

# Nonpoint Source Implementation Strategy Plan for Chocolate Run-Mahoning River HUC-12 (05030103-04-06)

*Approved: August 14, 2019*



*Leavittsburg Dam (photo courtesy Eastgate Regional Council of Governments)*



**EASTGATE**  
Regional Council of Governments

*Version 1.0*

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## Acknowledgements

Eastgate Regional Council of Governments (Eastgate) would like to thank the many partners who helped compile the information, maps, and projects needed to create this document. This Nine-Element Nonpoint Source Implementation Strategic (NPS-IS) Plan will help direct projects to expeditiously address the nonpoint source impairments in the Chocolate Run-Mahoning River HUC-12 of the Mahoning River watershed.

## Chapter 1: Introduction

The Chocolate Run-Mahoning River HUC-12 (05030103-04-06) is in southwestern Trumbull County, Ohio. This HUC-12 is immediately downstream of the Outlet Eagle Creek (05030103-04-05) HUC-12, the Marys Lake-West Branch Mahoning River (05030103-03-05) HUC-12, and the Charley Run Creek-Mahoning River (05030103-03-06) HUC-12 and flows into the City of Warren-Mahoning River (05030103-06-03) HUC-12. It is the furthest downstream subwatershed of the Eagle Creek-Mahoning River (05030103-04) HUC-10 in the upper Mahoning River basin. Named streams in the Chocolate Run-Mahoning River HUC-12 include the mainstem of the Mahoning River, Chocolate Run, and Lawson Run. The subwatershed is approximately 42.88 square miles in size, has a mix of undeveloped, urbanized, and agricultural land uses, and is an impaired subwatershed in non or partial attainment of Ohio's water quality standards.

State and Federal nonpoint source funding is now closely tied to strategic implementation-based planning that meets U.S. EPA's nine minimum elements of a watershed plan for impaired waters. Eastgate has taken the lead on authoring this NPS-IS with assistance from Environmental Design Group, Inc. Eastgate is a voluntary association of local governments in Northeast Ohio, Ashtabula County, Mahoning County, and Trumbull County; all cities, villages, and townships in the counties are members. Eastgate brings communities together to create a unified voice in areas such as transportation, water and air quality, land use planning, and local infrastructure projects.

Eastgate is directly responsible for a variety of federal, state, and local planning and project implementation programs. As a Metropolitan Planning Organization, an Area wide Water Quality Management Agency, an Economic Development District, and an Appalachian Regional Commission Local Development District, Eastgate continues to maintain required certifications and planning documents to qualify the region for federal and state funding, including the development of Nine-Element Nonpoint Source Implementation Strategic Plans.

### 1.1 Report Background

This NPS-IS was created as an update to the draft Mahoning River Watershed Action Plan, which was prepared in 2004 by Youngstown State University and received conditional endorsement by Ohio EPA and Ohio Department of Natural Resources. The planning process was supported by a Section 319 grant issued to the Trumbull Soil and Water Conservation District (SWCD) and was directed by the Mahoning River Consortium. Youngstown State University was retained to coordinate development of the plan using the approach described in *A Guide to Developing Local Watershed Action Plans in Ohio* (Ohio EPA, 1997), and Dr. Scott C. Martin, Professor of Civil and Environmental Engineering, served as the Project Coordinator. The Mahoning River Watershed Planning Task Force, composed of Mahoning River Consortium members and stakeholders, was established to supervise the planning process, and to play an active role in converting the results of the Watershed Inventory and public input into an action plan. The plan identifies specific goals and objectives related to water quality, and actions to be implemented to achieve those goals and objectives.

The initial goal of the project was to develop a plan for the entire Mahoning River watershed, but during the course of the project, the Ohio EPA developed a formal process for review and approval of watershed action plans, including guidelines for plan content (Appendix 8 to the *Guide to Developing Local Watershed Action Plans in Ohio*), and a decision was made to focus planning efforts on the Mosquito Creek and Lower Mahoning River subwatersheds rather than the entire Mahoning River basin. With the further change of program focus to align plans with *Ohio's Nonpoint Source Management Plan Update (FY2014 to FY2018)*, this NPS-IS is being created to guide the region in addressing nonpoint source pollution issues for the Chocolate Run-Mahoning River HUC-12 (05030103-04-06), rather than a watershed plan for all issues in the watershed. Other programs will be creating plans or lists to address other impairments that need attention in order to restore the area to

fishable, swimmable, and drinkable waters that meet water quality standards. Eastgate with assistance from other community partners expects to create NPS-IS documents for all the impaired waters with hydrologic unit codes (HUCs) in the Eastgate regional jurisdiction.

## 1.2 Watershed Profile & History

The Mahoning River watershed drains approximately 1,132 square miles and extends from its confluence with the Shenango River in Pennsylvania upstream to the headwaters located in western Columbiana County, Ohio. The Mahoning River watershed is located in seven counties: Columbiana, Stark, Mahoning, Trumbull, Portage, Ashtabula, and Geauga Counties in Ohio and Lawrence County in Pennsylvania. The flow of the river originates from a wetland (Watercress Marsh) in Butler Township, Columbiana County, where it flows north between Sebring And Alliance, passes through Berlin Reservoir and Lake Milton, and joins the West Branch just north of Newton Falls. Near Warren, the Mahoning River changes direction, curving to the east and then the southeast. After passing through Warren, the river flows southeast through several cities (Niles, McDonald, Girard, Youngstown, Campbell, Struthers, and Lowellville) before reaching Pennsylvania. From its headwaters at an elevation of 1,204 feet, the Mahoning River falls an average of 3.92 ft/mi to an elevation of 761 feet at its confluence with the Shenango River near New Castle in Lawrence County, Pennsylvania, where the two rivers become the Beaver River. The Beaver River then flows into the Ohio River, which eventually flows into the Gulf of Mexico via its confluence with the Mississippi River. Main tributaries of the Mahoning River are West Branch, Eagle Creek, Mosquito Creek, Meander Creek, Mill Creek, and Yellow Creek. The watershed contains 39 HUC-12 subwatersheds which are organized into eight HUC-10 subwatersheds.

The Mahoning River watershed is located in the Erie Drift Plains Level III ecoregion (Omernik, 1988), which is characterized by hardwood vegetation with beech-maple and elm-ash forests. Common geographic features in the ecoregion include low round hills, scattered end moraines, kettles, and wetlands. As human populations increased in the Eastern United States through the 19<sup>th</sup> and 20<sup>th</sup> centuries, much of the original forest was cleared for agricultural uses. The watershed is rich in natural resources, including fertile farmland, natural gas, coal, limestone, iron ore, and salt. These resources first attracted settlers to the region in the early 1800s and led to the development of a huge steel-making industry along the lower Mahoning River, between Warren and Youngstown, in the 20<sup>th</sup> century. Mill workers and their families, including immigrants from many countries, settled in the cities along the river, increasing the population of Youngstown to 168,330 by 1950 and Warren to 61,423 by 1967. Most of the steel mills closed in the late 1970s and early 1980s. For the past 40-50 years, there has been a rapid migration of population out of Youngstown, Warren, and other cities toward the surrounding townships, and commercial districts have largely moved from the cities to the suburbs. The environmental impacts of the steel mill industry remain along the Mahoning, however, in the form of channelization and dams with their resulting impoundments, as well as legacy pollutants in the sediment along the lower Mahoning River.

The watershed contains urban-industrial areas such as Alliance, as well as dairy, livestock, corn and soybean farming. The area from about Newton Falls northward is characterized by poor drainage, wetlands, low-gradient streams, and moisture-tolerant woodlands, underlain by clay till and fine lacustrine deposits. Between Alliance and the low-head dam in Leavittsburg, the Mahoning River changes in hydrology from a headwater stream to a small river. Two large reservoirs, Berlin Lake and Lake Milton, impound approximately 20 river miles of the mainstem between RM 84 and RM 64. The construction of these large reservoirs and low-head dams have significantly altered the natural riverine habitat and created an alternating series of free-flowing and impounded segments in the watershed (Ohio EPA, 2008).

The bedrock geology of the Mahoning River watershed consists of layered sedimentary rocks that represent former sands, silts, and muds, deposited 280 million to 400 million years ago. Rocks exposed in the watershed

are primarily from Mississippian and Pennsylvanian Age systems. Rocks of the Mississippian system, including thick shales, sandstone, and interbedded shales and sandstones, are exposed over most of Trumbull County. Rocks of the Pennsylvanian system, composed of a sequence of sandstones, shales, siltstones, coal, clay, and limestone, are exposed throughout Mahoning County. The watershed is largely covered by deposits of unconsolidated clay, sand, and gravel, left by at least two continental ice sheets. The entire watershed was at one time covered by glaciers, with the last major advance being about 20,000 years ago. The glaciers scoured and eroded the soils and bedrock as they advanced and accumulated an unsorted mixture of clay, sand, and gravel. This material was deposited in front of the ice sheet, creating glacial moraines, or left behind when the glaciers melted, forming a landscape marked by kettles, kames, and glacial erratics. Soils in the Mahoning River watershed are generally poorly drained, with moderate to steep slopes and a significant portion of the soils classified as hydric or with hydric inclusions (Ohio EPA, 2011). The availability of underground water varies from east to west with yields ranging from 25-100 to 5-25 gallons/min. in a westerly direction. A zone of higher water yields ranging from 100-500 gallons/min. is located along the Mahoning River mainstem extending roughly from the Mahoning-Columbiana county line upstream to Berlin Reservoir (ODNR, 1961).

The Köppen-Geiger climate classification in the Mahoning River watershed is known as warm summer continental, typified by average temperatures in the warmest months below 70 degrees Fahrenheit, with summer high temperatures between 70-82 degrees Fahrenheit during the day (Kottek et. al, 2006). Average temperatures during the coldest months are typically below 27 degrees Fahrenheit. Average temperatures for the year in the Mahoning River watershed are approximately 49.5 degrees Fahrenheit, with July being the warmest month (average 71.6 degrees Fahrenheit) and January being the coldest month (average 26.6 degrees Fahrenheit). On average, there are approximately 143.5 days of precipitation in the watershed, with the most precipitation occurring in December with 13.9 days and the least in August with 9.3 days. The month with the most snowfall is January, with an average of 11.8 inches of snow.

The Mahoning River and its tributaries are all assessed by Ohio EPA as Warmwater Habitat (WWH) streams with the exception of Dry Run, Silver Creek, Camp Creek, and the headwaters of the Mahoning River upstream of RM 97.69, which are assessed as Coldwater Habitat (CWH) for their Aquatic Life Use (ALU). The upper Mahoning River along its mainstem has been assessed at 35 locations, 43% of which are in full attainment of WWH standards and 57% are in partial or non-attainment of WWH standards. Tributary streams to the Mahoning River are even more impaired, with only 36.7% of tributary streams in full attainment of their designated ALU and 63.3% of tributary streams in either partial or non-attainment of their ALU. Causes of impairment in the upper Mahoning River watershed are listed as sedimentation/siltation, other flow regime alterations, nutrient/eutrophication, natural conditions of flow or habitat, direct habitat alterations, organic enrichment (sewage), bottom deposits, alteration in streamside or littoral vegetative covers, fish-passage barriers, specific conductance, low dissolved oxygen, turbidity, total dissolved solids, fish kills, and other unknown impairments. Sources of impairment in the watershed are listed as agriculture, urbanized high-density areas, upstream impoundments, channelization, unrestricted cattle access, streambank modifications/destabilization, natural sources, package plants or other permitted small flow discharges, dams/impoundments, on-site treatment systems (septic systems and similar decentralized systems), habitat modification (other than hydromodification), urban runoff/storm sewers, combined sewer overflows, loss of riparian habitat, illicit connections/hook-ups to storm sewers, municipal point source discharges, crop production with subsurface drainage, sewage discharges in unsewered areas, and upstream sources or unknown sources.

The Mahoning River mainstem is also monitored as a Large River Assessment Unit (LRAU) from the Pennsylvania border upstream to its confluence with Eagle Creek (RM 9.8 to RM 45.09). Ohio EPA monitors the LRAU and has determined that approximately 16.04 miles are in full attainment, while 25.57 miles are in partial or non-attainment of water quality standards. The LRAU is designated as impaired for Aquatic Life Use, Recreational Use, and Fish Tissue. It is not designated as impaired for Public Drinking Water as no waters in this

stretch are currently utilized for public water supply. Causes of impairment in the LRAU are listed as organic enrichment (sewage), flow regime alteration, direct habitat alterations, sedimentation/siltation, and other non-specified causes. Sources of impairment in the LRAU are listed as combined sewer overflows, municipal point source discharges, upstream sources, and dams/impoundments.

### 1.3 Public Participation and Involvement

Public participation and involvement is a critical component of any planning process and should include not only the general public but diverse stakeholders such as local officials, businesses, academia, non-profit groups, and other agencies and organizations. Eastgate is well-positioned to continuously engage these diverse stakeholders through their Citizens Advisory Board (CAB), a public forum for participation in regional planning and decision-making processes as well as their Mahoning River Corridor Initiative (MRCI) a committee composed of eleven members that represent the communities along the Mahoning River, including the mayors of those communities. In addition, Eastgate engaged the Friends of the Mahoning River (FOMR), a local non-profit watershed group who has advocated for the stewardship and restoration of the Mahoning River since 2012, for their input on the nine-element planning process.

On March 7, 2019, Eastgate hosted a session of the CAB to discuss the Chocolate Run-Mahoning River and the City of Warren-Mahoning River NPS-IS plans. Environmental Design Group, Inc., presented on the status of the Chocolate Run HUC-12 NPS-IS and facilitated a feedback session where attendees provided input on watershed issues they felt were important to help inform critical area development. Twenty local citizens attended this meeting and identified prevalent issues they saw in the Chocolate Run HUC-12, including the following:

- Backwater flooding at the Leavittsburg Dam
- Stream erosion in the Chocolate Run tributary along the Meadow Brook Memorial Park in Champion Township
- Stream erosion on the mainstem of the Mahoning River SE of the intersection of Allen Smith Road and Nelson Mosier Road in Braceville Township
- Stream erosion along the mainstem of the Mahoning River along Riverview Golf Course in Braceville Township
- Agricultural runoff concerns in the headwaters of Lawson Run
- Backwater flooding south of I-80, upstream of the Mahoning River Corridor Restoration area
- Potential package plant discharge issues at the Arhaven Estates mobile home park

Feedback from this meeting helped inform critical area development and recommendations for water quality improvement in the critical areas, as well as potential projects beyond the Leavittsburg Dam removal.

