



Nine-Element Nonpoint Source Implementation Strategic Plan (NPS-IS Plan)

Tuscarawas River: Wolf Run – Tuscarawas River
HUC: 05040001 12 04

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Rural Action

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Chapter 1: Introduction

1.1 Report Background

This NPS-IS plan was created to address water quality concerns identified by local government officials, state and federal agencies, non-government organizations, and citizen stakeholders. The overarching intent of this plan is to highlight critical areas and aid in identifying and securing funding to implement projects that will result in improvements in habitat and water quality. These improvements will enhance biological communities and ultimately improve or maintain aquatic life and recreational use attainment status within the Wolf Run - Tuscarawas River HUC-12.

The landscape of this watershed mirrors much of the rest of the Tuscarawas Watershed, with fairly rural and forested areas with small urban towns sprinkled throughout. This HUC 12 is impacted by land development/suburbanization, acid mine drainage, nonirrigated crop production, and surface mining causing issues with high nutrient and metal concentrations, low pH, siltation and flow alteration.

Because state and federal nonpoint funding is now tied to the development and approval of these nine-element nonpoint source strategic plans, Rural Action has plans to develop several of these plans moving forward. Rural Action and our partners also recognize the importance of strategic planning and project development for watershed improvements. Historically, Rural Action's Watershed Restoration Program has spent many years working in acid mine drainage impacted streams in Appalachian Ohio and has seen first-hand the effectiveness of our Acid Mine Drainage Abatement and Treatment (AMDAT) Plans, which are very similar to the 9 Element plans in planning principles, identification of problem areas, and project development. Rural Action is interested in playing a role in the identification and implementation of water quality improvement projects across Appalachian Ohio, dealing with other water quality impairments in addition to acid mine drainage. This particular HUC-12 was identified for a 9 Element Plan so that plans can move forward on pursuing funding for a project on the Tuscarawas River in Dover.

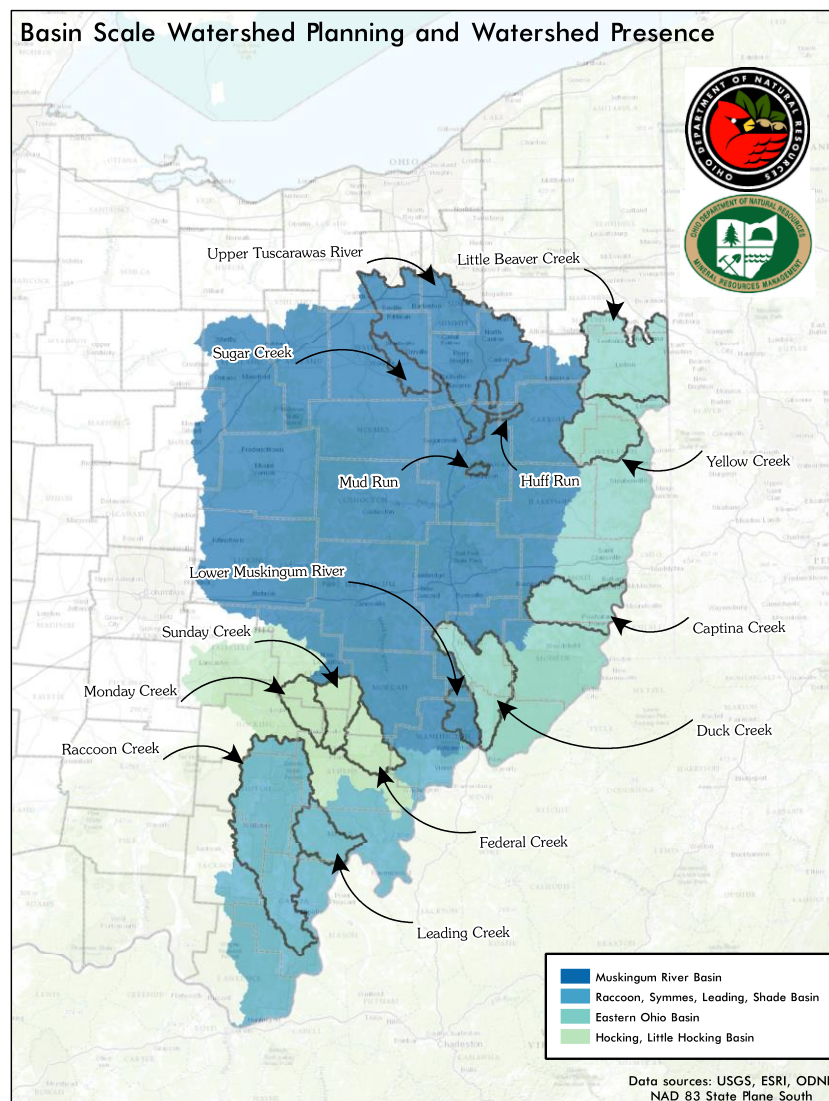
Figure 1. Location of Wolf Run - Tuscarawas River HUC 12



1.2 Watershed Profile and History

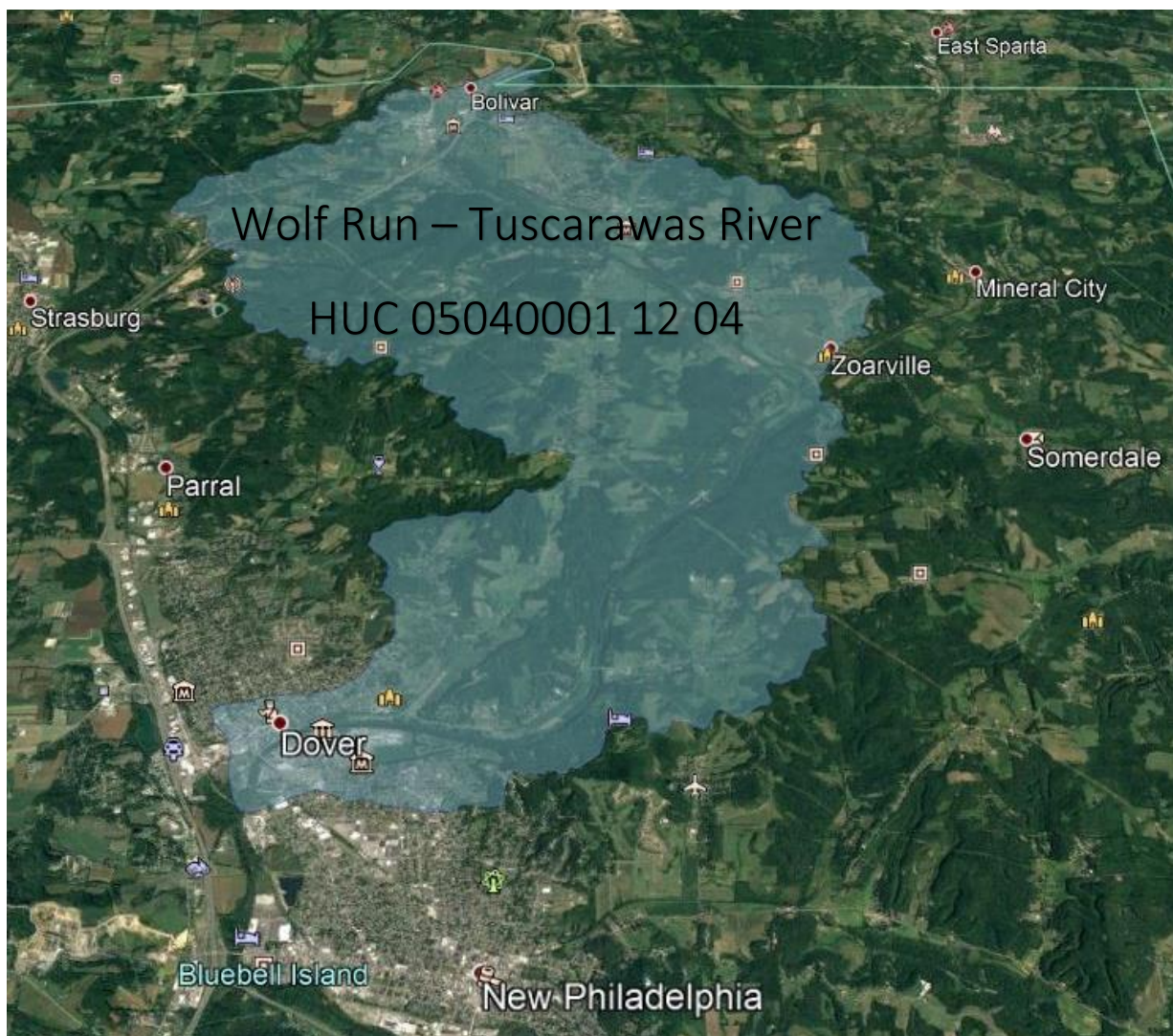
The Tuscarawas River is 129.9 miles long and its full watershed covers 2,600 square miles within 13 counties in eastern Ohio. The Tuscarawas River is a major watershed in eastern Ohio, with headwaters beginning to the north and the east of the Portage Lakes in northern Stark, Summit, and Medina counties and flowing south to Newcomerstown, then west to Coshocton where it joins the Walhonding River to form the Muskingum River, a major tributary to the Ohio River. The Muskingum Watershed covers more than 8,000 square miles and is the largest watershed completely contained within the state of Ohio, covering about 20 percent of the entire state.

Figure 2. Map showing the relative size of the Muskingum River Basin shown in the darkest blue



The Wolf Run – Tuscarawas River HUC-12 (05040001 12 04) is one of 98 HUC-12 watersheds in the Tuscarawas Watershed and one of 302 HUC-12 watersheds that comprise the Muskingum River Watershed. It is located at the north-central edge of Tuscarawas County, Ohio, with just an incredibly small amount of land just over the Stark County border near Bolivar, Ohio. This HUC-12 is immediately upstream from the Beaverdam Creek HUC-12 (05040001 17 03), west of the Huff Run HUC-12 (05040001 08 04) and east of the Brandywine Creek – Sugar Creek HUC-12 (05040001 11 05). The Wolf Run – Tuscarawas River HUC-12 encompasses 37.17 square miles or about 23,800 acres from Bolivar in the north down to Dover in the south. This HUC-12 encompasses most of the land stretching between the towns of Strasburg to the west and Mineral City to the east, including the towns of Zoar and Zoarville within its boundaries.

Figure 3. Aerial view of Wolf Run-Tuscarawas River HUC 12 showing local towns



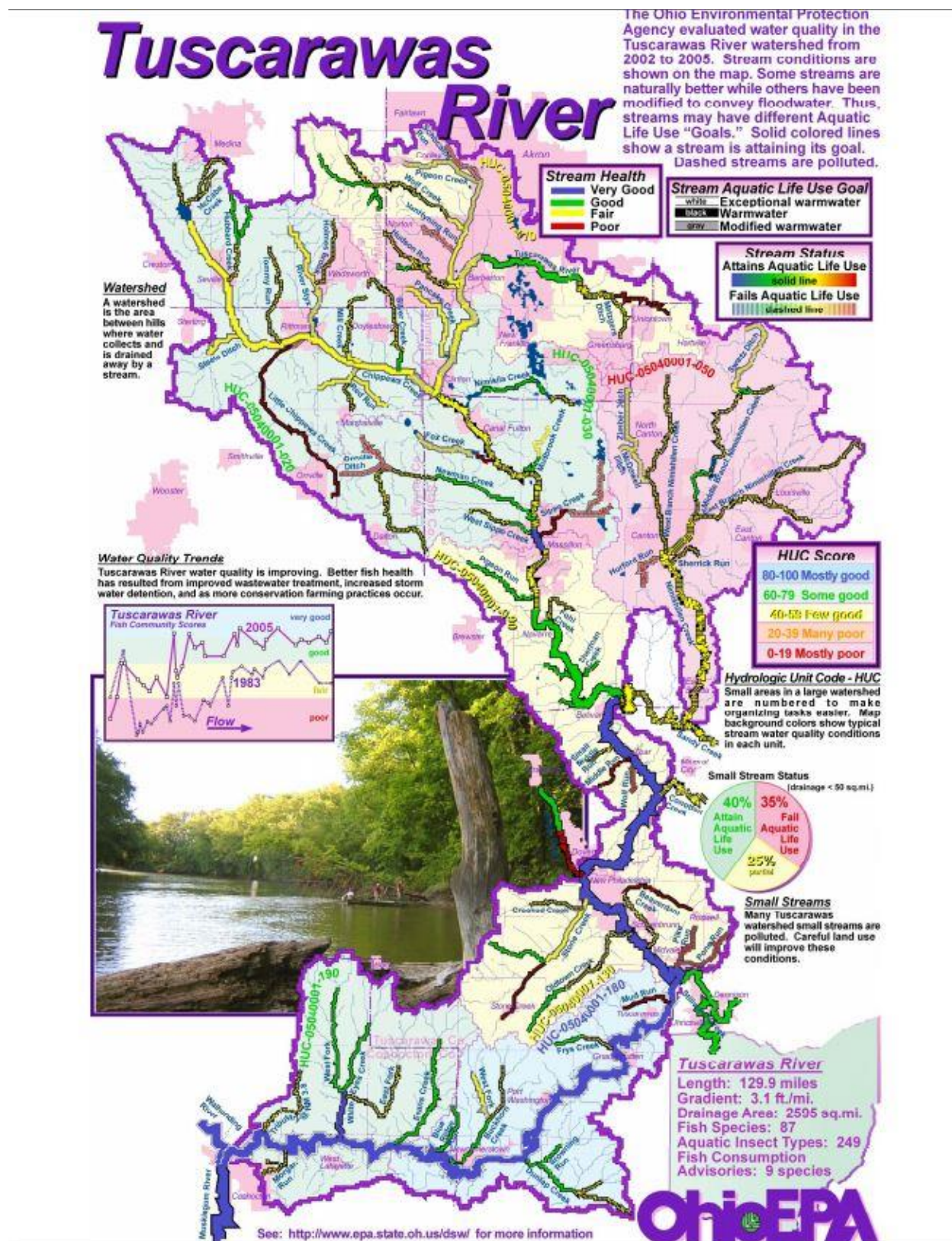
Due to the transition of the landscape from glaciated to unglaciated Allegheny Plateaus around the Stark/Tuscarawas County line, there is less agricultural development along the hillsides which protects stream quality. There are multiple legacy mines and coal mine drainages in this watershed that pollute streams with acidic and metallic waters.

