	x	x	x
Storm Water Best Management Practices	planning	Develop/implement local ordinances/resolutions			
		Develop local comprehensive land use plans			
	construction practices	Implement erosion controls			
		Implement sediment controls			
		Implement non-sediment controls			
	post construction practices	Reduce pollutant(s) through treatment			
		Reduce pollutant(s) through flow/volume management			
	post development/ storm water retrofit	Implement erosion controls			
		Implement sediment controls			
		Implement non-sediment controls			
		Reduce pollutant(s) through treatment			
		Reduce pollutant(s) through flow/volume management			
Regulatory Point Source Controls (includes Storm Water, Sanitary, and Industrial)	planning	Develop long-term control plan (CSOs)			
		Develop/implement local ordinances/resolutions			
		Develop water quality management/208 plans			
	collection and new treatment	Install sewer systems in communities			
		Implement long-term control plan (CSOs)			
		Eliminate SSOs/CSOs/by-passes			
	enhanced treatment	Issue permit(s) and/or modify permit limit(s)			
		Improve quality of effluent			
	monitoring	Establish ambient monitoring program			

Restoration Categories		Specific Restoration Actions	Lake Fork Mohican River (05040002 07)		
			Crab Run (07 01)	Mohicanville Dam-Lake Fork Mohican River (07 02)	Plum Run-Lake Fork Mohican River (07 03)
		Increase effluent monitoring			
	alternatives	Establish water quality trading			
	construction practices	Issue permit(s) and/or modify permit limit(s)			
		Implement erosion controls			
		Implement sediment controls			
		Implement non-sediment controls			
	post construction practices	Issue permit(s) and/or modify permit limit(s)			
		Reduce pollutant(s) through treatment			
		Reduce pollutant(s) through flow/volume management			
	post development/ storm water retrofit	Issue permit(s) and/or modify permit limit(s)			
		Implement erosion controls			
		Implement sediment controls			
		Implement non-sediment controls			
		Reduce pollutant(s) through treatment			
		Reduce pollutant(s) through flow/volume management			
		Reduce volume to CSOs			

6.9 Mohican River (05040002 08)

Perrysville is located in the Town of Perrysville-Black Fork Mohican River nested subwatershed. Perrysville is currently replacing its chlorination with ultraviolet disinfection. This should make disinfection more dependable and reduce bacteria concentrations in the stream.

Table 6-13. Recommended implementation actions in the Mohican River subwatershed.

Restoration Categories		Specific Restoration Actions	Mohican River (05040002 08)					
			Honey Creek (08 01)	Town of Perrysville-Black Fork Mohican River (08 02)	Big Run-Black Fork Mohican River (08 03)	Sigafoos Run-Mohican River (08 04)	Negro Run-Mohican River (08 05)	Flat Run-Mohican River (08 06)
Bank &	constructed	Restore streambank using bio-engineering						

Restoration Categories		Specific Restoration Actions	Mohican River (05040002 08)					
			Honey Creek (08 01)	Town of Perrysville-Black Fork Mohican River (08 02)	Big Run-Black Fork Mohican River (08 03)	Sigafoos Run-Mohican River (08 04)	Negro Run-Mohican River (08 05)	Flat Run-Mohican River (08 06)
Riparian Restoration		Restore streambank by recontouring or regrading						
	planted	Plant grasses in riparian areas						
		Plant prairie grasses in riparian areas						
		Remove/treat invasive species						
		Plant trees or shrubs in riparian areas						
Stream Restoration		Restore flood plain						
		Restore stream channel						
		Install in-stream habitat structures						
		Install grade structures						
		Construct 2-stage channel						
		Restore natural flow						
Wetland Restoration		Reconnect wetland to stream						
		Reconstruct & restore wetlands						
		Plant wetland species						
Conservation Easements		Acquire conservation easements						
Dam Modification or Removal		Remove dams						
		Modify dams						
		Remove associated dam support structures						
		Install fish passage and/or habitat structures						
		Restore natural flow						
Levee or Dike Modification or Removal		Remove levees						
		Breach or modify levees						
		Remove dikes						
		Modify dikes						
		Restore natural flood plain function						
Abandoned Mine Land Reclamation	treatment	Construct lime dosers						
		Install slag leach beds						
		Install limestone leach beds						
		Install limestone channels						
		Install successive alkalinity producing systems						
		Install settling ponds						
		Install vertical flow ponds						