On March 12, 2019, Eastgate hosted a session of the MRCI to discuss the Chocolate Run-Mahoning River and the City of Warren-Mahoning River NPS-IS plans. Environmental Design Group, Inc., presented on the status of the Chocolate Run HUC-12 and facilitated a feedback session where attendees provided input on potential critical areas and projects for the plan, as well as opportunities for funding and project implementation. Attendees at this meeting included representatives from the following:

- Friends of the Mahoning River
- Trumbull Canoe Trails
- Trumbull County MetroParks
- Trumbull County Combined Health District
- Youngstown/Warren Regional Chamber
- Western Reserve Land Conservancy

- Trumbull County Planning Commission
- Western Reserve Port Authority
- Community Foundation of the Mahoning Valley

The potential for removal of the Leavittsburg Dam was a key point of discussion in the Chocolate Run HUC-12 at this meeting, with local flooding cited as a major issue due to the dam backwater. Other opportunities for conservation and restoration were discussed too, such as potential areas for land conservation, as well as project funding sources like the Ohio EPA 319 and the Water Resource Restoration Sponsor Program. Feedback from this meeting and further discussions with Eastgate helped inform the development of the Leavittsburg Dam removal project for inclusion in the Chocolate Run-Mahoning River NPS-IS.

On April 15, 2019, on behalf of Eastgate, Environmental Design Group presented on the Chocolate Run-Mahoning River and City of Warren-Mahoning River NPS-IS plans at a FOMR meeting and solicited feedback from the fourteen attendees on watershed issues to help inform critical areas and potential locations for projects. The Leavittsburg Dam was identified as a primary barrier to water quality in the mainstem of the Mahoning, as well as other concerns like streambank erosion



*Figure 1: Friends of the Mahoning River stakeholder input meeting.*

and lack of healthy riparian cover along portions of the streams in the HUC-12. Failing septic systems were also noted as an issue, and the effects of increased stormwater runoff from further development in the watershed.

In addition, Eastgate developed an online survey and sent it to decisionmakers (commissioners, mayors, trustees, etc.) of Trumbull County and the 11 communities that drain to the Chocolate Run-Mahoning River and/or the City of Warren-Mahoning River HUC-12s. The survey ran from May 7, 2019 to June 10, 2019, and had the following questions:

1. What watershed are you taking the survey for?
2. What do you feel are key issues affecting the water quality of the Mahoning River, its tributaries, and its natural resources in the watershed?
3. What do you feel causes these issues?
4. What locations do you see these issues in?
5. What actions do you feel could be taken to solve these issues?
6. Would you be interested in pursuing state or federal grant funding to accomplish the actions you've selected?

Two of the nine survey responses received were for the Chocolate Run-Mahoning River HUC-12. Key issues identified from the survey were contamination from septic/sanitary flows and industrial waste, and primary causes of pollution were identified as stormwater runoff, dams/impoundments, poor stream habitat, excess sediment, low oxygen, flooding, and failing septic treatment systems. Recommended actions identified for this watershed were:

- Modify flood control basins to further improve water quality
- Restore natural flow to streams
- Restore floodplains and floodplain access

- Protect streams and wetlands under conservation easements
- Improve local zoning and regulations to include conservation
- Inspect, maintain, repair or replace failing septic systems
- Implement best practices for timber harvesting
- Modify or remove dams/impoundments
- Reduce livestock access to waterways
- Implement manure management practices

Environmental Design Group also reached out to Trumbull Soil and Water Conservation District (SWCD) for feedback on nonpoint water quality issues and watershed planning in both the City of Warren-Mahoning River HUC-12 and the upstream Chocolate Run-Mahoning River HUC-12. Email correspondence identified, in addition to the established causes and sources of water quality per Ohio EPA, local resident concerns of illegal dumping and/or spills in the watershed. Trumbull SWCD also performs chemical monitoring in the Mahoning River and its tributaries. Their most recent sampling in the Chocolate Run HUC-12 was in 2014 on a tributary to the Mahoning River in Newton Township and noted high levels of iron and phosphorus. Trumbull SWCD also provides educational materials for landowners and residents on a variety of topics, including but not limited to backyard conservation, streamside management, nonpoint source pollution, watersheds, storm water, water quality monitoring, wildlife, drainage, and pond management.

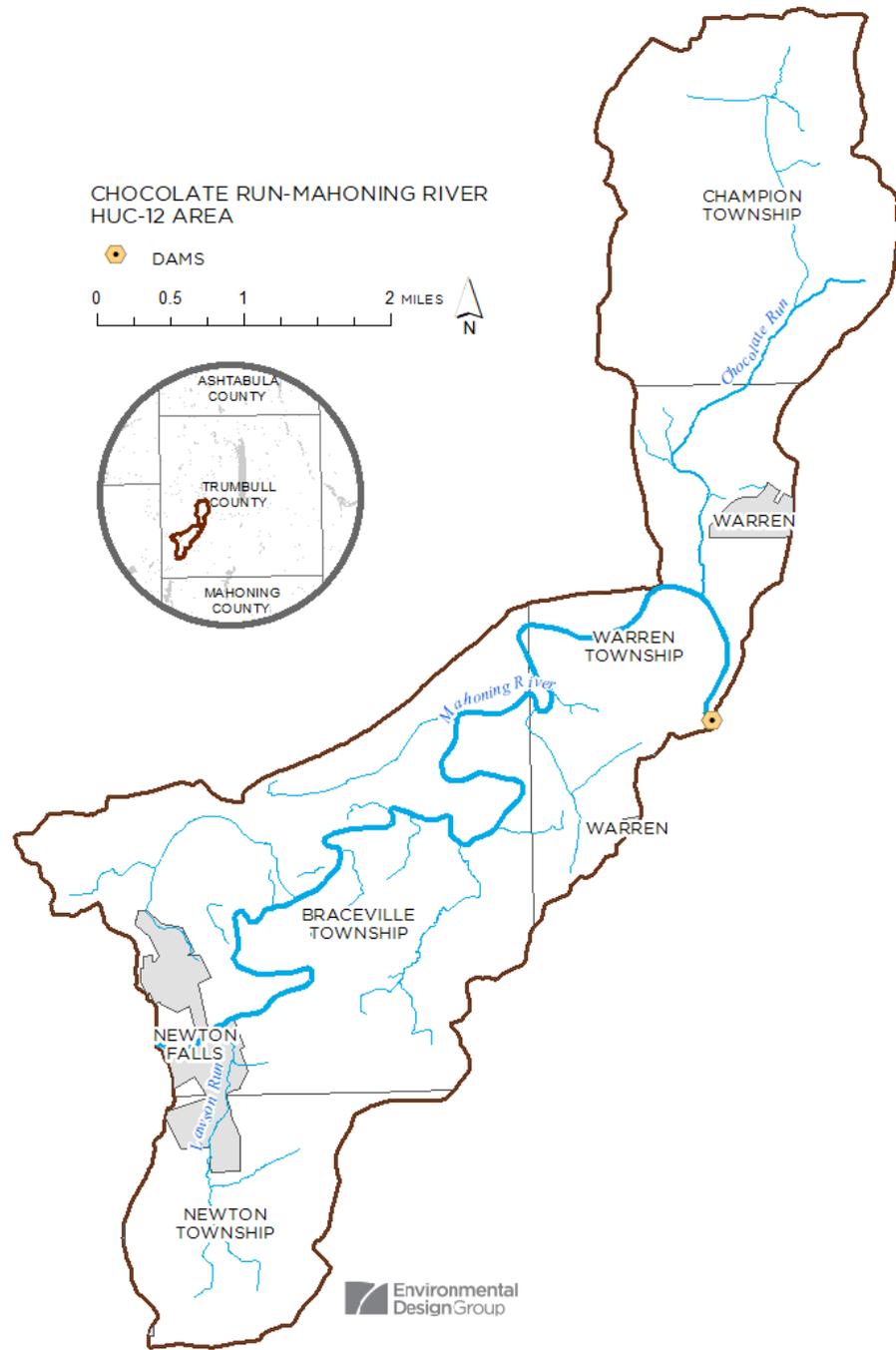
Eastgate will continue to engage stakeholders within the Chocolate Run NPS-IS planning area as projects in the plan are developed and implemented through their regular CAB and MRCI meetings, as well as through other Eastgate committees such as the Technical Advisory Committee. The MRCI in particular serves as the regional guiding body for the watershed planning and implementation process in the Lower Mahoning River. The Friends of the Mahoning River have a presence on several of these committees and will continue to stay engaged in watershed planning and project implementation.

# Chapter 2: HUC-12 Watershed Characterization and Assessment Summary

## 2.1 Summary of HUC-12 Watershed Characterization

### 2.1.1 Physical and Natural Features

The Chocolate Run HUC-12 is located within Ohio's Erie-Ontario Lake Plains (EOLP) Ecoregion. This HUC-12 drains 16.57 square miles (10,604.8 acres) and contains approximately 34.7 total stream miles (calculated from the National Hydrography Database), which includes approximately 10 miles of the mainstem of the Mahoning River from RM 53.74 to RM 43.84. Named tributaries in this HUC-12 include Chocolate Run and Lawson Run. The subwatershed is entirely located within Trumbull County and includes parts of Champion Township, the City of Warren, Warren Township, Braceville Township, Newton Falls, and Newton Township.



The Chocolate Run HUC-12's relationship to the other HUC-12 watersheds in the Mahoning River watershed are shown in the table below:

Subwatershed	HUC-12	Drainage Area (square miles)	Relationship to Chocolate Run HUC-12
Michael J Kirwan Reservoir-West Branch Mahoning River	050301030304	37.28	Upstream
Tinker Creek	050301030404	16.46	Upstream
Kale Creek	050301030301	25.50	Upstream
Headwaters Mill Creek	050301030801	37.03	Not Connected
Headwaters Eagle Creek	050301030401	20.77	Upstream
Dry Run-Mahoning River	050301030807	25.36	Downstream
Upper Mosquito Creek	050301030501	25.82	Not Connected
Coffee Run-Mahoning River	050301030809	49.52	Downstream
Lower Meander Creek	050301030703	30.65	Not Connected
Crab Creek	050301030804	21.05	Not Connected
South Fork Eagle Creek	050301030402	26.16	Upstream
Headwaters West Branch Mahoning River	050301030302	31.07	Upstream
Duck Creek	050301030601	33.21	Not Connected
Squaw Creek	050301030704	18.61	Not Connected
Mill Creek	050301030203	32.40	Upstream
Headwaters Yellow Creek	050301030805	19.35	Not Connected
Marys Lake-West Branch Mahoning River	050301030305	27.50	Adjacent-Upstream
Fish Creek-Mahoning River	050301030103	56.67	Upstream
Upper Meander Creek	050301030701	23.07	Not Connected
Indian Run	050301030802	14.27	Not Connected
Middle Mosquito Creek	050301030502	71.46	Not Connected
Deer Creek	050301030201	37.54	Upstream
Middle Meander Creek	050301030702	32.32	Not Connected
Barrel Run	050301030303	12.42	Upstream
Mud Creek	050301030602	14.18	Not Connected
Outlet Eagle Creek	050301030405	20.68	Adjacent-Upstream
Beaver Run-Mahoning River	050301030101	41.12	Upstream
Island Creek-Mahoning River	050301030204	29.03	Upstream
Little Squaw Creek-Mahoning River	050301030705	26.12	Downstream
Charley Run Creek-Mahoning River	050301030306	33.13	Adjacent-Upstream
Chocolate Run-Mahoning River	050301030406	16.55	-
Hickory Run	050301030808	27.10	Not Connected
City of Warren-Mahoning River	050301030603	40.34	Adjacent-Downstream
Beech Creek	050301030102	31.62	Upstream
Andersons Run-Mill Creek	050301030803	27.09	Not Connected
Camp Creek-Eagle Creek	050301030403	26.27	Upstream
Lower Mosquito Creek	050301030503	40.88	Not Connected
Willow Creek	050301030202	20.01	Upstream
Burgess Run-Yellow Creek	050301030806	20.18	Not Connected

The Chocolate Run HUC-12 is located entirely in the Erie Drift Plains Level III ecoregion but is divided into two Level IV ecoregions: the Low Lime Drift Plain and the Mosquito Creek/Pymatuming Lowlands. The Mahoning River mainstem and its drainage up to the confluence with Chocolate Run is located in the Low Lime Drift Plain, and nearly the entire Chocolate Run catchment is located in the Mosquito Creek/Pymatuming Lowlands. The Low Lime Drift Plain is characterized by a rolling landscape composed of low rounded hills with scattered glacial end moraines and kettles. Urban-industrial activity as well as dairy, livestock, corn, and soybean farming are common, and many ridges and lowlands are wooded. The Mosquito Creek/Pymatuming Lowlands region is characterized by poor soil drainage, wetlands, low-gradient streams, and moisture-tolerant

woodlands. The region is nearly flat and is typically underlain by clay till and fine lacustrine deposits. The historical vegetation was beech forest, but today many areas are cleared for dairy farms or systematically cleared and managed as woodlots.

Predominant soils in the Chocolate Run HUC-12 are Mahoning, urban land (where 80% of the surface is covered by asphalt, concrete, buildings, or other structures), Fitchville, Haskins, Sebring, Remsen, udorthents (areas of disturbed soils where the upper soil material has been removed, filled or graded), Canadea, Canadice, Orrville, Glenford, Holly, Jimtown, and Tioga. These soils are mainly characterized as poorly to somewhat poorly draining with slow permeability and runoff and can be challenging for traditional septic systems. They are also generally poorly suited to agricultural use unless tile, ditches or other surface/subsurface drainage systems are used. Tiling and channelization of streams has been used in the rural areas of this watershed to help manage drainage, which can cause excessive erosion and sedimentation in streams and contribute to poor in-stream habitat. In addition, removal of riparian vegetation often accompanies channelization which further exacerbates streambank erosion and poor in-stream habitat.