The Wolf Run section of the Tuscarawas River has a colorful past. Delaware Indians inhabited the bountiful forests and floodplains. As white settlers began entering the area in the late 1700s, conflict occurred between the natives and new arrivals. The area served as an encampment for British soldiers during Pontiac's War. Fort Laurens, the westernmost fort of the American Revolution, is located just south of Bolivar along the river.

Following the Revolution, economic development proceeded in the region. Iron ore was mined and trees were felled for charcoal and timber. A large portion of the Ohio and Erie Canal was constructed alongside the Tuscarawas River. Completed in the 1830s, this canal fueled trade throughout Ohio. However, it began to be supplanted by rail in the 1850s and was largely destroyed by the 1913 flood. Today, the Zoar Valley Trail follows the old towpath trail from Zoarville to Bolivar.

As alluded to above, flooding has been and still is common in the Tuscarawas River valley. The 1913 flood led to the formation of the Muskingum Watershed Conservancy District. Dams were installed throughout the river to protect people and farmland, including the Dover Dam between Dover and Zoarville. Portions of the river were channelized for additional flood protection. Incidents of flooding in recent years has spurred authorities to take a fresh look at the impact dams have on water quality, recreation opportunities and safety.

Figure 4. Summary of water quality in the Tuscarawas River Watershed (Ohio EPA 2007)



1.3 Public Participation & Involvement

To create a new road map for watershed restoration, Rural Action led a planning process to identify the challenges to developing and implementing a regional watershed strategy. A planning team came together from October 2014 – March 2016, representing many of the different stakeholders working on watershed restoration in Appalachian Ohio:

- Rural Action
- Ohio Environmental Protection Agency
- Ohio Department of Natural Resources
- Ohio University Voinovich School of Leadership and Public Affairs
- Muskingum Watershed Conservancy District
- Raccoon Creek Partnership
- Federation of Soil and Water Conservation Districts

The planning team turned directly to the communities within the Ohio Appalachian coal region for input to the process. They coordinated eight community meetings in St. Clairsville, Canton, Jackson, Logan, Cambridge, Athens, Marietta, and Steubenville and collected 146 citizen surveys to assess how residents feel about their water quality and restoration work being done in their watershed. A second, similar survey was conducted for local governments.

Survey respondents identified water quality as the largest environmental concerns in their community (Figure 5). When asked what local areas need to be protected 31% of the respondents said “all streams or land,” several respondents said “The Tuscarawas River” and several also said “Abandoned Mine Areas” (Figure 6). The projects identified in this NPS-IS plan address some of the concerns citizens identified from the survey.

Figure 5.

Citizen Identified Environmental Concerns

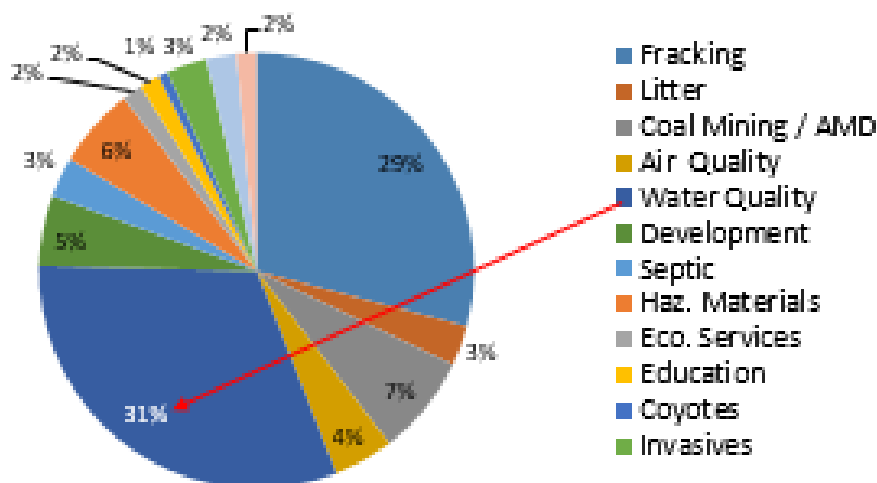
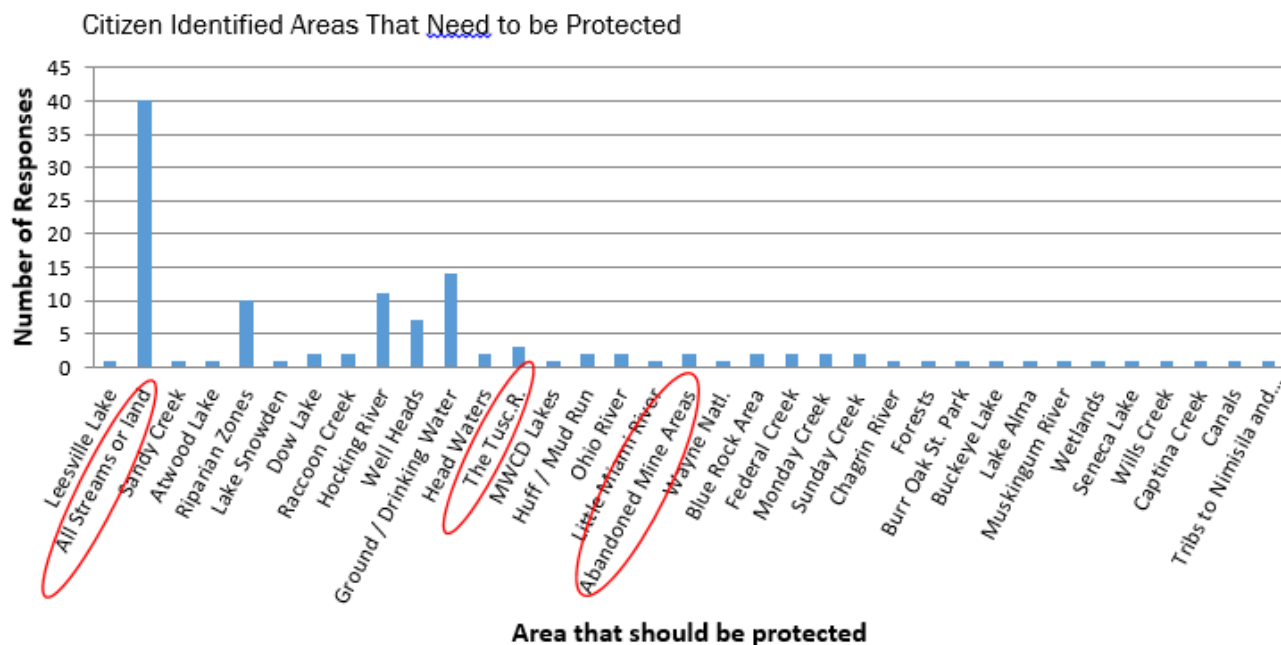


Figure 6.



This document was developed internally by the Rural Action Watershed Restoration program staff. Staff members reached out to partners at the Ohio Department of Natural Resources Division of Mineral Resources Management, Muskingum Watershed Conservation District, City of Dover, the Huff Run Watershed Restoration Partnership, Tuscarawas Soil and Water Conservation District and OSU Extension in order to gather information, data, and input on this plan.

Much of the data cited in this document was found in the Total Maximum Daily Loads (TMDL) for the Tuscarawas River Watershed, written by Ohio EPA in 2009. Public involvement during the development of that data and resulting report included ongoing communications between Ohio EPA and representatives of the Northeast Four County Regional Planning Commission. Also, numerous meetings with the public, local watershed groups, creation of an advisory group of stakeholders and the acceptance of public comments.

Chapter 2: Watershed Characterization & Assessment Summary

2.1 *Summary of HUC-12 Watershed Characterization*

2.1.1 *Physical and Natural Features*

The Tuscarawas River Watershed is comprised of nineteen eleven-digit Hydrologic Units (HUs). This document focuses on the Wolf Run – Tuscarawas River HUC-12 (05040001 12 04). The Tuscarawas River mainstem drains most of this basin directly. Several small tributaries, including Wolf Run, Middle Run, and Small Middle Run drain the upper northwest quadrant of this HUC-12 into the Tuscarawas River.

The Tuscarawas River basin straddles two physiographic regions, with the Glaciated Appalachian Plateau to the north and the unglaciated Allegheny Plateau to the south. However, the entire basin's topography, soil types, geology and overall hydrology were strongly impacted by glaciation over 10,000 years ago. Sands and gravels from glacial outwash and alluvial processes can be found in stream valleys throughout the basin. Topographic relief is greater in the southern two-thirds of the Tuscarawas basin. The Wolf Run – Tuscarawas River HUC-12 is right on the line. Due to the change from glaciated to unglaciated Allegheny Plateaus around the Stark/Tusc. County line there is less agricultural development along the hillsides. This does improve the stream quality, although there are multiple legacy mines and coal mine drainages that pollute with acidic and metallic waters. Bedrock in this region is comprised of gently sloping Pennsylvanian-age sandstone, limestone, coal and shales.

Notable features in this watershed include:

- Fort Laurens State Memorial
- Union Hospital
- Wilkshire Golf Course
- Zoar Village Golf Course
- Union Country Club
- Zoar Lake
- Zoar Village
- Interstate 77
- Agricultural fields
- Businesses and residential housing near the river

2.1.2 *Land Use and Protection*

The Tuscarawas River is broadly characterized by urban development and row crop agriculture in its upper (northern) reaches and forest and pasture in its lower (southern)

reaches. This watershed includes the transition from glaciated terrain in the north to unglaciated, rolling land in the south. The Wolf Run HUC-12 (050400011204) consists of unglaciated land and is situated almost entirely within Tuscarawas County. The watershed includes a portion of the city of Dover and contains two villages (Zoar and Bolivar). Dover's WWTP represents the watershed's only major discharge. The city also has a storm water discharge permit.

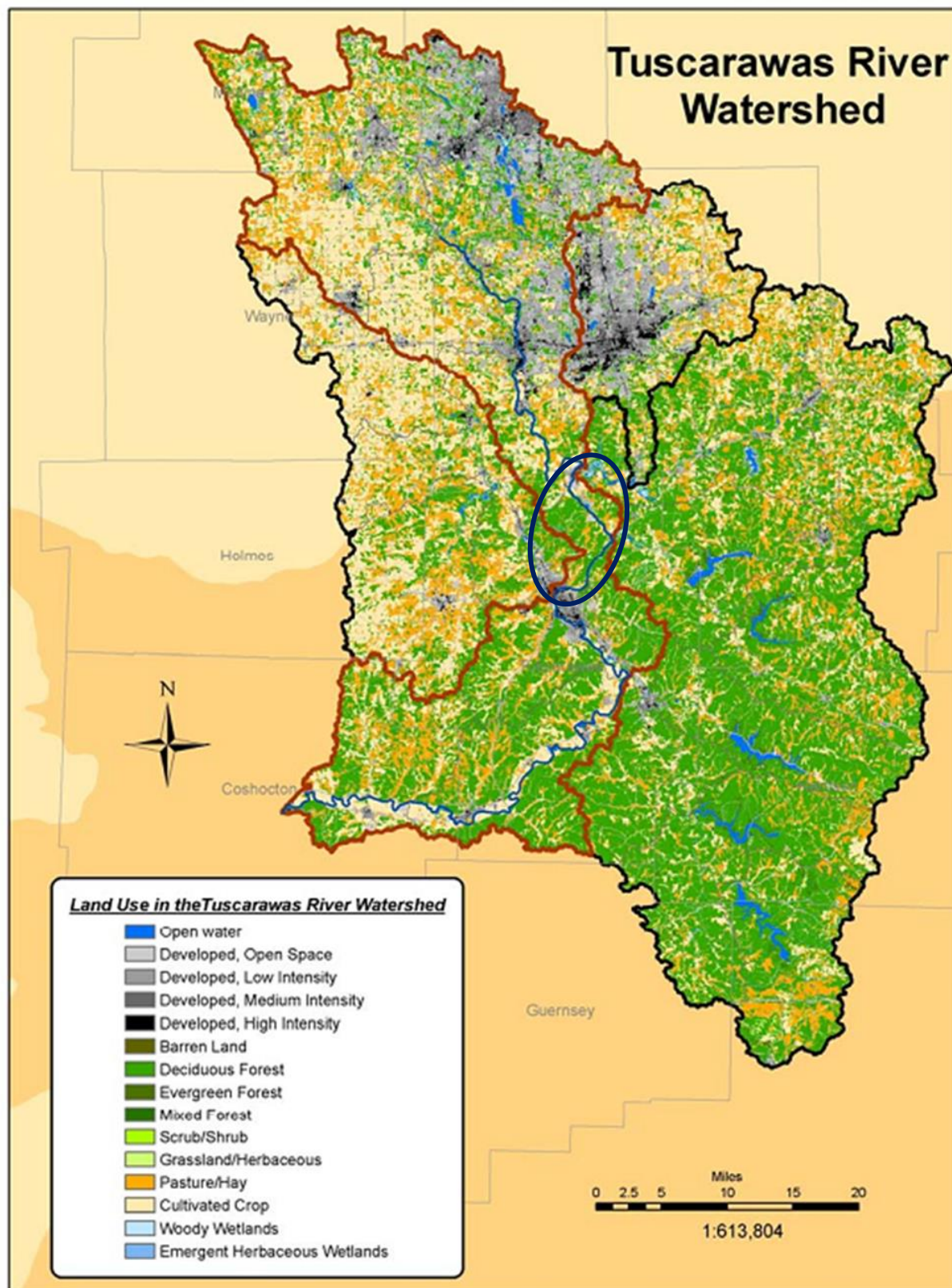
The most widespread land use within the Wolf Run HUC-12 is hay/pasture lands which account for 51.65% of the watershed area. Adding in 11.42% for croplands makes agricultural lands a significant 63.07% of the watershed's land use. Forest, herbaceous, wetlands, and shrub areas together account for 29.77%. Only 5.34% of the HUC-12 is developed, with high intensity development in the city of Dover and low intensity development in smaller villages such as Bolivar and Zoar.