Restoration Categories		Specific Restoration Actions	Mohican River (05040002 08)					
			Honey Creek (08 01)	Town of Perrysville-Black Fork Mohican River (08 02)	Big Run-Black Fork Mohican River (08 03)	Sigafoos Run-Mohican River (08 04)	Negro Run-Mohican River (08 05)	Flat Run-Mohican River (08 06)
		Install limestone drains (anoxic and/or oxic)						
		Construct acid mine drainage wetland						
	flow diversion	Repair subsidence sites						
		Reclaim pit impoundments						
		Reclaim abandoned mine land						
		Eliminate stream captures						
		Eliminate mine drainage discharges						
		Restore positive drainage						
		Cover toxic mine spoils						
Home Sewage Planning and Improvement		Develop HSTS plan	x					
		Inspect HSTS	x					
		Repair or replace traditional HSTS	x					
		Repair or replace alternative HSTS	x					
Education and Outreach		Host meetings, workshops, and/or other events	x		x			
		Distribute educational materials	x		x			
Agricultural Best Management Practices	farmland	Plant cover/manure crops						
		Implement conservation tillage practices						
		Implement grass/legume rotations						
		Convert to permanent hayland						
		Install grassed waterways						
		Install vegetated buffer areas/strips	x		x			
		Install location-specific conservation buffer						
		Install / restore wetlands						
	nutrients / agro-chemicals	Conduct soil testing						
		Install nitrogen reduction practices						
		Develop nutrient management plans						
	drainage	Install sinkhole stabilization structures						
		Install controlled drainage system						
		Implement drainage water management						
		Construct overwide ditch						
		Construct 2-stage channel						
	livestock	Implement prescribed & conservation grazing practices			x			

Restoration Categories		Specific Restoration Actions	Mohican River (05040002 08)					
			Honey Creek (08 01)	Town of Perrysville-Black Fork Mohican River (08 02)	Big Run-Black Fork Mohican River (08 03)	Sigafoos Run-Mohican River (08 04)	Negro Run-Mohican River (08 05)	Flat Run-Mohican River (08 06)
		Install livestock exclusion fencing			x			
		Install livestock crossings			x			
		Install alternative water supplies			x			
		Install livestock access lanes			x			
	manure	Implement manure management practices	x		x			
		Construct animal waste storage structures	x		x			
		Implement manure transfer practices	x		x			
		Install grass manure spreading strips	x		x			
	misc. infrastructure and mgt	Install chemical mixing pads						
		Install heavy use feeding pads						
		Install erosion & sediment control structures						
		Install roof water management practices						
		Install milkhouse waste treatment practices						
		Develop whole farm management plans	x		x			
Storm Water Best Management Practices	planning	Develop/implement local ordinances/resolutions						
		Develop local comprehensive land use plans						
	construction practices	Implement erosion controls						
		Implement sediment controls						
		Implement non-sediment controls						
	post construction practices	Reduce pollutant(s) through treatment						
		Reduce pollutant(s) through flow/volume management						
	post development/ storm water retrofit	Implement erosion controls						
		Implement sediment controls						
		Implement non-sediment controls						
		Reduce pollutant(s) through treatment						
		Reduce pollutant(s) through flow/volume management						
Regulatory Point Source Controls (includes Storm Water, Sanitary, and	planning	Develop long-term control plan (CSOs)						
		Develop/implement local ordinances/resolutions						
		Develop water quality management/208 plans						
	collection and new treatment	Install sewer systems in communities						
		Implement long-term control plan (CSOs)						
		Eliminate SSOs/CSOs/by-passes						

Restoration Categories		Specific Restoration Actions	Mohican River (05040002 08)					
			Honey Creek (08 01)	Town of Perrysville-Black Fork Mohican River (08 02)	Big Run-Black Fork Mohican River (08 03)	Sigafoos Run-Mohican River (08 04)	Negro Run-Mohican River (08 05)	Flat Run-Mohican River (08 06)
Industrial)	enhanced treatment	Issue permit(s) and/or modify permit limit(s)		x				
		Improve quality of effluent		x				
	monitoring	Establish ambient monitoring program						
		Increase effluent monitoring						
	alternatives	Establish water quality trading						
	construction practices	Issue permit(s) and/or modify permit limit(s)						
		Implement erosion controls						
		Implement sediment controls						
		Implement non-sediment controls						
	post construction practices	Issue permit(s) and/or modify permit limit(s)						
		Reduce pollutant(s) through treatment						
		Reduce pollutant(s) through flow/volume management						
	post development/ storm water retrofit	Issue permit(s) and/or modify permit limit(s)						
		Implement erosion controls						
		Implement sediment controls						
		Implement non-sediment controls						
		Reduce pollutant(s) through treatment						
		Reduce pollutant(s) through flow/volume management						
		Reduce volume to CSOs						

6.10 Mohican River Mainstem

When Ohio EPA sampled the Mohican River in 2007, there were several small campgrounds in the lower portion of the watershed that discharged to the Mohican River mainstem that had no permits. Since 2007, all of those campgrounds now have permits to operate their package plants. It is believed that any other bacterial contamination is resulting from wildlife, which cannot easily be prohibited access to the river.

Table 6-14. Recommended implementation actions for the Mohican River mainstem.