Symbol	Acres	Name	Percent of HUC-12
MgA	4162.9	Mahoning silt loam, 0 to 2 percent slopes	14.91%
Ur	3052.8	Urban Land	10.93%
FcA	2598.1	Fitchville silt loam, 0 to 2 percent slopes	9.31%
MgB	2288.7	Mahoning silt loam, 2 to 6 percent slopes	8.20%
HaA	2255.8	Haskins loam, 0 to 2 percent slopes	8.08%
Sb	1653.5	Sebring silt loam	5.92%
RmB	1334.2	Remsen silt loam, 2 to 6 percent slopes	4.78%
Ud	1022.9	Udorthents, loamy	3.66%
CcA	831.2	Canadea silt loam, 0 to 2 percent slopes	2.98%
Cb	771.0	Canadice silty clay loam	2.76%
RoB	767.3	Remsen-Urban land complex, 2 to 6 percent slopes	2.75%
Or	694.5	Orrville silt loam, frequently flooded	2.49%
W	598.4	Water	2.14%
GfB	561.6	Glenford silt loam, 2 to 6 percent slopes	2.01%
HaB	510.6	Haskins loam, 2 to 6 percent slopes	1.83%
FcB	510.4	Fitchville silt loam, 2 to 6 percent slopes	1.83%
Ho	487.7	Holly silt loam, frequently flooded	1.75%
JtA	480.6	Jimtown loam, 0 to 2 percent slopes	1.72%
RmA	453.1	Remsen silt loam, 0 to 2 percent slopes	1.62%
Tg	412.4	Tioga loam, occasionally flooded	1.48%

The major geologic types in this HUC-12 are Allegheny and Pottsville Groups, Berea Sandstone and Bedford Shale, and the Maxville Limestone with the Rushville, Logan, and Cuyahoga Formations. Aquifers in the HUC-12 are the Alliance Thin Upland Aquifer, the Mahoning Alluvial Aquifer, and the Mahoning Buried Valley Aquifer, and the locations of highest yield (5-25 gpm) in the HUC-12 are along the mainstem of the Mahoning River and its adjacent floodplain areas. The Mahoning River mainstem, portions of Chocolate Run and Lawson Run, and some unnamed tributaries within the HUC-12 are also located in the Federal Emergency Management Agency (FEMA) designated Special Flood Hazard Area.

### Rare, Threatened, and Endangered Species

The Ohio Department of Natural Resources (ODNR) Division of Wildlife catalogs known rare, threatened, and endangered species through its Natural Heritage Database Program. A request was made to ODNR for a list of known species identified in the Chocolate Run HUC-12. According to ODNR's Natural Heritage Database, the Straw Sedge (*Carex straminea*, observed in 2014), Thin-leaved Sedge (*Carex cephaloidea*, observed in 2013), and Eastern Sand Darter (*Ammocrypta pellucida*, observed in 1980) have all been identified in the HUC-12. However, below is a table of known species identified in Trumbull County (which the Chocolate Run HUC-12 is entirely located in) that have the potential to be present in the HUC-12. The Natural Heritage Database relies on information supplied by many individuals and organizations, and a lack of records for any particular area is not a statement that rare species or unique features are absent from that area.

Status: X = Extirpated, E = Endangered, T = Threatened, PT = Potentially Threatened, SC = Species of Concern, SI = Species of Interest

State Status	Federal Status	Species	Common Name	Most Recent County Record
<b>Fauna</b>				
E	SC	<i>Cryptobranchus alleganiensis alleganiensis</i>	Eastern Hellbender	-
E		<i>Circus cyaneus</i>	Northern Harrier	2003
E		<i>Ichthyomyzon fossor</i>	North Brook Lamprey	2007
E		<i>Ichthyomyzon greeleyi</i>	Mountain Brook Lamprey	2013
E		<i>Fusconaia maculata maculata</i>	Long-solid	1850
E		<i>Pleurobema clava</i>	Clubshell	-
E	E	<i>Myotis sodalis</i>	Indiana Myotis	-
E		<i>Ursus americanus</i>	Black Bear	2001
E		<i>Sistrurus catenatus catenatus</i>	Eastern Massasauga	1956
T		<i>Psilotreta indecisa</i>	Caddisfly sp.	2008
T		<i>Ligumia recta</i>	Black Sandshell	1995
SC		<i>Hemidactylium scutatum</i>	Four-toed Salamander	2009
SC		<i>Colinus virginianus</i>	Northern Bobwhite	1995
SC		<i>Dolichonyx oryzivorus</i>	Bobolink	2014
SC		<i>Ammocrypta pellucida</i>	Eastern Sand Darter	2007
SC		<i>Esox masquinongy</i>	Muskellunge	2013
SC		<i>Orconectes (Crokerinus) obscurus</i>	Allegheny Crayfish	2008
SC		<i>Orconectes (Crokerinus) propinquus</i>	Great Lakes Crayfish	2007
SC		<i>Lasmigona compressa</i>	Creek Heelsplitter	2013
SC		<i>Pleurobema sintoxia</i>	Round Pigtoe	2013
SC		<i>Ptychobranchus fasciolaris</i>	Kidneyshell	1850
SC		<i>Condylura cristata</i>	Star-nosed Mole	1974
SC		<i>Eptesicus fuscus</i>	Big Brown Bat	2012
SC		<i>Lasiurus borealis</i>	Red Bat	2012
SC		<i>Lasiurus cinereus</i>	Hoary Bat	2012
SC		<i>Mustela erminea</i>	Ermine	1987

SC		<i>Myotis lucifugus</i>	Little Brown Bat	2012
SC	T	<i>Myotis septentrionalis</i>	Northern Long-eared Bat	2012
SC		<i>Perimyotis subflavus</i>	Tri-colored Bat	2012
SC		<i>Peromyscus maniculatus</i>	Deer Mouse	1982
SI		<i>Carpodacus purpureus</i>	Purple Finch	1994
SI		<i>Catharus guttatus</i>	Hermit Thrush	2002
SI		<i>Empidonax minimus</i>	Least Flycatcher	1996
X		<i>Actinonaias ligamentina ligamentina</i>	Mucket	1995
<b>Flora</b>				
T		<i>Buxbaumia aphylla</i>	Bug-on-a-stick	2003
P		<i>Calla palustris</i>	Wild Calla	2006
T		<i>Callitriche verna</i>	Vernal Water-starwort	1971
P		<i>Carex albolutescens</i>	Pale Straw Sedge	1990
P		<i>Carex cephaloidea</i>	Thin-leaved Sedge	2013
P		<i>Carex lupuliformis</i>	False Hop Sedge	1989
P		<i>Carex pallescens</i>	Pale Sedge	1987
T		<i>Carex projecta</i>	Necklace Sedge	1997
P		<i>Carex straminea</i>	Straw Sedge	2006
E		<i>Clintonia umbellulata</i>	Speckled Wood-lily	1987
T		<i>Epilobium strictum</i>	Simple Willow-herb	1987
P		<i>Equisetum sylvaticum</i>	Woodland Horsetail	1975
P		<i>Geum rivale</i>	Water Avens	1998
E		<i>Isoetes engelmannii</i>	Appalachian Quillwort	1987
P		<i>Larix laricina</i>	Tamarack	1955
T		<i>Lathyrus ochroleucus</i>	Yellow Vetchling	1984
P		<i>Luzula bulbosa</i>	Southern Woodrush	2010
E		<i>Lycopodium lagopus</i>	One-coned Club-moss	1995
P		<i>Moehringia lateriflora</i>	Grove Sandwort	1998
P		<i>Persicaria robustior</i>	Coarse Smartweed	2008
P		<i>Phegopteris connectilis</i>	Long Beech Fern	1960
E		<i>Potamogeton pulcher</i>	Spotted Pondweed	1992
T		<i>Sparganium androcladum</i>	Keeled Bur-reed	2011
T		<i>Triadenum walteri</i>	Walter's St. John's-wort	2009
E		<i>Vaccinium myrtilloides</i>	Velvet-leaved Blueberry	1995
T		<i>Viburnum alnifolium</i>	Hobblebush	1989
T		<i>Viburnum opulus var. americanum</i>	Highbush-cranberry	1995

Status: X = Extirpated, E = Endangered, T = Threatened, PT = Potentially Threatened, SC = Species of Concern, SI = Species of Interest

In 2014, an angler fishing just downstream of the Leavittsburg Dam caught an Eastern Hellbender (*Cryptobranchus alleganiensis alleganiensis*) which was confirmed by the Ohio State University's Amphibian and Reptile Conservation Coordinator at the Ohio Biodiversity Conservation Partnership. Hellbenders are the largest amphibian in North America and are State-Endangered and a Federal Species of Concern.

## 2.1.2 Land Use and Protection

### Land Cover

Land cover in the Chocolate Run HUC-12 is characterized in the Ohio EPA’s 2018 Integrated Assessment Report as 24.10% Developed, 38% Forest, 9.6% Grass/Pasture, 14.4% Row Crops, and 14% Other. 2011 data from the National Land Cover Database (NLCD) lists the dominant types of land cover in the HUC-12 as deciduous forest, cropland, and developed open space. The 2016 Ohio EPA Integrated Assessment Report estimates historical wetland presence at 18.5% in the Chocolate Run HUC-12 and a current wetland presence of 5.47%, which is an over 70% loss of wetlands. Approximately 264 wetlands were inventoried in the HUC-12 through the National Wetland Inventory (NWI). The 2016 Integrated Assessment Report assigned the HUC-12 an area-weighted Level 1 score of 63.79, indicating the average quality of NWI wetlands in the HUC-12 are high Category II or Category III, or “Superior Wetland Habitat.” Despite not being in attainment of water quality standards, the Chocolate Run HUC-12 has approximately 65.1% of its stream miles flowing through wooded riparian and/or wetland cover, as estimated from a GIS analysis using the NLCD.

Assessment Unit Landuse

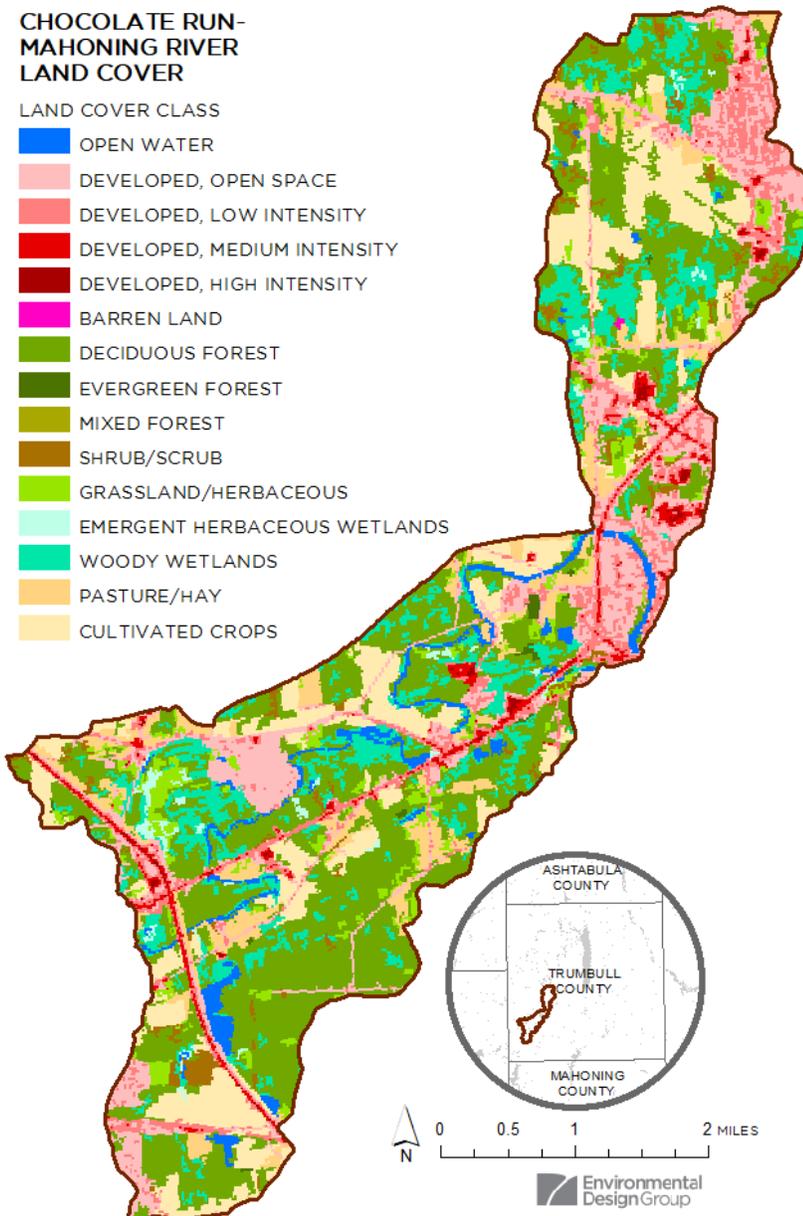
- Developed 24.10%
- Forest 38.00%
- Grass/Pasture 9.60%
- Row Crops 14.40%
- Other 14.00%



### CHOCOLATE RUN-MAHONING RIVER LAND COVER

#### LAND COVER CLASS

- OPEN WATER
- DEVELOPED, OPEN SPACE
- DEVELOPED, LOW INTENSITY
- DEVELOPED, MEDIUM INTENSITY
- DEVELOPED, HIGH INTENSITY
- BARREN LAND
- DECIDUOUS FOREST
- EVERGREEN FOREST
- MIXED FOREST
- SHRUB/SCRUB
- GRASSLAND/HERBACEOUS
- EMERGENT HERBACEOUS WETLANDS
- WOODY WETLANDS
- PASTURE/HAY
- CULTIVATED CROPS



NLCD Land Cover	Acres	Percent of HUC-12
Deciduous Forest	3660.5	34.5%
Cultivated Crops	1448.5	13.7%
Developed Open Space	1390.9	13.1%
Woody Wetlands	1142.6	10.8%
Developed Low Intensity	888.2	8.4%
Hay/Pasture	673.1	6.4%
Herbaceous	429.0	4.0%
Open Water	321.6	3.0%
Developed Medium Intensity	233.0	2.2%
Shrub/Scrub	224.4	2.1%
Emergent Herbaceous Wetlands	99.8	0.9%
Developed High Intensity	49.1	0.5%
Evergreen Forest	31.6	0.3%
Barren Land	2.7	0.03%

### Land Use

Land use data received from Eastgate shows that land use in the Chocolate Run HUC-12 is predominantly agricultural and residential, with the residential density concentrated around the Mahoning River mainstem near RM 53 in the City of Warren and Warren Township and in the headwaters of Chocolate Run in Champion Township. Interstate 80 (the Ohio Turnpike), US Route 422, and State Routes 5 and 82 traverse the watershed, and three active rail lines owned by CSX and Norfolk Southern operate within the HUC-12 (14 miles of track). Other significant features include:

- LaBrae High School (68 acres)
- 422 Auto Wrecking (junkyard, 17.4 acres)
- Riverview Golf Course (215.1 acres)

GIS analysis using the NLCD's Impervious Cover Dataset estimates that 526 acres or 4.9% of the Chocolate Run HUC-12 are impervious cover, most of which is concentrated along Interstate 80 and the other major roads, particularly near the confluence of Chocolate Run with the Mahoning River.