With the Wolf Run HUC-12 consisting of hilly terrain, a smaller amount of grazing and row crop agriculture is present compared to other watersheds, but flood plains along the Tuscarawas River and tributaries like Wolf Run serve as hay and pasture fields. Nutrient and sediment impacts may occur in these areas. Extraction of coal and natural gas may impact the area in the future. The impact of run-off from urban areas is limited, with Dover being a small city in comparison to Canton and Akron. Besides the storm water and wastewater discharges from Dover, a few minor discharges exist from industries in the city.

Table 1. Land use characteristics of the Wolf Run - Tuscarawas River HUC-12 (NLCD 2011)

Land Use	%	Sq. Miles
Barren	0.37%	0.14
Crop	11.42%	4.24
Hay/Pasture	51.65%	19.18
Deciduous Forest	0.86%	0.32
Evergreen Forest	3.65%	1.36
Mixed Forest	1.65%	0.61
Herbaceous	9.28%	3.45
Herbaceous Wetlands	0.05%	0.02
Woody Wetlands	1.02%	0.38
Shrub/Scrub	13.26%	4.92
Developed, High Intensity	2.71%	1.01
Developed, Medium Intensity	0.00%	0.00
Developed, Low Intensity	2.57%	0.95
Developed, Open Space	0.06%	0.02
Water	1.45%	0.54
Total	100.00%	37.13

Figure 7. Land use in the Tuscarawas River Watershed. Location of Wolf Run HUC-12 is approximated by purple oval. Note the high occurrence of forest there contrasting with dense urban development to the north. (Ohio EPA Tuscarawas River Watershed TMDL 2009)



2.2 Summary of HUC-12 Biological Trends

The Ohio EPA monitors the Wolf Run – Tuscarawas HUC-12 area as part of the Tuscarawas River water quality studies and TMDL reports. Data from the 2009 Tuscarawas River TMDL for five monitoring stations within this HUC-12 can be found below (Table 2). Of these five, three are located on the Tuscarawas River while 2 are located on tributaries (Wolf Run and Small Middle Run).

Fish and macroinvertebrate communities were healthy on the Tuscarawas River, with all three sites receiving at least a “Good” score in the ICI, IBI, and MIWB. The southernmost site, just upstream of the junction with Sugar Creek, received “Exceptional” ratings for all three indices. QHEI scores along the Tuscarawas River ranged from 74.5 to 80.8. The EPA considers these sites to be in full attainment of their Warm Water Habitat designation. Additional Tuscarawas River stations between river miles 57-59 were monitored most recently by the City of Dover and Midwest Biological Institute in 2016-17. In 2017, MBI found two of these sites (downstream of the low head dam in Dover) to meet biocriteria for full attainment of Exceptional Warm Water Habitat and one site (found in the run of river impoundment above the low head dam in Dover) to be partially attaining Warm Water Habitat. Monitoring stations in this stretch of river were also sampled by OEPA in 2010, 1988, and 1983 (Table 3). The Wolf Run and Small Middle Run sites are not attaining their Limited Resource Water and Warm Water Habitat designations, respectively. Wolf Run received a “Very Poor” score in the IBI and ICI, as well as scoring the lowest of the five sites in the QHEI (52). Small Middle Run did score a 72.5 on the QHEI, but received “Fair” scores in the IBI and ICI.

No threatened, endangered, or species of concern are found within this HUC 12.

Table 2. Biological data for monitoring stations within the Wolf Run - Tuscarawas River HUC-12 (OEPA 2009)

STATION	AQUATIC LIFE USE	IBI SCORE	MIWB SCORE	ICI SCORE	QHEI SCORE
Tuscarawas R. near Bolivar, dst Sandy Creek	Full Attainment WWH	41 Good	9.25 Very Good	42 Very Good	78.5
Wolf Run w of Zoar @ lane off TR 411	Non Attainment LRW	12 Very Poor		Macro Narrative - Very Poor	52
Small Middle Run S of Zoar @ TR 411	Non Attainment WWH	30 Fair		Macro Narrative - Fair	72.5
Tuscarawas R. ust Dover, ust SR 416	Full Attainment WWH	41 Good	9.19 Very Good	46 Exceptional	74.5
Tuscarawas R. just ust Sugar Creek	Full Attainment WWH	53 Exceptional	9.71 Exceptional	46 Exceptional	80.80

Table 3. Aquatic life use attainment status at sites sampled in the Tuscarawas River in 2017 by MBI and 1983, 1988, and 2010 by Ohio EPA. The IBI values are means of all fish passes combined per Ohio EPA practice.

River Mile	IBI	MIwb	ICI	QHEI	Status	Comments
Western Allegheny Plateau Ecoregion – Warmwater Habitat (WWH) Designated Use						
Tuscarawas River (2017) MBI						
58.64	36 ^{ns}	7.2*	46	46.50	PARTIAL	Ust. Dam ¹
58.30	52	9.7	56	78.50	FULL	Dst. Dam
57.89	52	10.0	54	80.25	FULL	Dst. Sugar Cr.
Tuscarawas River (2010) Ohio EPA						
58.10	53	9.8	46	80.80	FULL	Dst. Dam
57.80	52	9.7	50	83.50	FULL	Dst. Sugar Cr.
Tuscarawas River (1988) Ohio EPA						
59.00	<u>21</u>	6.4*	<u>18</u> *	45.50	NON	Ust. Dam
58.00	34*	9.2	22*	66.50	NON	Dst. Dam
57.80	40	8.5 ^{ns}	30*	77.50	PARTIAL	Dst. Sugar Cr.
Tuscarawas River (1983) Ohio EPA						
59.20	<u>23</u> *	6.0*	32 ^{ns}	ND	NON	Ust. Dam
57.20	33*	7.1*	30*	ND	NON	Dst. Sugar Cr.

^{ns} Nonsignificant departure from biocriteria (≤ 4 IBI or ICI units, or ≤ 0.5 MIwb units).

* Denotes significant departure from applicable biocriteria (> 4 IBI or ICI units, or > 0.5 MIwb units). Underlined scores are in the Poor or Very Poor range.

ND – no data.

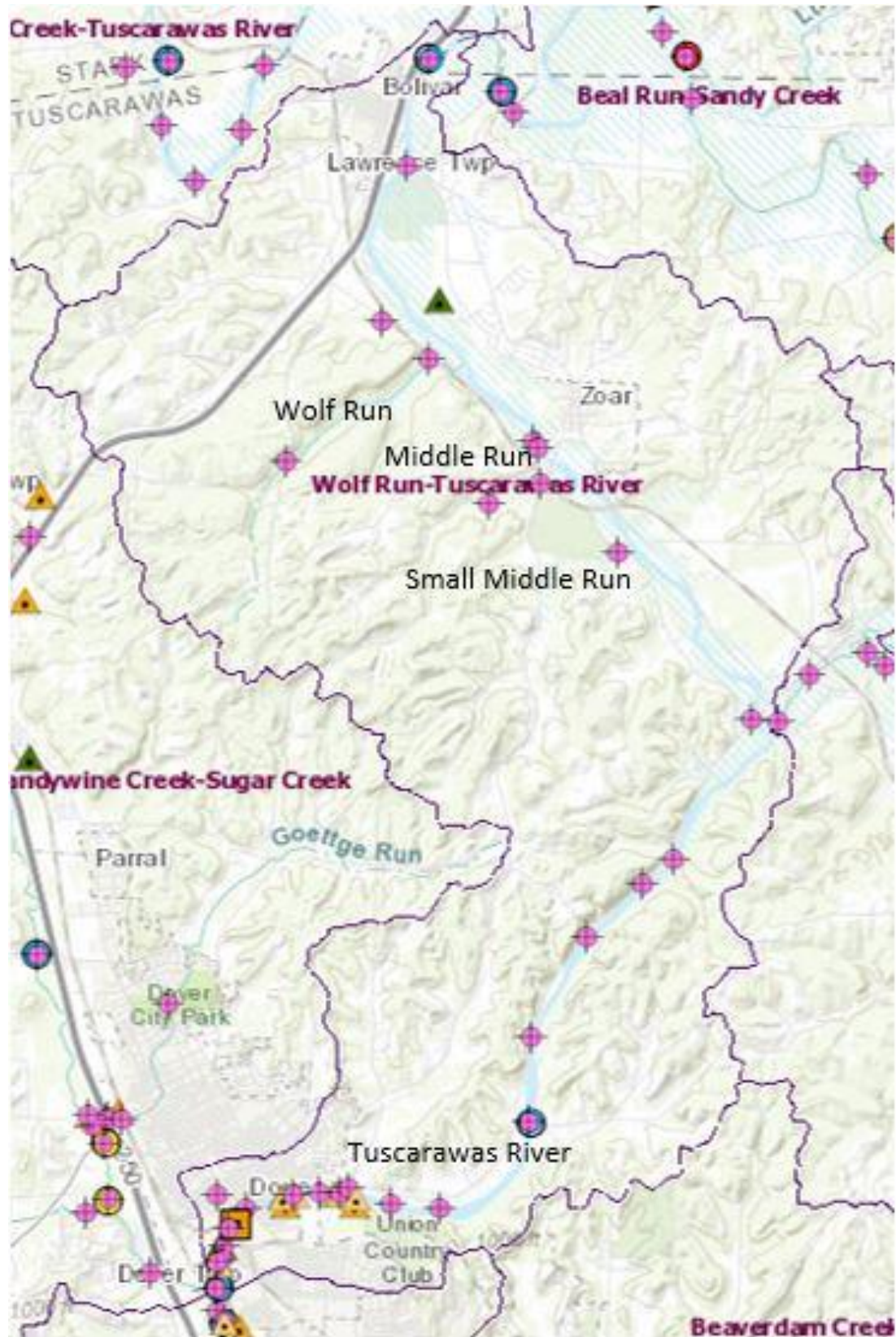
¹ – Low head dam in Dover at Dover Power & Light.

Ecoregion Biocriteria: Western Allegheny Plateau Ecoregion (WAP)

Index	WWH	EWB	MWH ²
IBI – Boatable	40	48	30
MIwb – Boatable	8.6	9.6	6.6
ICI – all sites	36	46	22

² Modified Warmwater Habitat biocriteria for impoundments.

Figure 8. Map indicating locations of OEPA monitoring stations. The three ALU monitoring stations on the Tuscarawas River are marked by blue circles within the Wolf Run - Tuscarawas River HUC-12



2.3 Summary of HUC-12 Pollution Causes and Associated Sources

The Ohio EPA TMDL Report from 2009 documents conditions in seven of the nineteen HUC-11s in the Tuscarawas River. The conditions in the Wolf Run – Tuscarawas River HUC-12 are found under the Tuscarawas River (below Sippo Creek to above Sugar Creek) HUC-11 05040001090. According to the TMDL, this HUC 12 is impacted by land development/suburbanization, acid mine drainage, nonirrigated crop production, and surface mining causing issues with high nutrient and metal concentrations, low pH, siltation and flow alteration.

According to the *Summary of Hydrologic Data for the Tuscarawas River Basin, Ohio, with an Annotated Bibliography*, a document published by the USGS, the water quality in the basin has been “degraded by urban, suburban, and rural agricultural activity, discharges from municipal and industrial wastewater treatment and thermoelectric power plants, mining, and disposal of solid and hazardous wastes. Environmental effects from mining coal during the 1800s through the mid- to late-1900s continue to affect water quality and aquatic habitat in the basin.”

The Wolf Run – Tuscarawas River HUC-12 contains the towns of Bolivar, Zoar, Zoarville, and parts of Dover. Dover is the most developed urban area in this HUC-12. Dover’s Union Hospital is within the boundaries of this watershed. There are three golf courses in this watershed – Wilkshire Golf Course, Zoar Village Golf Course, and Union Country Club. Interstate 77, a major highway, runs through this area.

There are four NPDES Permitted Dischargers in this HUC-12 including the Dover Municipal Light and Power Plant, Greer Steel Company, the Dover Waste Water Treatment Plant and the Wilkshire Hills Waste Water Treatment Plant. Of these four, only the Dover Waste Water Treatment Plant is considered a major discharge facility, with a daily discharge of one million gallons or more. The smaller dischargers are termed minor.