Restoration Categories		Specific Restoration Actions	Mohican River Mainstem
Bank & Riparian Restoration	constructed	Restore streambank using bio-engineering	
		Restore streambank by recontouring or regrading	
	planted	Plant grasses in riparian areas	

Restoration Categories		Specific Restoration Actions	Mohican River Mainstem
		Plant prairie grasses in riparian areas	
		Remove/treat invasive species	
		Plant trees or shrubs in riparian areas	
Stream Restoration		Restore flood plain	
		Restore stream channel	
		Install in-stream habitat structures	
		Install grade structures	
		Construct 2-stage channel	
		Restore natural flow	
Wetland Restoration		Reconnect wetland to stream	
		Reconstruct & restore wetlands	
		Plant wetland species	
Conservation Easements		Acquire conservation easements	
Dam Modification or Removal		Remove dams	
		Modify dams	
		Remove associated dam support structures	
		Install fish passage and/or habitat structures	
		Restore natural flow	
Levee or Dike Modification or Removal		Remove levees	
		Breach or modify levees	
		Remove dikes	
		Modify dikes	
		Restore natural flood plain function	
Abandoned Mine Land Reclamation	treatment	Construct lime dosers	
		Install slag leach beds	
		Install limestone leach beds	
		Install limestone channels	
		Install successive alkalinity producing systems	
		Install settling ponds	
		Install vertical flow ponds	
		Install limestone drains (anoxic and/or oxic)	
		Construct acid mine drainage wetland	
	flow diversion	Repair subsidence sites	
		Reclaim pit impoundments	
		Reclaim abandoned mine land	
		Eliminate stream captures	
		Eliminate mine drainage discharges	
		Restore positive drainage	
		Cover toxic mine spoils	
Home Sewage Planning and Improvement		Develop HSTS plan	
		Inspect HSTS	

Restoration Categories		Specific Restoration Actions	Mohican River Mainstem
		Repair or replace traditional HSTS	
		Repair or replace alternative HSTS	
Education and Outreach		Host meetings, workshops, and/or other events	
		Distribute educational materials	
Agricultural Best Management Practices	farmland	Plant cover/manure crops	
		Implement conservation tillage practices	
		Implement grass/legume rotations	
		Convert to permanent hayland	
		Install grassed waterways	
		Install vegetated buffer areas/strips	
		Install location-specific conservation buffer	
		Install / restore wetlands	
	nutrients / agro-chemicals	Conduct soil testing	
		Install nitrogen reduction practices	
		Develop nutrient management plans	
	drainage	Install sinkhole stabilization structures	
		Install controlled drainage system	
		Implement drainage water management	
		Construct overwide ditch	
		Construct 2-stage channel	
	livestock	Implement prescribed & conservation grazing practices	
		Install livestock exclusion fencing	
		Install livestock crossings	
		Install alternative water supplies	
		Install livestock access lanes	
	manure	Implement manure management practices	
		Construct animal waste storage structures	
		Implement manure transfer practices	
		Install grass manure spreading strips	
	misc. infrastructure and mgt	Install chemical mixing pads	
		Install heavy use feeding pads	
		Install erosion & sediment control structures	
		Install roof water management practices	
		Install milkhouse waste treatment practices	
		Develop whole farm management plans	
Storm Water Best Management Practices	planning	Develop/implement local ordinances/resolutions	
		Develop local comprehensive land use plans	
	construction practices	Implement erosion controls	
		Implement sediment controls	
		Implement non-sediment controls	

Restoration Categories		Specific Restoration Actions	Mohican River Mainstem
	post construction practices	Reduce pollutant(s) through treatment	
		Reduce pollutant(s) through flow/volume management	
	post development/ storm water retrofit	Implement erosion controls	
		Implement sediment controls	
		Implement non-sediment controls	
		Reduce pollutant(s) through treatment	
		Reduce pollutant(s) through flow/volume management	
Regulatory Point Source Controls (includes Storm Water, Sanitary, and Industrial)	planning	Develop long-term control plan (CSOs)	
		Develop/implement local ordinances/resolutions	
		Develop water quality management/208 plans	
	collection and new treatment	Install sewer systems in communities	
		Implement long-term control plan (CSOs)	
		Eliminate SSOs/CSOs/by-passes	
	enhanced treatment	Issue permit(s) and/or modify permit limit(s)	Done
		Improve quality of effluent	
	monitoring	Establish ambient monitoring program	
		Increase effluent monitoring	
	alternatives	Establish water quality trading	
	construction practices	Issue permit(s) and/or modify permit limit(s)	
		Implement erosion controls	
		Implement sediment controls	
		Implement non-sediment controls	
	post construction practices	Issue permit(s) and/or modify permit limit(s)	
		Reduce pollutant(s) through treatment	
		Reduce pollutant(s) through flow/volume management	
	post development/ storm water retrofit	Issue permit(s) and/or modify permit limit(s)	
		Implement erosion controls	
		Implement sediment controls	
		Implement non-sediment controls	
		Reduce pollutant(s) through treatment	
		Reduce pollutant(s) through flow/volume management	
		Reduce volume to CSOs	

6.11 Reasonable Assurances

The recommendations made in this TMDL report will be carried out if the appropriate entities work to implement them. In particular, activities that do not fall under regulatory authority require that there be a committed effort by state and local agencies, governments, and private groups to carry out and/or facilitate such actions. The availability of adequate resources is also imperative for successful implementation.