Land Use	Acres	Percent of HUC-12
Agriculture	5116.6	52.2%
Residential	2218.7	22.6%
Vacant	874.8	8.9%
Commercial	550.8	5.6%
Government or Public	467.2	4.8%
Industrial	228.2	2.3%
Rail	169.5	1.7%
Water	149.7	1.5%
No Data	23.0	0.2%

### Land Protection

Parks GIS data received from Eastgate notes approximately 165.6 acres of parkland in the Chocolate Run HUC-12, represented by community parks, township parks, the Trumbull County MetroParks, and preserved land through the Clean Ohio Fund:

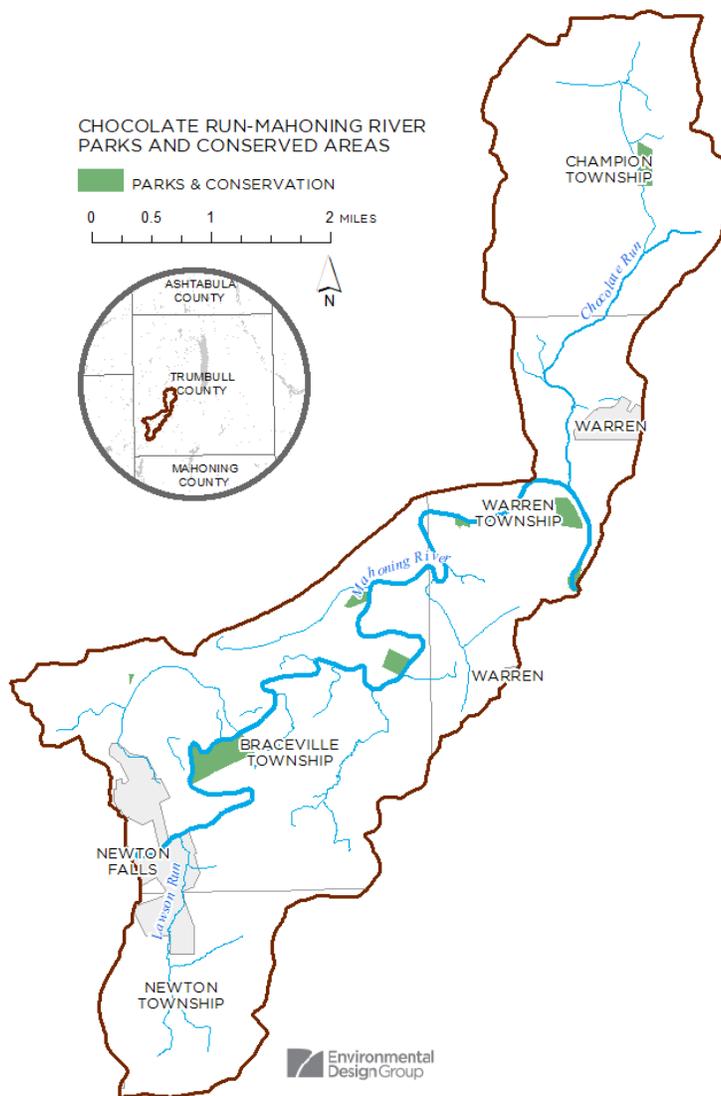
- Braceville Township Park – approximately 1.4 acres in the HUC-12
- Canoe City Metropark – approximately 5.3 acres in the HUC-12
- Mahoning River Floodplain Preservation (Clean Ohio) – approximately 11.9 acres in the HUC-12
- Labrae Athletic Club (baseball fields) – approximately 20 acres in the HUC-12
- Johnson Park – 26.9 acres in the HUC-12
- Meadow Brook Memorial Park – approximately 28.4 acres in the HUC-12
- Mahoning River Corridor Preservation (Clean Ohio) – approximately 71.7 acres in the HUC-12

The Canoe City MetroPark is operated by Trumbull County Metroparks and flanks the Mahoning River for 1,545 feet upstream of the Leavittsburg Dam. It provides public access to the Mahoning River in the HUC-12 and has facilities for fishing and canoeing. LaBrae Athletic Club, Meadow Brook Memorial Park, and the two Clean Ohio preservation sites also have river or stream frontage, but do not allow for public access to the water.

Trumbull County has adopted riparian setbacks into its County subdivision regulations (701.10, Establishment of Riparian Buffer Areas). Riparian and wetland setbacks function similarly to front, side, and rear yard setback zoning but are placed along stream corridors rather than parcel lines. They protect the services of riparian areas by providing reasonable controls governing structures and uses in riparian setbacks. Braceville Township, Norton Township, Warren Township, and Champion Township have not adopted local riparian setback regulations beyond the County regulations. Newton Falls applies riparian setback regulations in line with Trumbull County’s regulations, and the City of Warren has not adopted riparian setbacks.

### STS and NPDES Discharges

Data obtained from Eastgate shows approximately 194 septic treatment systems in the Chocolate Run HUC-12, with the majority clustered in Warren Township and Champion Township along Chocolate Run and the Mahoning River mainstem upstream from its confluence with Duck Creek. Failing septic discharge is identified as a water quality concern in the Chocolate Run HUC-12 and STS maintenance and repair should be prioritized in locations where connection to a sewer line is not planned or feasible.



Five individual NPDES permit holders discharge to the Chocolate Run HUC-12; none are major (greater than 1 MGD flow). These minor permit holders are listed below, along with the receiving stream.

Ohio EPA Permit #	Facility Name	Permit Type Description	Facility Type Description	Receiving Stream
3PG00106*FD	Warren No 3 WWTP	Individual Permit - Public	County - Under 0.1 MGD	Mahoning River
3PR00162*ED	Short Stop Truck Plaza	Individual Permit - Public	Semi-Public - Under 0.05 MGD	Unnamed tributary to Mahoning River
3PR00645*AD	Dollar General	Individual Permit - Public	Semi-Public - Under 0.05 MGD	Mahoning River
3PV00064*ED	Arhaven Estates Mobile Home Park	Individual Permit - Public	Mobile Home Park	Mahoning River
3PV00067*FD	Pleasant Park Mobile Court	Individual Permit - Public	Mobile Home Park	Chocolate Run

Of these permitted dischargers, the Pleasant Park Mobile Court was identified in the *Biological and Water Quality Study of the upper Mahoning River and Selected Tributaries, 2006* (Mahoning TSD, 2008) as contributing to elevated phosphorus levels in Chocolate Run.

#### *Stormwater Management and Regulation*

All of the municipalities and townships within the Chocolate Run HUC-12 are part of the regulated Municipal Separate Storm Sewer System (MS4). Stormwater can be one of the most significant and difficult nonpoint source pollutants to address within a watershed. Stormwater is problematic because any substance such as chemicals, nutrients, sediment, and other debris is carried into the storm sewer system and discharged untreated into surrounding waterbodies. This has subsequent effects on drinking water, recreational activities, and industries that rely on clean water. The main sources of stormwater runoff come from urban, suburban, and agricultural activities; with each source effecting water quality in a variety of ways. Champion Township, Warren Township, Braceville Township, Newton Township, and the City of Warren and Newton Falls are all regulated as Phase II communities under the MS4 program with the Ohio EPA. Each regulated MS4 is required to develop and implement a stormwater management program to reduce the contamination of stormwater runoff and prohibit illicit discharges. Trumbull County has also implemented a Regional Storm Water District, which includes ten townships and six municipalities. In the Chocolate Run HUC-12, Champion Township, Warren Township, Newton Township, Newton Falls are all part of the Regional Storm Water District, which charges a drainage fee based on Equivalent Hydrologic Units (EHUs). The calculation assigns a value for residential properties and a proportionally higher value for commercial and industrial properties based on acreage and EPA runoff coefficients. The fees collected can be used for technical, labor, and support services or for community-specific capital improvement projects. More information on the Regional Storm Water District can be found at: <http://stormwater.co.trumbull.oh.us/index.html>.

#### *Leavittsburg Dam*

Located in the Chocolate Run HUC-12 on the Mahoning River at approximately RM 42.99, the Leavittsburg Dam is a low-head earthworks dam in Warren Township and owned by Trumbull County MetroParks. The dam is approximately 8 feet tall (USACE, 2006) and is one of a series of low-head dams located along the Mahoning River mainstem that have been targeted for removal by Eastgate and nearby communities to restore free-flowing conditions and improve water quality and alleviate flooding in this reach. The Leavittsburg Dam has frequently been cited as a source of flooding in surrounding neighborhoods and its presence accounts for nearly 10 miles of backwater conditions on the Mahoning River mainstem.

The area originally had a small dam upstream from the current dam site constructed in the early 1900s. The current Leavittsburg Dam was constructed a few years later and submerged the small upstream dam in the process. The Leavittsburg Dam's original use was to support an electric generation facility which has long been in disuse and has been replaced by an electrical substation still in use today. Trumbull County MetroParks reports that the dam and surrounding Canoe City MetroParks property is regularly submerged during seasonal floods.



Figure 2: Location of the Leavittsburg Dam (in red) in the Chocolate Run HUC-12 (image courtesy Eastgate).



Figure 3: Photo of the Leavittsburg Dam looking upstream near the Canoe City MetroPark (photo courtesy Eastgate).



## 2.2 Summary of HUC-12 Biological Trends

The Ohio EPA’s 2018 Integrated Water Quality Report lists the Chocolate Run HUC-12 as impaired for its Warmwater Habitat (WWH) aquatic life use. The WWH use applies to “typical” warmwater assemblages of aquatic organisms for Ohio rivers and streams and represents the principal restoration target for the majority of water resource management efforts in Ohio.

From June-October 2006, ambient biological, water column chemical and sediment sampling was conducted in the upper Mahoning River basin with additional fish sampling conducted in September 2007 in order to facilitate a TMDL assessment for the upper Mahoning River and tributaries. These data were published in 2008 as the *Biological and Water Quality Study of the upper Mahoning River and Selected Tributaries, 2006* (OEPA, 2008). In the TSD, the Chocolate Run HUC-12 was included in the Eagle Creek HUC-11 (05030103-040) WAU. The Eagle Creek HUC-11, including Chocolate Run HUC-12, had TMDLs prepared for sediment, bacteria, flow, and habitat as a result of this monitoring which was published in 2011 as the *Total Maximum Daily Loads for the Upper Mahoning Watershed* (OEPA, 2011). No waters in the Chocolate Run HUC-12 are currently used for public drinking water supply. The 2008 TSD and the 2011 TMDL were used extensively in the development of the Chocolate Run HUC-12 NPS-IS plan.

The below table lists the metrics for what is considered attainment of the WWH, EWH, and MWH aquatic life use designations using the Index of Biotic Integrity (IBI), Modified Index of well-being (MIwb), and Invertebrate Community Index (ICI). IBI, ICI, and MIwb monitoring were performed in the Chocolate Run HUC-12 for TMDL development.

Ecoregion	Biological Index	Assessment Method <sup>2,3</sup>	Biological Criteria for the Applicable Aquatic Life Use Designations <sup>1</sup>		
			WWH	EWH	MWH <sup>4</sup>
Erie-Ontario Lake Plains (EOLP)	IBI	Headwater	40	50	24
		Wading	38	50	24
		Boat	40	48	24/30
	MIwb	Wading	7.9	9.4	6.2
		Boat	8.7	9.6	5.8/6.6
	ICI	All <sup>5</sup>	34	46	22

<sup>1</sup> Coldwater habitats (CWH), limited warmwater habitat (LWH), resource waters (LRW) and seasonal salmonid habitat (SSH) do not have associated biological criteria

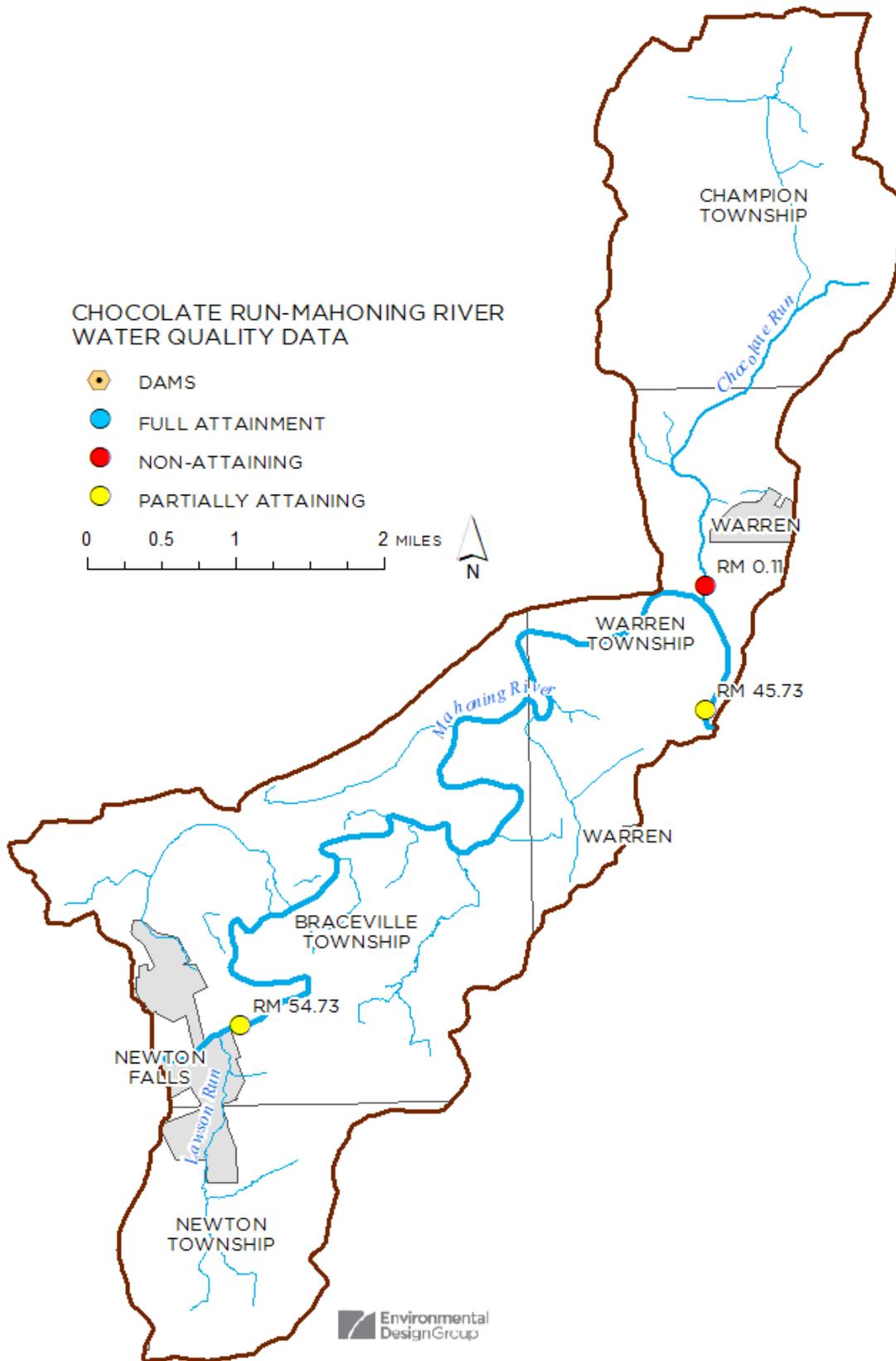
<sup>2</sup> The assessment method used at a site is determined by its drainage area (DA) according to the following: Headwater: DA ≤ 20mi<sup>2</sup>; wading: DA > 20mi<sup>2</sup> and ≤ 500mi<sup>2</sup>; boat: DA > 500mi<sup>2</sup>

<sup>3</sup> MIwb not applicable to drainage areas less than 20mi<sup>2</sup>

<sup>4</sup> Biocriteria depend on type of MWH. MWH-C (due to channelization) is listed first and MWH-I (due to impoundment) is listed second

<sup>5</sup> Limited to sites with appropriate conditions for artificial substrate placement

Monitoring was performed by Ohio EPA at three locations in the Chocolate Run HUC-12 in 2006; the Mahoning River downstream of its confluence with the West Branch Mahoning River and I-80 (RM 54.73), the Mahoning River upstream of the dam at Leavittsburg (RM 45.73), and on Chocolate Run at Eagle Creek Road (RM 0.11). Additional monitoring was performed in 2013 at the RM 45.73 location. None of the monitoring points were in full attainment of the WWH aquatic life use. The below figure shows the sampling locations and attainment status of each monitoring point.