Figure 9. Map showing locations of NPDES Permitted Discharges in the Wolf Run - Tuscarawas River HUC-12

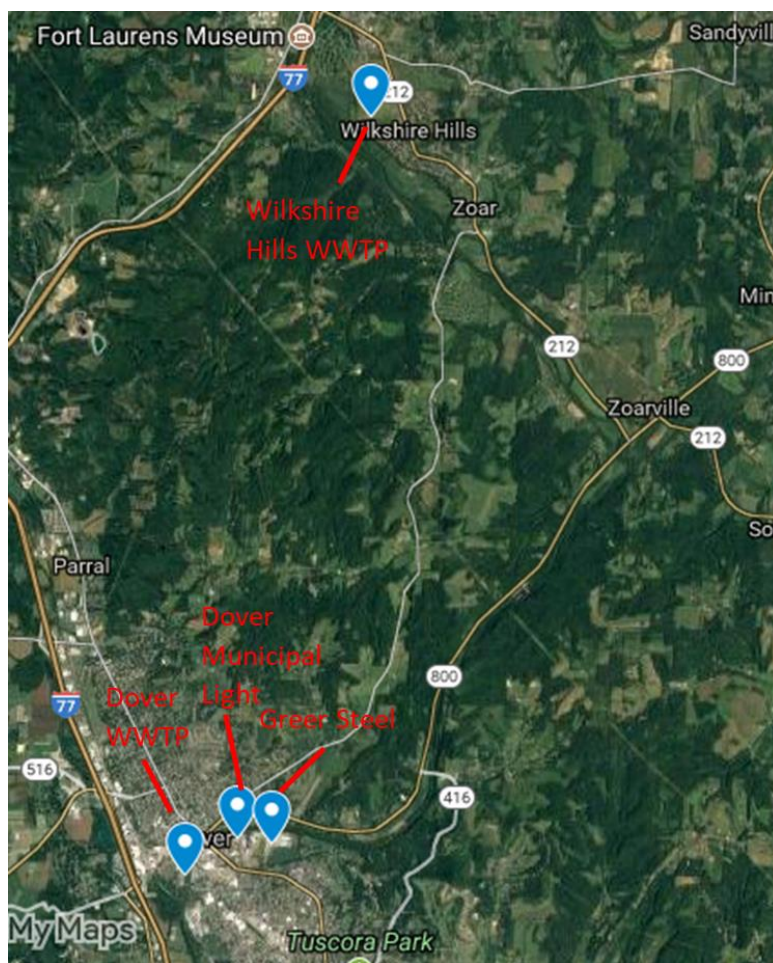


Table 4. NPDES Permitted Discharges in the Wolf Run - Tuscarawas River HUC-12

Facility	Facility Class Size	Ohio EPA Permit Number	Permit Expiration Date	Average Daily Flows (Gallons/day)
City of Dover-Municipal Light Plant	Minor	OIB00016	2-28-2023	Not Stated in Permit
City of Dover WWTP	Major	OPD00005	1-31-2020	1,370,000
Greer Steel Company	Minor	OID00003	8-31-2017	750 (design flow)
Wilkshire Hills WWTP	Minor	OPJ00008	8-31-2018	750,000 (design flow)

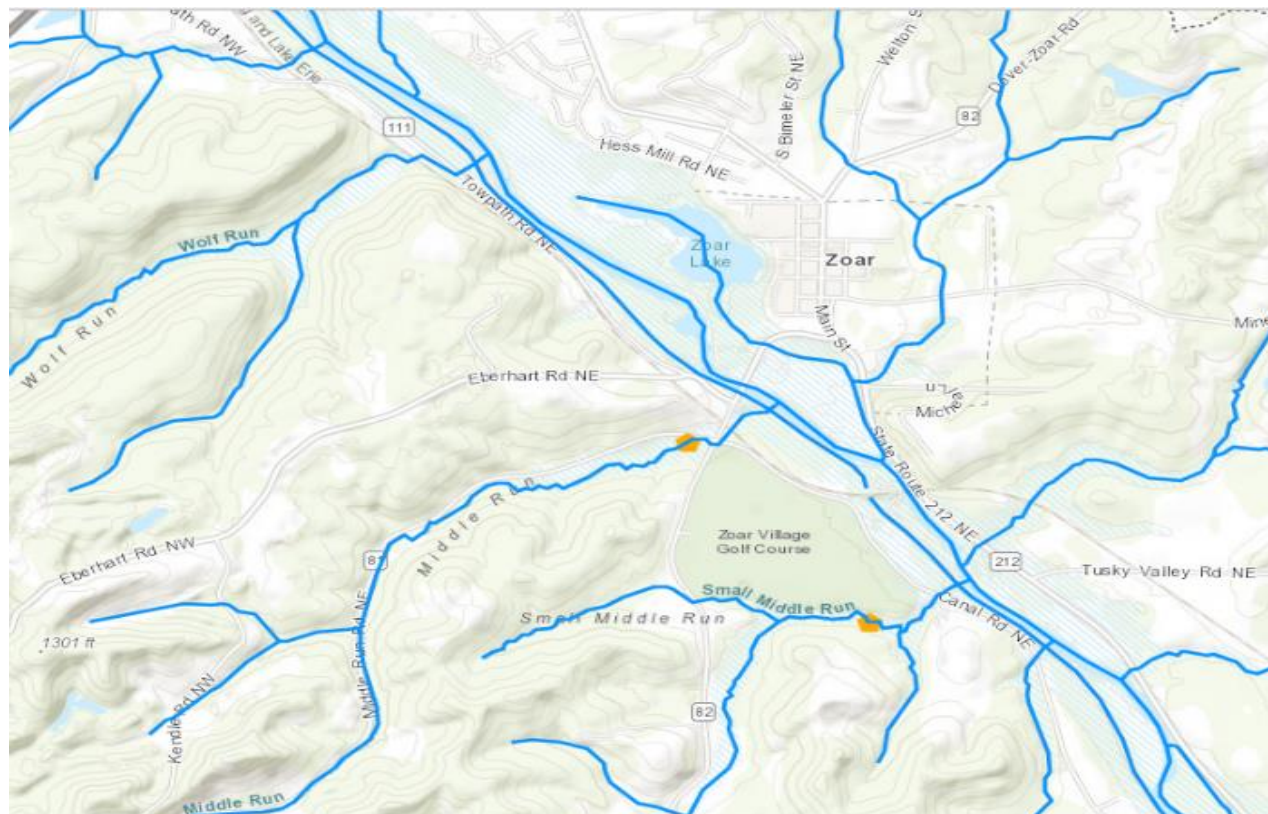
Failing HSTS is impairing four subwatersheds and resulting in a failure to meet recreation use standards, calling for a reduction of nonpoint source runoff of fecal coliform by 75% to meet TMDL standards. The most widespread land use within the Wolf Run HUC-12 is hay/pasture lands which account for 51.65% of the watershed area and there are an estimated 30 livestock operations in this area. However, much of the recreation use impairments are likely from failing HSTS. The Tuscarawas County Health Department estimates there may be an estimated 150 failing systems in this HUC-12, based on the average 30-40% failure rate and estimated number of households (2017).

Table 5. Causes and Sources of Impairment in the Wolf Run - Tuscarawas River HUC-12

Cause	Source
Siltation/Sedimentation	Habitat alteration Mining
Metals	Habitat alteration Mining
Pathogen	Septic discharges Livestock
Acid mine drainage	Mining
Low pH	Mining
Nutrients	Septic discharges Livestock Non-irrigated crop production
Flow alteration	Siltation Acid mine drainage Land development/suburbanization Non-irrigated crop production Dams

Two Tuscarawas River tributaries, Middle Run and Small Middle Run have sediment impairment. Both these tributaries, along with Wolf Run contain abandoned strip mines.

Figure 10. Map showing the tributaries impaired by sediment in the Wolf Run - Tuscarawas River HUC-12. Impairment noted with yellow hexagons



Abandoned mines in this area contribute heavily to sediment impairment. Small Middle Run and Middle Run are both in non-attainment status due to these impairments (Table 5). All three of these tributaries are impaired by other common impacts of abandoned minelands and acid mine drainage including metals and low pH in addition to siltation. These areas are heavily wooded, but have legacy mines on the hilltops.

Tables 5 and 6 from the 2009 TMDL report show the aquatic life use and recreation use attainment status for the Wolf Run, Middle Run and Small Middle Run tributaries at that time, as well as the mainstem Tuscarawas River within the Wolf Run- Tuscarawas River HUC-12. Impairment causes for the tributaries include siltation, metals, acid mine drainage, low pH and pathogens. The impairment sources are habitat alteration (much of it can be attributed to mining in these tributaries), septic discharges, and mining. Impairment causes for the mainstem include nutrients and pathogens, with impairment sources being septic discharges and livestock. In the 2016 OEPA Integrated Report, flow alteration was also included as an impairment cause (siltation, metals, pH and nutrients remained listed) and sources included siltation, land development/suburbanization, and nonirrigated crop production, in addition to acid mine drainage.

Table 6. Aquatic life use (ALU) and recreation use (RU) attainment status for the Lower Tuscarawas River tributaries. Area shaded red indicates NON or Partial attainment

Stream & RM	Attainment Status		QHEI	Impairment Cause	Impairment Source	Addressed in TMDL?
	ALU	RU				
Assessment Unit 05040001 090 Tuscarawas River Tributaries (Downstream from Sippo Creek to Upstream from Sugar Creek, excluding Sandy and Conotton Creeks)						
Small Middle Run (17-527) WWH - WAP						
0.1/0.7	NON	NON	72.5	Siltation, metals, pathogen	Habitat alteration, septic discharges	Yes
Middle Run (17-528) WWH - WAP						
0.3	NON	FULL	67.5	Siltation, metals	Habitat alteration	Yes
Wolf Run (17-529) WWH – WAP						
0.1	NON	FULL	52.0	Acid mine drainage, low pH	Mining	No – AMDAT recommended

Table 7. Aquatic life use (ALU) and recreation use (RU) attainment status for the Tuscarawas River (excluding tributaries). Area shaded red indicates NON or partial attainment

Stream & RM	Attainment Status		QHEI	Impairment Cause	Impairment Source	Addressed in TMDL?
	ALU	RU				
Tuscarawas River (17-500) WWH – Western Allegheny Plateau (WAP)						
73.6	FULL (NON)	PART	73.5	Nutrients, Pathogen	Septic discharges, livestock	Yes
72.6	FULL	PART	78.5	Pathogen	Septic discharges, livestock	Yes
63.1	FULL	PART	78.0	Pathogen	Septic discharges, livestock	Yes
61.9	FULL	PART	74.5	Pathogen	Septic discharges, livestock	Yes
55.6	FULL	FULL	86.5			No
54.2	FULL	FULL	85.0			No
53.5	FULL	FULL	88.0			No
Tuscarawas River (17-500) EWH –(WAP)						
43.8	FULL	FULL	80.0			No

2.4 Additional Information for Determining Critical Areas and Developing Implementation Strategies

This plan was developed primarily using data from Ohio EPA and USGS studies and the 2009 Total Maximum Daily Load report for the Tuscarawas River. In addition, water quality data collected by the Ohio Department of Natural Resources – Division of Mineral Resources Management was used specifically for the Wolf Run and Middle Run tributaries. These studies are included in the Works Cited Section. No additional studies or surveys were used in developing this NPS-IS Plan.

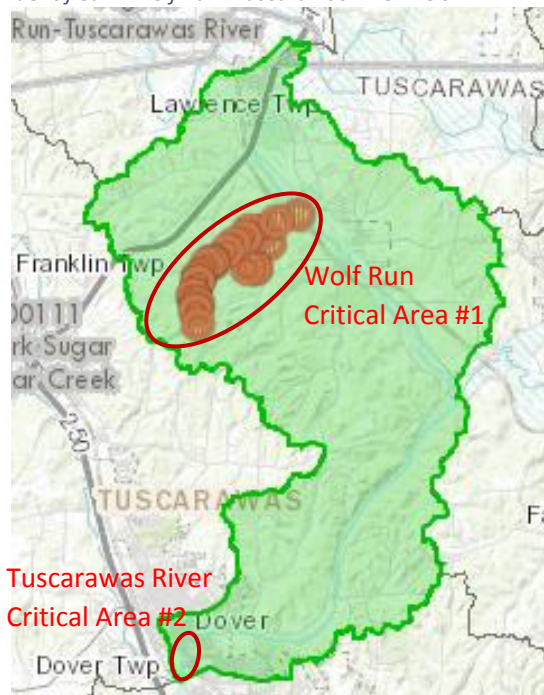
The critical areas identified in this report are currently under more intensive monitoring for project identification. ODNR-MRM currently has completed a single round of AMDAT sampling throughout the Wolf Run watershed, but it is still too soon to estimate the potential recovery of the watershed since they have not analyzed the data. The most downstream portion of the Tuscarawas River in this HUC-12 was most recently sampled for fish and macroinvertebrates in the summer of 2017 by Midwest Biodiversity Institute, in partnership with the City of Dover, Rural Action, and the Muskingum Watershed Conservation District. The resulting data showed partial attainment of WWH upstream of the low head dam in Dover and full attainment of EWH downstream of the dam. More detail on these sampling efforts and the resulting data is found in the Critical Area 2 section of this document.