When a TMDL is developed for waters impaired by point sources only, the issuance of a NPDES permit(s) provides the reasonable assurance that the wasteload allocations contained in the TMDL will be achieved. This is because 40 C.F.R. 122.44(d)(1)(vii)(B) requires that effluent limits in permits be consistent with the assumptions and requirements of any available wasteload allocation in an approved TMDL.

When a TMDL is developed for waters impaired by both point and nonpoint sources, and the WLA is based on an assumption that nonpoint source load reductions will occur, U.S. EPA's 1991 TMDL Guidance states that the TMDL should provide reasonable assurances that nonpoint source control measures will achieve expected load reductions. To this end, Appendix E discusses organizations and programs that have an important role or can provide assistance for meeting the goals and recommendations of this TMDL. Efforts specific to this watershed are described in this section.

6.11.1 Local Zoning and Regional Planning

The Muskingum Watershed Conservancy District (MWCD) is a political subdivision of the State of Ohio created in 1933 to develop and implement a plan to reduce the effects of flooding and conserve water for beneficial public uses under Ohio Revised Code Chapter 6101 (commonly called the Conservancy Act).

The MWCD mission statement reads as follows: *Responsible stewards dedicated to providing the benefits of flood reduction, conservation and recreational opportunities in the Muskingum River Watershed.*

The MWCD is the largest conservancy district in the state and led the effort to construct 14 dams and reservoirs. Two others were built later and the system of dams and reservoirs has been credited by the federal government with saving more than $7 billion worth of potential damage from flooding since its original construction.

The MWCD is a partner with the U.S. Army Corps of Engineers (USACE) in the operation of the system of dams and reservoirs in the watershed, as the USACE operates the dams and the MWCD manages most of the reservoir areas behind the dams.[1]

6.11.2 Local Watershed Groups

There are no existing local watershed action groups in the Mohican River watershed. However, because the Mohican River is a State Scenic River, the Ohio Department of Natural Resources (ODNR) obtained a

[1] Source: http://www.mwcd.org/about-mwcd/what-is-the-mwcd

Section 319 grant to draft a watershed action plan (see below). ODNR was active in the watershed while it gathered information for the draft plan.

6.11.3 Other Sources of Funding and Special Projects

A 319 grant was given to the Ohio Department of Natural Resources in 2005 to develop a watershed action plan (WAP) for the Mohican River watershed; a draft was completed in 2009. The WAP is currently in draft form.

Ashland University owns the Black Fork Wetlands Environmental Study Center in the Black Fork subwatershed. The goals of the center include wetland preservation; outreach to the community; development and implementation of an interpretive center; and field research and education. For further information, see: http://www.ashland.edu/departments/environmental-science/black-fork-wetlands-environmental-studies-center.

6.11.4 Past and Ongoing Water Resource Evaluation

Ohio EPA's watershed survey in 2007 was the first year in which Ohio EPA did a comprehensive survey of the watershed. However, some monitoring was also completed in 2004 in the Town of Lexington-Clear Fork Mohican River nested subwatershed. The monitoring assessed a DERR remediation project for ground water contamination.

Recommended Approach for Gathering and Using Available Data

Early communications should take place between the Ohio EPA and any potential collaborators to discuss research interests and objectives. Areas of overlap should be identified and ways to make all parties research efforts more efficient should be discussed. Ultimately, important questions can be addressed by working collectively and through pooling resources, knowledge and data.

6.11.5 Potential and Future Evaluation

According to the 2012 Ohio Integrated Water Quality Monitoring and Assessment Report (Ohio EPA 2012), Ohio EPA will next survey the Mohican River watershed in 2023.

6.11.6 Revision to the Improvement Strategy

The Mohican River watershed would benefit from an adaptive management approach to restoring water quality. An adaptive management approach allows for changes in the management strategy if environmental indicators suggest that the current strategy is inadequate or ineffective. Adaptive management is recognized as a viable strategy for managing natural resources (Baydack *et al.* 1999).

If chemical water quality does not show improvement and/or water bodies are still not attaining water quality standards after the improvement strategy has been carried out, then a TMDL revision would be initiated. The Ohio EPA would initiate the revision if no other parties wish to do so.

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