A summary of the monitoring locations and their biological status in the Chocolate Run HUC-12 from the 2018 Integrated Assessment Report are provided in the following table. Indexes with stressed communities or below baseline scores are highlighted. The RM 45.73 location was also assessed in 2013 and was determined to be in

partial attainment of ALU per the 2018 Ohio EPA Integrated Assessment Report; this score and the 2006 score are reflected in the table below.

Station ID	Sample Station Name	River Mile	ALU Attain.	Fish Sample Year	IBI Score	IBI Narr.	MIwb Score	MIwb Narr.	Bug Sample Year	ICI Score	ICI Narr.	Bug Narr.	QHEI
N02S11	MAHONING R. DST W. BR. MAHONING R., DST. I-80	54.73	Partial WWH	2006	42	Good	8.61	Good	2006	22	Fair	N/A	58.5
N03S64	MAHONING R. AT LEAVITTSBURG, UPST. DAM	45.73	Partial WWH	2006	40	Good	7.70	Fair	2006	20	Fair	N/A	48.5
N03S64	MAHONING R. AT LEAVITTSBURG, UPST. DAM	45.73	Partial WWH	2013	39	Marginally Good	8.63	Good	2013	28	Fair	N/A	45.0
N02K01	CHOCOLATE RUN @EAGLE CREEK RD.	0.11	Non WWH	2006	32	Fair	N/A	N/A	2006	N/A	N/A	Low Fair	46.5

### 2.2.1 Fish (Index of Biotic Integrity (IBI) and Modified Index of well-being (MIwb))

IBI sampling along the Mahoning River mainstem in 2006 returned an IBI score of 42 at the RM 54.73 location and a 40 at the 45.73 location, which are indicative of WWH communities within the Leavittsburg dam backwater. MIwb scores declined from upstream to downstream with an 8.61 at RM 54.73 to 7.7 at RM 45.73. 2013 sampling at the RM 45.73 location, however, show an improvement in MIwb to an 8.63 but a decline in IBI to a 39, which indicates that the dam pool is still not providing habitat diversity for fish community, and is typical of slow-moving, monotypic habitat conditions found in dam pools.

The sampling point at Chocolate Run (RM 0.11) had an IBI score of 32, which is in the Fair range and below minimum WWH expectations, and reflects the modified habitat present along the stream due to channelization. Impaired biological communities, both fish and macroinvertebrate, were found at the RM 0.11 Chocolate Run sampling location. Poor habitat quality due to channelization (QHEI = 46.5) was a significant stressor on biological integrity. Discharges from the Pleasant Park mobile home park contributed to elevated phosphorus levels, and nutrient enrichment may be an additional biological stressor. The 2008 TSD also notes areas in the Chocolate Run catchment that have failing home sewage treatment systems that discharge into ditches, which may also be contributing to impairment.

### 2.2.2 Macroinvertebrates (Invertebrate Community Index (ICI))

Macroinvertebrate sampling conducted in 2006 shows an ICI score of 22 (Fair) at the RM 54.73 location and an ICI score of 20 (Fair) at the 45.73 location, neither of which are in the expected WWH criteria range. A low relative density at each location was collected, and scuds (facultative to moderately tolerant) were the predominant organisms on the natural substrates found in both assemblages, indicating an overall low quality of assemblage. Non-detectable current was also noted at the RM 45.73 location. The two stations are influenced by the presence of the Leavittsburg dam, as the station at RM 54.73 was in the backwaters created by the dam while the RM 45.73 is located directly in the dam pool.

ICI scoring was not conducted at the RM 0.11 location on Chocolate Run, but a narrative evaluation of Low Fair was given to the assemblages collected. Only 22 total taxa were collected, of which only four were pollution-sensitive. Scuds were the most common on the natural substrates; flatworms, leeches, and aquatic worms

were also in high abundance. The 2008 TSD notes that benthic communities of this nature are indicative of nutrient and organic enrichment, and water chemistry samples show high levels of total phosphorus, which reinforces the assumption of enrichment issues. Discharge from the mobile home park and failing septic systems could account for the impairment observed in the macroinvertebrate community.

### 2.2.3 Habitat (Qualitative Habitat Evaluation Index (QHEI))

The Mahoning River sampling location downstream of I-80 (RM 54.73) had a QHEI of 58.5, indicating the stream should be able to support WWH communities. Within the Leavittsburg dam pool sampling location at RM 45.73, the QHEI score was listed in 2006 as a 48.5 and has further dropped to a score of 45 in 2013. The lowering score reflects the lack of diversified current and more monotypic habitat associated with dam pools, as well as the associated sediment settling and deposition that occurs in sluggish waters, contributing to embedded substrate and poor in-stream habitat. The highest average measured TSS concentration in the Mahoning River basin was also noted upstream of the RM 45.7 location at the Leavittsburg dam pool.

The Chocolate Run sampling location at RM 0.11 had a QHEI score of 46.5 and two high-influence MWH attributes as shown in the below table. These attributes are indicative of poor to fair habitat quality and are strongly correlated with low IBI and ICI scores in WWH streams. Direct in-stream habitat alterations in Chocolate Run have increased embeddedness and left a straightened channel devoid of proper channel development (OEPA, 2008).

River Mile	QHEI	Gradient (ft/mile)	WWH Attributes										Total WWH Attributes	MWH Attributes										Total M.I. MWH Attributes			
			No Channelization or Recovered Boulder/Cobble/Gravel Substrates	Silt Free Substrates	Good/Excellent Substrates	Moderate/High Sinuosity	Extensive/Moderate Cover	Fast Current/Eddies	Low-Normal Overall Embeddedness	MaxDepth > 40 cm	Low-Normal Riffle Embeddedness	High Influence					Moderate Influence										
												Channelized or No Recovery		Silt/Muck Substrates	No Sinuosity	Sparse/No Cover	MaxDepth < 40 cm (WD, HW)	Recovering Channel	Heavy/Moderate Silt Cover	Sand Substrates (Boat)	Harapan Substrate Origin	Fair/Poor Development	Low Sinuosity		Only 1-2 Cover Types	Intermittent and Poor Pools	No Fast Current
<i>(18-001) Mahoning River</i>																											
54.7	58.5	2.87	□	□			□	□		□		5	◇				1	●		●	●		●		●		5
45.7	48.5	0.1		□			□			□		3	◇	◇			2	●		●	●		●	●		●	6
<i>(18-039) Chocolate Run</i>																											
0.1	46.5	9.78	□				□			□		3	◇	◇			2			●			●	●		●	4

The above table details the QHEI scores and subcomponent attributes for each sampling location in 2006 (detailed QHEI information was not available for the 2013 sampling). The RM 54.7 site exhibits typical WWH attributes of an unchannelized or recovered channel, the presence of boulder/cobble/gravel substrates, extensive/moderate stream cover, locations of fast currents or eddies, and pool areas that have a depth greater than 40 cm, but downstream at RM 48.5 several of those attributes have been lost due to the Leavittsburg dam pool and the river exhibits channelization and low or no current in addition to the other MWH attributes that both locations have. The RM 0.11 Chocolate Run location exhibits both recovered areas as well as areas of channelization and is noted as having good substrate quality despite the channelization, embeddedness, lack of sinuosity and absence of riffles or good stream development present in the reach.

### 2.3 Summary of HUC-12 Pollution Causes and Associated Sources

Ohio EPA sampled water quality in the Upper Mahoning watershed, including the Chocolate Run HUC-12, in 2006. Of the sites sampled in the Upper Mahoning, only 38 percent fully met aquatic life use goals and five percent met recreational use goals. Problems in the Upper Mahoning were noted as an excessive amount of fine sediment in the channels and nutrient enrichment from runoff and other drainage from cropland and animal farming, high nutrients in wastewater, substantial habitat degradation associated with dam impoundment and a generally unnatural stream flow regime from the regulated flows caused by the large dam releases. The major sources of bacteria loading were noted as cropland drainage and home septic systems, with lesser contributions from wastewater systems (Combined Sewer Overflows (CSOs) and WWTPs) and urban runoff.

05030103 04 06  <i>Priority Points 8</i>	Chocolate Run-Mahoning River	Habitat alterations	QHEI TMDL
		Nutrients	Not addressed
		Flow alterations	QHEI TMDL
		Sedimentation / siltation	QHEI TMDL
		<i>E. coli</i>	LDC TMDL - <i>E. coli</i>

As anthropogenic influences increase, fish community integrity decreases. The best fish community scores were noted in the 2008 TSD where large riparian buffers were present in headwater locations and depressed scores were noted in impounded conditions such as the Mahoning River at RM 45.73. Highly altered flow regimes from the presence of the Leavittsburg dam continues to impact the fish community throughout the Mahoning River mainstem in the Chocolate Run HUC-12.

The Mahoning River RM 54.73 and RM 45.73 sampling locations are listed as being in partial attainment of ALU with flow regime alteration as their causes of impairment, and the Leavittsburg dam backwater and dam pool as the source of impairment. The Leavittsburg low-head dam is contributing to the significant physical alteration of the free-flowing riverine habitat. The 2011 TMDL states while sites were impacted to some extent by both industrial and municipal discharges, most impairments to the biological community were related to alterations in flow regime as a result of the dams located along the Mahoning River. Low head dams in Alliance, Newton Falls, and Leavittsburg account for nearly 17 miles of slow-moving waters on the upper Mahoning River, including the entire reach in the Chocolate Run HUC-12. Unless these structures can be removed and the river’s free-flowing status restored, it is unlikely that biological performance will improve enough to meet the designated WWH ALU. The 2011 TMDL specifically recommends the removal of the low-head dam at Leavittsburg as the single best mechanism that would allow for significant improvement in the fish and benthos along the Mahoning River mainstem. Removal of the dam at Leavittsburg has the potential to result in biological communities that fully attain WWH criteria within the nearly 10-mile section of the Mahoning River that is currently impounded in this HUC-12.

The 2006 USACE Environmental Dredging Draft Feasibility Report describes the effects low-head dams including the one at Leavittsburg have on the water quality of the lower Mahoning River:

“The low head dams adversely impact the Mahoning River ecosystem in several ways. These dams impound over 25 miles of the 31-mile reach of river under study. Within the impounded areas, flow (river currents) is slower and river stages (elevations) are more constant than they would be in the normal or natural conditions. Due to the lower velocities behind the dams, more fine-grained sediment settles to the river bottom than in the free-flowing reaches. Since many pollutants adhere to fine-grained sediments, the greater accumulations of legacy contamination are located immediately behind the dams. Slower currents also reduce sediment transport and change the streambed grain-size distribution compared to natural conditions. Without these

dams, the distribution would be expected to consist of various gradations of cobble that provide the type and quality of benthic habitat necessary for a diverse aquatic community. Natural riffles that enhance aquatic habitats are smothered by the sediment in the impounded areas reducing the diversity of aquatic substrate available for benthic organisms. The greater constancy of river elevations also ‘deactivate’ floodplains by reducing over bank flooding that is critical to many native riparian species. Lower velocities also cause channel narrowing, reduced braiding, and associated loss of habitat complexity. Finally, these dams reduce or sever important biologic connections for aquatic species throughout the entire river basin (mainstem and tributaries). All of these problems within the project area contribute to the low biologic indices, including the QHEI values, relative to both the free-flowing areas both in the project area and model reach.”

The Chocolate Run tributary sampling location is listed as being in non-attainment of ALU with siltation, nutrient/eutrophication, and direct habitat alteration as causes of impairment, and channelization as the primary source of impairment. Discharge from septic was also noted as affecting the benthic quality of Chocolate Run. Agricultural activities (including channelization) as well as channelization from other sources are also lowering habitat quality and fish community integrity and contributing excessive sediment and nutrients to the Chocolate Run catchment. Sediment impairs aquatic life by damaging streambed habitat. Riffles and other areas comprised of coarser material become embedded with fine sediment effectively reducing or eliminating the void spaces that provide cover to macroinvertebrates and fish as well as their eggs. Sediment itself is damaging to the aquatic ecosystem as it delivers pollutants such as phosphorus and causes abrasion to organisms.

The 2011 Upper Mahoning TMDL makes the following non-point pollution recommendations for the Eagle Creek HUC-10, which includes the Chocolate Run HUC-12:

#### *In Towns and Rural Residential Areas*

- Improve home septic system treatment
  - Work with homeowners to identify deficiencies with the condition and/or operation of their systems
  - Provide centralized sewer collection and treatment services to some areas where feasible
- Remove or modify lowhead dams

#### *On Farmland*

- Minimize nutrient losses from cropland
- Use cover cropping and conservation tillage
- Control sub-surface drainage
  - Increase the retention of water in treatment areas such as wetlands, filter strips, or in the soil profile
- Create wetlands and other runoff treatment areas
- Install streamside buffers
  - Facilitate floodplain connection and growth of riparian trees and vegetation
- Restore natural channel shape and habitat

## **2.4 Additional Information for Determining Critical Areas and Developing Implementation Strategies**

### **Mahoning River Reconnaissance Study**

In 1999 US Army Corps of Engineers produced a reconnaissance study on the removal of contaminated sediments and dams to restore the lower Mahoning River. The report called for dredging 750,000 cubic yards of

contaminated in-stream and riverbank sediment and the removal of seven small dams, including the Leavittsburg Dam in the Chocolate Run-Mahoning River HUC-12. This study was used as the basis for a subsequent feasibility report for removal and remediation of contaminated sediments in the Mahoning River.