Chapter 3: Critical Area Conditions and Restoration Strategies

3.1 Overview of Critical Areas

Two critical areas were identified for the Wolf Run – Tuscarawas River HUC-12. Critical Area 1 encompasses the entirety of the Wolf Run subwatershed. Critical Area 2 is the mainstem of the Tuscarawas River between river miles 63 and 58 as the river flows into and through the city of Dover, Ohio (Figures 11, 13, 15). Critical Area 1 is currently not meeting attainment for aquatic life use designation. Wolf Run is impaired by acid mine drainage. Critical Area 2 is currently partially meeting attainment for aquatic life use designation. The Tuscarawas River meets Exceptional Warm Water (EWH) standards as set forth by Ohio EPA in some sections of the river; this section of the river is not meeting that standard. In the 2009 Total Maximum Daily Load (TMDL) report published by OEPA, many areas upstream and near the low-head dam in Dover at river mile 58.4 suffer from flow alterations, siltation, and excessive metal and nutrient loadings, all of which amount to a poor aquatic environment for fish and macroinvertebrates.

Figure 11. Map showing location of critical areas identified in Wolf Run- Tuscarawas River HUC-12



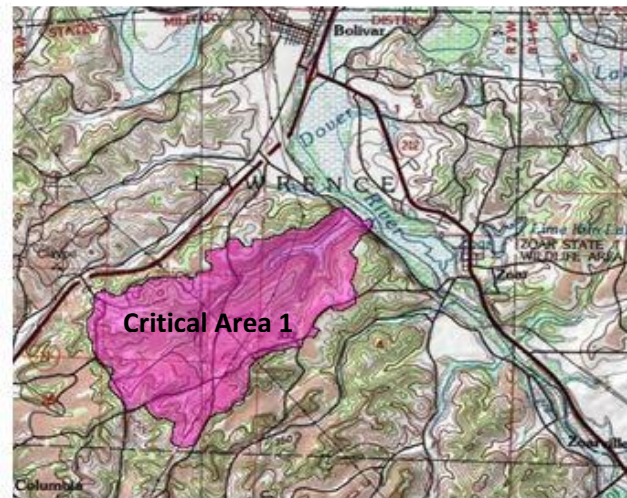
3.2 Critical Area 1: Conditions, Goals & Objectives for Wolf Run

3.2.1 Critical Area 1 - Wolf Run Detailed Characterization

Critical Area 1 encompasses the entirety of the Wolf Run subwatershed. While there are discrete sources of AMD identified, the impacts are seen along the entire length of Wolf Run. Wolf Run, a tributary of Tuscarawas River, is located between Bolivar and the town of Zoar, in Tuscarawas County at RM 69.71. It is approximately 3 miles in length with a drainage area of 3.6 square miles and has been identified by Ohio EPA's 2009 Tuscarawas River TMDL and DMRM as being impaired by acid mine drainage (AMD). Wolf Run is an area impacted by historical mining of the #5 and #6 coal seams. Although 79.2% of watershed land cover is forested, erosion and mining spoils contribute heavily to the elevated concentrations of acidity, metals, and siltation. Preliminary investigation of Wolf Run mainstem and tributaries indicate impacts to the Tuscarawas River. Low pH and high siltation levels have resulted in non-attainment of WWH for Aquatic Life Use. 2010 biological

survey results revealed low IBI and MAIS scores and detected no fish presence. Initial examination of Wolf Run through Google Earth's (version 7.1.7.2606) 'leaf off' imagery showed eleven potential source tributaries. Nearly all of the AMD impacts are due to un-reclaimed, pre-law surface mining. A couple of deep mine discharges are located in the headwaters. Further investigation of these tributaries are required to determine if they are impacting the Wolf Run mainstem. Initiating basin wide sampling, remaining reconnaissance, and Phase II sampling is necessary to begin the secondary assessment or AMDAT process. After the first round of Phase II sampling, the basin wide information was placed into the ODNR - DMRM decision making matrix and was ranked as a priority 1 basin.

Figure 12. Map showing Critical Area 1, the entirety of the Wolf Run subwatershed, shaded in pink.



ODNR-MRM collected chemical samples at 27 sites in the Wolf Run subwatershed and the Tuscarawas River mainstem downstream of Wolf Run in 2016-17. Monitoring sites are shown on the map below (figure 13).

Figure 13. Map detailing Critical Area 1 and marking ODNR-DMRM's Wolf Run tributary monitoring locations. (Ohio University watersheddata.com)

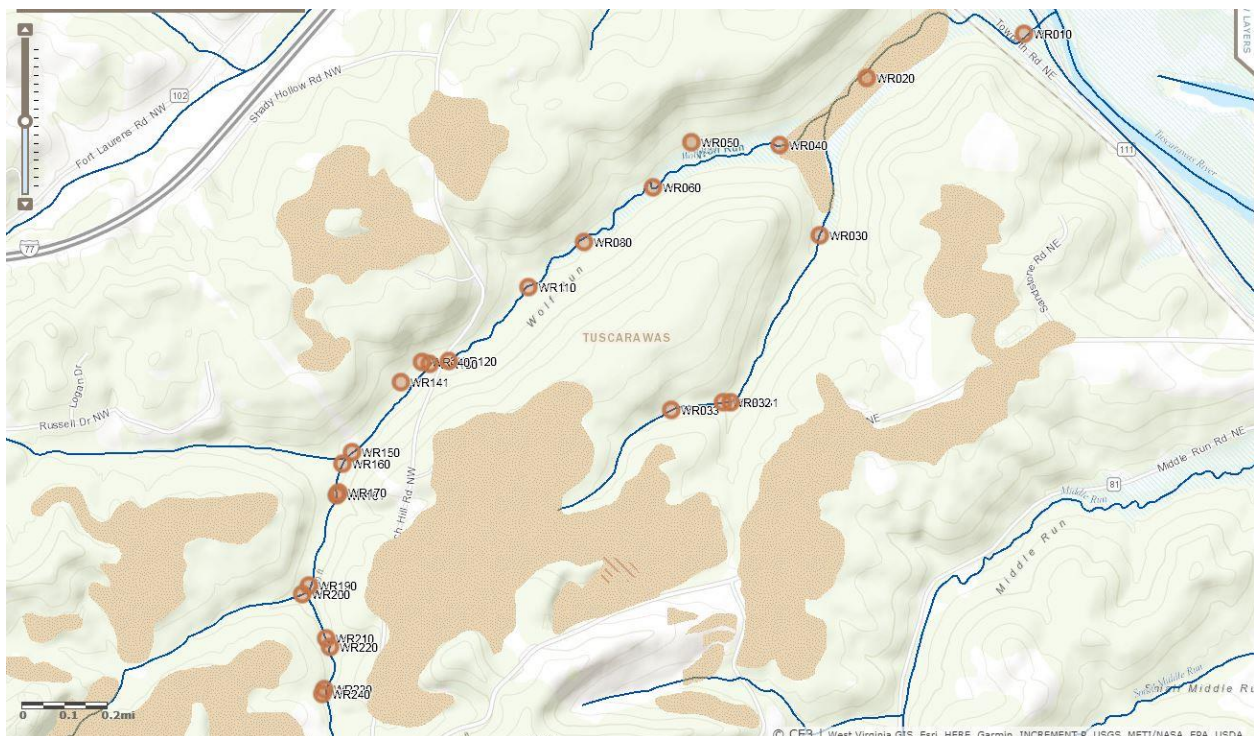
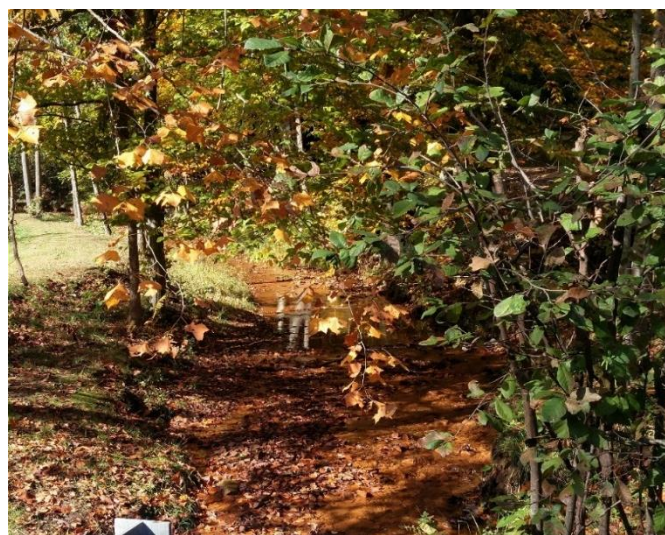


Figure 14. Aerial view of Wolf Run monitoring sites near the confluence with the Tuscarawas River. (ODNR 2016).



Tables 8 and 9 show chemical sampling locations and water quality data in the Wolf Run subwatershed. Sampling conducted by ODNR-DMRM in 2016-17 show indicators of acid

Figure 15. Wolf Run is stained by iron precipitate from acid mine drainage.



mine drainage and abandoned mineland impacts including low pH, high conductivity, high TDS, and elevated concentrations of iron, manganese, and aluminum. One tributary to Wolf Run in particular (sample sites WR030, WR031, WR032, and WR033) showed some of the highest levels of acidity, TDS, and metals. Its confluence with Wolf Run is near the mouth of Wolf Run, meaning these impacts are likely still seen at Wolf Run's confluence with the Tuscarawas River. The most downstream monitoring site on Wolf Run (WR010) had a pH of 4.95, was still net acid, had a conductivity of 1070 uS/cm, and elevated concentrations of iron, manganese and aluminum.

Table 8. Locations of ODNR-DMRM monitoring stations (ODNR 2016)

Site ID	Site Type	Location
WR010	Mainstem	Mouth of Wolf Run at OH-111 bridge
WR020	Mainstem	At RM 0.5, upstream of wetland
WR030	Tributary 1	First tributary upstream of WR020
WR031	Tributary 1- Mainstem	Approx. 0.46 mi upstream of WR030
WR032	Tributary 1- Tributary	Upstream of WR031, splits west
WR033	Tributary 1- Mainstem	Upstream of WR031, splits south
WR040	Mainstem	RM 0.8
WR050	Mainstem	RM 0.9, splits north
WR060	Mainstem	RM 1.0, splits south
WR070	Mainstem	RM 1.5
WR080	Tributary	Tributary upstream of WR070
WR090	Mainstem	RM 1.8, at French Hill Rd
WR100	Tributary	Tributary upstream of WR090
WR110	Tributary	Tributary upstream of WR090, past pond
WR120	Mainstem	RM 2.0
WR130	Tributary	Tributary upstream of WR120
WR140	Mainstem	RM 2.2
WR150	Tributary	Tributary upstream of WR140
WR160	Mainstem	RM 2.4
WR170	Tributary	Tributary upstream of WR 160
WR180	Mainstem	RM 2.6
WR190	Tributary	Tributary upstream of WR 180
WR200	Mainstem	RM 2.8
WR210	Tributary	SW of WR200
WR220	Tributary	SE of WR200 and WR210
WR230	Mainstem	RM 3.0
WR240	Mainstem	RM 3.1

Table 9. Chemical data for ODNR-DMRM monitoring stations in Wolf Run (ODNR 2017)

Site	Sample Date	pH	Conductivity (uS/cm)	Acidity (mg/L)	Alkalinity (mg/L)	TDS (mg/L)	Fe (mg/L)	Mn (mg/L)	Al (mg/L)
WR030	1/6/2016	3.34	1660	131	0	1290	8.63	21	9.29
WR031	1/6/2016	3.09	2370	254	0	2120	29.6	35.2	15.9
WR032	1/6/2016	3.13	2020	180	0	1720	25.9	27.6	8.53
WR033	1/6/2016	3.12	2480	270	0	2290	75.8	35.3	5.28
WR010	6/26/2017	4.95	1070	23.5	2.02	874	1.83	9.94	0.96
WR050	6/26/2017	6.95	403	5.04	71.9	291	<0.05	<0.03	0.1
WR020	6/26/2017	5.3	1080	20.5	3.28	895	2.02	10.1	0.751
WR040	6/26/2017	5.96	1080	11.6	9.42	900	1.55	9.63	0.258
WR060	6/26/2017	6.53	1090	10.6	11.8	904	2.35	9.65	0.4
WR080	6/26/2017	6.22	1130	13.9	8.82	944	2.54	9.97	0.53
WR110	6/26/2017	4.04	916	64.7	0	709	0.1	13.9	7.28
WR120	6/26/2017	6.24	1180	13.5	12.2	995	4.62	10.6	0.65
WR220	6/26/2017	3.13	1880	141	0	1500	6.05	28	10.1
WR240	6/26/2017	3.44	2090	184	0	2020	52.1	31.8	6.92
WR130	6/26/2017	5.86	2120	30.3	12.9	2100	1.36	28.6	0.17
WR140	6/26/2017	6.94	1130	12.9	103	863	0.28	0.5	0.46
WR141	6/26/2017	6.57	1120	14.6	11	909	5.18	10.1	0.7
WR150	6/26/2017	6.4	1100	18.3	10.7	905	5.99	10.1	0.79
WR160	6/26/2017	6.63	573	5.7	23.9	372	0.19	1.58	0.1
WR160	6/26/2017	6.71	571	4.98	24	386	0.18	1.57	0.1
WR161	6/26/2017	3.04	1760	126	0	1270	3.25	22.1	8.05
WR170	6/26/2017	5.94	1270	22.5	14.1	1070	9.68	11.9	0.77
WR190	6/26/2017	5.96	1250	25.3	13.5	1050	10	11.9	1
WR200	6/26/2017	5.82	1280	27.2	7.14	1120	6.6	13.9	0.91
WR210	6/26/2017	6.03	1240	24.7	21	1030	14.1	10.6	1.17
WR230	6/26/2017	5.82	1060	24.4	4.46	869	6.02	8.53	1.45
WR250	6/26/2017	5.97	998	15.9	7.86	801	3.77	7.22	1.62

3.2.2 Critical Area 1 - Wolf Run Detailed Biological Condition

Biological data was previously collected for Wolf Run by OEPA for the 2009 Tuscarawas River TMDL. Baseline biological water quality data exists to preliminarily evaluate the gradient of severity of acid mine drainage. Sampling site at the mouth of Wolf Run was evaluated for QHEI score. QHEI will help to determine AMD and other land use impacts on habitat and "restorability" of stream biota. Baseline MAIS and IBI data were collected in 2010 by DMRM at the mouth of Wolf Run and at RM 1.80. Macroinvertebrate and fish data will continue to be collected by ODNR-DMRM at these sites along with any additional sites. Biological monitoring in 2010 in Wolf Run showed very low quality macroinvertebrate and

fish assemblages (Table 9). No fish presence was found at the two sites monitored in Wolf Run, resulting in an IBI score of 12.00 for both sites, which is the lowest possible score. The one site at TWP Rd 379 in Wolf Run that was sampled for macroinvertebrates scored a 4.00 using the Macroinvertebrate Aggregated Index for Streams (MAIS) method. For wading sites and headwaters, sites need to score at least a 12 on the MAIS to meet criteria for WWH. The QHEI scores for the two Wolf Run sites were also lower than all of the Tuscarawas River mainstem sites.