### **Mahoning River, Ohio Environmental Dredging Draft Feasibility Report and Environmental Impact Statement**

In 2006 USACE produced a feasibility report that primarily dealt with the dredging and removal of contaminated sediments in the lower Mahoning River downstream of its confluence with Duck Creek to the Pennsylvania state line. The report also describes nine dams, including the Leavittsburg Dam, as a target for removal, and details the accumulation of sediments and channel conditions present in the stagnating dam pool area. The report states that the presence of the nine impoundments along the lower Mahoning River impede fish migration and recreation, have negative impacts on river quality by increasing temperature and lowering dissolved oxygen, and degrade aquatic habitat through deposition of sediment and decreased habitat diversity. The dams are an important factor contributing to the non-attainment of warmwater habitat criteria, and the report concludes that without action, the overall health of the Mahoning River in the study area will not substantially change from current conditions. Slight increases in fish populations have occurred largely because of a reduction in industrial discharges from the steel industry over the past 30 years, but the non-attainment of aquatic health will continue due to the presence of excessive sediment (some contaminated) and the low-head dams.

### **U.S. Fish & Wildlife Service Coordination Act Report**

U.S. Fish and Wildlife Service reviewed the USACE Environmental Dredging Draft Feasibility Report in 2005 and produced a Coordination Act Report that concurred with the USACE recommendations for dredging and/or dam removal, specifically noting that if dams were removed from the river subsequent to sediment cleanup, it would still provide positive results for aquatic life in the Mahoning River, and that overall aquatic benefits would be much greater if dam removal occurred rather than simply dredging. This coordination report was included in the 2006 USACE Environmental Dredging Draft Feasibility Report as Appendix N.

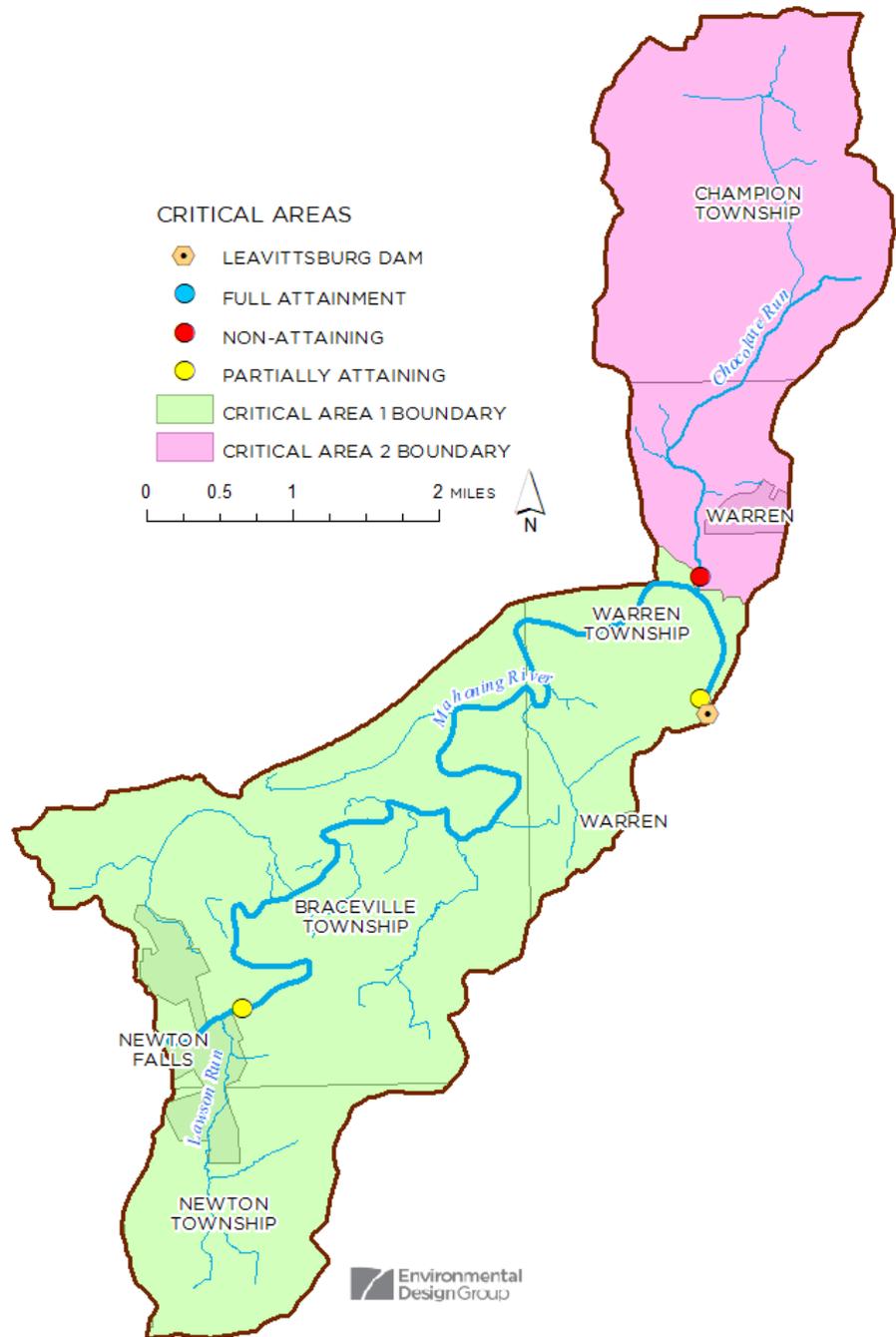
## Chapter 3: Critical Area Conditions & Restoration Strategies

### 3.1 Overview of Critical Areas

Effective application of nonpoint source best management practices requires that these measures are properly planned, sited, and sized for implementation. An important aspect of the planning process is the identification of critical areas. Implementation of best management practices in critical areas is a key part of meeting targets set by NPS-IS plans or TMDLs, which ultimately lead to achieving water quality goals and objectives including the restoration and protection of degraded beneficial uses of waters of the US. Effective determination of critical areas supports targeted, cost-efficient implementation of practices and measures to meet water quality goals in the most efficient manner possible.

In the Chocolate Run HUC-12, none of the three sites sampled are in attainment. The two sites sampled along the Mahoning River mainstem are in partial attainment and the site sampled in the Chocolate Run tributary is in non-attainment. Two critical areas have been identified to address the primary nonpoint source pollution issues believed to be causing the impaired states of these reaches.

- Critical Area 1: Mahoning River mainstem and drainage
- Critical Area 2: Chocolate Run Tributary and drainage

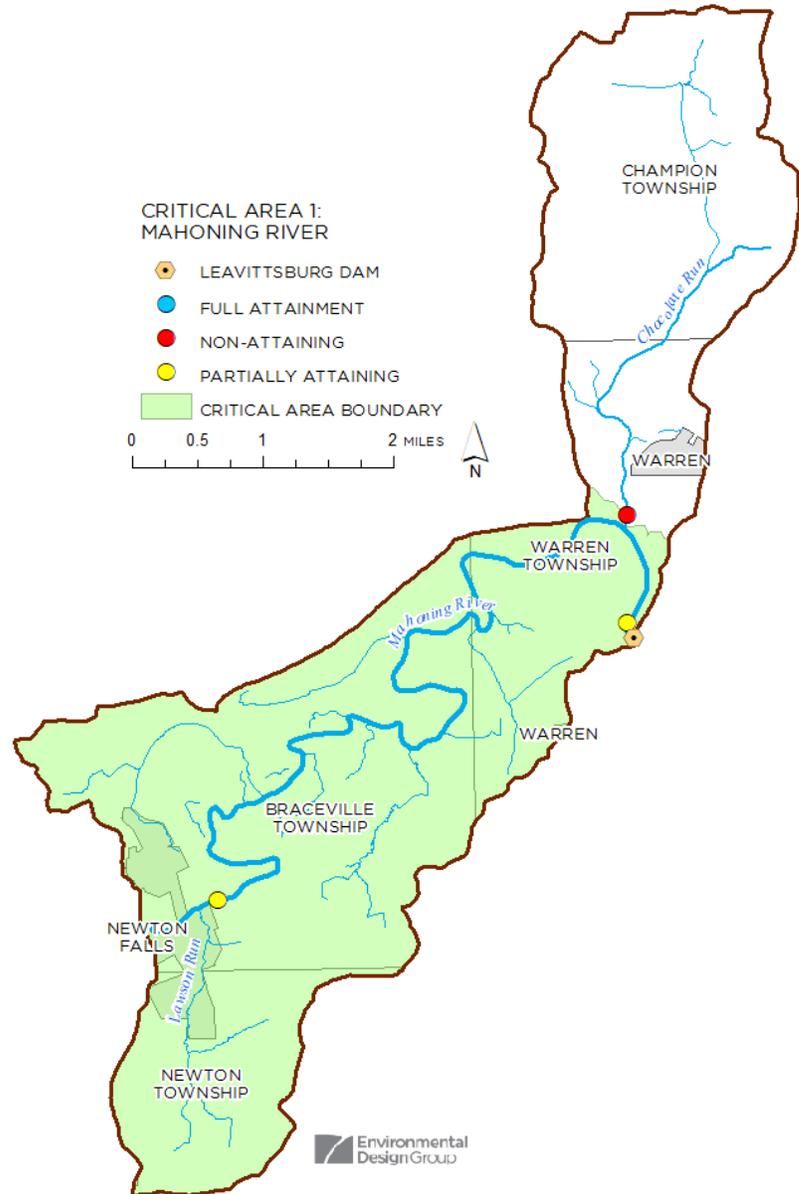


## 3.2 Critical Area 1: Conditions, Goals & Objectives

### 3.2.1 Detailed Characterization

This critical area includes the Mahoning River mainstem and its direct tributary drainage in the Chocolate Run HUC-12 from the Leavittsburg Dam upstream to the Mahoning River mainstem’s confluence with the West Branch Mahoning River (RM 53.74), except for the drainage area of the Chocolate Run tributary. Critical Area 1 drains approximately 6,435 acres and contains all 10 stream miles of the Mahoning River mainstem and approximately 17.3 stream miles of tributary streams, including Lawson Run, a small named tributary that has its confluence with the Mahoning River around RM 55. The critical area contains portions of Newton Township, Newton Falls, Braceville Township, the City of Warren, and Warren Township.

Land use data provided by Eastgate reflects mainly agricultural (53.2%) and residential (19.8%) zoned land use in the critical area. Land cover data from the 2011 National Land Cover Dataset shows approximately 1,370.6 acres (21%) of agricultural land cover (cultivated crops and pasture/hay) and 3,297.2 acres (51%) of forested land cover (deciduous forest, woody wetlands, and evergreen forest). About 138 acres of active or passive parkland are in the critical area. Johnson Park, Braceville Township Park, and the Labrae Athletic Club Baseball Fields are active community parks and Trumbull County MetroParks manages about 89 acres in the critical area, including the Canoe City MetroParks property at the Leavittsburg Dam and



two passive protected areas located along approximately 4,930 linear feet of the Mahoning River mainstem. The National Wetland Inventory estimates about 539.5 acres of palustrine wetlands in the critical area, or 8.8% of the critical area, although some of these have been excavated or filled. Notable features in the critical area are Interstate 80 which traverses the western portion of the critical area from northwest to southeast and crosses the Mahoning River mainstem in Newton Falls; and Riverview Golf

Land Use	Acres	% of Critical Area
Agriculture	3425.1	53.2%
Residential	1277.1	19.8%
Vacant	475.2	7.4%
Commercial	437.5	6.8%
Government or Public	308.0	4.8%
Industrial	185.0	2.9%
Rail	154.5	2.4%
Water	149.6	2.3%
NoData	23.0	0.4%

and two passive protected areas located along approximately 4,930 linear feet of the Mahoning River mainstem. The National Wetland Inventory estimates about 539.5 acres of palustrine wetlands in the critical area, or 8.8% of the critical area, although some of these have been excavated or filled. Notable features in the critical area are Interstate 80 which traverses the western portion of the critical area from northwest to southeast and crosses the Mahoning River mainstem in Newton Falls; and Riverview Golf

Course, a 220-acre golf course that fronts 6,570 linear feet of the Mahoning River.

The critical area also contains the Leavittsburg Dam, a low-head earthworks dam in Warren Township and owned by Trumbull County MetroParks as part of their Canoe City MetroParks facility. The dam is approximately 8 feet tall (USACE, 2006) and is one of a series of low-head dams located along the Mahoning River mainstem that have been targeted for removal by Eastgate and nearby communities to restore free-flowing conditions and improve water quality and alleviate flooding in this reach. The Leavittsburg Dam has frequently been cited as a source of flooding in surrounding neighborhoods and its presence accounts for nearly 10 miles of backwater conditions on the Mahoning River mainstem. Trumbull County MetroParks reports that the dam and surrounding Canoe City MetroParks property is regularly submerged during seasonal floods.

Priorities in this critical area are removal of the Leavittsburg Dam on the mainstem of the Mahoning, addressing streambank erosion and removal of riparian vegetation from changing land uses, and implementing riparian setback protections on stream corridors at the local level.

### 3.2.2 Detailed Biological Conditions

IBI sampling along the Mahoning River mainstem in 2006 returned an IBI score of 42 at the RM 54.73 location and a 40 at the 45.73 location, which are indicative of WWH communities within the Leavittsburg dam backwater. MIwb scores declined from upstream to downstream with an 8.61 at RM 54.73 to 7.7 at RM 45.73. 2013 sampling at the RM 45.73 location, however, show an improvement in MIwb to an 8.63 but a decline in IBI to a 39, which indicates that the dam pool is still not providing habitat diversity for fish community, and is typical of slow-moving, monotypic habitat conditions found in dam pools. Macroinvertebrate sampling conducted in 2006 shows an ICI score of 22 (Fair) at the RM 54.73 location and an ICI score of 20 (Fair) at the 45.73 location, neither of which are in the expected WWH criteria range. A low relative density at each location was collected, and scuds (facultative to moderately tolerant) were the predominant organisms on the natural substrates found in both assemblages, indicating an overall low quality of assemblage. Non-detectable current was also noted at the RM 45.73 location. The two stations are influenced by the presence of the Leavittsburg dam, as the station at RM 54.73 was in the backwaters created by the dam while the RM 45.73 is located directly in the dam pool. The Mahoning River sampling location downstream of I-80 (RM 54.73) had a QHEI of 58.5, indicating the stream should be able to support WWH communities. Within the Leavittsburg dam pool sampling location at RM 45.73, the QHEI score was listed in 2006 as a 48.5 and has further dropped to a score of 45 in 2013. The lowering score reflects the lack of diversified current and more monotypic habitat associated with dam pools, as well as the associated sediment settling and deposition that occurs in sluggish waters, contributing to embedded substrate and poor in-stream habitat. The highest average measured TSS concentration in the Mahoning River basin was also noted upstream of the RM 45.7 location at the Leavittsburg dam pool, indicating significant slowing and settling out of sediment in the slackwater and dam pool locations.