Table 10. Wolf Run - Tuscarawas River HUC-12 Biological Data (Wolf Run monitoring sites highlighted)

12 Digit HUC Watershed Name	Map Key	OWD* Site ID	Site Description	Data Source	Sample Year	River Mile	IBI	Mlwb	MAIS	ICI	QUAL	QHEI
Wolf Run-Tuscarawas River	359	MIDR010	Middle Run Mouth	ODNR DMRM	2010	2.20			5.00			
Wolf Run-Tuscarawas River	607	R06G70	SMALL MIDDLE RUN S OF ZOAR @ TWP. RD. 411	OEPA SEDO	2003	0.10	30.00					72.50
Wolf Run-Tuscarawas River	610	R06K03	TUSCARAWAS R. NEAR BOLIVAR, DST. SANDY CREEK	OEPA SEDO	2003	72.60	41.00	9.25		42.00		78.50
Wolf Run-Tuscarawas River	612	R06P01	TUSCARAWAS R. AT BOLIVAR @ ST. RT. 212	OEPA SEDO	2003	71.73	48.00	9.58				79.00
Wolf Run-Tuscarawas River	657	R10K15	TUSCARAWAS R. JUST DST. EMPIRE DETROIT STEEL	OEPA SEDO	2003	59.20	26.00	7.27				56.50
Wolf Run-Tuscarawas River	658	R10K18	TUSCARAWAS R. NE OF DOVER @ POWER LINES DST. DOVER DAM	OEPA SEDO	2003	63.20	42.00	10.05				78.00
Wolf Run-Tuscarawas River	668	R10W17	TUSCARAWAS R. UPST. DOVER, UPST. ST. RT. 416	OEPA SEDO	2003	61.52	41.00	9.19		46.00		74.50
Wolf Run-Tuscarawas River	838	WRT010	Wolf Run Mouth	ODNR DMRM	2010	0.40	12.00					53.00
Wolf Run-Tuscarawas River	839	WRT020	Wolf Run at TWP rd 379	ODNR DMRM	2010	1.80	12.00		4.00			69.00

Aquatic Life Protection Criteria / Use Designations	Biological Indices			
	IBI Headwaters/Wading	Mlwb Wading	ICI	MAIS
Exceptional Warmwater Habitat (EWH)	50	9.4	46	N/A
Warmwater Habitat (WWH)	44	8.4	36	≥ 12
Modified Warmwater Habitat Mine Affected (MWH-MA)	24	5.5	30	N/A

N/A = not applicable

Non-significant departure from biological criteria = < 4 IBI or ICI units, or < 0.5 Mlwb units

Mlwb is not applicable to headwater streams with drainage areas ≤ 20 sq. mi.

3.2.3 Critical Area 1 - Wolf Run Detailed Causes and Associated Sources

Wolf Run is an area impacted by historical coal mining and the resulting acid mine drainage. Although 79.2% of watershed land cover is forested, erosion and mining spoils contribute heavily to the elevated concentrations of acidity, metals, and siltation. Low pH and high siltation levels have resulted in non-attainment of WWH for Aquatic Life Use. 2010 biological survey results revealed low IBI and MAIS scores and detected no fish presence. Nearly all of the AMD impacts are due to un-reclaimed, pre-law surface mining, along with a few deep mine discharges were found in the headwaters.

3.2.4 Critical Area 1 - Outline Goals and Objectives for Wolf Run

Goals

The overall nonpoint source restoration goals of any NPS-IS plan include improving or maintaining IBI, MlWB, ICI and QHEI scores so that streams achieving Full Attainment are preserved and so that streams in Partial or Non-Attainment status can achieve Full Attainment of the designated aquatic life use for that waterbody. IBI and MAIS scores in the Wolf Run Critical Area are not high enough to achieve attainment in this subwatershed. Specific goals for this critical area include:

Goal 1.1. Achieve an ICI score of ≥ 30 at the Wolf Run mouth (WR010)

- **Not Achieved** – Site currently has a narrative rating of “Very Poor”

Goal 1.2. Achieve an IBI score of ≥ 24 at the Wolf Run mouth (WR010)

- **Not Achieved** – Score is currently 12

Objectives

In order to achieve the overall nonpoint source restoration goal of Full Attainment in the Wolf Run – Tuscarawas River HUC-12, the following objectives that address acid mine drainage treatment and abatement need to be achieved within the Wolf Run critical area. These objectives are the prioritized management measure and practices in this critical area and will be the primary objectives as projects are conceptualized and developed to reduce NPS impacts in this critical area.

Objective 1.1. Reclaim the gob and spoil areas to decrease acid mine drainage

- Reclaim 40 acres of gob in the headwaters of Wolf Run

Objective 1.2. Enhance or create one (1) AMD treatment wetland.

- Utilize limestone berms to facilitate the precipitation of metals within the wetland

- Site the wetland so that the majority of the AMD sources flow through it

As these objectives are implemented, water quality monitoring (both project related and regularly scheduled monitoring) will be conducted to determine progress toward meeting the identified goals (i.e., water quality standards). These objectives will be reevaluated and modified and additional projects will be added if determined to be necessary. Acid mine drainage treatment systems can be tweaked after construction to allow for maximum treatment and efficient operation.

3.3 Critical Area 2: Conditions, Goals & Objectives for the Tuscarawas River

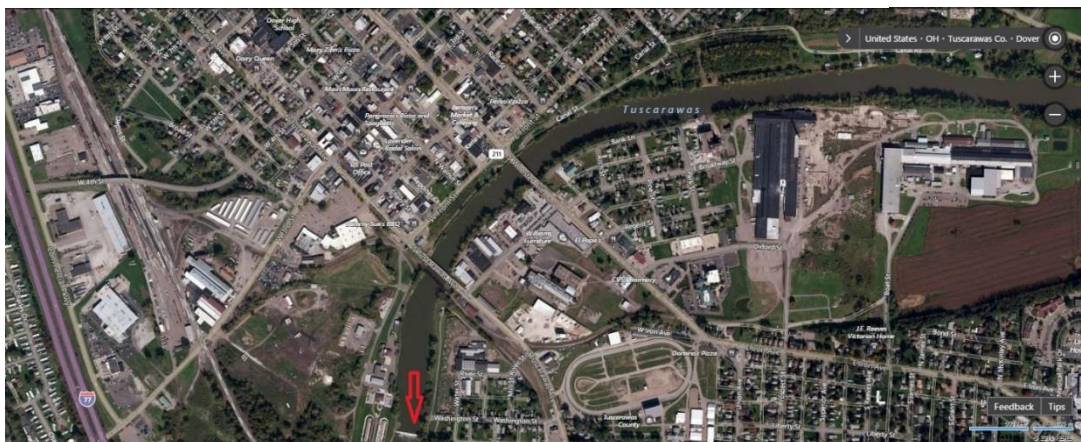
3.3.1 Critical Area 2 - Tuscarawas River (River Miles 63-58) Detailed Characterization

Critical Area 2 is located on the mainstem of the Tuscarawas River between river miles 63 – 58, as the river flows through the city of Dover. The city of Dover is centrally located in Tuscarawas County, with the Tuscarawas River bisecting the city. The Tuscarawas River has long been used for economic and recreational purposes, and still plays a major role in development in the area to this day. Monitoring conducted by the Ohio EPA in 1983 and 1988 showed this section of the Tuscarawas in non-attainment status. Conditions improved through point source pollution control and by 2010, OEPA data showed full attainment at monitoring sites at RM 58.10 and 57.80. However, data collected by Midwest Biodiversity Institute in 2017 shows only partial attainment status at RM 58.64. Aquatic life use attainment status is threatened in this critical area due to the presence of the low head dam at river mile 58.4.

The major characteristic that defines this section of the river is the presence of a low head dam at river mile 58.4. The low head dam forms a run-of-river impoundment extending more than two miles upstream. The Dover low-head dam was constructed in 1945 by the City of Dover to create a sustained river pool deep enough for industrial and recreational purposes.

The low-head dam is approximately five feet tall and 225 feet long, located at 40.51 / -81.48. It is directly adjacent to the Dover Wastewater Treatment plant, and downstream of the intake for the municipally-owned electric light plant. The pool created by the low-head dam is in used for fresh, cool water needed at the electric light plant.

Figure 16. Aerial view of Critical Area 2 as the Tuscarawas River flows through Dover. The red arrow indicates the low head dam.

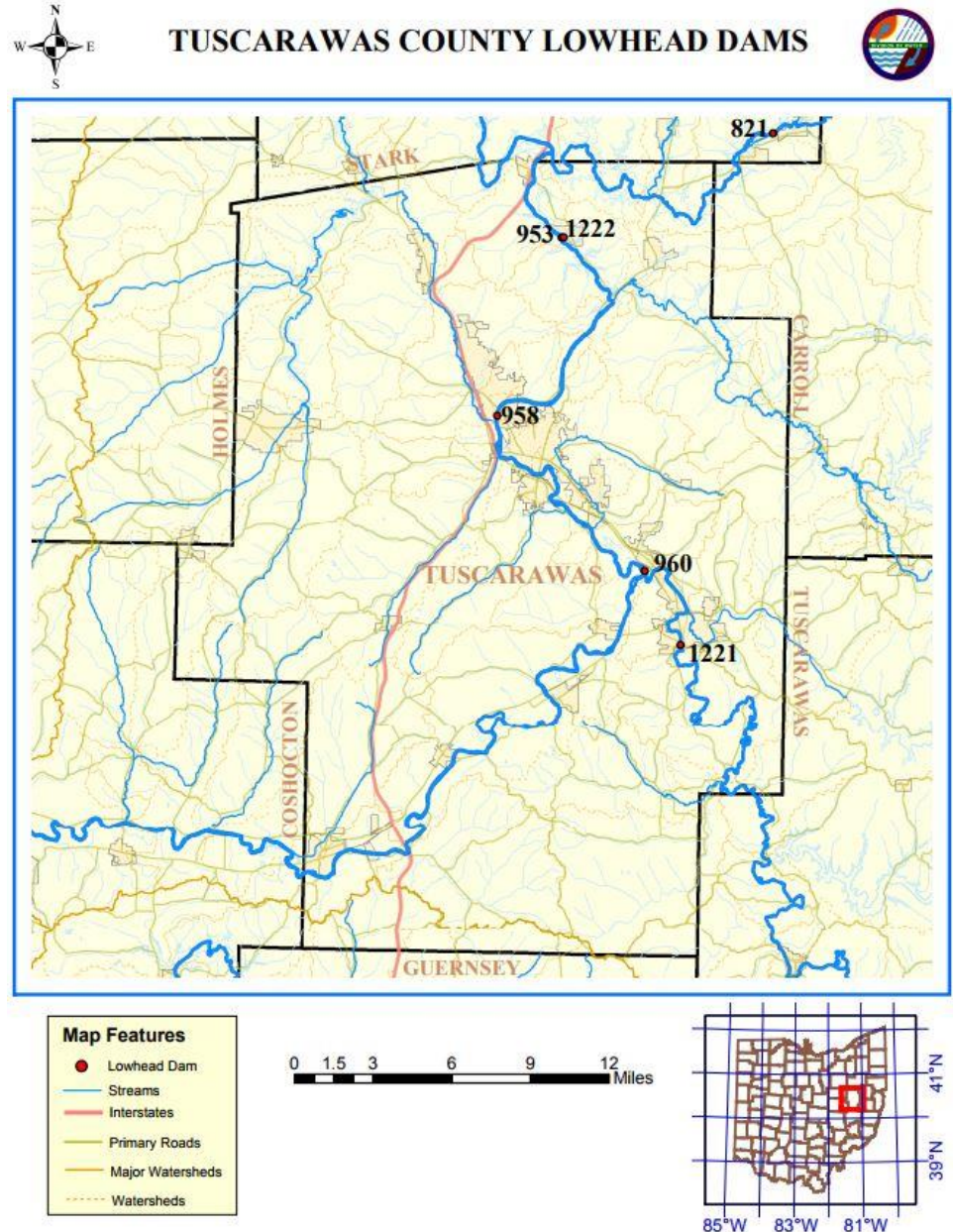


Low-head dams have been documented to have a detrimental environmental effect on the aquatic life and water quality of their adjoining water features. The Tuscarawas River meets Exceptional Warm Water (EWH) standards as set forth by Ohio EPA in some sections of the river; but the river is not meeting that standard near the low-head dam.