Tributary streams in the critical area such as Lawson Run do not have sampling information associated with them, but the 2011 Upper Mahoning TMDL notes that it is reasonable to extrapolate the results of the sites that were surveyed to the rest of the watershed assuming that the level of impairment and the causes and sources of impairment occur in similar proportion to areas that are not assessed. This extrapolation is especially relevant for sources of impairment related to land management such as polluted runoff or channel maintenance in small agricultural streams. Overall, tributary streams in the Upper Mahoning are of fair to poor quality, with stressed fish and macroinvertebrate populations, and habitat scores affected by direct habitat alterations, channelization, and siltation. Therefore, tributary streams such as Lawson Run will also be addressed as targets for restoration and other nonpoint source best management practices in the critical area, although removal of the Leavittsburg Dam should be the top priority in this critical area until that objective is achieved.

### 3.2.3 Detailed Causes and Associated Sources

The Chocolate Run HUC-12, including this critical area, had TMDLs prepared for sediment, bacteria, flow, and habitat. Highly altered flow regimes from the presence of the Leavittsburg dam continues to impact the fish community in the critical area. The RM 54.73 and RM 45.73 sampling locations are listed as being in partial attainment of ALU with flow regime alteration as their causes of impairment, and the Leavittsburg dam backwater and dam pool as the source of impairment. The Leavittsburg low-head dam is the primary source of the significant physical alteration of the Mahoning River mainstem. The 2011 TMDL states while sites were impacted to some extent by both industrial and municipal discharges, most impairments to the biological community were related to alterations in flow regime as a result of the dams located along the Mahoning River, and the entire reach of the Mahoning River in the critical area is affected by the presence of the Leavittsburg Dam. Unless the dam is removed and the river's free-flowing status restored, it is unlikely that biological performance will improve enough to meet the designated WWH ALU in the Mahoning River mainstem. The 2011 TMDL recommends removal of the low-head dam at Leavittsburg as the single best mechanism that would allow for significant improvement in the fish and benthos and has the potential to result in biological communities that fully attain WWH criteria within the nearly 10-mile impounded and backwater section of the Mahoning River in the critical area.

While dam removal should be the top priority in this critical area, stakeholder feedback has identified areas of eroding streambank along the Riverview Golf Course on the Mahoning River mainstem as well as in the tributary streams where riparian vegetation has been removed. Eroding streambanks contribute excess sediment to the stream and when combined with low-flow conditions cause sediment to settle out into the channel and embed into the substrates. Reforestation of riparian corridors and further protection of the corridors through riparian setback legislation are additional recommended measures to fully address water quality in this critical area.

### 3.2.4 Goals and Objectives for the Critical Area

#### Goals

The overall nonpoint source restoration goals for the NPS-IS plan is to improve IBI, MIwb, ICI, and QHEI scores so that partial or non-attainment status can achieve full attainment of the designated aquatic life use. Specific goals referencing the non-attaining assessment points are outlined below. Goal criteria are based on the biological criteria found in Ohio Administrative Code 3745-1-07, *Beneficial use designations and biological criteria* (effective 2/6/2017).

**Goal 1:** Achieve IBI score of 40 at the Mahoning River at Leavittsburg, upstream dam sampling station (RM 45.73).

**NOT ACHIEVED:** Site currently has an IBI score of 39 (Marginally Good).

**Goal 2:** Achieve MIwb score of 8.7 at the Mahoning River at Leavittsburg, upstream dam sampling station (RM 45.73).

**NOT ACHIEVED:** Site currently has a MIwb score of 8.63.

**Goal 3:** Achieve ICI score of 34 at the Mahoning River at Leavittsburg, upstream dam sampling station (RM 45.73).

**NOT ACHIEVED:** Site currently has an ICI score of 28 (Fair).

**Goal 4:** Achieve QHEI score of 55 at the Mahoning River at Leavittsburg, upstream dam sampling station (RM 45.73).

**NOT ACHIEVED:** Site currently has a QHEI score of 45.

**Goal 5:** Achieve IBI score of 40 at the Mahoning River downstream W. Branch Mahoning River, downstream I-80 sampling station (RM 54.73).

**ACHIEVED:** Site currently has an IBI score of 42.

**Goal 6:** Achieve MIwb score of 8.7 at the Mahoning River downstream W. Branch Mahoning River, downstream I-80 sampling station (RM 54.73).

**NOT ACHIEVED:** Site currently has a MIwb score of 8.6.

**Goal 7:** Achieve ICI score of 34 at the Mahoning River downstream W. Branch Mahoning River, downstream I-80 sampling station (RM 54.73).

**NOT ACHIEVED:** Site currently has an ICI score of 22 (Fair).

**Goal 8:** Achieve QHEI score of 55 at the Mahoning River downstream W. Branch Mahoning River, downstream I-80 sampling station (RM 54.73).

**ACHIEVED:** Site currently has a QHEI of 58.5.

### *Objectives*

In order to achieve the overall nonpoint source restoration goal of restoring full attainment to the Chocolate Run HUC-12, the following objectives need to be achieved within Critical Area 1.

**Objective 1:** Restore natural free-flow conditions in the Mahoning River

- Remove one (1) dam, the Leavittsburg Dam

**Objective 2:** Restore eroding streambanks using two-stage or natural channel design features and principles

- Restore 5,000 linear feet of eroding streambank within the critical area

**Objective 3:** Establish forested riparian buffer along impacted or barren stretches of stream

- Reestablish 100 acres of forested riparian buffer within the critical area

**Objective 4:** Protect and maintain riparian corridors

- Adopt comprehensive riparian setback regulations in five (5) communities within the critical area: Newton Township, Warren Township, Braceville Township, Newton Falls, and the City of Warren

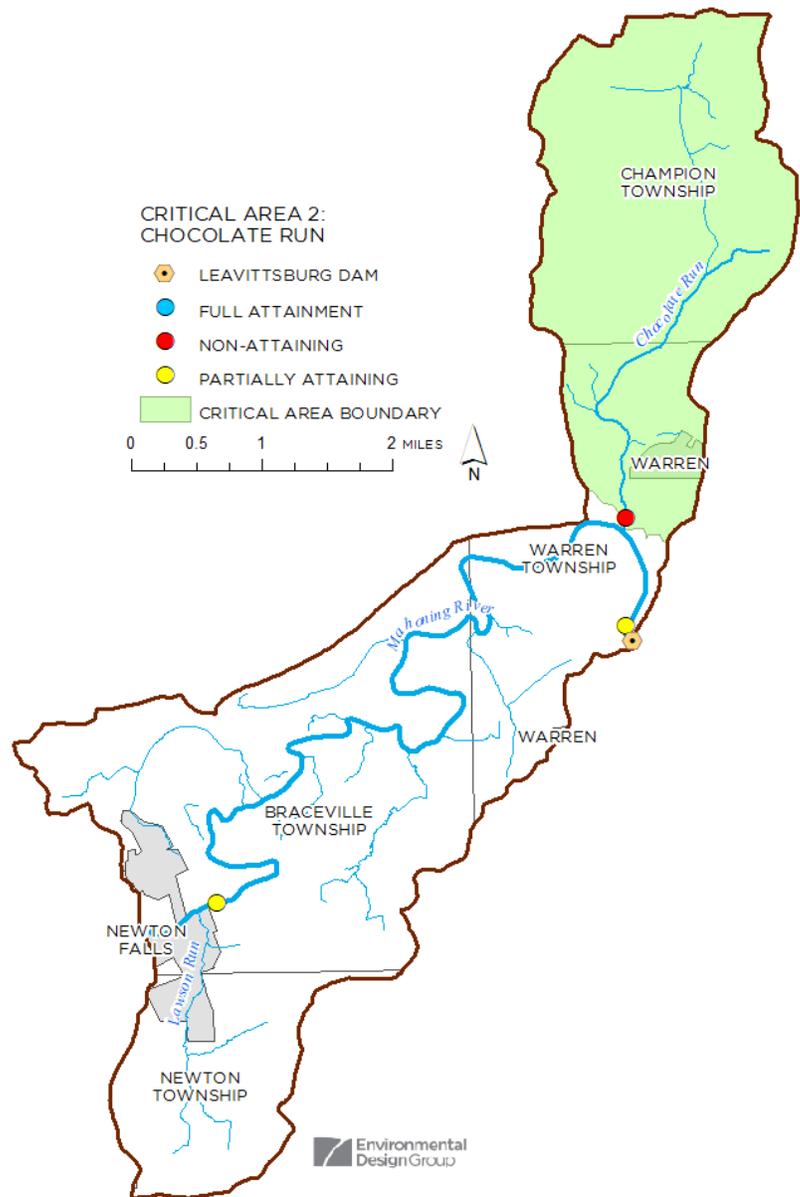
Water quality monitoring is an integral part of the project implementation process. Both project-specific and routinely scheduled monitoring will be conducted to determine progress towards meeting the goals (i.e., water quality standards). Through an adaptive management process, the aforementioned objectives will be reevaluated and modified as necessary. Objectives may be added to make further progress towards attainment goals, or altered, as a systems approach of multiple best management practices (BMPs) can accelerate the improvement of water quality conditions. The Ohio EPA Nonpoint Source Management Plan Update (Ohio EPA, 2013) will be utilized as a reevaluation tool for its listing of all eligible NPS management strategies to consider including:

- Urban Sediment and Nutrient Reduction Strategies;
- Altered Stream and Habitat Restoration Strategies;
- Nonpoint Source Reduction Strategies; and
- High Quality Waters Protection Strategies.

### 3.3 Critical Area 2: Conditions, Goals, and Objectives

#### 3.3.1 Detailed Characterization

This critical area consists of the drainage of the Chocolate Run tributary to its confluence with the Mahoning River at RM 44.88. Chocolate Run is the major tributary to the Mahoning River in this HUC-12 and drains approximately 3,600 acres (5.6 square miles) and contains approximately 7.4 miles of headwater stream. The northern portion of the critical area is located within Champion Township and the southern portion is primarily within Warren Township, with a small section of the City of Warren in the southeast. According to land use data provided by Eastgate, a little over half the land in the critical area is zoned for agriculture (50.3%), with the next highest uses being residential (28%) and vacant (11.9%). Industrial and commercial uses only comprise about 4.7% of the critical area. Most of the residential use as well as the greatest developed density is concentrated in the southern portion of the critical area near the confluence with the Mahoning River, and in the northeast in the Champion Heights area of Champion Township. Land cover data from the 2011 National Land Cover Dataset shows a breakdown of 20.7% agricultural (cultivated crops and hay/pasture) and 29.3% developed (low, medium, high intensity developed and developed open space), with developed open space and low intensity development comprising 90% of the developed land cover. Forested land covers approximately 42.5% of the critical area. Data from the National Wetland Inventory estimates that approximately 135 acres of forested/shrub or emergent wetland are present in the critical area, concentrated mainly in the northern headwater drainage of the critical area and along the Chocolate Run stream corridor and its small tributaries. Septic system data from Eastgate estimates approximately 60 HSTS present in the critical area, mainly in the southern portion in Warren Township and along the Warren Township/Champion Township boundary, and one NPDES permitted facility, the Pleasant Park Mobile Court, a mobile home park.



Priorities in this critical area are repair/replacement of HSTS, implementation of agricultural best management practices, restoration of channelized streams, and restoration/protection of wetland habitat.

### 3.3.2 Detailed Biological Conditions

The sampling point at Chocolate Run (RM 0.11) had an IBI score of 32, which is in the Fair range and below minimum WWH expectations, and reflects the modified habitat present along the stream due to lack of riparian cover and channelization. Impaired biological communities, both fish and macroinvertebrate, were found at the sampling location. Poor habitat quality due to channelization is a significant stressor on biological integrity. Discharges from the Pleasant Park mobile home park contributes to elevated phosphorus levels, and nutrient enrichment may be an additional biological stressor. The 2008 TSD also notes areas in the Chocolate Run catchment that have failing home sewage treatment systems that discharge into ditches, which may also be contributing to impairment.

ICI scoring was not conducted at the RM 0.11 location on Chocolate Run, but a narrative evaluation of Low Fair was given to the assemblages collected. Only 22 total taxa were collected, of which only four were pollution-sensitive taxa. Scuds were the most common on the natural substrates; flatworms, leeches, and aquatic worms were also in high abundance. The 2008 TSD notes that benthic communities of this nature are indicative of nutrient and organic enrichment, and water chemistry samples show high levels of total phosphorus, which reinforces the assumption of enrichment issues. Discharge from the mobile home park and failing septic systems may account for the impairment observed in the macroinvertebrate community. The sampling location had a QHEI score of 46.5 and two high-influence MWH attributes, which are indicative of poor to fair habitat quality and are strongly correlated with low IBI and ICI scores in WWH streams. Direct in-stream habitat alterations in Chocolate Run have increased embeddedness and left a straightened channel devoid of proper channel development (OEPA, 2008). The RM 0.11 Chocolate Run location exhibits both recovered areas as well as areas of channelization and is noted as having good substrate quality despite the channelization, embeddedness, lack of sinuosity and absence of riffles or good stream development present in the reach.

### 3.3.3 Detailed Causes and Associated Sources

The Chocolate Run tributary sampling location is listed as being in non-attainment of its warmwater habitat ALU with siltation, nutrient/eutrophication, and direct habitat alteration as causes of impairment, and channelization as the primary source of impairment. Discharge from septic was also noted as affecting the benthic quality of Chocolate Run. Septic system data received from Eastgate estimates approximately 60 HSTS present in the critical area, mainly in the southern portion in Warren Township and along the Warren Township/Champion Township boundary, and one NPDES permitted facility, the Pleasant Park Mobile Court, a mobile home park. The Pleasant Park Mobile Court was directly identified as a potential source of bacterial loading to Chocolate Run in the 2011 Upper Mahoning TMDL, and failing HSTS in the southern portion of the critical area may also be contributing to non-attainment of recreational use in Chocolate Run. Efforts should be made by the Trumbull County Health Department and Ohio EPA to ensure compliance at the Pleasant Park Mobile Court, and efforts should be made by Trumbull County and local communities for education on and maintenance of HSTS by landowners.

Agricultural activities (including channelization) as well as channelization from other sources are also lowering habitat quality and fish community integrity and contributing excessive sediment and nutrients to the Chocolate Run catchment. Sediment impairs aquatic life by damaging streambed habitat. Riffles and other areas comprised of coarser material become embedded with fine sediment effectively reducing or eliminating the void spaces that provide cover to macroinvertebrates and fish as well as their eggs. Sediment itself is damaging to the aquatic ecosystem as it delivers pollutants such as phosphorus and causes abrasion to organisms. Removal of riparian cover often accompanies channelization and results in increased sediment and nutrients to streams and streambank erosion.