The low-head dam also has potential safety impacts. The Ohio Department of Natural Resources recently provided funds to match Clean Ohio funding to complete a new public

access boat ramp on the Tuscarawas River. The boat ramp is located approximately 0.5 river miles upstream of the low-head dam. With the expected increase in traffic on the Tuscarawas River from the new boat ramp, understanding the implications of the low-head dam is all the more important. The City of Dover recently received funding to conduct a water quality study near the low head dam. In addition to concern over water quality, the city is also interested in pursuing options to decrease the drowning hazard directly downstream of the dam.

Figure 17. Map showing locations of all low head dams in Tuscarawas County. The Dover low head dam is 958.

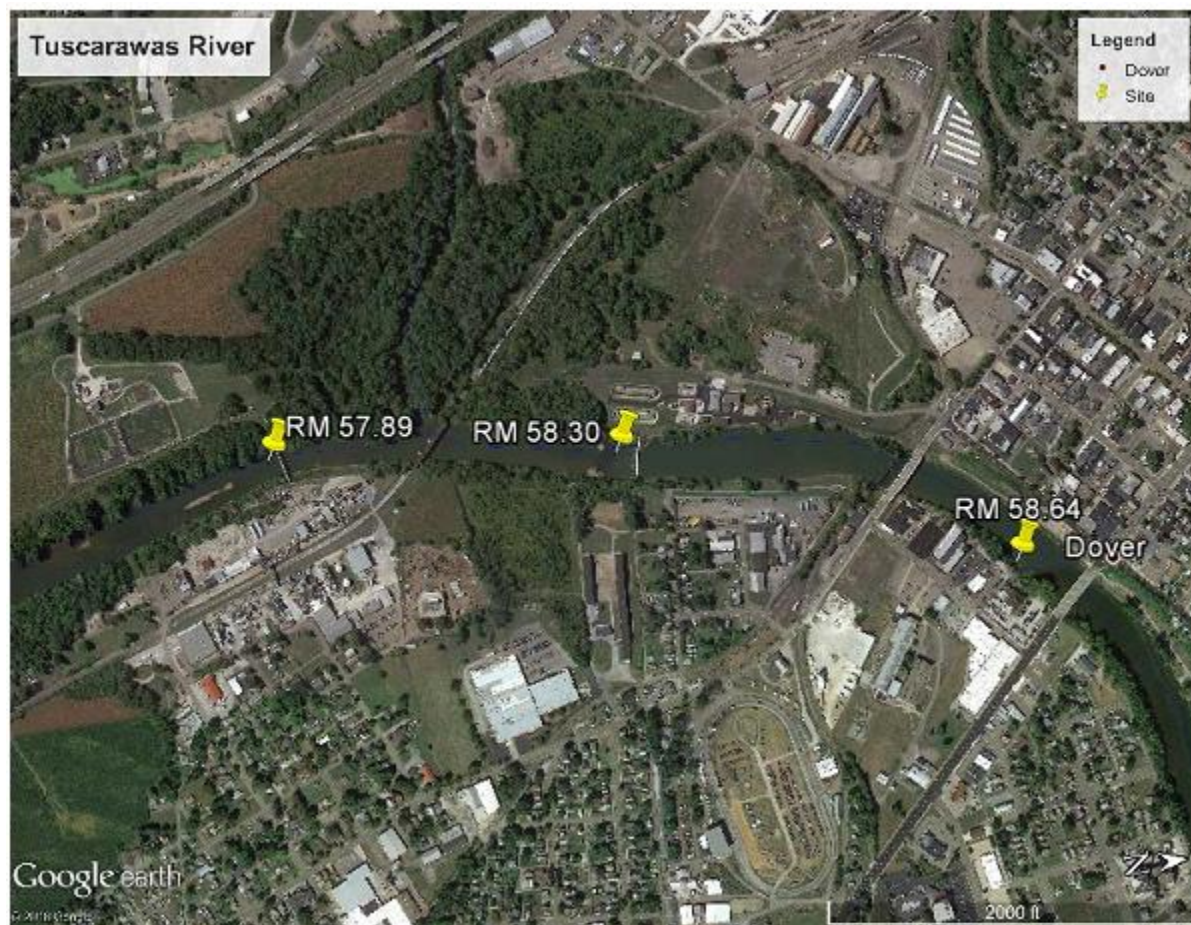


3.3.2 Critical Area 2 - Tuscarawas River (River Miles 63-58) Detailed Biological Conditions

The City of Dover received a grant from the Muskingum Watershed Conservancy District to contract with Midwest Biodiversity Institute to conduct a biological assessment of the Tuscarawas River in the vicinity of the low head dam and this critical area. The biological and habitat data represented below was collected during August-September 2017. All data was collected by MBI using methods developed and used by Ohio EPA.

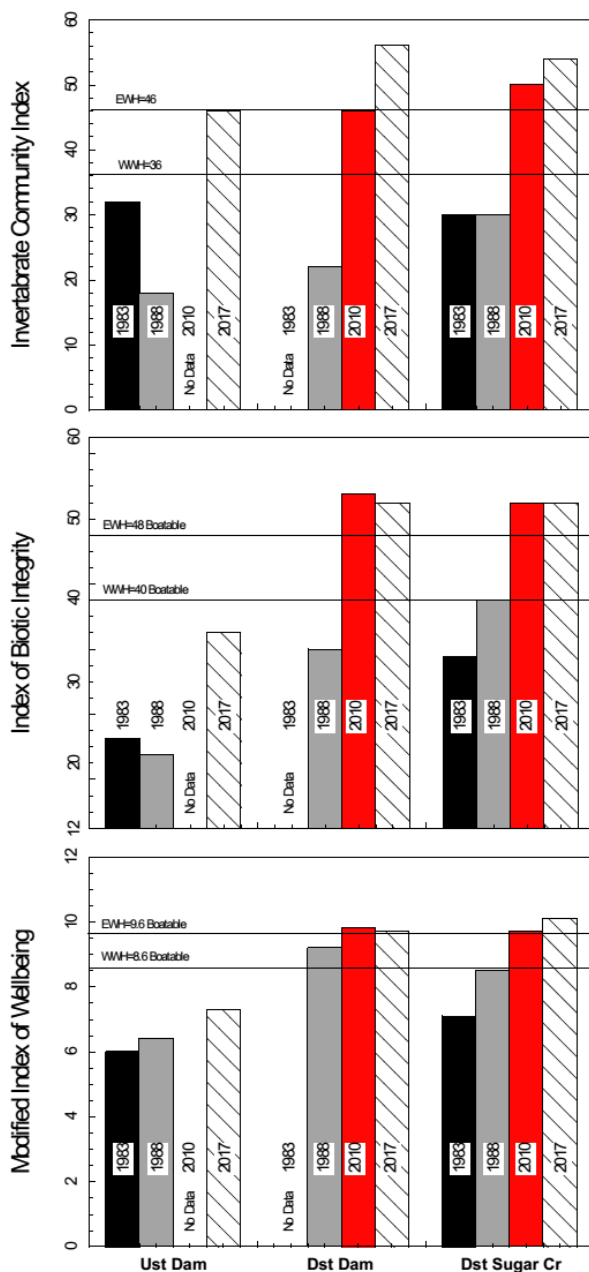
Three sample locations on the Tuscarawas River were used: one upstream of the low head dam (RM 58.64), one directly downstream of the low head dam (RM 58.30), and one immediately downstream from the confluence with Sugar Creek (RM 57.89). The most downstream site is just downstream of the boundary of this HUC-12.

Figure 18. Locations sampled by MBI in 2017 in the Tuscarawas River near Dover, OH for fish, macroinvertebrates and qualitative habitat. (MBI 2018)



The ICI scores for all three sites in 2017 surpassed the Warmwater Habitat (WWH) criteria and met Exceptional Warmwater Habitat (EWH). Although the most upstream site in the modified run of river impoundment met criteria with an ICI of 46, it is worth noting that the ICI scores increased to 56 at the site immediately downstream from the dam and continued

Figure 19. Invertebrate Community Index, Index of Biotic Integrity, and Modified Index of Well-Being scores for the Tuscarawas River in 1983, 1988, 2010 and 2017. The WWH and EWH thresholds are labeled on black lines. No data was available immediately upstream of Sugar Creek in 1988 nor immediately upstream of the dam in 2010. (MBI 2018)



to meet exceptional criteria down to the third site downstream of Sugar Creek. These results from 2017 show an improvement in the macroinvertebrate assemblage when compared to data from sampling conducted in 2010 and reported by Ohio EPA (2012). Even though the river meets attainment for ICI scores, the presence of the dam threatens attainment due to the impacts it has on available habitat.

MBI collected thirty-five native and one non-native fish species at their two sample sites downstream of the low head dam. These two sites met EWH biocriteria. Eighteen native and one non-native fish species were collected at the site upstream of the low head dam in the run of river impoundment. This site had an IBI score of 36, a non-significant departure from the WWH biocriteria score of 40, so technically meeting attainment. However, the Mlwb score was 7.2 which is a significant departure from the WWH biocriteria score of 8.6 putting it at partial attainment.

All of these scores show a marked improvement over OEPA data collected in 1983 and 1988, likely showing results of better regulation of point source pollution.

Habitat was also evaluated at these monitoring stations by MBI in 2016-17. QHEI values ranged from fair to excellent with a score of 46.50 in the run of river impoundment above the dam and scores of 78.25 downstream of the dam and 80.25 downstream of Sugar Creek. Habitat at the site above the dam was limited by

extensive embeddedness and sedimentation and a lack of riffles and runs. These were not issues at the sites downstream of the dam.

The 2017 results from the sites downstream of the dam attain both the WWH and EWH aquatic life use designation, showing similar results to those observed by OEPA in 2010. The site located upstream of the dam only partially met WWH biocriteria, as both the IBI and the

MIwb were below attainment threshold scores. The ICI score did meet WWH for macroinvertebrates. The QHEI and lower fish scores indicated lower quality habitat conditions due to the low head dam.

Table 11. Aquatic life use attainment status at sites sampled in the Tuscarawas River in 2017 by MBI and 1983, 1988, and 2010 by Ohio EPA. The IBI values are means of all fish passes combined per Ohio EPA practice (MBI 2018).

River Mile	IBI	MIwb	ICI	QHEI	Status	Comments
Western Allegheny Plateau Ecoregion – Warmwater Habitat (WWH) Designated Use						
Tuscarawas River (2017) MBI						
58.64	36 ^{ns}	7.2*	46	46.50	PARTIAL	Ust. Dam ¹
58.30	52	9.7	56	78.50	FULL	Dst. Dam
57.89	52	10.0	54	80.25	FULL	Dst. Sugar Cr.
Tuscarawas River (2010) Ohio EPA						
58.10	53	9.8	46	80.80	FULL	Dst. Dam
57.80	52	9.7	50	83.50	FULL	Dst. Sugar Cr.
Tuscarawas River (1988) Ohio EPA						
59.00	<u>21</u>	6.4*	<u>18</u> *	45.50	NON	Ust. Dam
58.00	34*	9.2	22*	66.50	NON	Dst. Dam
57.80	40	8.5 ^{ns}	30*	77.50	PARTIAL	Dst. Sugar Cr.
Tuscarawas River (1983) Ohio EPA						
59.20	<u>23</u> *	6.0*	32 ^{ns}	ND	NON	Ust. Dam
57.20	33*	7.1*	30*	ND	NON	Dst. Sugar Cr.

^{ns} Nonsignificant departure from biocriteria (≤ 4 IBI or ICI units, or ≤ 0.5 MIwb units).

* Denotes significant departure from applicable biocriteria (> 4 IBI or ICI units, or > 0.5 MIwb units). Underlined scores are in the Poor or Very Poor range.

ND – no data.

¹ – Low head dam in Dover at Dover Power& Light.

Table 2. Qualitative Habitat Evaluation Index (QHEI) scores showing good and modified habitat attributes at sites in Tuscarawas River upstream and downstream from the dam in Dover, Ohio between 1988 and 2017.

River Mile	QHEI	Good Habitat Attributes										High Influence Modified Attributes					Moderate Influence Modified Attributes												Ratios				
		No Channelization	Boulder, Cobble, Gravel	Silt Free	Good-Excellent Development	Moderate-High Sinuosity	Moderate-Extensive Cover	Fast Flow w Eddies	Little to No Embeddedness	Max Depth > 40 cm	No Riffle Embeddedness	“Good” Habitat Attributes	Channelized or No Recovery	Silt/Muck Substrates	No Sinuosity	Sparse No Cover	Max Depths <40 cm	High Influence Poor Attributes	Recovering from Channelization	Mod-High Silt Cover	Sand Substrates (Boatable sites)	Hardpan Origin	Fair- Poor Development	Low Sinuosity	≤ 2 Cover Types	Intermittent Flow or Pools <20 cm	No Fast Current Types	Mod-Extensive Embeddedness	Mod-Extensive Riffle Embeddedness	No Riffle	Poor Habitat Attributes	Ration of Poor (High) to Good	Ratio of Poor (All) to Good
Tuscarawas River (2017)																																	
58.64	46.5																																
58.30	78.5																																
57.89	80.3																																
Tuscarawas River (2010)																																	
58.10	80.8																																
57.80	83.5																																
Tuscarawas River (1988)																																	
59.00	45.5																																
58.00	66.5																																
57.80	77.5																																

(Table provided by MBI 2018)

3.3.3 Critical Area 2 - Tuscarawas River (River Miles 63-58) Detailed Causes and Associated Sources

This stretch of the Tuscarawas River (RM 63-58) is an area impacted by flow alteration, habitat modification, and development. Monitoring stations within this stretch show partial attainment of WWH for Aquatic Life Use upstream of the low head dam in Dover. Although 2017 data shows exceptional quality macroinvertebrate populations just upstream of the low head dam, the fish assemblages at this site did not meet WWH biocriteria. Compared to sites upstream and downstream of the run of river impoundment formed by the low head dam, these sites showed impairment due to modified habitat. This stretch of river is also impacted by high intensity development, as the river flows through the city of Dover.

3.3.4 Critical Area 2 - Outline Goals and Objectives for Tuscarawas River (River Miles 63-58) Critical Area

Goals

The overall nonpoint source restoration goals of any NPS-IS plan include improving or maintaining IBI, MIWB, ICI and QHEI scores so that streams achieving Full Attainment are preserved and so that streams in Partial or Non-Attainment status can achieve Full Attainment of the designated aquatic life use for that waterbody. IBI and MAIS scores in the Wolf Run Critical Area are not high enough to achieve attainment in this subwatershed. Specific goals for this critical area include:

Goal 2.1. Achieve an IBI score of ≥ 40 at Tuscarawas River mile 58.64 upstream of the Dover low head dam

- **Not Achieved** – Score is currently 36

Goal 2.2. Achieve an MIwb score of ≥ 8.6 at Tuscarawas River mile 58.64 upstream of the Dover low head dam

- **Not Achieved** – Score is currently 7.2

Goal 2.3. Maintain an ICI score of ≥ 36 at Tuscarawas River mile 58.64 upstream of the Dover low head dam

- **Achieved** – Score is currently 46

Objectives

In order to achieve the overall nonpoint source restoration goal of Full Attainment in the Wolf Run – Tuscarawas River HUC-12, the following objectives that address habitat

enhancements need to be achieved within the Tuscarawas River critical area. These objectives are the prioritized management measure and practices in this critical area and will be the primary objectives as projects are conceptualized and developed to reduce NPS impacts in this critical area.

Objective 2.1. Remove the low-head dam at Dover— or modify the low-head dam to allow fish passage

- Remove or modify the dam

Objective 2.2. Restore habitat and stream bank along the areas formerly affected by the dam impoundment.

- Restore ~25 acres of riparian habitat (50 foot riparian buffers on approximately 2 miles of river)
- Stabilize ~20,000 linear feet of stream bank along the areas formerly affected by the dam impoundments

As these objectives are implemented, water quality monitoring (both project related and regularly scheduled monitoring) will be conducted to determine progress toward meeting the identified goals (i.e., water quality standards). These objectives will be reevaluated and modified and additional projects will be added if determined to be necessary.

Chapter 4: Projects and Implementation Strategies

4.1 Projects and Implementation Strategy Overview Table

Applicable Critical Area	Goal	Objective	Project #	Project Title (EPA Criteria g)	Lead Organization (Criteria d)	Time Frame (EPA Criteria f)	Estimated Cost (EPA Criteria d)	Potential/Actual Funding Source (EPA Criteria d)
Acid Mine Drainage Treatment and Abatement Strategies								
1	1.1 1.2	1.2	1.1	Wolf Run AMD Treatment Wetland Enhancement Project	Rural Action	Short term (priority) 1-3 years	\$350,000	Ohio Department of Natural Resources – Division of Mineral Resources Management Ohio Environmental Protection Agency Section 319 Office of Surface Mining
1	1.1 1.2	1.1	1.2	Wolf Run Gob Reclamation Project	Rural Action	Short term (priority) 1-3 years	\$750,000	Ohio Department of Natural Resources – Division of Mineral Resources Management Ohio Environmental Protection Agency Section 319 Office of Surface Mining

Altered Stream and Habitat Restoration Strategies

2	2.1 2.2	2.1 2.2	2.1	Dover Low-head Dam Removal Project (option 1)	Rural Action or Athens Co. Health Department	Moderate Term (3-7 years)	In development	OEPA Section 319 City of Dover OEPA WRRSP Potential for mitigation funds
2	2.1 2.2	2.1 2.2	2.2	Dover Low-head Dam Modification Project (option 2)	Rural Action or ODNR, Division of Mineral Resources Management	Moderate Term (3-7 years)	In development	OEPA Section 319 City of Dover OEPA WRRSP Potential for mitigation funds

4.2 Project Summary Sheets

Critical Area 1: Project 1.1		
Nine Element Criteria	Information Needed	Explanation
N/A	Title	Wolf Run AMD Treatment Wetland Enhancement Project
Criteria d	Project Lead Organization and Partners	Lead Organization – Rural Action Potential Partners – Ohio Department of Natural Resources - DMRM, Ohio Environmental Protection Agency, Office of Surface Mining, private landowners.
Criteria c	HUC-12 and Critical Area	This project is located within the Wolf Run – Tuscarawas River HUC 12 # 050400011204 and is identified in this nine element plan in Critical Area # 1.
Criteria c	Location of Project	The Wolf Run AMD Treatment Wetland Enhancement Project is located in Lawrence Township, Tuscarawas County, Ohio.
N/A	Which Strategy is being addressed by this project	Acid mine drainage treatment strategies
Criteria f	Time Frame	Short term (priority) 1-3 years
Criteria g	Short Description	The Wolf Run AMD Treatment Wetland Enhancement Project is located in Lawrence Township, Tuscarawas County, Ohio. Impairments at this site include acid mine drainage resulting in high concentration of metals and acidity, and impaired habitat due to mining impacts. Proposed restoration activities include AMD treatment through the enhancement of an existing wetland, allowing time for the settling of metals and reducing acidity.
Criteria g	Project Narrative	The Wolf Run AMD Treatment Wetland Enhancement Project is located in Lawrence Township, Tuscarawas County, Ohio. Impairments at this site include acid mine drainage resulting in high concentration of metals and acidity, and impaired habitat due to mining impacts. Proposed restoration activities include AMD treatment through the enhancement of an existing wetland, allowing time for the settling of metals and reducing acidity. The tributary upstream of the existing wetland area is currently depositing ~60,820 pounds of acidity and ~18,000 pounds of metals (iron, aluminum and manganese) each year. The goals of this project are to (1) reduce acidity load by 98% and (2) reduce metal load by 75%. To achieve these goals, acid mine drainage treatment strategies will be implemented as follows:

Criteria d		<ul style="list-style-type: none"> Enhance the existing wetland in this subwatershed to allow for treatment of acid mine drainage by adding limestone berms Increase residence time of water within the wetland to facilitate the precipitation of metals within the wetland
	Estimated Total cost	\$350,000
	Possible Funding Sources	ODNR – DMRM AML funding OSM OEPA Section 319
	Identified Causes and Sources	<p>Causes</p> <ul style="list-style-type: none"> 60,820 pounds per year of acidity entering Wolf Run from the tributary at WR030 upstream of the wetland area 18,000 pounds per year of metals (iron, aluminum, and manganese) entering Wolf Run from the tributary at WR030 upstream of the wetland area <p>Sources</p> <ul style="list-style-type: none"> Mining impacts Acid mine drainage
	Part 1: How much improvement is needed to remove the NPS impairment for the whole Critical Area?	<p>This critical area is not attaining warm water habitat aquatic life use designation. IBI and MAIS scores, currently 12 and 4 respectively, will be need to be improved to allow this site to meet attainment of WWH. The ICI narrative score is “very poor.” The acidity and metal impairments in this critical area are likely having the most impact on water quality and habitat.</p> <p>The ICI score at WR010 would need to improve to ≥ 30 to meet Goal 1.1. It is currently a “very poor” narrative score, representing a numerical score of ≤ 6.</p> <p>The IBI score at WR010 would need to improve from 12 to ≥ 24 to meet Goal 1.2.</p>
Criteria b & h	Part 2: How much of the needed improvement for the whole Critical Area is <i>estimated</i> to be accomplished by this project?	Through this project, one wetland will be enhanced for acid mine drainage treatment, completing Objective 1.2. The IBI and ICI scores at WR010 are expected to improve to the “fair” narrative score for ICI (22-30) and to ~20 for IBI, but not meet the stated goals with only this project completed.

Criteria i		More reclamation work will be needed to fully meet the stated goals to meet ICI score of ≥ 30 and IBI score of ≥ 24 .
	Part 3: Load Reduction?	60,000 pounds per year of acidity 13,500 pounds per year of metals
	How will the effectiveness of this project in addressing the NPS impairment be measured?	Rural Action and ODNR-DMRM will monitor water quality discharging out of the treatment wetland. Rural Action and ODNR-DMRM will monitor biology at monitoring stations on Wolf Run downstream of the project site and at the confluence with the Tuscarawas River.
Criteria e	Information and Education	This project will be promoted via website updates, newsletter articles, and press releases. Rural Action's Middle Tuscarawas Watershed office would likely utilize this treatment site for public tours, as well.

Critical Area 1: Project 1.2		
Nine Element Criteria	Information Needed	Explanation
N/A	Title	Wolf Run Gob Reclamation Project
Criteria d	Project Lead Organization and Partners	Lead Organization – Rural Action Potential Partners – Ohio Department of Natural Resources - DMRM, Ohio Environmental Protection Agency, Office of Surface Mining, private landowners.
Criteria c	HUC-12 and Critical Area	This project is located within the Wolf Run – Tuscarawas River HUC 12 # 050400011204 and is identified in this nine element plan in Critical Area # 1.
Criteria c	Location of Project	The Wolf Run Gob Reclamation Project is located in Lawrence Township, Tuscarawas County, Ohio in the headwaters of Wolf Run.
N/A	Which Strategy is being addressed by this project	Acid mine drainage treatment and abandoned mineland reclamation strategies
Criteria f	Time Frame	Short term (priority) 1-3 years
Criteria g	Short Description	The Wolf Run Gob Reclamation Project is located in Lawrence Township, Tuscarawas County, Ohio in the headwaters of Wolf Run. Impairments at this site include exposed gob, acid mine drainage, and impaired habitat due to mining impacts. Proposed restoration activities include gob reclamation, establishing positive drainage, and AMD source control.
Criteria g	Project Narrative	The Wolf Run Gob Reclamation Project is located in Lawrence Township, Tuscarawas County, Ohio in the

		<p>headwaters of Wolf Run. Impairments at this site include exposed gob, acid mine drainage, and impaired habitat due to mining impacts. Proposed restoration activities include gob reclamation, establishing positive drainage, and AMD source control. This area is currently contributing ~60,280 pounds per year of acidity and ~18,000 pounds per year of metals (iron, aluminum, and manganese) that are entering Wolf Run from the tributary at monitoring site WR030 from the headwaters. The goals of this project are to reduce acidity load coming from the tributary at monitoring site WR030 by 80% and reduce metal load coming from the tributary at monitoring site WR030 by 80%. To achieve these goals, acid mine drainage treatment and abandoned mineland reclamation strategies will be implemented as follows:</p> <ul style="list-style-type: none"> • Reclaim approximately 30 acres of gob • Encourage positive drainage by regrading the area and creating rock channels for drainage off the site
Criteria d	Estimated Total cost	\$750,000 (\$25,000 / acre of gob restoration)
Criteria d	Possible Funding Sources	ODNR – DMRM AML funding OSM OEPA Section 319
Criteria a	Identified Causes and Sources	<p>Causes</p> <ul style="list-style-type: none"> • 60,820 pounds per year of acidity entering Wolf Run from the tributary at WR030 upstream of the wetland area • 18,000 pounds per year of metals (iron, aluminum, and manganese) entering Wolf Run from the tributary at WR030 upstream of the wetland <p>Sources</p> <ul style="list-style-type: none"> • Exposed gob • Acid mine drainage
Criteria b & h	Part 1: How much improvement is needed to remove the NPS impairment for the whole Critical Area?	This critical area is not attaining warm water habitat aquatic life use designation. IBI and MAIS scores, currently 12 and 4 respectively, will be need to be improved to allow this site to meet attainment of WWH. The acidity and metal impairments in this critical area are likely having the most impact on water quality and habitat.

Criteria i		<p>The ICI score at WR010 would need to improve to ≥ 30 to meet Goal 1.1. It is currently a “very poor” narrative score, representing a numerical score of ≤ 6.</p> <p>The IBI score at WR010 would need to improve from 12 to ≥ 24 to meet Goal 1.2.</p>
	Part 2: How much of the needed improvement for the whole Critical Area is <i>estimated</i> to be accomplished by this project?	Through this project, 30 acres of gob will be reclaimed, completing 75% of Objective 1.1. The IBI and ICI scores at WR010 are expected to improve, but not meet the stated goals with only this project completed. More reclamation work will be needed to fully meet the stated goals to meet ICI score of ≥ 30 and IBI score of ≥ 24 .
	Part 3: Load Reduction?	<p>~48,600 pounds per year of acidity entering Wolf Run from the tributary upstream of the wetland area at monitoring site WR030.</p> <p>~14,400 pounds per year of metals (iron, aluminum, and manganese) entering Wolf Run from the tributary upstream of the wetland area at monitoring site WR030.</p>
	How will the effectiveness of this project in addressing the NPS impairment be measured?	<p>Rural Action and ODNR-DMRM will monitor water quality at the project site and coming off the project site.</p> <p>Rural Action and ODNR-DMRM will monitor biology at monitoring stations on Wolf Run downstream of the reclamation site and at the confluence with the Tuscarawas River.</p>
	Criteria e Information and Education	This project will be promoted via signage at the site, website updates, newsletter articles, and press releases. Rural Action’s Middle Tuscarawas Watershed office will utilize this treatment site for public tours, as well.

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