The 2011 Upper Mahoning TMDL recommends stream restoration or two-stage approaches in the critical area as the low channel gradient makes natural recovery unlikely. Large proportions of hydric or partially hydric

soils in the critical area make wetland restoration or creation a recommended option for abating nutrients in this critical area, and nutrient management on cropland and highly managed developed open space (such as golf courses) are also recommended. The 2011 TMDL recommends floodplain, stream channel, and two-stage channel restoration throughout the critical area, while wetland creation/restoration, cover crops, conversion to permanent haylands, installation of nitrogen reduction practices, development of nutrient management plans, and implementation of manure management practices are specifically recommended for the more rural portions of the critical area.

### 3.3.4 Goals and Objectives for Critical Area 2

#### Goals

The overall nonpoint source restoration goals for the NPS-IS plan is to improve IBI, MIwb, ICI, and QHEI scores so that partial or non-attainment status can achieve full attainment of the designated aquatic life use. Specific goals referencing the non-attaining assessment points are outlined here. Goal criteria are based on the biological criteria found in Ohio Administrative Code 3745-1-07, *Beneficial use designations and biological criteria* (effective 2/6/2017).

**Goal 1:** Achieve IBI score of 40 at the Chocolate Run at Eagle Creek Road sampling station (RM 0.11).

**NOT ACHIEVED:** Site currently has an IBI score of 32 (Fair).

**Goal 2:** Achieve macroinvertebrate narrative of Good at the Chocolate Run at Eagle Creek Road sampling station (RM 0.11).

**NOT ACHIEVED:** Site currently has a macroinvertebrate narrative of Low Fair.

**Goal 3:** Achieve QHEI score of 55 at the Chocolate Run at Eagle Creek Road sampling station (RM 0.11).

**NOT ACHIEVED:** Site currently has a QHEI score of 46.5.

#### Objectives

In order to achieve the overall nonpoint source restoration goal of restoring full attainment to the Chocolate Run HUC-12, the following objectives need to be achieved within Critical Area 2. Achievement of the objectives described for Critical Area 2 should also assist with improvement downstream in Critical Area 1 as well as further downstream in the adjacent City of Warren-Mahoning River HUC-12.

**Objective 1:** Reduce bacterial loading to streams

- Ensure full compliance of 60 HSTS in the critical area

**Objective 2:** Protect, restore or create wetland habitat

- Protect, restore or create 200 acres of wetland habitat within the critical area

**Objective 3:** Develop nutrient management plans

- Develop three (3) nutrient management plans for landowners in the critical area

**Objective 4:** Install nitrogen reduction practices

- Install four (4) nitrogen reduction practices in the critical area

**Objective 5:** Implement manure management practices

- Implement manure management practices on 100 acres of pasture in the critical area

**Objective 6:** Plant cover crops for long-term conservation crop rotations

- Plant at least 400 acres of cover crops on row-crop fields in the critical area

**Objective 7:** Increase retirement of marginal and highly vulnerable lands

- Enroll at least 2% (greater than or equal to 15 acres) of current agricultural land in the critical area into programs such as the Conservation Reserve Program (CRP), Wetlands Reserve Program (WRP), and Conservation Reserve Enhancement Program (CREP), particularly along stream corridors and in floodplain areas

**Objective 8:** Restore channelized streams

- Restore 5,000 linear feet of channelized stream within the critical area using two-stage or natural channel design features and principles

Water quality monitoring is an integral part of the project implementation process. Both project-specific and routinely scheduled monitoring will be conducted to determine progress towards meeting the goals (i.e., water quality standards). Through an adaptive management process, the aforementioned objectives will be reevaluated and modified as necessary. Objectives may be added to make further progress towards attainment goals, or altered, as a systems approach of multiple best management practices (BMPs) can accelerate the improvement of water quality conditions. The Ohio EPA Nonpoint Source Management Plan Update (Ohio EPA, 2013) will be utilized as a reevaluation tool for its listing of all eligible NPS management strategies to consider including:

- Urban Sediment and Nutrient Reduction Strategies;
- Altered Stream and Habitat Restoration Strategies;
- Nonpoint Source Reduction Strategies; and
- High Quality Waters Protection Strategies.

## Chapter 4: Projects and Implementation Strategy

### Section 4.1 Project and Implementation Strategy Overview Table

Below are the projects and evaluation needs currently believed to be necessary to remove the impairments to the Chocolate Run-Mahoning River HUC-12 as a result of the identified causes and associated sources of nonpoint source pollution. Because the attainment status is based on biological conditions, it will be necessary to periodically re-evaluate the status of the critical area to determine if the implemented projects are sufficient to achieve restoration. Time is an important factor to consider when measuring project success and overall status. Biological systems in some cases can show response fairly quickly (months); others may take longer (years) to show recovery. There may also be reasons other than nonpoint source pollution for the impairment. Those issues will need to be addressed under different initiatives, authorities or programs which may or may not be accomplished by the same implementers addressing the nonpoint source pollution issues.

For Chocolate Run-Mahoning River HUC-12 (05030103-04-06)								
Applicable Critical Area	Goal	Objective	Project #	Project Title (EPA Criteria g)	Lead Organization (EPA Criteria d)	Time Frame (EPA Criteria f)	Estimated Cost (EPA Criteria d)	Potential/Actual Funding Source (EPA Criteria d)
<b>Urban Sediment and Nutrient Reduction Strategies</b>								
<b>Altered Stream and Habitat Restoration Strategies</b>								
1	1, 2, 3, 4, 5, 6, 7, 8	1, 3	1	Leavittsburg Dam Removal	Trumbull County Metroparks	Medium Term	\$2.2 million	WRRSP, Ohio EPA 319, local funds
1	1, 2, 3, 4	2, 3	4	Riverview Golf Course Stream Restoration	Braceville Township	Long Term	\$360,000	Ohio EPA 319, local funds
2	1, 2, 3	2, 8	3	Meadow Brook Memorial Park Stream Restoration	Champion Township	Long Term	\$300,000	Ohio EPA 319, local funds
<b>Agricultural Nonpoint Source Reduction Strategies</b>								
2	1, 2, 3	3, 4, 5, 6, 7	2	Nutrient & Sediment Reduction in Chocolate Run	Trumbull County SWCD	Long Term	\$20,000	CRP, WRP, CREP, EQIP, MRBI program funds
<b>High Quality Waters Protection Strategies</b>								
<b>Other NPS Causes and Associated Sources of Impairment</b>								
2	4, 5, 6	1	5	HSTS Repair and Replacement	Trumbull County Health Department	Long Term	Gravity-fed drainfields: \$5,000 to \$10,000 Mounds: \$10,000 to \$50,000	Ohio Water Pollution Control Loan Fund, local funds

## Section 4.2 Project Summary Sheet(s)

The information included in the Overview Table is a condensed overview of identified projects for nonpoint source restoration of the Chocolate Run HUC-12 Critical Areas. Project Summary Sheets are included for short term projects or any project that is considering seeking funding in the near future. Only those projects with complete Project Summary Sheets will be considered for state and federal NPS program funding.

Nine Element Criteria	Information needed	Explanation
<i>n/a</i>	<i>Title</i>	Project 1: Leavittsburg Dam Removal
<i>criteria d</i>	<i>Project Lead Organization &amp; Partners</i>	Trumbull County Metroparks, Warren Township, Eastgate
<i>criteria c</i>	<i>HUC-12 and Critical Area</i>	Chocolate Run-Mahoning River HUC-12 (05030103-04-06), Critical Area 1
<i>criteria c</i>	<i>Location of Project</i>	41.2389474, -80.8819869 in Warren Township, Trumbull County
<i>n/a</i>	<i>Which strategy is being addressed by this project?</i>	Altered Stream and Habitat Restoration Strategy
<i>criteria f</i>	<i>Time Frame</i>	Medium Term (3-7 Years)
<i>criteria g</i>	<i>Short Description</i>	Sediment dredging and removal of the Leavittsburg Dam, a lowhead dam on the mainstem of the Mahoning River, to restore natural flow to nearly 10 miles of impaired dam pool and backwater in the Chocolate Run HUC-12.
<i>criteria g</i>	<i>Project Narrative</i>	<p>The project proposes dredging and removal of sediment and removal of the Leavittsburg low-head dam, located in Warren Township on a bend in the Mahoning River at RM 42.99. The dam is an approximately 8 foot-tall low, linear weir of earth, gravel, and possibly slag, topped with natural rocks with a few concrete fragments mixed in. The area originally had a small dam upstream from the current dam site constructed in the early 1900s. The current Leavittsburg Dam was constructed a few years later and submerged the small upstream dam in the process. The dam's original use was to support an electric generation facility which has long been in disuse and has been replaced by an electrical substation still in use today. It is owned by Trumbull County MetroParks and is within their Canoe City MetroParks property. It is one of a series of low-head dams that have been targeted for removal by Eastgate and nearby communities to restore free-flowing conditions, improve water quality, and alleviate flooding in this reach. The Leavittsburg Dam has been frequently cited as a source of flooding in surrounding neighborhoods, and Trumbull County MetroParks reports that the dam and surrounding Canoe City MetroParks property is regularly submerged during seasonal floods. Ohio EPA has sampled upstream of the dam in both 2006 and 2013. None of the sampling locations fully attained WWH aquatic use, with the presence of the dam cited as the primary reason for impairment.</p> <p>Trumbull County MetroParks will be the lead on the project, with Trumbull County, Warren Township and Eastgate as project partners. Sediment behind the dam will be dredged and the dam structure will be removed to restore free-flowing conditions. Riparian restoration and bank stabilization will be done using bioengineering methods. Removal of the accumulated sediment and restoration of free-flowing conditions will encourage natural redistribution and deposition of more varied bed material which will</p>

		improve benthic conditions and provide significant habitat improvement for macroinvertebrate and fish populations. The restoration project area and adjacent banks are owned by the Trumbull County MetroParks, who will continue to own and manage the property as protected public park space.
<i>criteria d</i>	<i>Estimated Total cost</i>	\$2,200,000 estimated for permitting, planning and design, sediment and dam removal, dewatering, disposal, sediment sampling and testing, bank stabilization and restoration, construction administration and inspection.
<i>criteria d</i>	<i>Possible Funding Source</i>	Water Resources Restoration Sponsorship program (WRRSP), Ohio EPA Section 319, local funds
<i>criteria a</i>	<i>Identified Causes and Sources</i>	Causes: Habitat, Flow Regime Alteration Sources: Dam or impoundment
<i>criteria b&amp;h</i>	<i>Part 1: How much improvement is needed to remove the NPS impairment for the whole Critical Area?</i>	This project proposes to improve the IBI from 39 to 40 or greater, the MIwb from 8.63 to 8.7 or greater, the ICI from 28 to 34 or greater, and the QHEI from 45 to 55 or greater at RM 45.73; and to improve the MIwb from 8.6 to 8.7 or greater and the ICI from 22 to 34 or greater at RM 54.73. The project also proposes to maintain the currently attaining IBI at 42 or greater and the currently attaining QHEI at 58.5 or greater at RM 54.73. This project addresses all eight goals in Critical Area 1.
	<i>Part 2: How much of the needed improvement for the whole Critical Area is estimated to be accomplished by this project?</i>	This project addresses 100% of Objective 1 in Critical Area 1 and is expected to completely restore the main stem of the Mahoning River in this Critical Area to attainment of WWH use.
	<i>Part 3: Load Reduced?</i>	The project proposes to restore approximately 10 miles of in-stream habitat through elimination of a dam pool and backwater on the mainstem of the Mahoning River. Load reduction models such as STEP-L or Region 5 have difficulty estimating the water quality benefits from this type of project where impairments are from flow regime and habitat alteration. Guidance from Ohio EPA and US EPA has been requested as to how best to address these criteria.
<i>criteria i</i>	<i>How will the effectiveness of this project in addressing the NPS impairment be measured?</i>	If this project is funded through WRRSP or Section 319, Ohio EPA will perform IBI, MIwb, ICI, and QHEI monitoring pre- and post-implementation. Additional post-project monitoring may be performed depending on USACE permitting requirements for the dam removal and restoration.
<i>criteria e</i>	<i>Information and Education</i>	The project partners will share information about this project through their websites and presentations, including a presentation on the project at the Eastgate Council of Governments Annual Meeting. Eastgate will develop a project fact sheet to educate the public and interested parties about this restoration project. Eastgate will work with Trumbull County MetroParks to host a tour and kayak/canoe float of the completed project, and an educational sign will be posted to educate the public visiting the park on the importance of dam removal to improving water quality in the Mahoning River.

## Acronyms & Abbreviations

The acronyms and abbreviations below are commonly used by organizations working to restore Ohio's watersheds; many of which are included in this NPS-IS plan.

AOC	Area of Concern
BMP	Best Management Practice
BOD	Biochemical Oxygen Demand
CSO	Combined Sewer Overflow
DELT	Deformities, Eroded Fins, Lesions, and Tumors
EOLP	Erie-Ontario Lake Plain Ecoregion
EWH	Exceptional Warmwater Habitat
GIS	Geographical Information System
Hg	Mercury
HUC	Hydrologic Unit Code
IBI	Index of Biotic Integrity
ICI	Invertebrate Community Index
LRW	Limited Resource Water
Mg/l	Milligrams per Liter
MGD	Million Gallons per Day
MIwb	Modified Index of Well Being
MWH	Modified Warmwater Habitat
NPDES	National Pollutant Discharge Elimination System
ODA	Ohio Department of Agriculture
ODNR	Ohio Department of Natural Resources
ODH	Ohio Department of Health
OEPA	Ohio Environmental Protection Agency
PAH	Polycyclic Aromatic Hydrocarbons
PCB	Polychlorinated Biphenyls
QHEI	Qualitative Habitat Evaluation Index
RAP	Remedial Action Plan
SSO	Sanitary Sewer Overflow
SWCD	Soil and Water Conservation District
TMDL	Total Maximum Daily Load Limits
TSD	Technical Support Document
µg/kg	Micrograms per Kilogram
USACE	United States Army Corps of Engineers
USDA	United States Department of Agriculture
USEPA	United States Environmental Protection Agency
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
USPC	United States Policy Committee
VAP	Voluntary Action Program
WAP	Watershed Action Plan
WBP	Watershed Based Plan
WQS	Water Quality Standards (Ohio Administrative Code 3745-1)
WRAS	Watershed Restoration Action Strategy
WWH	Warmwater Habitat
WWTP	Wastewater Treatment Plant

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